INDEX

Electrical Review

VOLUME 75

JULY 4 -- DECEMBER 27, 1919

PUBLISHED WEEKLY BY THE

INTERNATIONAL TRADE PRESS, Inc.

FOR THE

ELECTRICAL REVIEW
MONADNOCK BLOCK
CHICAGO

CLEVELAND OFFICE:
301 Columbia Bldg.

NEW YORK OFFICE:
Rooms 1736—15 Park Row

DENVER OFFICE:
403 First National Bank Bldg.

LONDON OFFICE
42 Old Broad St., E. C.

SEATTLE OFFICE:
232 Burke Bldg.

HARTFORD CONN.:
414 Century Bldg.

Electrical Review

VOLUME 75, JULY-DECEMBER, 1919

Articles marked * are illustrated; (E) indicates "Editorial".

D

N

O

P

T

U

Index to Authors

Electrical Review

Vol. 75. No. 1. CHICAGO, JULY 5, 1919 Three Dollars a Year

Electrical Review

WITH WHICH IS CONSOLIDATED WESTERN ELECTRICIAN AND ELECTROCRAFT.

VOL. 75—No. 1. CHICAGO, SATURDAY, JULY 5, 1919. PAGE 1.

Fig. 1.—General View in Asbury Methodist Church from Balcony, Showing Lighting Fixtures and Illumination Effect.

Lighting Installation for a Church Auditorium

Modern Lighting System Provided for Asbury Methodist Church in Rochester — Chiefly Indirect Lighting with Luminous Bowl and Urn Fixtures—Concealed Sources for Direct Lighting of Platform

By H. O. STEWART

Engineer, Industrial Department, Rochester Railway & Light Co., Rochester, N. Y.

ONE of the best general tests for a proper system of illumination in an auditorium is the feeling of restfulness and the absence of eye fatigue which one experiences after being in the auditorium for some time. Although ample illumination should be provided, the method by which it is distributed should not detract the attention of the audience from the program. Very conspicuous fixtures, brilliant light sources, too much or too little illumination, should not be tolerated. The best system is one in which the light is soft, well diffused and supplied from light sources that are in harmony with the decorations and architecture.

The auditorium of the Asbury Methodist Church, of Rochester, shown in the accompanying illustrations was somewhat more difficult to illuminate than the average, as the lighting fixtures had to be placed near to the direct line of vision. A system of indirect lighting was, therefore, the only kind adaptable.

The extreme dimensions of the auditorium are 96 ft. by 64 ft. Its average height is 30 ft. A considerable part of the seating capacity is under the balcony, which extends around three of the four sides. A good light is required on the platform for the preacher, organist and choir. The decorations of the auditorium are ideal for indirect illumination. The ceiling and coves are a very delicate cream; the walls

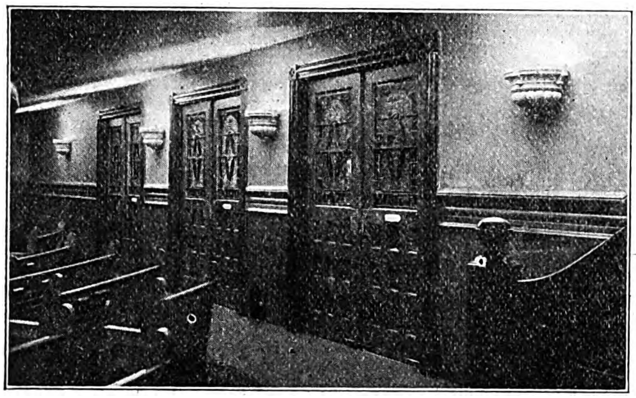


Fig. 2—Wall Urns Serving as Lighting Units at Main Entrance to Auditorium Under Balcony—Ordinary Brackets Would Cause Glare.

are colored with blended tones of brown over a coat of cream; the woodwork is natural oak and the organ is finished in dull gold. The windows are dark stained glass.

Most of the illumination is supplied by five large luminous-bowl type indirect fixtures (see Fig. 1) suspended 8 ft. below the ceiling, each containing five 200-watt Mazda type C lamps and X-ray reflectors. The art glass bottom of each fixture is dimly lighted with three 40-watt Mazda B lamps. One of these bowls is hung from the top of the central dome as a semi-direct fixture. The cross-sectional diagram (Fig. 5) shows the location of this lighting unit, as well as some of the others.

As the ceiling under the balcony is too low for ceiling fixtures, wall type fixtures were selected. The wall urns shown in Figs. 2 and 4, are 8 ft. above the floor and each contains an X-ray reflector which throws most of the light from its 100-watt lamp at an angle of 45° away from the wall. This angle was chosen, as the bulk of the illumination is required at the seats rather than in the passageway.

The platform is illuminated by four 200-watt lamps and X-ray concentrating reflectors placed in a metal box over the slot in the ceiling (see Figs. 3 and 5). The lamps are 4 ft. above the ceiling. The box is partitioned into four compartments so that the light sources can not be seen by those sitting near the front and at the sides of the auditorium. These lighting units are tilted slightly so as to increase the illumination on the organ. Those parts of the box which are visible have been painted a dull black for the elimination of glare. These units are quite inconspicuous and serve to light the platform very well.

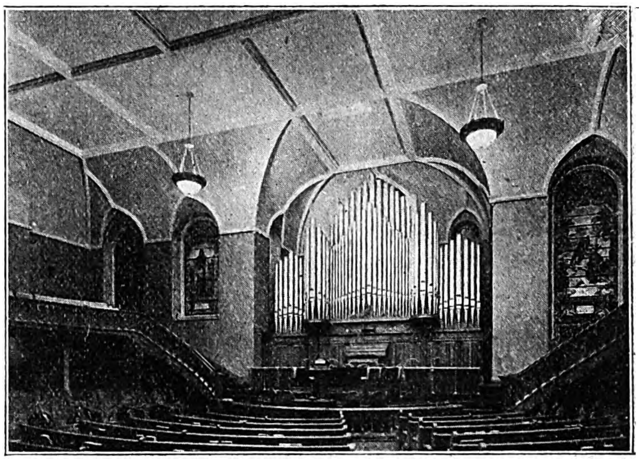


Fig. 3.—General View on Main Floor of Auditorium—Note Location of Four Light Boxes on Ceiling for Lighting Organ and Platform.

The control of the lighting units was designed to be sufficiently flexible, so that economy could be exercised in supplementing daylight with artificial illumination as needed. A small amount of general illumination is supplied by the central fixture in the dome.

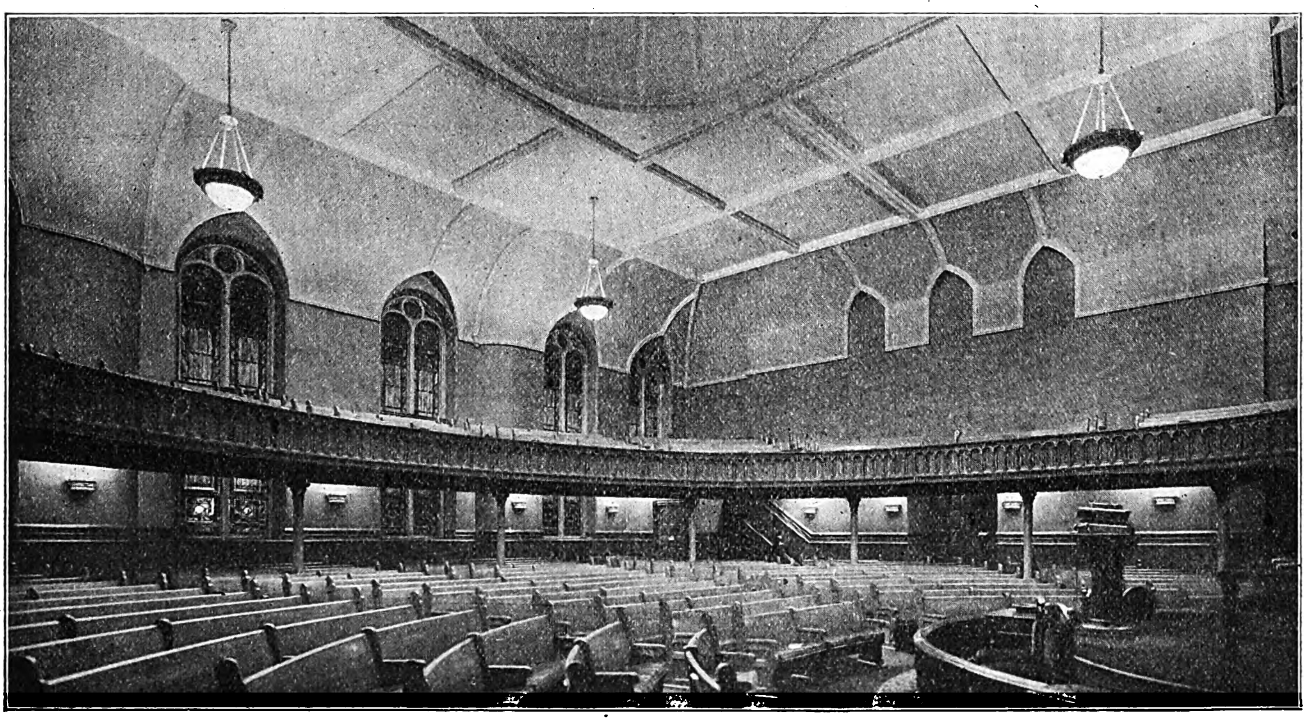


Fig. 4.—General View of the Auditorium, Showing Both Ceiling and Wall Lighting Units.

The lighting units over the platform, the two front ceiling fixtures, alternate wall urns, the three remaining ceiling fixtures, the remaining wall urns—these are turned on in the order named as the requirements for additional illumination increase with the decrease in intensity of daylight.

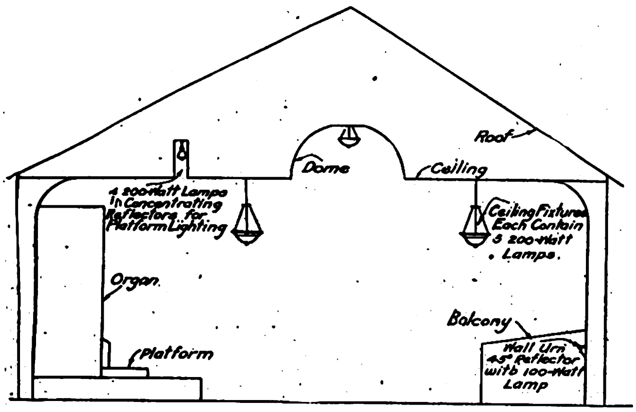


Fig. 5.—Cross Section of Asbury Methodist Church, Showing Location of Lighting Units.

Favorable comment on the new lighting of this church has been made by the congregation, by the trustees and minister, and by visitors. The illumination is very pleasing and yet efficient.

SUPPLEMENTAL STATEMENT ON ELECTRIC RAILWAYS GIVEN OUT.

Director Sam. L. Rogers, of the Bureau of Census, Department of Commerce, has issued the following supplemental statement in regard to capitalization and traffic of the electric railways in the United States. The original statement showing the growth of electric railways in this country during the past decade was published in our issue of May 31.

The total capitalization of the electric railways, street and interurban, for the year 1917 was $5,525,-025,923, representing an increase of 46.4% over 1907; and deducting investments in securities and non-operating property, the net capitalization was $4,882,764,-201, as compared with $4,243,317,727 in 1912 and $3,400,107,899 in 1907, representing an increase of 15.1% for the period 1912-1917 and of 24.8% for the period 1907-1912.

The total number of revenue passengers was 11,304,660, 462 in 1917, 9,545,554,667 in 1912, and 7,441,114,508 in 1907, representing an increase of 51.9% for the decade. The average number of revenue passengers per mile of track (based on total track mileage, including sidings) was 252,323 in 1917 and 216,522 in 1907; the average number per passenger-car mile, 5.4 in 1917 and 4.7 in 1907; and the average number per passenger-car hour, 53.7 in 1917 and 43.1 in 1907.

The detailed data are given in the following table:

ELECTRIC RAILWAY CAPITALIZATION AND TRAFFIC STATISTICS.

TRAFFIC.

	1917.	1912.	1907.	Per cent of increase.[1] 1907-1917.	1912-1917.
Passengers carried	14,506,914,573	12,135,341,716	9,533,080,766	52.2	19.6
Revenue	11,304,660,462	9,545,554,667	7,441,114,508	51.9	18.4
Transfer	3,021,137,935	2,423,918,024	1,995,658,101	51.4	24.6
Free	181,116,176	165,869,025	96,308,157	88.1	9.2
Revenue passengers by divisions:					
New England	1,242,076,786	1,051,161,737	875,115,527	41.9	18.2
Middle Atlantic	4,225,287,044	3,513,720,591	2,839,019,161	48.8	20.2
East North Central	2,712,624,699	2,159,620,746	1,607,894,497	68.7	25.6
West North Central	902,368,927	787,301,146	615,630,852	46.6	14.6
South Atlantic	747,561,816	616,724,741	487,981,528	53.2	21.2
East South Central	292,004,689	268,785,533	220,887,485	32.2	8.6
West South Central	313,203,554	270,745,675	193,338,141	62.0	15.7
Mountain	162,222,128	154,224,248	113,304,063	43.2	5.2
Pacific	707,310,819	723,270,250	487,943,254	45.0	—2.2
Average number of revenue passengers—					
Per mile of track (all tracks)	252,323	232,556	216,552		
Per mile of running track	260,868	[2]	[2]		
Per passenger-car mile	5.41	5.06	4.70		
Per passenger-car hour	53.69	48.38	43.06		
Per mile of track (all tracks) by divisions:					
New England	223,468	198,536	179,546		
Middle Atlantic	400,322	349,867	321,520		
East North Central	214,346	183,142	155,789		
West North Central	246,184	254,081	245,432		
South Atlantic	228,064	208,193	212,699		
East South Central	201,355	208,947	207,466		
West South Central	186,162	196,730	229,831		
Mountain	127,877	153,104	188,404		
Pacific	150,824	172,790	160,951		
CAPITALIZATION.					
Capital stock	$2,473,846,651	$2,379,346,313	$2,097,708,856	17.9	4.0
Funded debt[2]	3,051,179,272	2,329,221,828	1,677,063,240	81.9	31.0
Total	5,525,025,923	4,708,568,141	3,774,772,096	46.4	17.3
Investments in securities and non-operating property	642,261,722	465,250,414	374,664,197	71.4	38.0
Net capitalization	4,882,764,201	4,243,317,727	3,400,107,899	43.6	15.1
New England	352,553,026	320,491,727	263,842,127	33.6	10.0
Middle Atlantic	1,696,403,938	1,312,329,549	1,194,940,494	42.0	29.3
East North Central	1,109,374,472	1,024,768,763	900,387,383	23.2	8.3
West North Central	341,884,368	300,821,223	251,673,038	35.8	13.7
South Atlantic	415,149,716	361,599,371	250,135,621	66.0	14.8
East South Central	141,410,566	118,166,868	99,599,823	42.0	19.7
West South Central	160,936,399	128,049,146	84,192,034	91.2	25.7
Mountain	88,125,354	75,630,871	45,920,878	91.9	16.5
Pacific	576,866,362	601,460,209	309,416,502	86.4	—4.1
Net capitalization per mile of track	111,233	104,930	100,495		
New England	64,474	61,577	54,724		
Middle Atlantic	167,942	134,702	140,724		
East North Central	88,163	87,102	87,292		
West North Central	94,848	97,807	102,948		
South Atlantic	130,144	125,409	112,013		
East South Central	97,518	92,051	93,925		
West South Central	95,695	93,272	100,083		
Mountain	71,987	77,514	76,358		
Pacific	125,596	145,428	102,272		

[1]A minus sign (—) denotes decrease. [2]Not including real-estate mortgages: 1917, $7,197,895; 1912, $6,097,245; and 1907, $4,059,805.

Interborough Rapid Transit Company's 70,000-Kw. Turbogenerator

Salient Features of Turbine—Methods of Operating Three Elements — Steam Consumption of Unit

THE Interborough Rapid Transit Co., New York, has recently placed in operation at its 74th Street Power House, a turbine that is remarkable for two reasons. In the first place, it is rated at 60,000-kw. capacity continuously, and 70,000 kw. for two hours, so it is, therefore, the most powerful prime mover in the world. Secondly, it has three elements, one high-pressure and two low-pressure, and it is the first triple cross-compound turbine to be placed in operation.

This immense machine will assist in meeting the greatly increased demand for transportation in New York City, due to the opening up of a new subway system, and the extension of the service of the existing subway, elevated and subway lines. The Interborough's power requirements have increased in the past few years with extraordinary rapidity. In 1904 the 74th Street Station contained nine reciprocating engines driving direct-current generators, each rated at 5000 kw. This amount of power sufficed for a while, and then in 1913, it became necessary to remove four of these engines and install in their place, three compound 30,000-kw. turbines. Though 90,000 kw. was thus substituted for 20,000 kw., this increase was hardly obtained when it, in turn became insufficient. Now, 70,000 kw. more is added, and probably additional units will again be needed in the not distant future.

The new unit occupies a floor space of 52 by 50 ft., and is about 19 ft. high. The high-pressure element receives steam at 205 lb. gauge pressure, and superheated 150° F., and exhausts it into the low-pressure elements at 15 lb. gauge pressure. The two low-pressure elements are identical in construction, and each receives one-half of the steam from the high-pressure element and exhausts it into the condenser where a 29-in. vacuum is maintained. All three elements operate at 1500 r.p.m., and each drives a generator rated at 20,000 kw. continuously, 23,500 kw. for two hours, and 30,000 kw. for a half hour. The generators deliver three-phase, 25-cycle, 11,000-volt alternating current.

Details of Turbines.

Though consisting of three separate elements, the entire machine is started, synchronized, and controlled

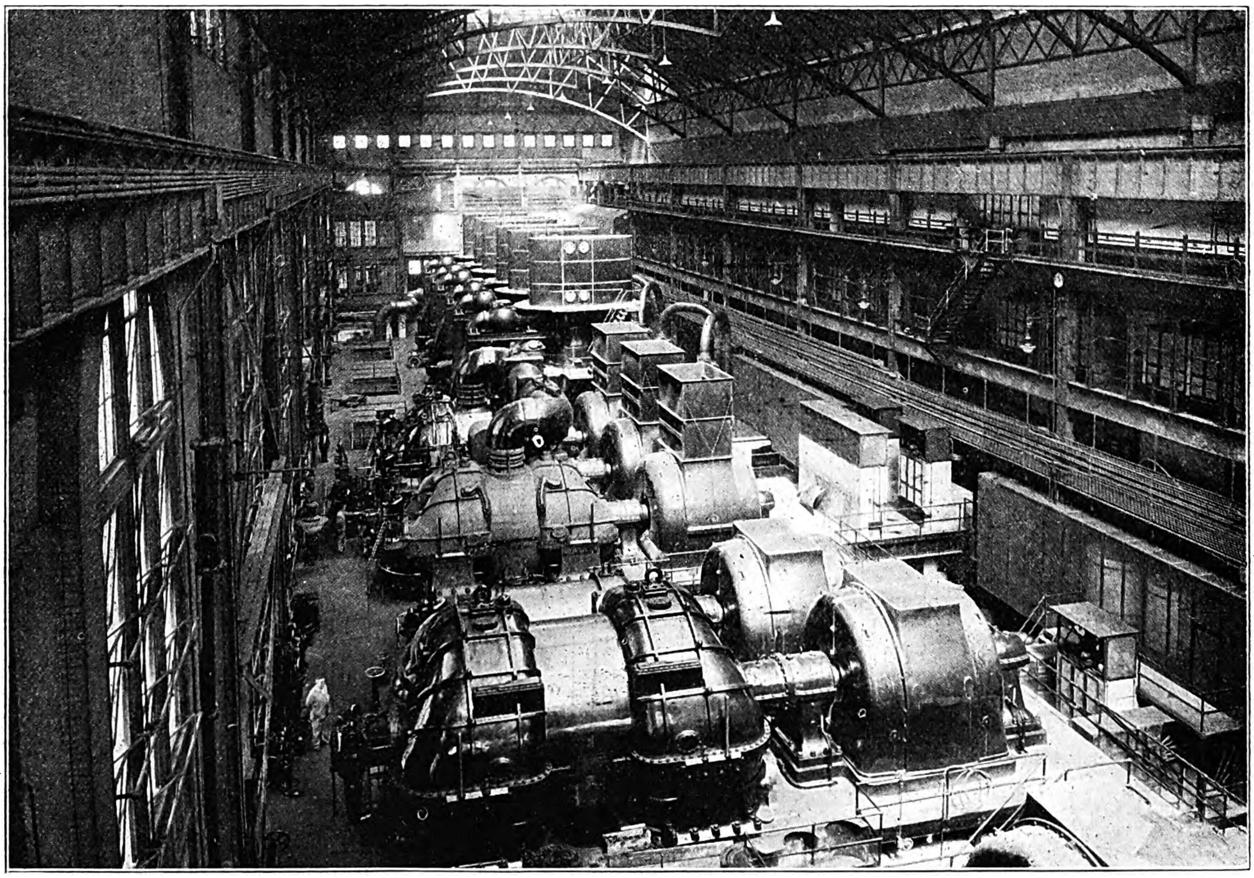


Fig. 1.—General View of Interior of Interborough Rapid Transit Power House, East 74th Street, New York, Showing One of the Westinghouse 30,000-Kw. Cross-Compound Units in Foreground, Newly Installed 70,000-Kw. Triple-Compound Unit in Center and Old 7500-Hp. Engine-Driven Units in Rear.

as a single unit. At the same time, any one or two of the elements can be shut down without interfering with the remainder, so that the high efficiency of a single large machine is combined with the flexibility of three smaller machines. In addition, the three small elements are mechanically much stronger than a single large one would be; the temperature differences in any cylinder are considerably less, and commercially common materials, with moderate blade speeds and stresses, can be used.

All of the turbines are of the pure reaction type, without the usual impulse elements, a form of construction considered preferable in view of the great volumes of steam to be handled. The high-pressure turbine is of the single-flow type, and is of cast steel. The low-pressure turbines are of the semi-double-flow type; that is, the steam enters near the center of the turbine and flows as a whole through a portion of the blading, and then divides into two portions, each of which flows through a separate section into the condenser. Since the low-pressure turbines must receive high-pressure steam in case the high-pressure turbine

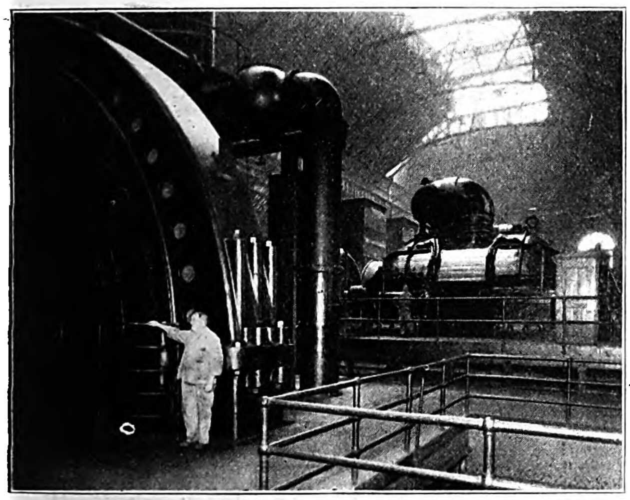


Fig. 2.—Interior of Interborough Rapid Transit Co.'s Power House, Showing Old 7500-hp. Engine-Driven Unit in Foreground and Newly Installed 70,000-kw. Turbine in Rear.

is shut down, the central portions of these turbines are made of cast steel also. All three rotors are equipped with Kingsbury thrust bearings, in order to prevent axial movement.

Features of the Generators.

The generators are so connected to the busbars that any combination of them can be operated in parallel. In practice, however, all three are brought up to speed together, and synchronized through a single oil-switch connecting the generator buses to the main bus. Reactance coils are installed between the various buses, which limit the amount of current that can flow between the generators. Should a short circuit develop in any of the feeder circuits, or a burn-out occur within a generator, the generator affected is disconnected from the buses by a circuit-breaker without interfering with the operation of the other generators.

The method of synchronizing the generators is as follows:

The field current is first applied to all of the generators, and then the throttle valve of the high pressure turbine is partly opened. As soon as the high-pressure rotor starts revolving, it will start the rotors of the low-pressure turbines through the field current. All three then come up to speed together in correct phase with each other. They are then synchronized with the system and connected to it by closing a single circuit breaker.

Operating Features of Governor.

The governing mechanism must not only control the unit as a whole, but also each turbine operating

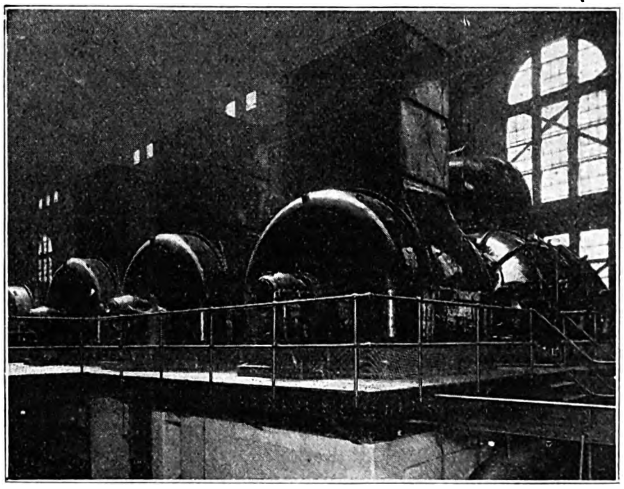


Fig. 3.—Close-Up View of 70,000-kw., Triple-Compound Turbine, Largest in the World.

separately. Some of the operations performed by the governors are as follows:

If serious electrical trouble develops on the circuit of one of the generators of the low pressure turbines, a circuit breaker will disconnect this generator from the bus bars. Relieved of load, the turbine begins to speed up, but before its speed has increased four per cent, its governor shuts off the steam supply from the high pressure turbine. This, of course, raises the back pressure of the high-pressure turbine, and a back-pressure valve opens allowing part of the exhaust from the high-pressure turbine to pass into the atmosphere, while the remainder goes into the other low-pressure turbine.

In the meantime, the first low-pressure turbine, being without steam, shuts down. When its speed reaches three per cent below normal, the governor admits high pressure steam, and the turbine continues

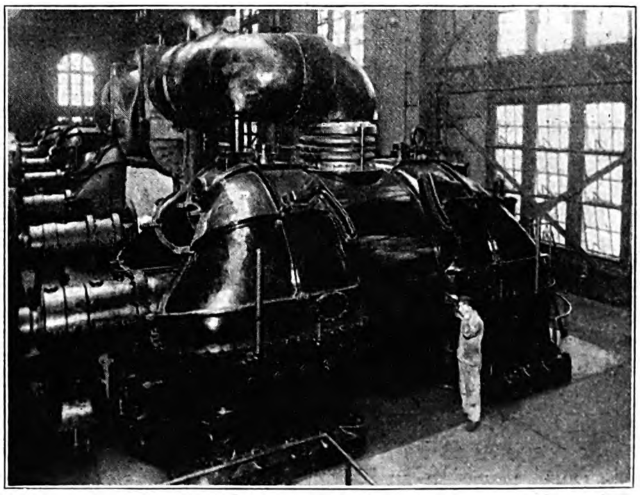


Fig. 4.—Governor and Controlling Mechanism for 70,000-kw. Turbine.

to operate at this speed until the switchboard operator either shuts it down or restores normal conditions.

Should the generator of the high-pressure turbine be cut out of the circuit, the governor cuts off practically all the steam to the entire system, leaving just a sufficient flow to maintain the speed of the high-pressure turbine now without load. The speed of the two low-pressure turbines decreases, and when the frequency drops three per cent, the governor admits high pressure steam direct to the low-pressure turbines, which then continue operating. The switchboard operator can now either restore matters to normal or shut down the high pressure turbine.

Each turbine also has an emergency stop, which will operate automatically in case the governor fails and the turbine begins to race, or it can be tripped by the switchboard operator.

When one of the turbines fails with the entire unit heavily loaded, the governors permit each of the remaining turbines to carry the maximum load of 30,000 kw. This can be maintained for a half hour, which is regarded as sufficient time to get other generators into operation, and thus relieve the overloaded turbine.

The condenser equipment consists of two 25,000 sq. ft. surface condensers for each low-pressure turbine. There are four circulating pumps, three Le Blanc air pumps, and four condensate pumps. All of these pumps are turbine driven (the air pumps directly and the others through gears), and all are so arranged that one or more can be put out of service without interfering with the operation of the condenser.

The steam consumption of the entire unit, which is a Westinghouse machine, at its point of best efficiency is 10.7 lb. per kw-hr. The high-pressure turbine and one low-pressure turbine, operating together, consume 12 lb. of steam per kw-hr.; and one low-pressure turbine alone consumes 14.25 lb. The total steam consumption at full load is 826,000 lb. per hour.

ELECTRIC STARTERS ADD TO SAFETY OF FLYING.

Description of Equipment Used on Trans-Atlantic Seaplanes.

It is not generally known that the "N. C." flying boats which accomplished the successful trans-Atlantic flight were the first heavier-than-air machines in this country to be equipped with electric self-starters for each of their big Liberty engine motors.

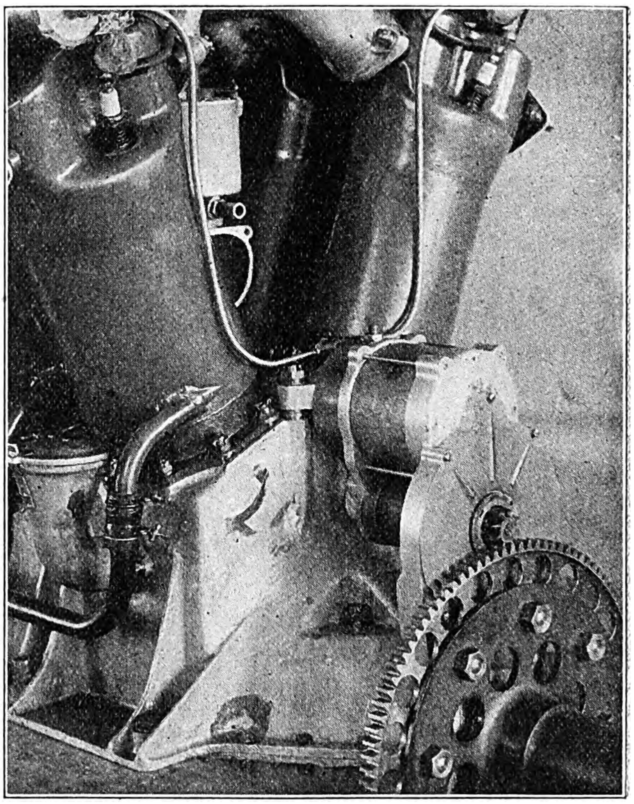
The result of the Navy Department's decision to so equip its seaplanes undoubtedly aided the success of the enterprise, for the NC-3, lost in the sea and fog near the Azores, all her engines stalled, wet and cold, would never have been able to taxi into Ponta del Gada under her own power without the assistance of mechanical means for starting her propellers.

This little device, the work of the Bijur Motor Appliance Co., of Hoboken, N. J., consists of a small 12-volt electric motor operated by a storage battery connected through a geared reduction to a Bijur automatic screw drive. On the end of the screw shaft is cut an 8-tooth pinion which meshes with a larger gear on the propeller shaft. The starter will turn over the engine at 40 to 50 r.p.m. with a consumption of 100 to 110 amperes and a maximum of 1300 ft-lb. is available on the engine crank shaft, for breaking loose a cold engine. When the engine begins firing the screw drive automatically demeshes from the crank shaft gearing. The storage battery weighs 26 lb. and has a rating of 24 ampere-hours, or sufficient to supply enough current to make 150 starts on one charging.

An interesting incident of the American trans-Atlantic flight was that all three planes carried extra propellers, intending if one should break, to descend to the water, change propellers, and start off again. They depended on the starter to make this possible.

It is also said that the C-5 (Blimp) met such strong head-winds on her trip from Montauk Point, Long Island, to New Foundland, that the force of the wind stopped her propellers, and it was necessary to ascend to a higher level to avoid them, the starter with which she was equipped starting the engines while in mid-air.

In the days before aeronautical starters were developed—which is to look back scarcely two years—it



Electric Starter on Airplane Engine.

took three men to start an airplane. One man turned over the propeller while two others, grasping him by his extended hand, stood ready to pull him away from the tremendous sucking power of the fast revolving blades.

A new aircraft engine starter, which fits on the non-driving end of the engine, has just been developed. It operates substantially the same as the propeller and starter (described above) except that the gearing is fully enclosed and the starter projects less than 5 in. from the crank case.

The starter is entirely disconnected from the engine except during the time of starting. The gears cannot be meshed while the engine is running and a safety device is provided which prevents damage in case of backfire.

Twin engine dirigibles of the "C" and "D" classes, U. S. Navy, have adopted the electric starting system. The equipment has also been in use for some time on Blimps, using Hispano-Luiza engines, and has more lately been applied to nacelles fitted with the "all-American" Union engine.

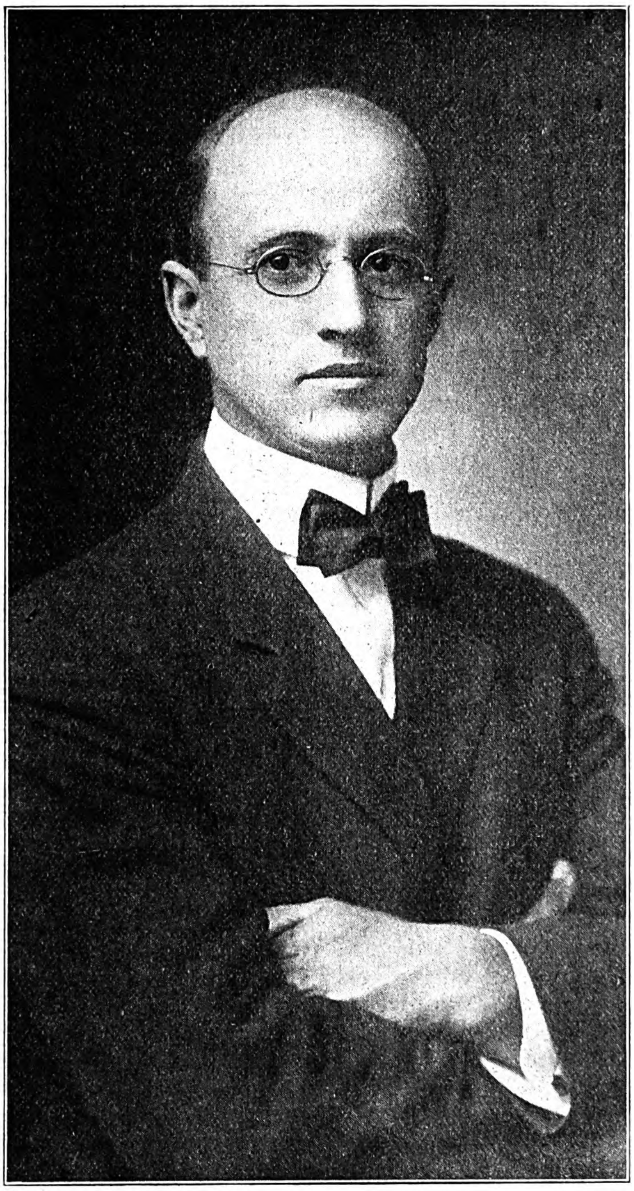
A. I. E. E. Convention at Lake Placid

President Adams' Address on Problems of the Day Makes Co-operation the Keynote—Technical Matters Receive their Due—Features of Convention

WITH a pleasing admixture of business, pleasure and relaxation, the thirty-fifth annual convention of the A. I. E. E. at Lake Placid, New York, came to a close on June 27. The program called for technical or business sessions during the mornings only, the afternoons and evenings being devoted to sports and pleasures and the relaxations that made the convention a real vacation. The program was a light one, as convention programs go, although the subjects might all be called heavy ones, serious problems of today and of tomorrow.

All the technical papers discussed problems of transmission—relay protection, the effects and benefits of grounding the neutral, effect of transient voltages, high-tension single-conductor cables for polyphase systems, dielectric field in an electric power cable, and problems of 222-kv. transmission—an arrangement that was thought to be more productive of results than a more widely diversified program. One of the outstanding features of the convention undoubtedly was the address by President Adams, excerpts of which follow and which will be found commented upon editorially on other pages.

In this issue will be found a report of the discussion on the two papers entitled "Transmission Line Relay Protection" and "Grounding the Neutral of Generating and Transmission Systems." The former of these papers appears on page 13 of this issue. The latter will be abstracted in the issue of July 12; in this same issue will be found an abstract of Mr. Silver's paper on "Problems of 220-Kv. Power Transmission," with the report of the discussions on the remaining papers and the important report of the Committee on Development.



President Comfort A. Adams.

In the opening address of the convention President Comfort A. Adams drew attention to the general unrest in all sections of the world arising out of the great war. This has led to a change in the old order of affairs. Speaking of the future he said: "Are we as engineers, educated men, who pride ourselves on our breadth of vision, who complain because we are not properly recognized in large questions affecting the public welfare, going to crawl back into our little cabins and leave the steering of the ship to those we consider incompetent, or are we going to scrutinize the ship's log to see why she ran on the rocks and then revise the sailing orders accordingly?"

With this simile Prof. Adams took up the subject of co-operation. He pointed out that the history of human society is the history of co-operation, that every commercial transaction is made on the assumption of mutual benefit to both parties concerned. "The more the mutual confidence and the co-operative spirit, the freer and the more efficient will be the interchange and the greater the mutual profit. This is merely the simplest possible illustration of co-operation to show its fundamental nature," said Professor Adams. "Industrial co-operation, from which my illustrations are drawn and with which engineers are mostly concerned, usually involves more than this simple and somewhat restricted co-operation between buyer and seller; it involves co-operation all along the line, internal and external, between producers, between consumers, and between producers and consumers.

"The obstacles to co-operation, particularly between the larger units, are of two varieties, material and human or intellectual. The chief material obstacles are space coupled with imperfect means of communication and transportation, differences in language, differences in coinage, weights and measures, and duties or tariffs. Some of these bear obviously only on international co-operation. The chief intellectual obstacles are tradition, custom, prejudice, suspicion, distrust, jealousy, narrow-minded and short-sighted selfishness or greed, or in general ignorance and lack of understanding one of the other. Most of this latter group bear upon minor or internal as well as upon international co-operation."

The Spirit of Co-operation.

Professor Adams traced the connection between engineering and industrial standardization and co-operation, showing that as a result of standardization the confusing and conflicting claims of competing salesmen are eliminated because the purchaser is placed in possession of definite knowledge of the characteristics or capacities of machines, and thus is able to select discriminately and wisely. But this co-operative spirit apparently does not always prevail. The speaker continued: "Until very recently the French national committee of the International Electrotechnical Commission contained none of the designing or manufacturing engineers, it being assumed that the latter would be biased and partisan in their attitude. As a result the manufacturers formed a syndicate with a committee and standardization rules of its own, which were and even now are to some extent the rules generally employed in France, although much inferior to our own. In some cases the American rules are specified. Even now the French rules originate in the manufacturers' syndicate and are passed on to the French national committee for its approval with a consequent loss of time and efficiency.

"As the work of our own standards committee expanded we found it overlapping the work of other societies in adjacent fields, and co-operative relations were established. This failed from the lack of any suitable and generally acceptable co-operative machinery. A movement was then started by the Institute, more than two years ago, to organize a central body (the American Engineering Standards Committee) to co-ordinate all the work of engineering standardization being done by the various engineering organizations. The objects of this organization are to avoid overlapping, duplication of effort and the confusion of conflicting standards; to insure the employment of an effective and sound procedure in the development of standards, to the end that a standard when promulgated may be not only workable but also acceptable to all concerned and the only accepted standard of its kind; to stimulate desirable standardization and at the same time to shut off premature or ill-advised attempts at standardization.

"The consummation of these objects will mean an enormous saving of effort in the production of standards, a tremendous increase in the value and usefulness of standards, and, when the work is brought up to the needs of the time, an incalculable saving in the cost of production and the productivity of labor. International standardization will be a tremendous stimulus to foreign commerce; but such international standardization is in most cases exceedingly difficult without a central authoritative body with which similar foreign bodies may co-operate. Several instances of this difficulty which have actually arisen during the past two years could be cited. These have resulted in hopeless confusion, misunderstandings and waste of time and money.

"Great Britain has its Engineering Standards Association, which during its eighteen years of life has demonstrated its reason for existence and its value to industry and to the government. The work in air craft standards alone which it is doing on behalf of the government involves some fifty odd sub-committees. France now has its permanent Standards Commission, a little more than a year old, and just getting under way. Holland also has its Normalization Bureau for the same purpose, and Switzerland is just starting a movement in this direction.

"With all these national bodies our American Standards Committee has already established cordial co-operative relations. The American Engineering Standards Committee, although organized last October, is now in process of reorganization; but the success of any such movement is in direct proportion to the degree in which the co-operative spirit prevails. It is the fear rather than the fact that causes the trouble. Even if the sacrifice were much more than it is, however, the price would be small in proportion to the result.

"It is the generous co-operative spirit for which I am pleading, rather than the timid spirit of him whose vision is of such short range that he dare not take a man's size step for fear of stubbing his toe, who holds the little present so close to his eye that it shuts out the whole landscape of the future, whose immediate self-interest or small-group interest is so dominant as to hide anything beyond.

Industrial Research.

"Another fertile but as yet little cultivated field for co-operation," Prof. Adams went on to say, "is that of industrial research. Here we have a field where the obstacles of the second group are specially dominant—particularly short-sighted self-interest and corporate interest and the timid desire for secrecy. That many of the most important and revolutionary developments of modern industry are dependent upon research needs no proof. It is not so obvious to many, however, that co-operation in industrial research is to any large extent feasible at the present time.

"After some experience in this field I am convinced that thorough-going co-operation in industrial research would mean not only a reduction of the cost of research to a small fraction of its present figure, a much more rapid industrial development of the country as a whole and a material increase in the productivity of labor, but also an increase in the profits of every intelligent party to the co-operation.

"Serious co-operation of any kind between widely separated groups is practically impossible without the mechanism of transportation and communication provided by the work of the engineer. Also, with this mechanism developed even to its present degree of perfection, co-operation becomes not only possible but also desirable and necessary, even between comparatively widely separated groups. Moreover, the problems which confront the world at this time are largely a direct result of this mechanism. Are we as engineers going to leave their solution to others? Are we going to be satisfied to play alone in our own little backyard and never look around us even after most of the fences have been removed by our own work? Are we going to fail to take an interest in our neighbor who has much that we need, from whom we have much to learn, and by co-operation with whom we can profit broadly? If we do offer co-operation, is it to be with the provision that we gain all and sacrifice nothing? Are we going to be satisfied to sit back and criticise destructively the details of a co-operative agreement, priding ourselves on our critical faculty, however valuable that may be at times, when the real basis of the criticism is either intellectual pride or short-sighted fear that we, as individuals or as a group, may lose a little of our independence or prestige; when the issue at stake is in some cases of such paramount importance even to us as individuals—had we only the vision to see it—as to overshadow our very existence?

"Let us rather make use of the logical habits of thought and freedom from bias which at least should be the result of our training and take our part in the solution of the problems we have helped to create. Let us see the goal ahead and start for it without thought of fear or favor, as sure-footedly as possible, but with that generous co-operative spirit which will surmount many an apparently impossible barrier, critical of details if so minded, but generously and constructively so."

Monopolies of Labor and Capital.

Professor Adams then dwelt upon the serious problems arising from the worldwide unrest in the labor group in the following words: "It is very easy to criticise and condemn this attitude because of its unreasonableness, looking down from our superior height of intelligence. It is very easy to assume that it is merely a matter of showing the laborer the error of his ways and of forcing him into line. But would it not be wiser at this time to examine our own attitude with equal care, to make sure that we are setting an example which if followed by labor would solve the problem? Is demanding 'all the traffic will bear' under the pressure of organized labor any worse than the same policy carried out by the capitalist whenever he has the monopoly grip? Unfortunately the two cases are not treated the same by our laws. Labor monopoly is not subject to the same limitations and responsibilities as is capital monopoly. That disparity should be removed. But there are two forms of monopoly other than of labor which are not only not limited by but are actually fostered and protected by our laws, and in which the only limitation ever dreamed of by the owner is 'all the traffic will bear.' These are patents and titles to land."

Professor Adams then explained at length these monopolies showing that it was incumbent on the engineer to assist in a progressive rational evolution of society rather than encouraging and inducing a revolution by a reactionary policy.

The Duty of the Engineer as a Citizen.

"Are we sincere in our desire to be more recognized in our broader capacity as citizens and to be consulted in matters of broad public interest if we are not sufficiently interested in those matters to make an intelligent study of them, if we are satisfied to accept without analysis the prejudices and propaganda of a biased group, however intellectually superior that group may consider itself, if we cease to utilize our logical habits of thought, our habit of analysis, of demanding the reason why, as soon as we step outside of the realm of those physical laws which force us to think straight? Are there no laws in this other realm of human relations which are just as inexorable as the physical laws with which we are so familiar? Is there no law of compensation which is the counterpart of our law of conservation of energy? Are we going to be allowed to go unpunished for crooked or careless thinking in this other realm any more than in the purely physical realm?

"What can we expect of labor in the way of intelligent fair-mindedness if we, with our superior advantages, encourage the perpetuation of institutions which work for serious injustice to the many for the benefit of the few, or even if we allow them to persist because of our lack of intelligent fair-mindedness?

"My opinion as to the seriousness of the present world situation, as to the importance of the problem before us, is not mine alone but that of many thinking men in this country and in others. I have talked with many influential men in France and England and have found a striking unanimity on this point.

"May we not as engineers utilize our training and experience, our method of thought of which we are so proud, to encourage clean, straight, unbiased and fair-minded thinking, and to encourage that broad, generous co-operative spirit which will mean so much in breaking down the barriers which separate classes within a nation, as well as the nations themselves, and which is essential to the solution of the world problem which is knocking so hard at our door?"

Discussion at Tuesday Morning Technical Session.

In responding to President Adams' introduction, the president-elect, Calvert Townley, expressed his appreciation of the honor conferred on him and especially of the opportunity for leadership. He contended that engineers should be just as able to be prominent in the public eye during peace times as they have been during the last few years in helping to carry the war to a successful conclusion. He could not see any far-reaching danger in the present labor agitation because he declared that any body which seeks to secure more benefits than are due it cannot succeed.

The first paper of Tuesday morning's session was presented by H. R. Woodrow, D. W. Roper, O. C. Traver and P. MacGahan on "Present-Day Practice of Transmission and Tie-Line Protection," an abstract of which appears elsewhere in this issue.

Two papers on grounding the neutral were presented at this session—one by H. R. Woodrow and the other by William E. Richards. In his paper, Mr. Woodrow said that experience had unquestionably shown that cable stresses are considerably relieved by grounding the neutral. Further, it is believed to be desirable to limit the ground current as much as possible, thereby reducing the stresses on the system, and particularly the burning of the lead sheath and grounding connections. The installation of grounding relays, set to disconnect a feeder more quickly than the straight normal-current relays, will further greatly relieve the potential stresses resulting from prolonged grounding current which occur even with a grounded system.

Mr. Richards in his paper said considerable improvement in operation has been observed since changing from an ungrounded system to a directly grounded Y system in Toledo, where about 16,000 kw. is transmitted over 23,000-volt, 25-cycle transmission circuits connected with underground cable.

The papers presented at the Tuesday morning session were on relay protection and grounding of the neutral and the discussion of these papers was taken up at the same time. The following were among those taking part in the discussion: Philip Torchio and H. R. Woodrow, New York Edison Co.; D. W.

Roper, R. F. Schuchardt, Commonwealth Edison Co.; H. C. Albrecht, Philadelphia Electric Co.; A. H. Lawton, Consumers' Power Co.; J. A. Johnson, E. A. MacKenzie, Don Carlos, Ontario Power Co.; F. L. Hunt, Turners Falls Power & Electric Co.; P. H. Adams, N. L. Pollard, Public Service Electric Co.; W. de L. Carr, United Gas Improvement Co.; R. R. Honaman, Bureau of Standards; A. E. Silver, Electric Bond & Share Co.; E. T. Moore, Halcomb Steel Co.; J. C. Parker, University of Michigan; H. B. Vincent, Day & Zimmerman; Chas. Proteus Steinmetz, J. R. Craighead, E. F. Creighton, E. G. Merrick, of the General Electric Co.; P. M. Lincoln, F. D. Newberry, F. C. Hanker of the Westinghouse Electric & Manufacturing Co.

Discussion on Relay Practice.

Terminology used in connection with relay practice received considerable discussion, some of the speakers even objecting to the classification of devices given by the protective devices committee.

J. R. Craighead declared that the future practice in designing or extending transmission lines should take into consideration the principles of protection as well as economy. Furthermore, increase in speed of operation of oil switches has required a corresponding improvement in relays. By so doing he believes it will be possible to reduce the time differential of delays below the ¾ sec. now believed to be the minimum. One of the greatest opportunities for improvement will be through the thorough understanding of operating conditions by actual measurements of current, etc.

J. A. Johnson expressed the belief that improvement could be made on combined use of under-voltage and over-current relays by letting the under-voltage relay control the current supplied to the tripping bus. This scheme has been successfully used at Niagara Falls in the generator neutral. Greater improvement in circuit breakers will have to be looked to in the future for isolating cable faults.

Mr. Albrecht said the cycle counter is used extensively at Philadelphia for setting and checking relays. A differential of 25 cycles is allowed for relays, 15 cycles for the oil switch to operate and 10 cycles for inaccuracy of relays. It was his opinion that it is impracticable and expensive to test on the primary side of current transformers as suggested in Mr. Woodrow's paper declaring that too much emphasis is placed on the reduction in busbar voltage during short circuits.

P. Torchio admired the ideal to which Mr. Johnson aimed, namely, a circuit breaker which would open any short circuit, but said it is too far in the future. The better way to do, in his opinion, is to reduce the amount of power that can go into a short circuit in order that the selective relays can be properly applied. He contended that it is better to follow this American development than to change to European practice.

P. M. Lincoln pointed out that the possibility of interruption of service is increasing with the increase in size of electric service systems, while there comes a greater need of reliable service. Hence there is vital need at this time and in the future for considerable investigation of the protection of large systems in order to offset these contending factors. In this connection it is encouraging to note that the efficacy of grounded neutrals is fairly well demonstrated, companies in Toledo, New York and Montana having reported favorably.

Dr. Steinmetz said the problem of relay protection is the production of simple, reliable and automatic apparatus that will permit an abnormal circuit, cable or piece of apparatus to be disconnected without interfering with the operation of any normal line or cable. When disturbances occur, normal circuits as well as the circuits in which the disturbance takes place are affected, so that devices that indicate or act merely when abnormal conditions take place will not solve the problem because the conditions require a device whose operation depends on the magnitude of the abnormality.

R. F. Schuchardt stated that engineers have been slow to recognize that relays reduce investment expense, due to the saving possible through interconnection. Now, he contended, it is very largely a case of providing the proper talent to maintain relays in order that the manufacturers may know where further improvement may be made. He suggested that the protective devices committee serve throughout the coming year as a clearing house on experiences with relays to permit an interchange of information on this subject. Chicago probably has a larger system in a limited territory than probably any other company; the conditions met there may be the same as those of other systems in the near future, so their problems and solutions are worthy of considerable study by such companies. On this system the circuits are sectionalized by reactors to limit the power which can be supplied to any fault. In each section one unit is grounded through a 2½-ohm resistance.

Don Carlos queried the need of so small a total time interval as two seconds in relay setting. The Ontario Power Co.'s system allows a total interval of eight seconds, while on an associated system four seconds is maintained without trouble, owing to the long time setting. It would be impossible to maintain the setting of ¾ sec. between relays with satisfactory results, he said, at least double that time being necessary with the equipment in use.

E. P. MacKenzie said that automobile batteries of both the lead and Edison types have been used for operating relays by the Ontario Power Co. The lead type appears to be more economical for this particular purpose, although dry cells are still more so. The latter are being used by some companies even for 110-volt oil-switch control. He recommended the method of Mr. Johnson of using under-voltage relays to control the tripping bus in conjunction with over-current relays, a master relay being employed for a similar purpose on the Ontario system with satisfactory results. For generator protection Mr. MacKenzie advocated definite-time relays. He does not consider it necessary to set relays from the primary side of the transformer but recommends testing them after each automatic operation for characteristics, including minimum current required to operate them.

E. G. Merrick considered it hardly necessary to reduce the total operating time of relays and switches below .2 sec. to protect generators and transformers as they can withstand short circuits for this period of time. On the Montana Power Co.'s system higher reliability of relay operation has been obtained by grounding neutrals, about the only trouble now experienced being on account of the high resistance of grounds.

D. W. Roper said that tests conducted by the Commonwealth Edison Co. show that if relay action is not very rapid, synchronous apparatus will be thrown out of step when a short circuit occurs very near the equipment. However, if the short circuit occurs some distance away, increasing the reactance and resistance of the circuit thereby, this trouble will not be so acute if the relays and switches operate properly. Since the effect of burn-outs in cables and the spreading of damage is more severe when a time element is introduced into relays, it is vitally important that rapid relay action be obtained.

P. H. Adams believed a total time interval of 2 sec. might be satisfactory to maintain in relay settings for short-circuit conditions, but it might be shorter for mere overload conditions.

F. L. Hunt, Turners Falls Power & Electric Co.; A. E. Silver, Electric Bond & Share Co.; N. L. Pollard, Public Service Electric Co., New Jersey, all corroborated the benefit resulting from the grounded neutral.

J. C. Parker said that relay application should not be considered so much from the viewpoint of protection of apparatus as from that of insuring continuity of service. If this distribution is made, the problem of determining time settings is considerably simplified. Engineers too often fail to recognize that the ultimate object of central stations is to give continuous service. Mr. Parker cited one instance in which a company lost about $500,000 in revenue from two consumers through failure to eliminate interruptions. This loss is sufficient to justify considerable investment on relays.

E. F. Creighton, in closing the discussion, pointed out that balanced relays sometimes trip when circuits are being synchronized owing to the switch blades failing to make contact simultaneously. While the arcing ground suppressor was very effective when used on radial systems, it is not at all satisfactory now on parallel feeders.

H. R. Woodrow closed the discussion on relay protection and grounding neutrals by answering comments made during the discussion. He emphasized the fact that the time interval between relays depends on several factors, including relay characteristics, time required for switch operation, and nature of the system of which the apparatus is employed. While some oil switches have a speed of operation as high as 1/4 to 1/2 sec., others are slower, hence the time interval of 3/4 sec. is not so far wrong. Until high-speed breakers are developed there is no way of reducing the time interval near the generators, although this would be desirable. It may be possible to reduce the total time interval below 2 sec. on large systems, although on smaller systems a long interval is permissible. Referring to the possibility of synchronous apparatus falling out of step, Mr. Woodrow pointed out that there will be less tendency to fall back into step again if the time interval is increased. Comparing single-turn and multiple-turn current transformers, it was pointed out that the former are very accurate on overloads, but that the accuracy depends greatly on the secondary load, which may cause the speed to range from 1/2 to 3/4 sec. For this reason it is advisable to use the primary-test method recommended instead of applying current directly to the relay terminals. The next best method, so far as accuracy of results is concerned, is to apply the test on the secondary terminals of the current transformer. It is not essential to test beyond the flat part of the relay characteristic curve, in Mr. Woodrow's opinion. Unless current is limited considerably by reactors, Mr. Woodrow believes 8 sec. is too long for the total time interval because all apparatus will not withstand full short-circuit current without injury. In addition to using short-circuit protective relays, the company with which Mr. Woodrow is connected employs ground relays to clear faults before they develop into short circuits.

Technical Committees Make Their Reports.

Notwithstanding the stress of the last year resulting from the war, the technical committees were able to collect a large amount of information and important data. The reports of these committees are abstracted as follows:

Power Stations Committee Reports.—Philip Torchio, chairman, advocated changes that would tend to improve the character of the papers and their discussions. He suggested that each committee discuss the papers before they are submitted to the membership; committees should put them into best form, revise them and endeavor to have them presented at general meetings. Committees should encourage and plan discussion and the work of many of the committees might be made broader and even overlap into the work of other committees and the work even of other engineering societies. For future work a paper outlining statistical data essential to recording power-plant efficiency was proposed, relative merits of shunt and compound-wound exciters, steam and motor-driven units, etc., also are to be taken up.

Comfort A. Adams emphasized Mr. Torchio's remarks, laying special emphasis upon the benefit that will accompany closer co-operation with authors in presenting accurate, suitable and concise papers. Prof. Slichter, Columbia University, mentioned that future national meetings will be more dignified than preceding meetings, hence great care in the selection of papers will be more imperative than ever.

Committee on Telegraphy and Telephony.—Some of the many developments and improvements made during the war were reviewed by Donald McNicol, chairman. Much improvement was made in apparatus for protecting telegraph and telephone lines against lightning. Closer co-operation between power companies and telegraph and telephone companies was coming about, thus assisting to reduce inductive interference between the heavy and the small-current circuits. The vacuum-tube amplifier has been highly developed and is today the preferable form of amplifier for long-distance telephone transmission.

Committee on Instruments and Measurements.—S. G. Rhodes, chairman, told of the activities of this committee in connection with the War Department and the Bureau of Standards, in which much assistance was given toward standardizing the specifications for purchasing electrical instruments. Improvements of thermocouples for accurate measurements of alternating currents at any frequency was dealt upon, these thermocouples being superior to any German couples on the market at the time the war began.

Committee on Industrial and Domestic Power.—During the year each of the various committees on application of electricity to machine tools, the cement industry, motor characteristics, to the textile industry, etc., confined and concentrated its efforts to its specialized branch. Chairman H. G. Pierce recommended that the personnel of the committee be retained intact and the work now underway be continued. The work of these committees in the printing, elevator and machine-tool applications was reviewed.

Committee on Electrophysics.—F. W. Peek, Jr., chairman, outlined the aims of his committee as being to encourage papers of a high technical standard dealing with advances in electrophysics; to have at least one broad general paper dealing with modern physics, but free from mathematics; and the promotion of closer co-operation and mutual understanding between the physicist and the engineer. The need for keeping engineers in closer touch with the work of the physicists was emphasized.

Committee on Lighting and Illumination.—This report touched upon the demands created by the war and what tendencies are to be expected now the war is over. Considerable activity in street lighting is to be looked for now that war-time restrictions have been removed. Developments in street lighting and the application of some form of prismatic reflector for incandescent street illumination was mentioned. Some of the achievements in lighting during the war were reviewed, including the perfection of the Lynn searchlight for military and naval purposes.

Marine Committee.—The enormous activity in marine matters necessitated subdividing the Marine Committee into sub-committees known as ship installation and electric ship propulsion committee, respectively. The former has been again divided into lighting, power apparatus and distribution committees. A number of matters taken up by the power apparatus and lighting sub-committees and not considered by the main committee were reviewed and proved to be of interest.

Committee on Iron and Steel Industry.—The iron and steel industry absorbs the largest amount of electrical energy of any one industry, the motor equipment alone requiring 650,000 kw. in generator capacity to care for it, while electric furnaces are absorbing 900,000 kw. There is great need for and enormous possibilities in standardization of electrical apparatus employed in the iron and steel industry, states Eugene Frielaender, chairman of the committee. He advocates much closer co-operation with the Association of Iron and Steel Electrical Engineers and advocated that the A. I. E. E. go much farther than it has done so far toward standardizing the mechanical dimensions of pulleys, shafts, gears, etc.

Committee on Electrochemistry and Electrometallurgy.—In submitting his report, Chairman Carl Hering advocates that papers dealing entirely with matters electrical such as regulation, power-factor, etc., be delivered either before the A. I E. E. or, better still, before joint meetings of the A. E. S. and the A. I. E. E. Co-operation between the two societies is the keynote of this report.

Committee on Protective Devices.—D. W. Roper, chairman, recommends that the following phases of relay protection, oil circuit-breakers, grounding the neutral, lightning arresters, current transformers and potential transformers be investigated from the aspect of protection. Developments and improvements depend very largely upon the operating companies whose experiences enable new or modified apparatus to be evolved to meet new problems as they arise. The paper, entitled "Transmission Line Relay Protection" (appearing in abstract elsewhere in this issue), represents a large part of the work of this committee.

Committee on Transmission and Distribution.—This report, presented by E. B. Meyer, chairman, showed the committee had been very active during the year in tackling the problems of insulators and underground construction. A number of papers have been delivered on allied subjects. It is advocated that depreciation be given more consideration in reducing insulator failures and service interruptions. The tendency is to go to higher voltages. Research work in connection with dielectric losses in subteranean cables, standardized test methods and the compilation of data on operating temperatures of underground conductors are some of the matters brought up.

Committee on Use of Electricity in Mines.—As a result of this committee's activities, several papers on matters pertaining to mining have been presented before the society. The report recommends closer co-operation between the various technical national and local engineering societies.

DUQUESNE LIGHT CO. REDUCES RATES FOR RESIDENTIAL SERVICE.

New Schedule of Pittsburgh Central Station Company Based on Maximum Demand Charge.

Effective July 1, the Duquesne Light Co has placed a new schedule of reduced rates for residential electric service into effect. The new charge is at the rate of 8 cents per kw-hr. for the first 30 hours' use of the customer's demand; for the next 60 hours, 6 cents per kw-hr., and for all consumption in excess, 3 cents per kw-hr.

The customer's demand in the new rate is based on the number of lamp outlets, the first 10-lamp outlets being rated at 30 watts each, the next 20 at 20 watts each, and all in excess at 10 watts each. The company will still maintain its fixed service charge, which provides for a rate of 15 cents per month graded to 5 cents for apartment houses, hotels, etc. The minimum fixed service charge is 65 cents per month, with a rate of 6 cents per kw-hr. and discount of 1% per kw-hr. for prompt payment of bills. Local electric companies in the retail branch of the trade are using the reduced rates as an incentive to consumers to purchase electrical appliances of different kinds with considerable success.

BALL BEARINGS FOR CONSERVING ENERGY.

Introduction of This Equipment for Power Plant Use During War Proves Successful.

When the coal shortage became acute last year, central stations and others set about reducing needless wastes of energy that were small individually but represented quite a large total when taken in the aggregate. Apparatus was operated so that the most efficient units were kept in service as long as possible, apparatus not actually used was taken out of service so as to reduce core losses, which react back to the coal pile. Needless friction was eliminated wherever possible.

In reducing friction in power plants one of the practices that came was that of employing ball bearings in places where they had previously been considered ill-adapted. Even in places such as the boiler room—proverbially dirty and grit and dust laden—ball bearings have been used for shaft and stoker drive. Tests made of the relative friction losses of a 3-hp. induction motor with ball bearings, waste-packed bearings and ring-oiler bearings showed efficiencies respectively of 84, 80.5 and 81.5%. An efficiency difference of 2.5% in favor of the ball bearings becomes a matter of importance where a machine operates continuously for a high portion of the year and where there are many machines.

Transmission Line Relay Protection

Review of Typical Applications of Current and Directional Relays—Excerpts from American Institute Paper

By D. W. ROPER, H. R. WOODROW, O. C. TRAVER and P. Mac GAHAN

THERE was a time when the protection of an electrical tranmission system with the single generating station and its radial feeders was not a matter of very grave importance. That time, however, has passed and the multiplicity of generating stations with tie lines and parallel feeders have greatly complicated the once simple problem. Furthermore the practice of interconnecting large transmission systems has brought about conditions which require very serious consideration when laying out a protective relay scheme. An effective sectionalizing relay scheme is necessary in order to secure both continuity of service and maximum efficiency of transmission, and the most complicated system can be effectively relayed if all the conditions are thoroughly analyzed and proper relays, carefully set for both time and current values, are applied.

Most of the large systems of the present day have grown out of a comparatively small beginning, stations and lines being added as required, without taking into consideration the relay problem. As a consequence this problem has, in a great many cases, become rather difficult and it has become evident that the application of protective relays for sectionalizing trouble is one of the principal features to be considered in determining the design of a transmission system. This point should be borne in mind whether additions are being made to an existing system or whether an entirely new system is being designed. Numerous instances could be given, if space permitted. whereby a slightly different design in extending lines and adding stations would have given a much more simple and effective protective scheme.

The same argument applies to the design of an entirely new system, particularly if it is likely to become very complex, and in so far as practical, possible extension should be considered in the original layout so that various methods of protection can be studied and their advantages weighed against possible disadvantages of a design to which they can be applied. It will be found in practically every case that one of the many sectionalizing schemes now in use can be combined with a proper layout of stations, transmission and tie lines to give proper selective action. Thus the many difficulties encountered when attempting to apply relays to a system laid out without regard for its protection may be avoided. It is therefore of paramount importance that the selective features of various types of relays be thoroughly analyzed before adapting them to any particular system.

The most perfect relay system cannot be expected to give the best results unless the man in charge of its installation and operation be thoroughly competent and familiar with the various precautions to be taken. It is absolutely essential that he know the characteristics and peculiarities of the relays as well as the scheme he is using. Results of experience have shown that an experienced man will secure more satisfactory results from an inferior type of relay than a less capable man can secure from the best equipment obtainable.

One of the principal factors controlling the settings of relays is the amount of short-circuit current available under various conditions as outlined later in this paper.

The proper type of relays to be selected for protecting transmission lines is dependent upon whether the system is operated radially, in parallel by groups, or in loop, and the time allowable for holding a short circuit on the system. In general, however, the most simple form of relay protection where several parallel feeders are involved is the straight inverse-time current relays which are set to give times of operation which are progressively longer as the source of power is approached. In some cases, however, where an extended system is considered, the time requirements for the relays approaching the generating station are so long that it is considered dangerous or inadvisable to hold short circuit currents on for this period. We believe a delay of two seconds to be the extreme time a dead short circuit should be allowed to remain on a system, except under very unusual conditions.

The introduction of directional relays at points where power is feeding into a station will materially reduce this maximum time setting as these relays can be given a short time setting as outlined later under the heading, "Typical Applications of Current and Directional Relays."

Another method of shortening this time is by the use of the balanced system, in which case current can only flow through the relay at time of short circuit as outlined later under the heading "Balanced Protection Schemes."

Another method has been developed for shortening this time by the combination of an under-voltage relay with the inverse time current relay, as outlined later under "Combination of Under-voltage and Overcurrent Relays for Protecting Tranmission Lines."

For relay protection on tie lines, between generating stations in general, the conditions are somewhat similar to the straight transmission line relay protection if the additional precautions are taken to prevent operation on heavy momentary surges of power that are likely to exist between two or more generating stations at time of synchronizing or momentary disturbances on the system. The relay desired here is dependent to a large extent upon the method of system operation, as in some cases an operating company will want the tie lines to open, in case of trouble on a portion of the system, whereas other companies want these tie lines held rigidly in service in all cases excepting in case of trouble on tie lines themselves. In the first case shorter time settings are given to the relays and the application of straight inverse time current relays with the possible application of directional relays, is all that is required. In the second case. however, application of some form of a balanced relay. as described later, may become necessary. If the tie lines are not to stay in indefinitely, inverse-time current and directional relays with long time settings would give a very suitable operation and allow the tie lines to open in case of more serious trouble on either side of the system.

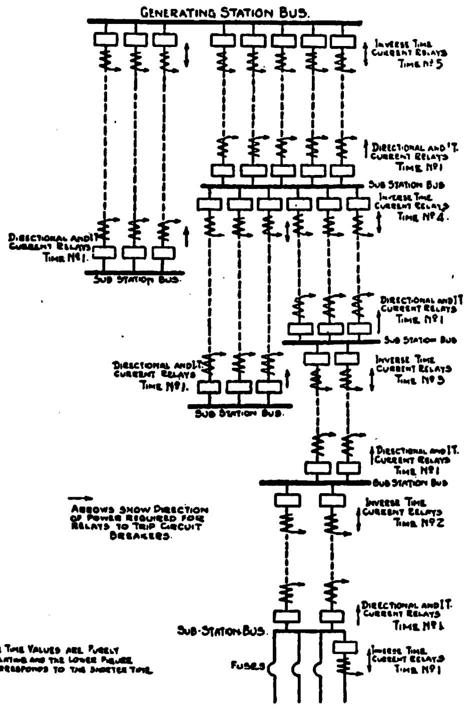


Fig. 1.—Inverse Time Current and Directional Relays as Applied to Parallel Feeders.

Some companies have connected their control and tripping circuits to the excitation bus, thereby obtaining the advantages of direct current, but sometimes this has led to considerable trouble due to the unstable conditions of this source, especially under alternating-current short circuits. It has resulted occasionally in a complete disabling of the control system on account of abnormally high induced voltages on the excitation bus with single-phase short circuits on the alternating-current generators. Great precaution should be taken against these conditions and for best results we feel that an auxiliary supply should be used if possible for obtaining at all times a constant power for the tripping circuits.

Typical Application of Current and Directional Relays.

The combination of inverse time current relays with directional relays is becoming very extensively used in cases of parallel operation of lines or of feeders forming a ring system.

Some of the trouble which was experienced in the early days was mainly due to the difficulty in obtaining a directional relay which would operate correctly under all conditions of faults, especially where low voltage was encountered. The directional relays produced at the present time are apparently giving very satisfactory results, even under low voltage conditions down to 1% of normal, and may be applied to loop or parallel group systems in series, in combination with inverse time current relays, if a careful analysis is made of the proposed installation.

For the protection of parallel groups in series, the relays are applied as shown in Fig. 1, with inverse-time current relays placed at the transmitting end and directional relays (combined with an inverse-time current element) at the receiving end. The directional relays are connected to close their contacts for power flowing from the bus to the line, and these contacts are placed in series with those of the inverse-time current relays of the same circuit so that the circuit-breaker is tripped only in case of power flowing in the direction away from the bus and of a magnitude exceeding a certain given amount for a certain time. Any time delay required is provided by the adjustments of the inverse-time current relay element.

For protecting the loop system both the inverse-time current and directional relays (with inverse-time current element) are used, as shown in Fig. 2. Each line, at each station, is provided with inverse-time current relays. Where these inverse-time current relays are given the lower time settings, directional relays are also used with the tripping contacts connected in series, so that both relays must operate before the circuit-breaker is tripped.

Reference to the time settings given in the diagram (purely relative) will show that they are graded on the same basis as a single series of tandem-connected substations, assuming that one end of the loop is open at the generator bus, and neglecting those breakers which would be incoming at the various substations. It should be noted that when the other end of the loop is considered open, the substation breakers which in the first case were incoming will now be outgoing, and *vice versa*. The directional relays are also installed if the time of an incoming line is lower than an outgoing line further from the source. This must be checked separately for each end, in turn, considered opened at the generator station.

To secure the operation of the directional relays under bad power-factor conditions, connections are made so that the maximum torque is obtained with lagging power-factor. This may be accomplished by

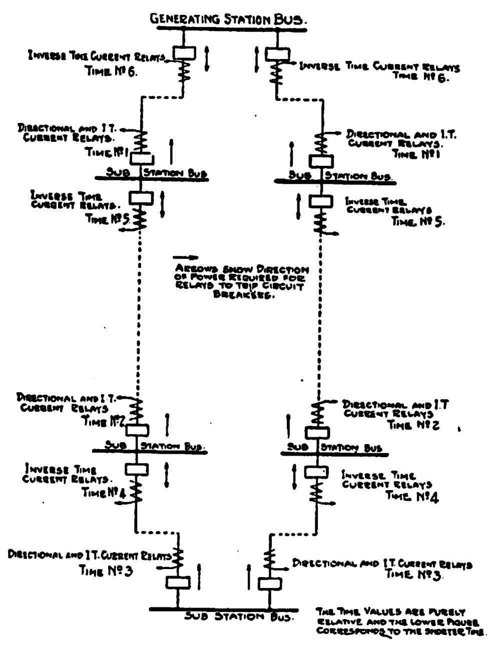


Fig. 2.—Inverser Time Current and Directional Relays as Applied to Ring System.

using directional relays with step-down transformers several schemes of connections of the potential and current elements, which schemes may not be interchangeable with different types of directional relays.

Some operators have found it advantageous when (particularly if not paralleled on the primary side) or reactors, to connect the voltage elements of the relays to the bus side of this apparatus in order to give a higher voltage in case of short circuit, thereby obtaining better operating conditions for the directional relays.

Balanced Protection Schemes for Transmission Lines.

Many operating companies have installed on a portion of their lines protective equipment designed to be inoperative so long as the currents in different circuits or at different points in the same circuit are substantially equal. To this end they have made use of (a) fully insulated lines in parallel between stations, (b) conductors in parallel having reduced separating insulation, *i. e.,* split conductor cable, and (c) pilot wires of relatively small cross-section between the two ends of a line to sense the degree of balance of the currents at these points. The basic principles involved are discussed below, which principles are sufficiently flexible to allow application in various ways to the problem which may be in hand.

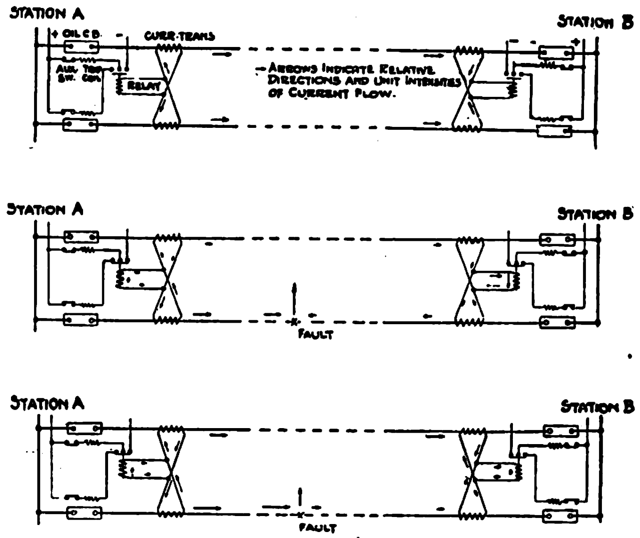
In the various diagrams accompanying the descriptions of these balances schemes, arrows are inserted to indicate the relative direction of current or of power. These arrows show power normally flowing from station A to station B. In each case, however, the equipment is equally suitable for power flowing in either direction.

In general, the over-current relays used are adjusted to operate instantaneously or nearly so. Some companies report that the opening of the breaker is so rapid that there have been cases where a cable has immediately rehealed, due to hot insulating material flowing into the opening made by the fault. Usually the point of breakdown has been actually located by subsequent inspection.

Balanced Protection of Two Parallel Lines (Not Discriminating).—The exceedingly simple scheme of balanced protection illustrated (Figs. 3, 4, 5) has given excellent results in a system so arranged that the lack of discrimination on the part of the relays between the sound and the injured line of a pair is not very vital. On the system referred to, each substation having such relay scheme, is provided with power over at least two different groups of lines. The complete, though temporary, interruption of one of these sources does not therefore kill the bus in question, and no hardship is imposed greater than the inconvenience of determining the good line preparatory to replacing it in service without its mate. This inconvenience is to a considerable extent compensated for by the freedom of the equipment from all alternating-current potential connections. While these potential connections, in present day relays, do not occasion the misgivings they were responsible for in older types, their elimination is a point not to be overlooked.

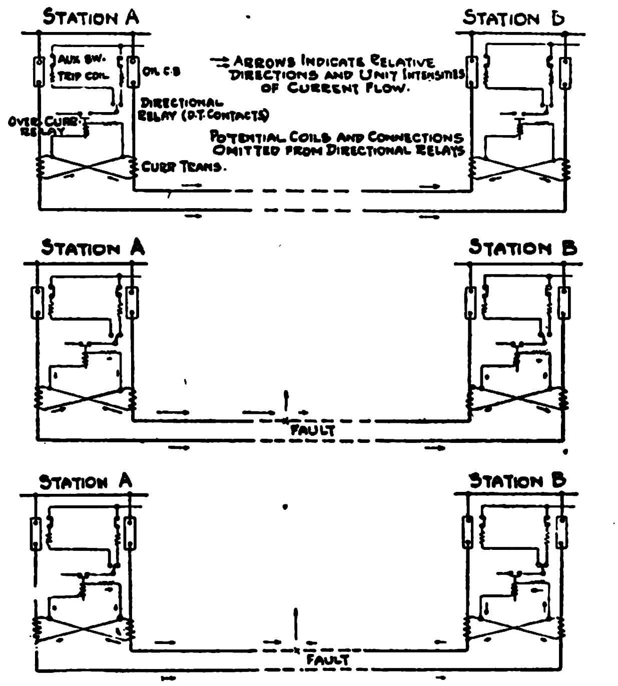
The balanced equipment, as shown above, consists of "cross connected" current transformers in the similar phases of the two lines, to the equi-potential points of the secondaries of which an over-current relay is connected. So long as the currents are equal and in the same direction in the two lines, there will be no current to flow through the relay coil, as demonstrated by the arrows on the secondary circuits. A through short circuit will not, therefore, improperly open these circuit-breakers providing the line characteristics are such that a suitable balance is maintained.

Assuming a fault, as shown in Fig. 4, there is an unbalance of currents at substation A and a relative reversal of current at substation B. The differential



Figs. 3, 4 and 5.—Balanced Protection for Two Parallel Lines (Not Discriminating).

of the secondary currents pass through the over-current relays, being an arithmetical difference at substation A and an arithmetical sum of substation B. Due to the differential current in the relay coils, the latter cause contacts to close, which trip both circuit-breakers at each end of the two lines. Following such operation it is reported to be the practice to find the healthy line and connect it in service with time over-



Figs. 6, 7 and 8.—Balanced Protection for Two Parallel Lines (Discriminating).

current protection (not illustrated in the diagrams) in place of the differential protection. If, at any time, the fault should occur so near station B that the currents at station A remain balanced, then the station A relay would not operate immediately, but at B the differential current would be very great, due to the reversal in the relative directions. Station B would, therefore, clear quickly, after which there would be established a large differential at A. An open circuit in either of the lines will likewise unbalance the pair and result in its isolation.

In order to protect against short circuits on the substation bus itself, or any possibility which would not give a relative unbalance or relative reversal of current on a parallel group of lines, the generator ends of all feeders are provided with inverse-time limit relays having comparatively high settings. It might be added here that with faults on the feeders between the generator station and substation, the substation relay clears the pair of lines from the substation, usually so quickly that the inverse-time limit relay on the faulty line, only at the generator end trips, thus leaving the good line of the pair connected at the generator substation.

Assume now a restricted fault in one of these lines, Fig. 5, such that the power direction remains throughout as formerly although the intensities have changed. It will be noted that the resulting difference in the currents in the two lines is reflected in the secondaries where it appears as a current through the relay coils and, causing the contacts to close, trips both circuit-breakers at each end of the two sides.

Balanced Protection for Two Parallel Lines. (Discriminating.)—In order to obtain discriminating action in the relay equipment for short circuits in either of two parallel lines, direction relays are included in the scheme previously shown in Fig. 3. With this modification the arrangement is as illustrated in Fig. 6. It should be noted that in case of an open circuit in one of these, selective isolation of the broken line is not obtained. The resulting unbalance would cause the opening of the sound feeder at one end and of the broken circuit at the opposite end, in case of sufficient current flow, as determined by setting of the time-current relay.

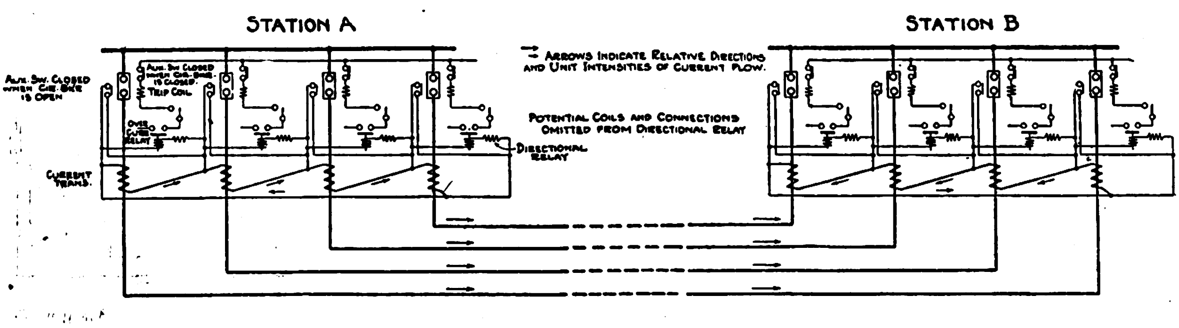
As in the previous case, so long as a balance is maintained between the corresponding phases in the two lines, no current flows in the differential or relay circuit. When a fault occurs, however, the vectorial unbalancing in the main circuits will be indicated in the relay coils, as illustrated in Figs. 7 and 8.

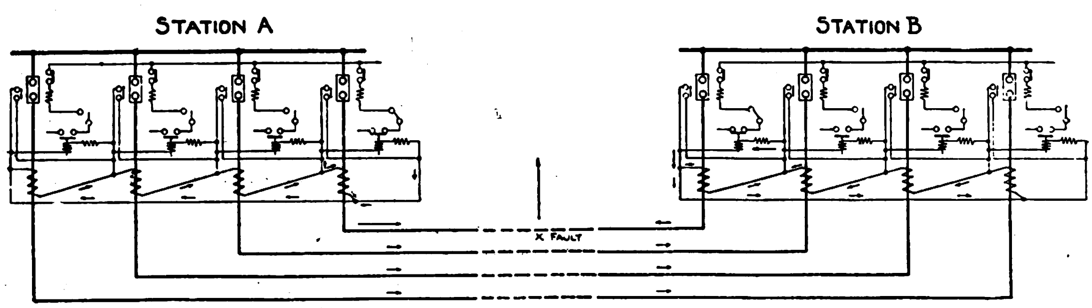
Looking at the matter from another viewpoint, if we assume for the moment that only one line is in service, then the current and potential connections to the directional relay should be so made that for power flowing from the bus to the line the contacts would close on the side to trip the breaker of the line in service. When both lines are working, the circuit having the greater flow of power from the bus to the line will control the operation of the directional relay and, therefore, trip the breaker of the line in trouble which always carries the greater power from the bus to the line.

It should be born in mind that power flowing from the line to the bus is of negative value, therefore, for cases such as shown in Fig. 7, where power flows from the line to station B bus over both circuits, the circuit having the greater flow from bus to line is the one having the least flow from line to bus.

In the event of one line being in service alone, it is the general practice automatically, by means of auxiliary switches on the circuit-breakers, to introduce time, over-current relays in the protective equipment which will operate in conjunction with the directional relays in a manner similar to that described in connection with Fig. 1 or Fig. 2 (tandem groups or loop circuits). This time delay also serves to prevent the opening of the sound line immediately following the tripping of the faulty one. In place of the single directional relay with double throw contact, it is also possible to obtain substantially the same results with two sets of relays with single-throw contacts arranged in a manner similar to that described for the protection of three or more parallel lines and shown in Fig. 9.

Balanced Protection for Three or More Parallel Lines (Discriminating).—Where a number of parallel lines are involved the underlying feature is the same as described in connection with Fig. 6, although the treatment of the matter is necessarily different. Here...





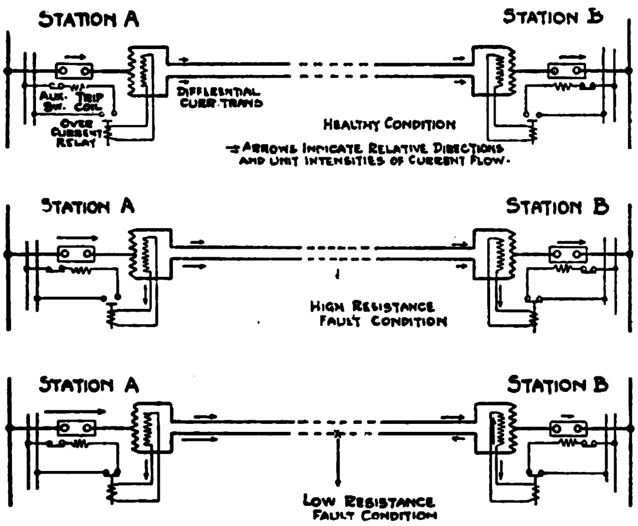
Figs. 9 and 10.—Balanced Protection for Three or More Parallel Lines (Discriminating), and Effect of Fault in One Line.

as shown in Fig. 9, the current transformer secondaries are connected all in series in a loop circuit so that, when the primary currents are all equal, the secondary currents will also be equal and will circulate through the loop as one current of the magnitude of each, and practically none will pass through the coils of the over-current and directional relays which are connected across each current transformer secondary.

Fig. 10 illustrates a fault in one line such that power is reversed at station B in this line from the direction taken by the remaining sound lines. It will be observed that only in the case of the injured line is the power direction through the directional relays (as indicated by the arrows) such that the contacts will close. At station A this is because there is a preponderance of positive power flowing from the bus into this particular line. At station B the injured line is the only one having positive outward flowing power.

Inasmuch as the success of the scheme depends upon the relatively low impedance of the loop circuit as compared to the impedance of the coils, it will be apparent that some method should be provided to eliminate the useless impedance injected in the loop circuits by the relays of a dead feeder. This is usually done automatically by short circuiting, by means of auxiliary switches on the circuit-breakers, or by auxiliary relays controlled by such auxiliary switches, the relay equipment of the line whose circuit-breaker is open.

It will be noted that when all but one line is out of service, the relay equipment of this last line will be



Figs. 11, 12 and 13.—Split-Conductor System Protection.

short circuited by the auxiliary switches or relays referred to in the preceding paragraph and accordingly the last line will be non-automatic unless some means is provided to open the loop circuit. This opening of the loop may be accomplished manually or it may be done automatically with considerable complication of auxiliary switches, etc., which complication is usually considered inadvisable. When the loop has been opened, each feeder will be left with over-current and directional protection at values determined by the settings of the over-current relays. Various other, also somewhat complicated, means may be used for inserting additional relays for the protection of this last line which on account of their variety will not be described here.

If an open circuit should occur in one of the conductors or if, when putting another line into service only the breaker at one end is closed, an unbalanced condition will result which may tend to open the good lines in use if the current flowing at the time is sufficiently great. This danger becomes relatively smaller as the number of lines involved is increased because the secondary unbalancing will be inversely proportional to the number of lines in service. For instance, if the over-current relays are set to operate at the normal load of each feeder and if four lines are in

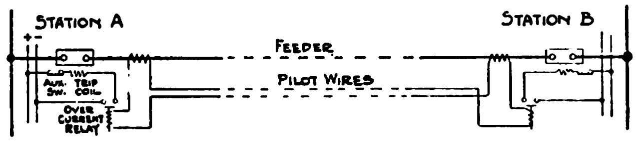


Fig. 14.—Pilot Wire System With Balanced Pressures—Merz-Price System.

(three continuous and one open at one point), an overload of three times normal on each feeder would be required before any trouble could be encountered.

Split Conductor Protection.—Split conductor cables are being tried out in this country by two operating companies who report good results to date. The cable is comprised of six conductors, each of the three phases being "split" into two halves.

The healthy and faulty conditions are illustrated in Figs. 11, 12 and 13. The action of relays is similar to that described in connection with the two-parallel-line equipment shown in Figs. 4 and 5, excepting that under end fault conditions, additional devices are required to provide the necessary unbalancing.

Pilot Wire System with Balanced Pressures.—Adaptations of the Merz-Price protective system have been used by two operating companies. One of these reports very satisfactory results, the other is not so favorable due to an inherent difficulty in obtaining the proper degree of balance.

Fig. 14 illustrates the scheme of connections. The current transformers in each end of the circuit have their secondaries connected in opposition so that when current flows through the feeder, a potential is produced across each current transformer secondary. As

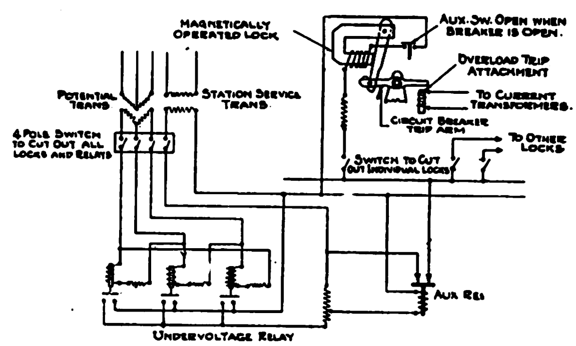


Fig. 15.—Undervoltage and Overcurrent Relay-Scheme of Connections.

these pressures, at the two ends of the line, are produced by equal currents passing through similar transformers, they also will be equal and, being in opposition, no current will flow.

If, however, the input to the cable exceeds its output the corresponding potentials across the transformers will become unbalanced and a current will pass through the pilot wires and, at the same time, through the relays connected in series at each end. The operation of these relays serves to trip the circuit-breakers.

Combination of Under-Voltage and Over-Current Relays for Protecting Transmission Lines.

One of the companies reported an application of a combination of under-voltage and over-current relays for their system which has given them very satisfactory results.

In this scheme all the circuit-breakers in any section are mechanically locked in the closed position by means of a magnetically operated lock. It is controlled by a voltage relay which releases the lock when the voltage falls below a predetermined value (approximately 70%). Upon the occurrence of a short circuit the voltage drops and when it has fallen below the predetermined point the voltage relays act to unlock the circuit-breakers which are then free to be opened by the over-current relay or other over-current device. Thus, in most cases only the breakers in the affected section can open on short circuit. It sometimes happens, however, that when two stations are close together, breakers in an unaffected section may be unlocked but usually the over-current device will act to open the proper ones only and clear the trouble before the others can operate.

Referring to the diagram, Fig. 15, the under-voltage relays are connected to the secondaries of potential transformers on the line buses. An auxiliary relay is actuated from the station service transformer and is controlled by the under-voltage relays. In its turn this auxiliary relay controls the locks on the circuit-breakers. One set of under-voltage relays, with the auxiliary relay, may control a number of locks on a number of circuit-breakers. The operation is as follows:

When the line potential drops below a predetermined value, one or more of the under-voltage relays drop and short circuit the auxiliary relay through a resistance which causes this auxiliary relay to open. This, in turn, releases the latch and leaves all the circuit-breakers under its control free to operate in case of over-current. Thus, so long as the potential remains above the predetermined value, no breaker can be opened by its automatic over-current feature.

This scheme, illustrated in Fig. 15, is reported as giving successful results on an overhead system covering 4000 square miles where there is a large number of stations located on an average of approximately 10 miles apart. As the lowest voltage occurs nearest the short circuit, it is probable that only the circuit-breakers in the immediate vicinity will be unlocked and allow the circuit-breakers to be automatically opened if the current is of sufficient magnitude.

Further information on this subject of relay protection will be found in papers by Philip Torchio entitled "Relays for High Tension Lines," and by R. F. Schuchardt entitled "Protective Relays," A. I. E. E. Proceedings, Vol. XXXVI, 1917, pages 361 and 383, respectively; and a paper by W. H. Cole on the subject of "Split Conductor Cables—Balanced Protection," Vol. XXXVII, page 793, A. I. E. E. Proceedings.

MANUFACTURE OF ELECTRICAL WIRING DEVICES IN OPORTO.

An industry of increasing importance in the consular district of Oporto, Portugal, is the manufacture of electrical wiring devices, according to the recent report of Consul Samuel Hamilton Wiley. This industry is in the hands of a Portuguese company, the Empreza Electro Ceramica, capitalized at about $375,000, fully subscribed, financed by local capital. The factory is located at Vila Nova de Gaya, a suburb across the Douro river from Oporto.

This company was organized about three years ago for the manufacture of the porcelain parts of electrical wiring devices, to supply the local demand for these articles which were formerly imported, chiefly from Germany. The venture has been a marked success, as the company is not only supplying the greater part of the local demand, but is exporting its products in increasing quantities to Spain, France, England and Brazil. Although the war is over this trade is expected to increase.

Output of Factory, Now Large, to Be Increased Shortly.

The plant covers an area of about three acres and consists of a modern installation for the manufacture of all porcelain wiring devices, for both high and low tension, and for the manufacture on a small scale of the metal parts of such devices. The manufacture of the metal parts has only recently been commenced. About 800 workmen are employed, and four large furnaces are operated in the manufacture of the porcelain parts. The preparation of the kaolin for use in the manufacture of the porcelain is carried out in the plant. All the steel molds, fire-clay receptacles, and other accessories employed are manufactured in the plant. With the exception of the metal used, all the raw materials are of local origin and are obtained from nearby. The production capacity of the factory is as follows: High-tension insulators (up to 15,000 volts), 1000 a day; low-tension insulators, 5000 a day; small insulators, fuses, switches, rosettes and other devices, 225,000 a day. With equipment now being installed the company hopes soon to double the present capacity.

Porcelain electrical wiring devices of the various types used in France, England, Spain and Brazil are produced, and many devices of German invention are initiated and improved upon.

American Co-operation Desired.

It is the intention of this company to greatly increase the output of its plant, and to endeavor to secure a large share of the trade in electrical wiring devices in European and South American markets formerly held by Germany. The greatest difficulty in the carrying out of this plan is the manufacture of the metal parts. Difficulty in obtaining raw materials and machinery for the manufacture of these parts prevents their being produced in quantities sufficient to complete the porcelain parts turned out. To insure the best results it is necessary to adjust the metal parts to the porcelain at the time of manufacture.

To overcome this difficulty this company desires to form a combination with some American company engaged in the manufacture of the metal parts of electrical wiring devices. Such metal parts to be manufactured in the United States and sent here for adjustment to the porcelain parts at this plant, or a factory to be established here in conjunction with the porcelain plant. The company here has excellent facilities for the manufacture of the porcelain parts of electrical wiring devices, and the plant is well situated geographically for the distribution of the products to European and South American markets, with quick deliveries.

Central-Station Rates in Theory and Practice

Outline of a Series of Articles on this Important Subject to Appear Weekly Throughout this Volume — H. E. Eisenmenger, Who Has Devoted Years of Research to Subject, Is Author

RATES for electric service are now to a large extent in a state of transition. Many central-station companies are being called upon to defend rates that were raised during the war and that are now being attacked because the war is virtually over. Other companies are being compelled to seek rate increases because there is no prospect of very material lowering of labor costs and costs of fuel and other supplies, so that the deficits involved in continuance of their present rates have threatened to wipe out previous surpluses or reserve funds and seriously impair net earnings.

Any rate revisions will very likely from now on be scrutinized with much more care than during the war when everyone recognized the emergency then existing and all new rates will be subject to severe scientific analysis and criticism. The whole subject of electric rates is therefore a very live one and should be given most careful study by central-station executives and all others interested in seeing fair rates established and maintained.

THE ELECTRICAL REVIEW has arranged for a very timely series of articles covering the entire subject of central-station rates in a very comprehensive manner and in such a way that will be found useful to every student of electric rates, *both the beginner and the expert*. These articles will cover about five or more pages of each weekly issue practically throughout the present volume, beginning next week, July 12, and probably ending Dec. 27, 1919. To suit the needs of various classes of readers, those portions dealing with elementary explanations for the beginners and those portions treating the technical features mathematically will be inserted in slightly different type, so that either of these portions can be passed over by the reader who does not care to or cannot follow these minor portions of the general text. The entire series of articles forms a connected whole, however, and besides being a comprehensive and original review of the entire subject includes much new matter which the author has developed.

A fairly good general idea of the scope of the entire series of articles can be obtained from the following:

GENERAL OUTLINE OF THE ARTICLES.

PART I—THE COST OF ELECTRIC SERVICE.

I. The Cost of Commodities in General.

A. THE COST OF A CERTAIN QUANTITY. TOTAL COST AND UNIT COST.

B. COST INCLUDING OR EXCLUDING CAPITAL EXPENSES.

C. SEGREGATE COST, INCREMENT COST AND AVERAGE COST.

D. BY-PRODUCTS.

E. PRODUCTS TO BE MEASURED IN MORE THAN ONE UNIT.

1. GENERAL EXPLANATION.
2. USING A SMALLER NUMBER OF ELEMENTS SIMPLIFIES THE COMPUTATION, BUT REDUCES THE ACCURACY.
3. USING A LARGER NUMBER OF ELEMENTS INCREASES THE ACCURACY, BUT COMPLICATES THE COMPUTATION.
4. INCREASING THE ACCURACY WITH A GIVEN NUMBER OF ELEMENTS BY SUBDIVIDING THE CUSTOMERS INTO CLASSES.

II. The Cost of Electric Service in Particular.

A. THE THREE ELEMENTS OF COST.

1. THE ENERGY COST.
2. THE DEMAND COST.
   - A. THE TOTAL DEMAND COST OF THE PLANT.
     1. *Capital Invested.*
     2. *The Constituents of the Demand Cost.*
        - a. Capital Charges.
          1. Net Returns (Interest, Dividend).
          2. Depreciation.
          3. Repayment.
          4. Other Capital Charges.
        - b. Demand Cost of the Plant Other than Capital Charges.
   - B. APPORTIONMENT OF THE DEMAND COST BETWEEN THE CUSTOMERS.
     1. *The Peak Responsibility.*
     2. *The Theoretically Exact Basis.*
        - a. Apportionment to Individual Customers, Considering the Shapes of Load Curves (Diversity-Factor).
     3. *Central Station's Peak Extending over a Certain Period of Time.*
     4. *The Consumer's Maximum Demand and Substitutes Therefor.*
     5. *The Diversity-Factor.*
     6. *Variations of the Demand Cost per Kilowatt Maximum Demand Between Customers.*
3. THE CONSUMER COST.
   - A. CAPITAL CHARGES.
   - B. OPERATING EXPENSES.
   - C. INFLUENCE OF THE CONSUMER COST ON THE TOTAL COST PER KILOWATT-HOUR.
   - D. VARIATIONS OF THE CONSUMER COST BETWEEN CONSUMERS.

B. DETERMINATION OF THE NUMERICAL VALUES OF THE THREE ELEMENTS OF COST.

PART II—THE PRICE OF ELECTRIC SERVICE.

PART III—SYSTEMS OF CHARGING.

PART IV—RATE ANALYSIS.

PART V—ACCURACY OF RATES.

PART VI—PUBLIC UTILITIES AND PUBLIC REGULATION.

(By S. F. Walker)

The Author—H. E. Eisenmenger.

The author of the articles is H. E. Eisenmenger, who has devoted a great many years of research to the subject of central-station rates. For about 10 years he has acted as assistant to S. E. Doane, chief engineer of the National Lamp Works of General Electric Co., in his rate investigations and similar central-station questions, such as serving the small consumer, codes of wiring, etc. As an outcome of these investigations there was formed the Rate Research Committee of the National Electric Light Association. A few years before the war Mr. Eisenmenger was sent to Europe for a year by the National Lamp Works, during part of which time he was accompanied by Mr. Doane; he visited all of the European countries to study conditions as to electric service and especially what means were taken to reach small customers. The results of this study created a great deal of interest.

Mr. Eisenmenger has worked with several committees of the National Electric Light Association, especially those on Rate Research, Wiring of Existing Buildings, and Wiring Codes. He is the author of numerous articles and papers on rates and related subjects and the originator of two different methods of geometrical representation of rates, one of which was explained in a series of articles in the ELECTRICAL REVIEW AND WESTERN ELECTRICIAN several years ago. For practically a year he made a tour among the central stations of the Pacific Coast in an educational campaign on rate subjects. Prior to his work in this country he spent considerable time in Central Africa erecting a 3000-volt central station for the British Government, and a year in Japan on export business. He is therefore well versed on electrical conditions generally in many countries of four continents and a specialist on electric rates to which he has devoted so much study both here and abroad.

CIVIL SERVICE EXAMINATIONS FOR RADIO POSITIONS.

The U. S. Civil Service Commission announces examinations for the following vacancies in the Navy Department, Washington, D. C., and in the navy yard service: expert radio aid, radio inspector and subinspector, radio laboratorian and radio laboratorian aid. Competitors will not be required to report for examination at any place but applications properly executed must be filed prior to the hour of closing, July 8, 1919. Applicants should apply at once for Form 2118. Applicants will be rated on the following subjects which will have the relative weights indicated: Education, training, experience and fitness, 80; publications, reports or thesis, to be filed with application, 20. Ability to send and receive wireless in the Continental Morse Code is very desirable.

Applicants for expert radio aid, Grade 1, $7.04 per diem, must have graduated from a standard high school or completed a course of study equivalent to that required for such graduation, and must have had at least four years' experience in the design or manufacture of radio apparatus for the Government or for a contractor who has supplied satisfactory apparatus of this class to the Government. The successful completion of each year in a college or university of recognized standing, with major courses in electricity, will be accepted in lieu of six months of the required experience. For Grade 2, $10 per diem, applicants must have the high-school or equivalent education and seven years' of experience prescribed for Grade 1 of each year in a college or university of recognized standing, being accepted in lieu of nine months of such experience. Applicants for Grade 3, $12 per diem, must have graduated with a B. S. degree from a four years' course in a college or university of recognized standing, with major courses of study in electricity, and have had (a) six years' experience in actual responsible administration of the design and manufacture of radio apparatus for the Government or by a company which has supplied satisfactory radio apparatus of this class to the Government; or (b) for six years have conducted advanced research work and made valuable contributions to the science of radio, and be well known to the technical world as an investigator of ability; or (c) a combination of the experience prescribed under (a) and (b) totaling six years.

Applicants for radio inspector, Grade 1, $6 per diem, must have graduated from a standard high school or completed a course of study equivalent to that required for such graduation. In addition, they must have had at least one year's experience in installing radio apparatus in shore or ship stations or in repairing and maintaining such stations in service. The successful completion of each year in a college or university of recognized standing, with major courses in electricity, will be accepted in lieu of three months of the required experience. For Grade 2, $7.60 per diem, applicants must have the high-school or equivalent education and three years of the experience prescribed for Grade 1, each year in a college or university being acceptable as six months of such experience.

Applicants for radio subinspector grade 1, $2.80 per diem, must have successfully completed seven units (usual two years) of high school, and must possess a first-grade amateur license as radio telegrapher. For grade 2, $4.40 per diem, applicants must have the education specified for Grade 1, and, in addition, must possess a commercial radio telegrapher's license, or have possessed for at least two years a first-grade amateur license as radio telegrapher.

Applicants for radio laboratorian, Grade 1, $6.40 per diem, must have graduated from a standard high school or completed a course of study equivalent to that required for such graduation. In addition, they must have been actually engaged for at least two years in the design and manufacture of radio apparatus by the Government or for a contractor who has supplied satisfactory apparatus to the Government. The successful completion of each year in college or university of recognized standing, with major courses in electricity, will be accepted in lieu of three months of the required experience. For Grade 2, $8.80 per diem, applicants must have the high-school or equivalent education and four years of the experience prescribed for Grade 2; the successful completion of each year in a college or university of recognized standing, with major courses in electricity, being accepted in lieu of six months of the required experience.

Applicants for radio laboratorian aid, Grade 1, $3.20 per diem, must have graduated from a standard high school, or completed a course of study equivalent to that required for such graduation. In addition, they must possess a commercial radio telegrapher's license or have possessed for two years a first-grade amateur's radio license. For Grade 2, $4.80 per diem, applicants must have the high-school or equivalent education prescribed for Grade 1, and must have been actually engaged for at least one year in the design or manufacture of radio apparatus by the Government or by a contractor who has supplied satisfactory apparatus of this class to the Government. The successful completion of each year in college or university of recognized standing, with major courses in electricity, will be accepted in lieu of three months of the required experience.

Editorial Comment

A Million Homes Needed

REAL ESTATE men at the recent national convention in Atlantic City reported that there is now a deficiency of something like 1,000,000 homes in various sections of the country as compared with the housing facilities available before we entered the war. Building to supply this deficiency has begun, but it must be accelerated. Electrical men will be sadly remiss if they do not see that the houses and apartments being, and to be, built are properly wired and liberally equipped with sockets and receptacles for convenient use of lighting units and appliances.

Scientific Central-Station Rates

COMPARED with other electrical utilities, the rates of the leading central-station companies are probably the most scientifically and equitably developed. And yet there are many such companies, especially the smaller ones, who have much to learn in this line. The present time, when rates are so largely being revised, is especially appropriate to become acquainted with the latest information on this subject. We take pleasure, therefore, in calling the attention of our readers to the valuable series of articles on central-station rates outlined on other pages of this issue and which will be begun next week. Even experts cannot know too much on this often involved topic and will find much of interest in the articles that Mr. H. E. Eisenmenger has written for the benefit of all having to do with electric rates.

The Street Railways' Case

OVER 13% of the electric railway mileage of the country, principally street railways, is in the hands of receivers. This is a striking indication of the desperate situation confronting these railways. The percentage of bankrupt lines will continue to increase if relief is not soon afforded to the hard-pressed companies. The high labor and other operating charges of the last year or two show no prospect of diminishing; in fact, in some cities the men are seeking wage increases beyond those granted last year.

We have repeatedly urged in these columns that the utility regulating commissions be empowered to pass on wage controversies so that when wage increases are found necessary they can be granted and the income adjusted to provide for them through increased fares or other additional revenue or relief from certain other expenditures. Little has yet been done along this line, but the need for it is greater than ever. The War Labor Board, after raising the wages, recommended to the state utility commissions increase in fares to provide the needed income. The state commissions have been reluctant to act in many cases, however, because lacking authority to review wage scales. It is to be hoped that the Federal Commission now studying the matter will be able to offer a satisfactory and early solution.

Coal Costs Favor Electrically Operated Ice Plants

THE electrically operated ice plant has come in for much publicity and adoption during the last few years for many reasons that have been mentioned many times in these columns. One of the reasons why this type of ice-making and refrigerating plant should be expected to continue is that the cost of coal is high and has every indication of remaining high.

At a meeting of the American Society of Mechanical Engineers, held last December, it was stated that, on an average, there are far more plants requiring one ton of coal to every 1.5 to 2.5 tons of ice produced than there are plants producing 5 tons of ice per ton of coal, these statements applying to simple non-condensing plants. With coal at present prices, the cost of fuel per ton of ice has doubled and trebled in a brief period. Many steam-driven plants are now paying from $1.50 to $2.00 for fuel alone per ton of ice. And then there is the high cost of labor also to be taken into consideration.

Conditions are now extremely favorable to the electrically driven ice and refrigeration plant, and conditions show little indication of radically changing for considerable time to come. Now is the time to go after this load.

Making the Storage of Coal Safer

STORE your coal now, the slogan of a year ago, is still a good slogan today. It should be the slogan every year at this time, because this is the season when the storing of coal should be done, when the output of the mines needs to be maintained, when the railroads can best haul coal.

This year there are many special incentives to buy coal now. The Fuel Administration states a coal shortage will ensue this winter. The Secretary of Labor says a labor shortage impends. The Director General of Railroads predicts a car shortage. These things are all against the production and movement of coal; they are cumulative in inflating prices. Therefore buy your coal now.

However, the summer months are, unfortunately, the least favorable months for storing coal, at least so far as the possibility of spontaneous combustion is concerned. But by following certain clearly defined policies trouble from internal heating of the coal pile can be greatly lessened and possibly eliminated. The safety of coal in storage depends partly upon the coal, but more perhaps upon the manner in which it is stored.

Avoid if possible storing coal that has the reputation of firing when stored. Store, preferably, 4-in. or 6-in. screenings, the portion passing through the screen to be used for current consumption. Keep the coal from one mine and seam together; from different mines separate. In choosing a pile site, avoid rough, hilly, soft, wet and boggy ground. Clear the ground of all vegetation, waste and dirt, and drain if it will not otherwise remain dry. Combustible material such as wood, rags and old clothes become hazards when buried under a coal pile. All sources of heat such as steam pipes, sewers, etc., have no place in proximity to a coal pile.

Coal fires spontaneously by the oxidation of fine coal particles presenting a maximum surface for the air to act upon. Coal, well screened and carefully piled seldom fires, because there is a minimum surface subject to oxidation. Store only approximately uniform coal sizes together because it is where the coarse and fine strata come together that a fire generally starts. Where this cannot be done adopt any of the several ways of watching the internal temperatures of the pile. When these things are done, spontaneous combustion in coal piles will lose most of its dread.

Is Not Co-operation the Solution to Today's Problems?

CO-OPERATION was the theme of Prof. C. A. Adams' presidential address before the A. I. E. E. convention at Lake Placid. In masterly style and with oratorical ability he touched upon many of the problems that are perplexing the world today. Into the problems of standardization, of labor, of capital and industry he brought the message of co-operation, harmony and understanding.

Every engineer should read and read again this presidential address. It is a challenge to some; it is a benediction to others and an inspiration to more. Engineers have been far too prone to consider themselves in the light of engineers, forgetting that they are citizens also. And no more valuable citizen should there be than the engineer with his training and his ability to utilize that training for his city, for his state and for his country.

Unquestionably the engineer can do much in developing solutions for many new vexatious economic, social and political problems. His approach of a problem without prejudices and his calm analysis of the conditions before attempting to pick out the remedy makes his final solution the most logical as well as most practical.

"May we not as engineers utilize our training and experience, our method of thought of which we are so proud, to encourage clean, straight, unbiased and fair-minded thinking, and to encourage that broad, generous co-operative spirit which will mean so much in breaking down the barriers which separate classes within a nation, as well as the nations themselves, and which is essential to the solution of the world problem which is knocking so hard at our door?"

The above, quoted from President Adams' presidential address, asks squarely and tersely what engineers are going to do in solving the pressing world problems of today. What, indeed, are we doing to give the engineer the place in the world that he deserves, that the world needs that he assume now?

Transmission-Line Relay Protection

RELAY protection has assumed very great importance of recent years. And the indications are that it will become even more important as time goes on. Today, many high-voltage transmission systems might more properly be called distributing systems. Systems are linked together, industrial substations and utility switching stations and substations are tied-in together in ring and radial systems so as to form a complete and complicated network in which each is an integral part of the whole.

Present-day standards require continuity of service to a very high degree. The growing complexity of networks, the vaster terraine covered, the greater magnitude of energy transmitted and interchanged between ever-growing loads makes relay protection against short-circuits and reversal of power and the segregation of power cessation vitally important and at the same time very difficult to obtain.

That this matter of relay protection is a pressing one is emphasized by the fact that a considerable portion of the program of the A. I. E. E. convention at Lake Placid was devoted to relay protection and allied subjects. For many years some of the largest transmission companies have been quietly and painstakingly tackling this problem of confining trouble where it occurs, segregating sections of line and substations in trouble and in other allied ways aiming to attain the goal of service continuity. Relay and protection engineering has thus become a recognized phase of central-station technique among those larger companies that tie in steel mills, electric furnaces, industrial plants and many more such loads with their ring and radial systems of high-voltage distributing systems.

Elsewhere appears an abstract of the very able report by Messrs. Roper, Woodrow, Traver and MacGahan on "Transmission-Line Relay Protection." This is an analysis of the protective relay situation throughout the country, and should thus be found enlightening to those that have already studied the matter seriously, and prove an inspiration to those whose systems are only now beginning to feel the need for something better than a hit-or-miss mode of protection.

Relay protection against short-circuits is not only a matter of protecting apparatus. More important still, perhaps, is its function of maintaining continuity of service. Cheap power is important. But central-station service is judged today, not by cost but by quality. Continuity of service is, therefore, vital. Relay protection has done much and will yet do more to make continuity of service and central station synonymous terms.

Popularizing the Convenience Service Outlet

ELSEWHERE in this issue, a definite, practical plan to promote the installation of baseboard and wall outlets, which has been introduced by Mr. John G. Learned, chairman of Commercial Section, N. E. L. A., is described. For many years the electrical industry as a whole has recognized the need for the more adequate installation of such outlets but until now no real workable plan has been evolved therefor.

The value of such outlets is now apparent to every electrical man for they affect every branch of the industry—manufacturer, contractor and dealer, central station, jobber and the electrical inspector. Of these, the latter is the only one that has hitherto given the problem any consideration and it is only fair to say that he deserves the thanks of the industry for not having adopted some arbitrary means of combating this difficulty before.

However, Mr. Learned's plan in itself is a worthy one and deserving of the fullest support and cooperation of all parties concerned. The plan as laid out provides for an educational campaign to create a demand for these outlets from the public. The first part of this campaign is to be carried out by the manufacturers of electrical appliances who in their advertising and displays will show their devices connected to a wall, floor or baseboard receptacle. This will impress the public with the convenience of such outlets and naturally create a demand for them. The rest is up to the contractors, dealers and central stations. If these interests will get behind the idea and through their efforts and example try to "put it across," one of the greatest barriers to the use of electric power and appliances in the home will be removed and the results will surely prove worth while.

Spread of Estimators' Organization

BEGINNING with the organization of the Chicago Electrical Estimators' Association about a year and a half ago, the idea of forming associations composed of electrical estimators has grown steadily until at present there are at least five such organizations composed only of estimators and several more that, although they include others in their membership, are making a study of estimating problems. These associations have already accomplished a great deal toward standardizing electrical construction and in addition have brought forth considerable data which should stabilize the contracting business. For the estimator is the heart of the contractor's business and upon his work and ability often depends the contractor's success or failure.

However, there is still a considerable amount of work to be done along these lines, which can best be undertaken by such associations, much of which is dependent upon local conditions and can therefore be accomplished more readily by local organizations. For this reason not only the contractors but the jobbers, central stations and manufacturers should encourage and foster such organizations where they exist and endeavor to have others formed wherever possible.

The Forty-four Hour Week

ORGANIZED labor throughout the world is tending toward better working conditions and shorter working houhs. Last week the American Federation of Labor went on record unanimously as advocating a 44-hour week. It went further, by forecasting a five-day week to take care of unemployment. British unions have already adopted a 44-hour week in some cases; although let it be said the workers are now finding it a two-edged sword.

The shorter day for the same pay is not the same in result as higher wages; the latter stimulates efficiency and increases production. Shorter hours for the same pay almost invariably means higher production costs and lower production. This will tend toward higher prices unless the employer can obtain more output per employe per hour to offset the shorter working hours. In some cases this cannot be done without forcing the men to work more intensively. In many cases it can easily be done, however, without driving anyone harder. This has been shown by the greater and greater use of machinery in almost all industries. Machinery and the use of more scientific and efficient production methods is permitting more output to be obtained during the present customary 48-hour week than during the former 60 or 64-hour week. We have by no means reached the climax in the use of automatic and labor-saving machinery.

It is impossible to foretell just what will be the effect of a shorter working day. It certainly will necessitate the adoption of more efficient methods in industry and more intensive employment of machinery, electrically driven. In industries, such as the steel mills and foundries, it may mean higher load-factors, because of the necessity of maintaining double shifts in many cases. In fact, the need for increased efficiency and production will in many industries compel working three shifts throughout the 24 hours per day.

Workmen in former days used to combat the use of machinery. Nowadays they recognize that through machinery their hours of work have steadily grown less and their condition as steadily has improved.

Current Events

Engineering Society Celebrates Fiftieth Anniversary—Central-Station Men Convene—Ruling on Competitive Service

WESTERN SOCIETY OF ENGINEERS CELEBRATES FIFTIETH ANNIVERSARY.

Review of the Society's Growth and of the Engineering Developments of Fifty Years.

On June 27 the Western Society of Engineers celebrated its fiftieth anniversary. Two meetings were held on that day in the rooms of the society at Chicago, the first one being in the afternoon, at which the Past-President H. J. Burt presided in the absence of President Baldwin, who was called out of the city. Secretary E. S. Nethercut read a paper reviewing the history of the organization, which was formed May 25, 1869, as the Civil Engineers' Club of the Northwest. It was the third engineering society formed in the United States, the two preceding ones being the Boston Society of Civil Engineers, organized in 1847, and the American Society of Civil Engineers, organized in 1852. At the present time there are 15 national engineering societies, beside a great many state and local organizations.

Only two of the original charter members of the Engineers' Club of the Northwest survive. The first president was Roswell B. Mason, then mayor of the city. In June, 1880, the club was reorganized and its name changed to the Western Society of Engineers. In 1908 the present quarters in the Monadnock Block were enlarged and have become the chief engineering headquarters in the Chicago district. Up to 1909 the membership of the society was practically doubled each 10 years, but since then its growth has been much slower because the national societies at that time began the establishment of local sections. The Chicago sections of these societies hold meetings jointly with the Western Society of Engineers very frequently and in its rooms.

Many notable papers have been presented before the society, among these being several dealing with the investigations in aerial flight by Octave Chanute, a former president of the society. The society's code of ethics has a number of unique features. A standard of length was set up in the City Hall of Chicago through the influence of the society. The latter also took a prominent part in the passage of a law licensing structural engineers. Mr. Nethercut in conclusion pointed out the possibilities for the society becoming in a still larger sense the headquarters for engineering organization activities in the district tributary to Chicago, in which there are some 5000 members of various engineering societies, a large part of whom should have membership connection with the organization.

Samuel O. Dunn, editor of the *Railway Age,* reviewed the developments of 50 years in railroad engineering. The railroad engineers of this country have had an entirely different task from those abroad, because they had to build lines to develop the country, instead of merely furnishing transportation in sections already developed. In 1869 the first transcontinental line was opened and from then on up to 1895 there occurred an enormous building of railroad lines, especially in the West. Since that time the development has been more in the way of intensifying traffic and facilities along lines already built. As an instance of the growth in train weights, Mr. Dunn cited that when the Interstate Commerce Commission was established freight trains averaged about 175 tons, whereas now they average about 700 tons. A similar increase in length and weight of passenger trains has occurred. Railroad development now is at a crisis because of high labor and material costs, which call for more efficient utilization of each. The question of returning the lines to private ownership is a very difficult one. Although Mr. Dunn has some misgivings regarding the future of railroad development, he feels that the public will not let the lines suffer and thereby impair the commercial and industrial progress of the country.

James R. Bibbins gave a review of the developments in steam and power engineering, which he said were especially noteworthy since the beginning of this century. From very small sizes steam turbines have grown to extraordinary capacities. Boiler units also developed from 250 hp. to duplex units of 3000 hp. rating, with enormous and very efficient combustion chambers and a stoker at each end. Extreme care has been given to study and design of the parts of steam turbines, to the utilization of higher pressures and superheats and to the use of higher speeds. The outcome has been the gradual development of the very large units of today. At the same time important developments have taken place in the way of generators and other rotating electrical machinery and other power plant auxiliaries. Much of this has been made possible through the developments in the metallurgical line, which have permitted the imposing of much more severe strains upon metals and alloys. Together with the growth in capacity has been an extraordinary advance in efficiency in every step of the process of power production from the coal pile to the busbars. In the case of the largest turbo units the thermodynamic efficiency at the best load now is nearly 25%, which has given the internal-combustion engine a very close race. Improvement in reliability has also taken place, as for instance improved condenser practice has practically eliminated air troubles and the water that leaves the condenser is practically the same temperature as the entering steam. Organization of power plants has also been highly developed. Remote control is now largely used because of its simplicity and directness at the command of the load dispatcher. Many automatic protective devices, indicating and recording instruments are now employed, so that the operation has been highly perfected. As the result of the increase in size of units the installation cost has been decreased from something from $150 per kw. to about $70. At the same time the over-all commercial efficiency has been very greatly raised.

J. R. Cravath gave a review of the developments in electric lighting and power applications, all of which took place within 50 years. During the 70's the electric motor was developed and a few years later the arc lamp, followed in the early 80's by the introduction of incandescent lamps, and in the later 80's by the use of motors for electric railways. The alternating-current developments began in the early 90's and soon resulted in the growth of power distribution systems or networks, which have become very extensive especially since the beginning of the present century. Machine drive is now almost entirely electrical, whether power is derived from the central station or an isolated plant. Electric lighting developments have been very rapid and now electricity has replaced almost everything else in the illuminating line, even on the farm. Especially in lamp and lighting development the result of research has been of untold value.

Frank F. Fowle gave a review of developments in electrical communication, especially in telephony. He reviewed the development of the telephone from the inventions of Dr. Bell and the gradual growth that took place during the life of the original basic patents. After these expired great stimulus was given to the industry, many independent manufacturing and operating companies entering the field soon after 1895; now there are about 13,000,000 telephone stations in the United States. During the late 80's took place the development of simultaneous telephony and telegraphy on the same wires; later the introduction of Pupin loading coils extended long-distance telephone service. The use of repeating coils aided this further and during the last few years the use of the vacuum type of repeater, based on the audion, has given telephony wonderful possibilities. The automatic telephone was first developed by the independent telephone interests. The war has aggravated the operating troubles of all telephone companies, due to higher wages and scarcity of operators, so that the automatic telephone is undoubtedly going to be put into quite extensive service, as soon as the companies can provide the necessary heavy financial investment required. A change is now coming about through gradual abandoning of the open overhead wire lines and converting them to cable lines, either overhead or underground; the use of the audion repeater has made this commercially possible and this will make for great increased reliability of service during storms. The audion has also made possible the use of multiplex telephony.

John W. Alvord gave a review of sanitary engineering, showing that from 90 to 95% of what we call modern sanitation has been developed within 50 years. Since in the early 80's, when the study of bacterial origin of disease began, water and food supplies have been very materially purified. The filtering of water supplies is now carried out very extensively. Water works systems have become common only since about 1880. The treatment of sewage and other wastes, as well as the purification of water supplies has helped increase the average human life from 23 years at the close of the 18th century until about 40 years in 1900. Typhoid fever is no longer a serious menace. Whereas 20 years ago it was common to have 20 to 120 deaths per 100,000 persons annually from this cause, now this seldom exceeds 5 deaths for the same number.

After dinner at the Chicago Engineers' Club, an evening session was held in the rooms of the society at which Col. Henry A. Allen of the 108th Engineer Regiment was the principal speaker. He gave a general summary of the history of this regiment, which was originally the First Regiment of Engineers, Illinois National Guard. Soon after the outbreak of the war it was increased in strength, trained at Camp Logan and sent to France. Colonel Allen gave an interesting account of the various experiences of the regiment in building all kinds of structures for the expeditionary forces, as well as bridges and other military works close to and frequently in advance of the firing line. He spoke very emphatically in favor of thorough preparedness and much longer training than was possible during the recent war. A soldier should have at least two years of training and an officer from 4 to 6 years. To rush insufficiently trained troops into service under insufficiently trained officers is practically committing murder, because of the absolutely unnecessary sacrifice of the men involved thereby. He also emphasized the need of thorough equipment.

The remainder of the evening was devoted to addresses by past presidents of the society. The society has had 41 presidents, of whom 17 have died. Of the remaining, 12 were present at the meeting. Addresses were made by Past-Presidents S. G. Artingstall, Isham Randolph, John F. Wallace, Ralph Modjeski, William L. Abbott, C. F. Loweth, Andrews Allen, John W. Alvord, Albert Reichmann, H. J. Burt and Charles B. Burdick. Most of these addresses were of a reminiscent character and several of the late past-presidents pointed out the opportunity for the society as the engineering headquarters for Chicago. Communications were also read from Past-Presidents W. B. Jackson, W. C. Armstrong, B. E. Grant, R. W. Hunt and E. H. Lee, and from a former secretary, J. W. Weston, and Mr. Blunt, one of the charter members.

Saturday, June 28, was devoted to an all-day outing at the Dunes, a very interesting geological sand formation with a great variety of botanical specimens at the southern end of Lake Michigan in Indiana.

INDEPENDENT TELEPHONE MEN DISCUSS THEIR PROBLEMS IN CONVENTION.

Annual Gathering of United States Independent Telephone Association Held in Chicago June 24-26.

A very well attended annual convention of the United States Independent Telephone Association was held at the Hotel La Salle, Chicago, on June 24 to 26. inclusive. The 900 odd delegates and guests were welcomed to Chicago by E. T. Stevens, of the Chicago Association of Commerce, and O. F. Berry replied for the association. In his annual address President G. W. Robinson, St. Paul, reviewed the principal features of the association's work and its importance to the industry. He referred to the taking over of the telephone lines by the Government last year and said that, on the whole, the companies had benefited thereby.

Secretary-Treasurer W. S. Vivian, who recently returned from service in France, in presenting his annual report made many valuable suggestions on how the association could develop and increase its service to its member companies. He urged employment of practical specialists in several branches of telephone work. A committee was appointed to consider means for putting Mr. Vivian's ideas into effect. L. E. Hurtz, of Lincoln, Neb., narrated his experiences in Washington, D. C., assisting F. B. MacKinnon in representing the independent companies before congressional committees and various executive branches of the Government, especially since the Government took over the lines.

At the Wednesday session the election of ten members of the board of directors was effected, after which

Capt. Terry W. Allen, of Jackson, Tenn., spoke of the strenuous work of the Signal Corps in France. B. J. Mullaney, Chicago, described the publicity campaign of the Illinois Committee on Public Information. Samuel Insull, president Commonwealth Edison Co., spoke on "The Present Position of Public Utilities," as reported in our last issue.

A luncheon session was then held at which H. F. Atwood spoke on "Our Constitution—an Antidote to Bolshevism." F. B. MacKinnon, vice-president of the association and for many years its representative at Washington, D. C., spoke at length on the work accomplished at the capital. He reviewed in detail the steps taken when and since the Government took over the lines and interpreted many orders of the Postmaster-General and also his general policy.

During the afternoon the board of directors held a meeting at which F. B. MacKinnon was elected president of the association for the ensuing year; Frank L. Beam, J. B. Earle and W. F. Goodrich were elected first, second and third vice-presidents, respectively. President-elect MacKinnon presided at the concluding session on Thursday. O. A. Knell, St. Paul, Minn., presented a paper on "Choosing Employes by Test." Dr. F. A. Wolff, of the Bureau of Standards, led a discussion on telephonic standardization, in which A. B. Smith, H. D. Currier, and R. H. Manson participated. Miss M. Martin spoke of the work of the girls with the Signal Corps in France. After addresses were made by several other incoming officers and resolutions were adopted approving the rate changes made by the Postmaster-General, the convention adjourned.

IOWA SECTION, N. E. L. A., HOLDS INTERESTING MEETING.

Features of Public Utility Management Brought Out at Annual Convention at Colfax.

Public utility management was the principal topic of discussion at the annual convention of the Iowa Section, N. E. L. A., held on June 18, 19 and 20, in Colfax, Iowa. According to the preliminary announcements sent out, this convention offered an opportunity to get a four-year course in this subject in three days and from the variety of excellent papers presented, together with the lively discussion that followed, it is evident that this contention was true.

In his opening address, President Bellamy made several valuable suggestions intended to further the activities of the section and broaden its scope and pointed out the difficulties being encountered by many companies due to the higher costs of labor and materials. These advances, he explained, would not be overcome by operating economies and it was therefore necessary to increase the rates in many cities.

William Chamberlain, general counsel of the United Light & Railways Co., Cedar Rapids, Iowa, then addressed the members on "Rate Litigation in Iowa," in which he described the difficulties encountered by many utilities in securing necessary rate increases. Following Mr. Chamberlain, Dean William G. Raymond, of the State University of Iowa, explained the work of the Board of Conciliation which rendered valuable assistance to the utilities during the war but, being purely a war-time measure, will be dissolved shortly. Other papers presented during the meeting which dealt with the subject of rates were: "Rates as Affected by the Increased Cost of Production and the Attitude of Regulatory Bodies Thereto," by X. A. Warfield, Illinois Traction System, Peoria, Ill., and "Principals to Be Observed in Determining a Rate for Electric Service in Cities Under 5000," by Prof. J. B. Hill, of Iowa State University. At the conclusion of Professor Hill's address a lively discussion ensued which brought out very clearly the value of having a uniform method of determining rates for service in the various localities in the state. W. A. Jones, of the Empire District Electric Co., Joplin, Mo., explained the accounting system recommended by the Accounting Section of the N. E. L. A. for use in small plants. Prof. F. O. Paine, of Iowa State College, told of the four-day course in meter testing for the employes of small plants which was conducted during the past winter and described the many valuable results which had been obtained.

The principal addresses at the banquet were delivered by John F. Gilchrist and E. W. Lloyd, both of the Commonwealth Edison Co., Chicago. Mr. Gilchrist's address dealt with public relationship and the advantages of securing the good will of the public. Mr. Lloyd described the work which is to be carried on by the national association during the coming year and its effect on the local section activities.

Several interesting and instructive papers relative to farm services were also presented, the principal one being "The Electric Transmission Line and Telephone Interference Situation in Iowa With Respect to Farm Line Service," by H. S. Phelps, electrical engineer, Iowa Railroad Commission. From the discussion it is evident that the companies realize the necessity of devising some means of serving the farmer for the demand for such service has grown tremendously in the past few years. Several other addresses were also made which dealt principally with municipal ownership and socialism.

The meeting closed with the election of officers for the coming year which resulted as follows: President, O. H. Simonds, Dubuque; vice-president, J. P. Ingle, Keokuk; secretary-treasurer, M. G. Lind, Des Moines. The following directors were also chosen: Austin Burt, Waterloo; B. G. Schmidt, Elkrader; Paul Myers, Grinnell; John Drabelle, Cedar Rapids; C. E. Burke, Sioux City; F. J. Hanlon, Mason City; Charles Miller, Claremont; C. G. Johnson, Davenport; C. E. Farney, Ottumwa, and F. W. Brooks, Omaha.

NEBRASKA CENTRAL-STATION MEN HOLD ANNUAL CONVENTION.

Probable Effect of Coming State Constitutional Convention on Utilities Principal Topic of Discussion.

The Nebraska Section of the National Electric Light Association held its annual convention at Grand Island, Neb., June 18 and 19. The meeting this year proved to be exceptionally interesting, for in addition to the usual technical discussions, several interesting addresses on public relationship were presented.

J. E. Davidson, of the Nebraska Power Co., Omaha, president of the section, presided during the meeting and also delivered a very interesting address in which he reviewed the effects of the war-time conditions on Nebraska central stations and explained that the efforts to meet these conditions which will undoubtedly prevail for some time to come, should be continued. He also pointed out the need of co-operation among the members in order to secure the proper support of the state authorities which would enable the companies to overcome these conditions.

Charles Kelsey, of Norfolk, Neb., described the probable effect of the coming constitutional convention on public utility companies. This convention has been called to remodel the present state constitution and will undoubtedly incorporate in the new constitution some measures affecting the utility companies. The exact nature of these measures cannot be determined as yet, but the utilities should exert every effort to secure proper legislation. At present, the only work that can be done is to educate the public to the utilities' problems and thus secure their co-operation.

Another interesting paper entitled "The Man in the Street" was read by R. J. Andrus, Grand Island, Neb. In this paper, which was written by S. M. Kennedy, of the Southern California Edison Co., Los Angeles, Cal., the necessity of securing the co-operation of the general public and the methods to be followed in accomplishing it were clearly brought out. J. M. Smith, of Omaha, presented a paper on the "Sale of Utility Securities to the Public" in which he pointed out the value to the utility of taking the consumer into partnership by making him a shareholder. In addition the "Attitude of the Public Toward Utility Companies" was described by F. E. Helvey, of Lincoln, Neb.

The work which is being done on the National Electrical Safety Code was described by Mr. Sahm of the Bureau of Standards, Washington, D. C. In addition the following papers were also presented: "New Business," by W. S. Byrne, of Omaha, Neb.; "Modern Steam Central-Station Practice," by H. A. Lynette, Chicago, and "Safety Measures and Accident Prevention," by C. B. Scott, of Chicago.

The following officers were elected: T. H. Fritts, Central Power Co., Grand Island, Neb., president; James B. Harvey, Nebraska Power Co., Omaha, vice-president. J. E. Shuff of the Lincoln Gas & Electric Co., Lincoln, Neb., is at present secretary, but arrangements are being made to provide for a paid appointee to this position.

At the close of the meeting an inspection trip was made to the new hydroelectric station of the Central Power Co., at Boelus, Neb.

PENNSYLVANIA SUPREME COURT MAKES IMPORTANT RULING ON COMPETITIVE UTILITY SERVICE.

The State Supreme Court, Pennsylvania, has handed down a decision in connection with the application of the Perry County Telephone & Telegraph Co., Landisburg, Pa., to the Public Service Commission for permission to construct a new line between New Bloomfield and Newport. The Court upholds the Commission in its refusal to permit the company to construct the line; the Commission held that the present service to these communities, as rendered by the Perry County company and the Cumberland Valley Telephone Co., was fully adequate. In this the Commission maintained that the construction of the line under the circumstances would double the capital charge upon which the public would pay and would also divide the service between two companies so that the same public would be required to rent two telephones in place of one in order to reach all local users.

In sustaining this view, the Supreme Court establishes important precedents as regards so-called ruinous competition by public utilities and says, in part:

"Competition may be and is very desirable in many lines of business; there are, however, a number of quasi-public enterprises which may be classified as natural monopolies in case the duplication of facilities merely results in the placing of an additional burden upon the public by forcing persons to maintain two systems where one would serve the purpose as effectually and at less cost. In this class may be placed the furnishing of gas, water, electricity and telephone service to the public. The argument that competition between rival facilities serves to reduce the price to the consumer is not sustainable logically.

"The duplication of telephone systems, for instance, in a given locality without connection between their lines requires subscribers to install both systems and pay double service to reach subscribers on but one of the two systems. Or, as frequently happens, subscribers maintain both systems when they can reach other users with equal facility on either system.

"It is useless to argue that the cost of construction of such duplicate systems is paid by investors and the risk of financial failure is theirs, because to the burden of finally paying the carrying charges, and income to the investors is imposed upon the public with the result that a higher charge on the part of each competing company becomes necessary, due to the division of the patronage of the public. This is especially true in the smaller cities and country districts where the public to be served is limited in numbers. To hold, therefore, that public policy, as indicated by the section of the constitution in question, was intended to permit the construction of competing lines under any and all conditions without inquiry into the character of the territory to be served and the existence in the locality of facilities adequate to accommodate the public, would amount to a destruction of the very object the policy is designed to establish."

ELECTRIFICATION OF RAILWAY IN BRAZIL.

A director of the Central of Brazil Railway, Government owned and operated, has presented to the Minister of Communications plans for the electrification of the suburban lines of the road and the trunk line from Barra to Pirahy, as well as general plans for the suburban service and the closing of the roadbed from the main station to Deodoro.

The Commission chose high-tension, direct current for the suburban service, and recommended that the current be purchased from one of the existing power companies rather than have the company install a plant of its own.

The approximate cost of the rolling stock, substations, aerial lines, etc., is estimated at $4,307,377. This does not include the cost of car sheds at the main station and at Deodoro.

The first work to be undertaken will be fencing in and raising the level of the track in order to avoid accidents. It is believed that by closing in the lines the revenues of the suburban service will be greatly increased, as such a step will facilitate a better fiscalization of the passenger receipts. This work will probably cost about $1,398,238, the estimate being based on the prevailing prices of materials.

The director added that in case the total amount required for this work was not available during the present fiscal year, it would at least be well to begin the work of closing the line, as a half million dollars was appropriated for this purpose in the budget law for this year.

Upon receipt of the plans, the Minister of Communications approved them and directed that the work of closing in the line from the central station to Deodoro be initiated.

Commercial Practice

Vigorous House-Wiring Campaign — Live Window Displays—Truck Fleet Large Power User—Message by Movie

DUQUESNE LIGHT CO. PUSHING VIGOROUS HOUSE-WIRING CAMPAIGN.

Aims to Wire Five Thousand Houses by the End of the Year.

The Duquesne Light Co. is pushing a vigorous house-wiring campaign, that is a very ambitious one. Special effort is being made to wire old houses, and the high mark or goal the company is after is 5000 such houses in the Allegheny and Beaver Counties of Pennsylvania. A new reduced electric light rate goes into effect on July 1, and this, coupled with the campaign and healthy conditions, leads the company to look for the most prosperous year in its history so far as concerns the wiring of houses and obtaining the residential load.

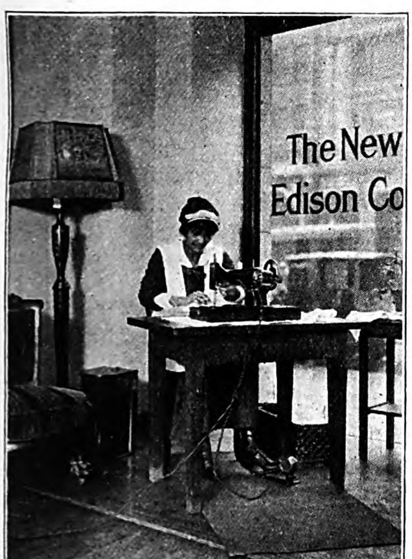
The greatest year in the company's wiring history was in 1917, when 2612 houses were wired. During the first five months of that year 940 old houses for wiring were secured. During the first five months of this year the company actually closed 1804 contracts for wiring old houses in Allegheny County alone, as compared with 1829 for the whole of 1918. In Beaver County, 270 contracts have been closed, as compared with 200 during the whole of 1918. This means that for the first five months of this year a total of 2074 old house-wiring contracts have been obtained, whereas the total for the entire year of 1918 reached 2029. It is in face of these facts that the company faces with enthusiasm and faith the campaign which carries with it the slogan, "5000 Wiring Contracts by Jan. 1, 1920."

LIVE SHOW-WINDOW DISPLAYS BRING MANY SALES.

New York Edison Co. Finds Window Demonstrations of Labor-Saving Devices to Have Great Drawing Power.

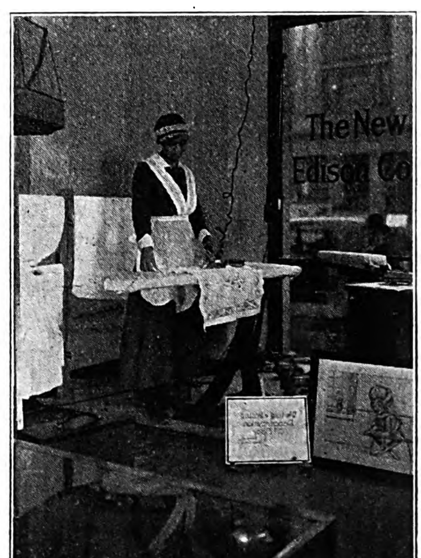
An elaborate system of window demonstrations of electric labor-saving devices for the home has been instituted by the Showroom Committee of the New York Edison Co., New York City, and is producing most satisfactory results in increasing the sales of household appliances. This window-display work was begun last December simply to catch the attention of the Christmas shopping crowds that pass along Forty-second street, that busy up-town thoroughfare where the Edison company has a branch office. The demonstrations, however, were so successful that they have been extended to seven of the company's showrooms and recently, by special arrangement, to the showroom of the Yonkers Electric Light Co., Yonkers, N. Y.

For each week a different subject is selected. Thus, the first week might be washing and ironing; the second, cooking on small electric appliances; the third, sewing by motor-driven machine; and the fourth, vacuum cleaning. The windows are arranged to represent home conditions as much as possible and to give reality; real work is done, not merely the lifeless doing the same thing over again, which is the bane of most window demonstrating. Blankets and small rugs are washed in the laundry machines, features which have scored among the women in the crowds gathered to watch. When cooking is done in the window, the women outside are invited to step in and



Electric Sewing Machine, Operated by a Uniformed Attendant, Proves Excellent Show-Window Attraction in New York Edison Co.'s 42nd Street Showroom.

Electric Dish-Washing Exhibit Ready to Go Into Display Window—Where Customers Cannot Afford to Purchase a Dish-Washing Machine, Electric Fans Are Recommended for Drying.



The Electric Ironing Window Demonstration Produces More Orders Than Any Other—After a Week in the Window This Exhibit Was Used in the Showrooms and Still Brought Sales.

sample the food, to convince them that it does taste as good as it looks. When vacuum cleaners are demonstrated, not only rugs are cleaned, but clothes, curtains, cushions and sofa pillows, to suggest the wide usefulness of a cleaner in an actual home.

Although these extensive demonstrations were intended originally for the crowds along Forty-second street only, when the showroom orders began assuming a marked ascent, other of the larger offices requested demonstrations. Then experimentally, a vacuum cleaner exhibit was made for a few days in the window of one of the smaller offices, in a location supposedly not favorable to this method. Within a few days, ten cleaners were sold there; needless to say, it was arranged to continue demonstrations in this supposedly "unproductive" territory. With the smaller offices, however, the best results are obtained by having demonstrations on alternate weeks, so as not to exhaust local interest. As an added attraction for the summer, window demonstrations of drying and preserving fruits and vegetables will be made, using electric fans for drying and an electric fireless cooker for canning.

A rather surprising item of this campaign has been the extraordinary success of an ironing exhibit arranged at first simply as a background for a window demonstration of washing and ironing. Behind the window was arranged a large table filled with flatirons of every type and make, and nearby stood a demonstrator, who ironed all day long without apparent effort or fatigue. During the first week of this exhibit, orders were taken for a daily average of 14 irons, and the showroom force requested its continuance until the sales fell away. That was two months ago, and the pulling-power of the exhibit has remained almost undiminished. At a conservative estimate, nearly $2500 worth of orders have been taken at a cost of between 5 and 6% of the amount represented.

These demonstrations also follow out the well-known policy of the New York Edison Co., as determined by Arthur Williams, general commercial manager, to have Edison showrooms take orders for manufacturers, but not to have the company go into the selling business on its own account. Customers attracted by the demonstrations go into the showrooms where they see appliances representing the products of the best known manufacturers, who in this way, profit as well by the advertising value of the "live" windows. On the other hand, the Edison company believes that it gains more than the actual new business as the demonstrations tend to increase the usage of apparatus already on the lines, when people in passing the windows see some of the less common applications of the devices illustrated by the demonstrators. Although not so spectacular as the widely advertised and elaborately conducted flatiron or cleaner "week" usually advocated, the net results of this new form of sales-pushing indicate that it is more satisfactory for a city of the size of New York.

ELECTRIC TRUCK FLEET GOOD CONSUMER OF ENERGY.

Fleet of Thirty Trucks Uses Nearly 11,000 Kw-hr. Each Month.

The Duquesne Light Co. operates a fleet of 30 electric trucks in Pittsburgh in connection with its business. These trucks are giving a good account of themselves as to work, while proving economical as to operation.

The average energy consumption of these 30 electric trucks averages about 10,900 kw-hr. each month, or about 364 kw-hr. per truck per month. On the basis that the average family uses about 18 kw-hr. per month the year round, the energy consumed by this fleet of 30 trucks is about the same as would be consumed by 7266 houses during one month, or 605 houses for a whole year. This fact emphasizes the value of the electric truck as a load builder, it being borne in mind that the energy consumed by these vehicles is consumed at a time when the houses or residents would be using little if any.

THE ELECTRICAL MESSAGE TO MILLIONS VIA THE MOVIE ROUTE.

Society for Electrical Development Displays Seven Educational Films to Exporters.

On June 27 there was held a review of seven motion-picture electrical films prepared by the Society of Electrical Development and one by the Western Electric Co. This exhibit was unique in its inception and its execution.

Not long ago, Mrs. May Savell Croy, an expert on electrical house furnishings, installed a complete electrical kitchen and laundry in the beautiful new Bush Terminal Sales building at 130 West Forty-second street, New York. This is part of an "ideal cottage" in which the wonders of electricity are explained to visiting importers, exporters and buyers from all over the world.

Exporters who recently visited the Bush Sales building were interested in knowing that a film had been made the previous day at Mrs. Croy's exhibit and wanted to know where they could see it. The film, "Table Cookery," was developed by the Society for Electrical Development and the Universal Film Co. So, for the special benefit of the exporters and by courtesy of the Bush Terminal Co., an exhibit was arranged at which the Society's films and one of the Western Electric Co. were shown, and to which also were invited prominent men of the industry in New York, Brooklyn, New Jersey, and the members of the Society in the Metropolitan District. Also there were in attendance newspaper men, representatives of the trade press, and the women household editors of prominent magazines.

The Society's staff works with various film companies to offer electrical suggestions, correct errors and devise useful educational propaganda. The Society has prepared over a dozen special electrical moving-picture films, in conjunction with the Universal Film Co., and has worked with the Western Electric Co. and other manufacturers and jobbers to the same end.

DEVICE CAMPAIGNS FLOURISH IN ARKANSAS.

The commercial department of the Arkansas Valley Railway, Light & Power Co., Pueblo, Colo., is conducting a series of campaigns on electric household devices. A recent electric washing machine campaign resulted in the sale of 18 machines and prospects for many more. An electric vacuum cleaner campaign is now in progress and later another campaign will be opened on the small labor saving electric appliances. In a recent week local contractors secured in co-operation with the company's commercial department, orders for wiring 52 already-built houses.

Operating Practice

Reducing Flash-Overs of Converters — Generator Waterproofing — Relay Engineering — Identification of Piping

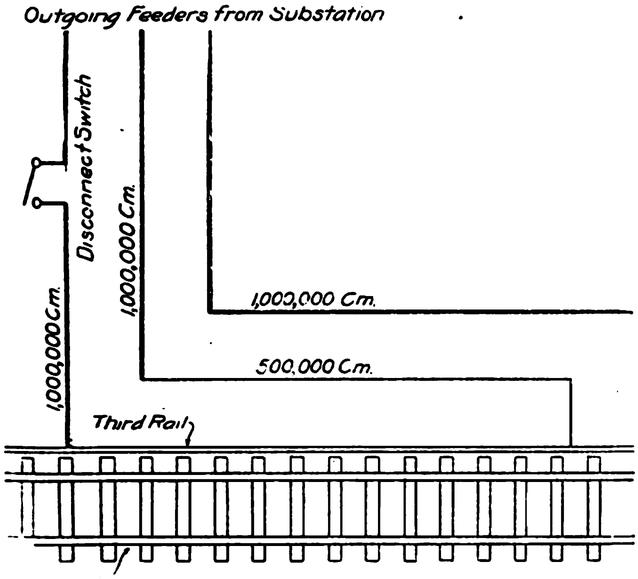
REDUCING CONVERTER SHUT-DOWNS BY CHANGING FEEDER LENGTHS.

Variable Feeder Lengths According to Loads Overcomes Trouble.

It has been the experience of companies supplying electric railroads with direct current that trouble is to be expected when the synchronous converters are located at heavy load centers where the loads are heavy and the feeders of short length. Such locations are those where a substation is located directly at a railroad terminus or freight yard. In these instances the third rail or trolley may be used as a feeder, and feeder lengths may be short. The result is that a heavy swing of current due to trouble on the railroad reacts directly back to the station bus.

One manner in which this trouble may be overcome is to increase the length of the feeders or insert resistance so as to increase the equivalent feeder length —that is, the resistance of the circuit. And then the introduction of resistance is not the same as the introduction of inductance, resistance being effective while current is passing through it, while inductance is effective only while the current value is changing. Obviously, therefore, the introduction of inductance is preferable to the insertion of resistance since it affects the circuit—the voltage regulation—only when actually needed, namely, on current change.

In one instance where a substation was located



Schematic Layout of Railway Feeders for Changing Equivalent Feeder Length With Load.

directly at a large electric terminal yard, the current rushes due to short circuits were very severe. When two synchronous converters were operating these short circuits only opened the feeder breaker, but when one machine was operating alone its breaker would open, shutting down the converter, and sometimes causing it to flash over. There were a number of heavy feeders going to the yard. Two of these were of 1,000,000 c.m. and about 300 ft. in length. One of these tapped directly to the third rail; the other connected to a 500,000-c.m. cable which tapped to the third rail some 1000 ft. away.

Flash-overs and the opening of the machine circuit-breakers occurred only when one synchronous converter was operating. The trouble was overcome in the following simple and inexpensive manner. In the substation basement, the 1,000,000-c.m. cable that connected directly to the third rail was cut open and connected to a disconnect switch of sufficient current-carrying capacity. During comparatively light load periods, when only one synchronous converter was used, this switch was opened by the operator and left open, the effect of which was to feed the third rail over the feeders having 1000 ft. of additional length. The result was that the low resistance of the 300 ft. of 1,000,000-c.m. conductor was eliminated, thereby reducing the current rush on short circuit, and yet without increasing seriously the voltage drop at the normal current of light load. When the load increases sufficiently to warrant operating two converters, the disconnect switch in the short 1,000,000-c.m. feeder is closed.

WATERPROOFING TURBOGENERATOR WINDINGS.

Generous Use of Varnish Lessens Objections to Use of Water.

Considerable publicity has been given of late to the matter of fireproofing turbogenerators and how best to fight internal fires when they do occur. Water, steam, carbon tetrachloride and carbon dioxide have been suggested, with water and steam in preference on the score of cost, availability and safety.

In using steam cognizance must be taken of its effect upon insulation and to what extent the heat and moisture will cause disintegration of cambric and varnishes. The insulation of turbogenerator windings may be divided into three classes, all-fibrous, composite and all-mica, and each of these will be affected differently by both water and steam.

All-fibrous insulation is now used only on the older machines, and is not waterproof in any sense of the word. Composite insulation is made up of mica tape, is treated in a vacuum and finished with layers of tape which is fibrous material. By careful and generous application of varnish this composite insulation can be made to approach if not attain a waterproof condition. All-mica insulation is waterproof, except where tape is applied on the job, and here also several good coats of varnish makes this type of insulation waterproof.

Little fear need, therefore, be apprehended in applying water to turbogenerators whose windings are insulated with all-mica or composite insulation. On the other hand it should be made a special point when overhauling and doing the periodic annual repairs to the older types of machines using fibrous insulation to pay special attention to applying generous coatings of varnish so as to seal up this form of insulation lest the time come when it may be necessary to fight an internal fire with water or steam.

CONSIDERATIONS AFFECTING OPERATION OF OVERLOAD RELAYS.

By A. E. Hester.

No set rules can be laid down to govern the application of relays. Each and every power system has its own peculiarities and the choosing and setting of relays must be governed by these. However, if a careful study is made of the system and the conditions existing on each section are thoroughly analyzed no great difficulty should be encountered in securing satisfactory protection on any power distribution system. The accuracy and permanence of calibration of the modern induction type relay insure satisfactory operation if proper application is made.

In laying out a protective scheme on any system a great many factors have to be taken into consideration. The characteristics of the line and each piece of apparatus, generating, switching, transforming and converting, should first be carefully studied as this is what determines the amount of short circuit current available. In determining this short circuit current it should always be considered as due to a solid metallic short circuit with minimum generating capacity.

One method of determining the possible short-circuit current is to observe the voltage drop between two stations at normal load, when the short circuit current is given by $\dfrac{\text{Normal voltage}}{\text{Voltage drop} \times \text{load}}$

This is only approximate however and is very likely to give high results.

Another method is to determine the total impendance, including that of the generator between any point where the short circuit value is desired and the generator, then short circuit current $= \dfrac{\text{Star voltage}}{\text{Impedance}}$.

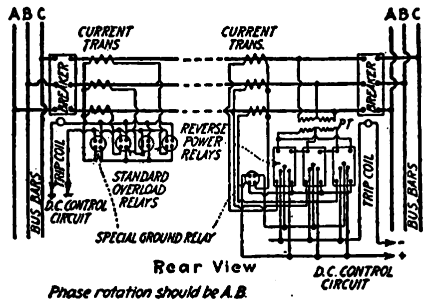
This gives the instantaneous short circuit, however, and the sustained value is much less, usually about 2 or 25 times full load current.

Unless a special scheme is used for disconnecting a line on a high resistance ground, as would be necessary in the case of a generator having its neutral ground through a comparatively high resistance, modern relays will not clear a high-resistance short circuit. This is no disadvantage, however, as a high resistance short circuit will invariably develop into an arc before any damage is done and since an arc has a very low resistance the effect of a metallic short circuit will be obtained and the relays will operate.

The various connections and combinations used on a system also deserve careful attention when laying out a protective scheme. First the number and location of the power sources should be taken into consideration. The main thing to be considered is whether or not there is more than one source, since a layout which would be suitable for a system having one source of power might not be suitable for another having more than one source.

It sometimes happens that a system has its neutral grounded through a comparatively high resistance and when a ground occurs conditions may be such that the trouble current is actually less than the full load current. Such a ground cannot be cleared by reverse power and overload relays connected to protect the system against short circuits.

This difficulty may be overcome by using an overload relay, constructed to operate on low currents,



connected in the neutral lead of the current transformers as shown in the accompanying diagram. Then under normal conditions no current flows through the neutral lead of the current transformer bank. But as soon as the ground occurs the unbalanced current flows through this lead and the ground relay and the circuit breaker is opened.

When used with overload relays the ground relay contacts so that its operation opens the circuit breaker directly. When used with reverse power relays, however, the ground relay contacts are used to short circuit the contacts of the overload element of the reverse power relays thus leaving the watt elements to discriminate as to the direction of power flow. This is clearly shown in the diagram.

It is possible by carefully studying and analyzing the conditions to secure automatic sectionalizing on any network regardless of its complications.

IDENTIFICATION SCHEMES FOR STEAM AND WATER PIPES.

In most power plants and electrical generating stations electrical circuits and control apparatus is marked and identified in a conspicuous and practical manner, because it may be necessary at any time to be able to identify and segregate a circuit, a circuit breaker, transformer, etc., at any time on short notice.

What is done for the electrical equipment should also be done with the apparatus for the steam and water. Both are as important as the electrical equipment; although it is true less attention and less hasty action is usually called for. High-tension wiring is often colored red, the low-tension blue or black. So too low and high-pressure steam piping should have colors that discriminate between them. Live and exhaust steam pipes, pipes for oil, for water for turbines and for house service should have distinctive colorings. Pipe coverings should be stenciled also.

In addition to distinctive coloring of pipes, it is well to tag them. Tags should be placed at locations where it would otherwise be difficult to trace continuity, for example where a pipe enters another chamber and turns around. All valves should be tagged. Using distinctive colorings for the different pipes saves time and lessens accidents due to mistakes. Stencils and tags serve to identify the various pipes of the same class of service.

Contracting-Construction

Connection and Operation of Autotransformers — Estimators' Association—Report of New York State Meeting

METHOD OF CONNECTING AND OPERATION OF AUTOTRANSFORMERS.

Use of This Device for Connecting Lights to Power Circuits Not Generally Understood.

By J. D. Bernard.

It is often desirable in large manufacturing plants using alternating current to connect the power and lighting circuits to the same source of supply. In this way the additional expense of a separate service for each of these purposes is avoided and, in plants where the power is purchased on a maximum demand basis, the demand factor is reduced because the peak periods do not occur at the same time. Although the voltage on such circuits is subject to fluctuations due to the starting of motors, etc., which also affect the lighting, it is suitable for use in many places where the work is such that steady light is not necessary.

In the majority of plants such circuits are three-phase, 220 or 440 volts. In order to use this service for lighting either high-voltage lamps must be used, the lamps must be wired in series or a transformer installed to reduce the line voltage. On account of the greater cost of the high-voltage lamps and the difficulty of using the lamps in series, the latter method is usually employed. The transformers may be either of the ordinary type having primary and secondary windings or it may be an autotransformer having but one winding with a middle tap brought out. On 220-volt circuits the autotransformer is generally used and from the difficulties encountered, it is evident that many contractors do not thoroughly understand the connection and operation of this apparatus.

The function of the autotransformer when used in this way is simply to supply a neutral wire having the same difference of potential from either of the line wires. Its installation on one phase of a 3-phase 220-volt system, therefore, is equivalent to a 3-wire, 110/220-volt system, as shown in the accompanying diagram. This neutral tap is only required to take care of the unbalanced portion of the load as the balanced portion can be considered as being in series across the line. For example, in the diagram eight lamps are shown connected to the circuit, three to one side and five on the other. If all these lamps were in use at one time, three lamps on one side would be in series with three on the other, leaving only the two lamps on one side that would be supplied through the autotransformer. If each of these lamps was of 200 watts capacity, the load on the autotransformer would be 400 watts while the entire load would be 1600 watts. It is evident therefore that the size of the autotransformer is dependent upon the size of the probable unbalance in the load. This unbalanced portion of the load will average about 25% of the full load but will vary according to local conditions and the wiring layout. The size of conductor to be used, however, is determined by the connected load and the same rule that is ordinarily followed in making 3-wire, 110/220-volt installations should be used.

When an autotransformer is used on a 3-phase system on which the neutral point of one of the transformers is grounded, as is the system shown in the diagram, it should be installed in this phase, rather than either of the other phases. The reason for this is that there is a difference of potential between the neutral point of either of these other phases and the ground which would prove dangerous should a ground develop in the wiring. Where for some reason it is not possible to install the autotransformer on this phase or where the system is not grounded, a ratio transformer having two windings is recommended. Such a transformer, of course, provides for the entire load and its size therefore must be determined accordingly.

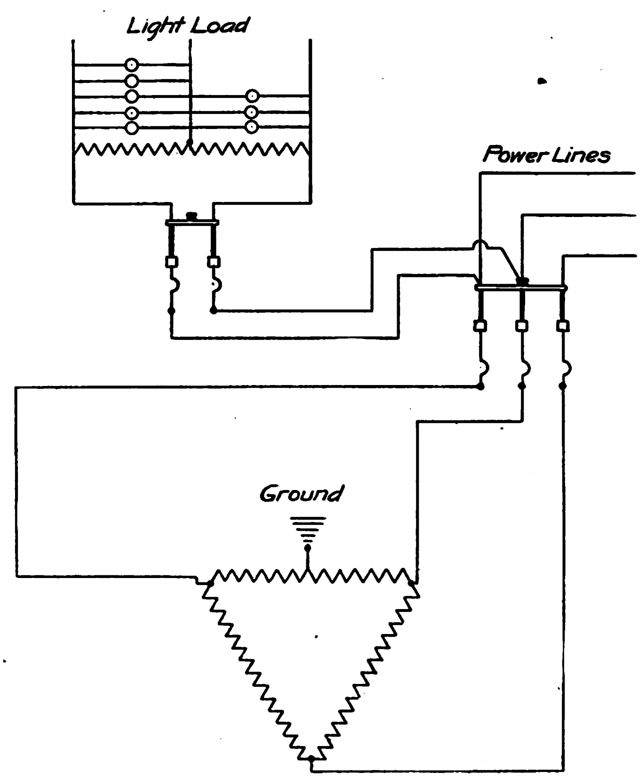


Diagram Showing Method of Connecting Autotransformer in 3-phase Power System.

In installing an autotransformer the switch or fuse protection should be connected ahead of the device rather than between it and the load. The reason for this is that should one of the fuses blow between the autotransformer and the load, the entire load on one side of the line would be carried by the autotransformer which would undoubtedly burn it out. With the switch connected ahead of it, however, the blowing of a fuse only cuts the service off. The actual connection of the autotransformer is very simple as the leads are always marked and only have to be connected to the proper lines.

NEW YORK CITY ELECTRICAL ESTIMATORS FORM ASSOCIATION.

Electrical Estimators' Club Organized to Study Conditions and Benefit Members.

The electrical estimators of New York City have organized an association to be known as the Electrical Estimators' Club of New York. According to the constitution the purpose of the organization is to study the values of the electrical devices and methods which may be included in making up an estimate of the costs of electrical construction: to promote more intimate acquaintance and good fellowship among those who estimate electrical work; also, by the interchange of experiences, ideas and assistance to raise the efficiency of its members. Membership in the club is open to any person estimating electrical construction work.

In order that the work of the club may be carried on as rapidly and efficiently as possible, several committees have been appointed, each to investigate and report on a certain subject. In order to stimulate interest in the association's activities among its members, the constitution provides that the appointments to such committees be so divided that as many individuals as possible serve on them. Other articles having the same tendencies have also been incorporated in the constitution. One of these is that every member, including the officers, should rise at least once during a meeting and express at least one thought on the subject under discussion. The other states that the officers shall be elected for a term of one year and, with the exception of the secretary, no officer shall be eligible to re-election to succeed himself.

John B. Curtis, of J. Livingston & Co., Inc., 70 East 45th street, has been elected president.

NEW YORK STATE CONTRACTORS DISCUSS BUSINESS RELATIONS.

Many Interesting Papers on this Subject Presented at Convention in Saratoga Springs.

All phases of the electrical contractor-dealers business were brought up and thoroughly discussed at the annual convention of the New York State Association of Electrical Contractors and Dealers held in Saratoga Springs, N. Y., June 23 to 25, inclusive. The success of the convention as well as the future success of the state association is indicated by the expressions from all groups of the industry who were present and took an active part in the proceedings. Chairman M. H. Johnson presided.

On Monday morning, prior to the formal opening of the convention a meeting of the Executive Committee was held at which the reports of officers and committees were presented and discussed. The treasurer's report showed the finance of the association in a very sound condition with a sufficient surplus for active organization work. The Insurance Committee recommended an agreement with Mr. Block of the Utilities Indemnity & Exchange for group insurance covering the membership policies through which a considerable saving in premiums will be effected. The Labor Committee, appointed at the January 1919 meeting was continued with instructions to prepare a universal form of agreement between labor unions and district associations, the members of which employ union labor. It is hoped through this course to standardize labor conditions throughout the state and avoid discussion and controversy which have been a source of more or less misunderstanding in the past and also obviate the possibility of any agreement clauses the legality of which might be questioned. The report of the Membership Committee showed that at the time of the transfer of the association from the old to the new constitution which occurred at the 1918 convention the membership was about 150 and is at present approximately 450, several new districts have been formed and the names of their Executive Committeemen submitted and approved.

The convention was opened with an address by Mayor Schwartz of Saratoga Springs in which he welcomed the delegates and their guests. W. C. Peet, chairman of the National Association, responded and, in the absence of W. H. Morton, described the work that was being done by the national body particularly in regard to the Data and Sales book and the new educational campaign. C. C. Dailey of Rochester, N. Y., then explained overhead costs and their application in estimating wiring. This feature of the contractor-dealers business although a very important one has been sadly neglected in the past but during the past year has received considerable attention. Mr. Dailey was followed by Lynton T. Block of the Utilities Indemnities & Fire Exchange, St. Louis, Mo., who described the operation and effects of compensation laws and liability insurance.

W. L. Goodwin of the General Electric Co., author of the Goodwin plan addressed the members on merchandising on Tuesday and on general topics of interest on Wednesday. Both subjects were treated in a way that he has never excelled if equalled, on previous occasions.

The other speakers on Tuesday were: Samuel A Chase of the Westinghouse Electric & Manufacturing Co., who described in a very interesting manner the "Channels of Distribution Between Manufacturer and Consumer," and which is reproduced, substantially in full, in another part of this issue. W. A. Kennedy of New York City, whose subject was "Wholesale Only and Its Co-operative Benefits;" J. T. Hutching, Rochester Railway & Light Co., who explained the effect of central-station rates for service on the contractor-dealers business. F. G. R. Gordon of Haverhill, Mass., spoke on "The Menace of State Socialism in America," which might be considered a departure from the usual routine of conventions; the information and statistics presented by him are a subject for serious thought for both business men and associations regarding fundamental obligations to their country as well as their business.

On Wednesday morning J. J. Raftery of New York City discussed the relations between the electrical jobbers and contractors. He was followed by Louis Kalischer, of Brooklyn, who delivered an interesting and instructive address on the "Advantages of Co-operative Selling Campaigns."

In addition to the regular sessions a meeting of the Joint Conference Committee, consisting of the representatives of the Empire State Gas and Electric Association, the Underwriters Association, and the New York State Association of Electrical Contractors and Dealers was held on Wednesday morning at which the previous work was gone over and their future program arranged. It was decided that its first activity will be the standardizing of services and meters in all districts of the state.

Contractor-Dealer

Plans to Encourage Installation of Convenience Outlets—Channels of Distribution from Manufacturer to Consumer

INSTALLATION OF CONVENIENCE OUTLETS TO BE POPULARIZED.

John G. Learned, Chairman Commercial Section, N. E. L. A., Introduces Plan to Promote Use—Of Interest to Contractor-Dealer.

Perhaps the greatest attempt that has been made thus far to promote the installation of outlets for the use of appliances is being introduced by the Commercial Section, National Electric Light Association through its chairman, John G. Learned of the Public Service Co. of Northern Illinois. In effect, the plan is an educational campaign to popularize the use of such outlets and thus to create a demand for them from the public.

Originally the manufacturers of electrical appliances, in their advertisements and window displays showed these devices connected to lighting fixtures. As their use in this manner was not approved by the inspection authorities and also because many of the more modern fixtures made such connections difficult, this practice was soon discontinued. Since this time the manufacturers have featured their devices showing the cord dead ended, that is, not connected to any outlet.

Through Mr. Learned's efforts several of the larger manufacturers have been asked to show their products in the future connected to a convenience service outlet. In this way the appliances can be illustrated in the most attractive manner and at the same time the added convenience of the outlet will be shown.

This campaign and the progress which has been made was outlined in a recent letter from Mr. Learned to E. W. Floyd of the Commonwealth Edison Co., which was read by O. R. Hogue at the recent convention of the Illinois State Association of Electrical Contractors and Dealers held in Decatur, Ill. In addition, the advantages to be derived by the contractor-dealers from the aid of such outlets was pointed out.

This letter is substantially as follows:

Chicago, Illinois, June 17th, 1919.

Dear Mr. Lloyd:

Confirming conversation with you of last evening relative to the Illinois State Association of Electrical Contractors and Dealers meeting at Decatur, I would appreciate it very much if you will bring to the attention of the contractors the importance of getting that body of men to feature the proper equipment of the home with special reference to installing adequate number of baseboard and wainscoting outlets so as to provide the facilities for the use of appliances.

Special reference should be made to the importance of proper electrical equipment for the bath room for the use of appliances. Although it is not generally known, the hair dryer, vibrator, curling iron, fan, and heater are valuable adjuncts in the bath room. In order to utilize such appliances it is only necessary to have one or two wainscoting outlets.

This matter is of vital interest to the contractors as it directly adds to the volume of their business and a concerted effort on the part of all contractors to exploit outlets will undoubtedly gradually create a greater demand not only from those whose homes are not wired but also from existing customers.

In line with this idea the Commercial Section of the N. E. L. A. in its activities is planning to get the manufacturers of appliances, accessories and other appurtenances used in home equipment to include in their advertising reference to an illustration of the baseboard receptacle.

This matter has been brought to the attention of the Edison Electric Appliance Company which company at present only illustrates appliances with the dead end of the cord.

The idea is to show both ends of the cord. The matter has also been brought to the attention of the Cutler Hammer Company. Both companies are showing considerable interest.

If this is taken up in a big way and we ask all the manufacturers who do national advertising to cover this feature in their advertising, I believe that after a reasonable period of time the public will be subconsciously impressed with the idea of proper wiring.

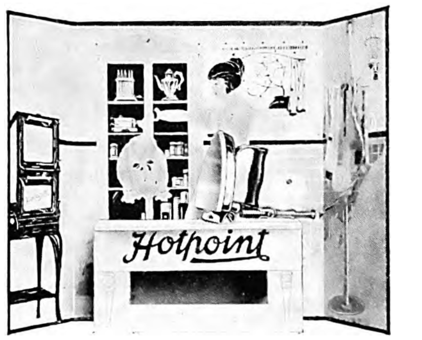
It is self evident that it is to the mutual advantage of everyone engaged in the electrical industry. It follows as a matter of course that the manufacturer will sell more appliances, the contractors will do more wiring, the accessories manufacturers will turn out a larger volume of products and last but not least, the central-station company will enjoy added revenue, and probably most important of all, it will make it easier to sell merchandise.

I have already spoken of this matter to Mr. L. H. Lamont, of Lamont & Company, 9 S. Clinton Street, Chicago, who is a member of the Commercial Section Executive Committee.

Yours very truly,

(Signed) JOHN G. LEARNED.

In order to realize the best results from this campaign however, the fullest co-operation must be received from the electrical contractors and dealers. As stated in the letter the installation of more outlets will result in added profits for wiring which should be of interest to the contractor. In addition, as the general trend at present is for contractors to conduct retail stores in connection with their wiring business, the fact that it will make it much easier to sell appliances should be especially attractive at this time.



Reproduction of May Display of Hotpoint Irons Showing Appliance Connected to Convenient Wall Outlet.

The co-operation of the contractor-dealer can be rendered in two ways. First, by an earnest effort to have a sufficient number of outlets included in the original wiring specification. It is a well-known fact that the installation of outlets is much more expensive if it is done after the building is completed or as an extra. Furthermore, it is much easier to persuade the owner to have outlets installed at this time. Secondly, contractors and dealers should follow out the plan suggested in their stores, windows and local advertising by displaying appliances connected to such outlets and encouraging their installation in every possible way.

In the accompanying illustration is shown one of the recent window displays furnished to its dealers by the Edison Electric Appliance Co., Chicago, featuring the Hotpoint electric iron. As illustrated the convenience of the iron is more clearly brought out by showing the cord so connected that it will not interfere with its use.

THE CHANNELS OF DISTRIBUTION FROM MANUFACTURER TO CONSUMER.

Paper Presented Before the New York State Association of Electrical Contractors and Dealers at Saratoga Convention.

By Samuel Adams Chase

Special Representative, Westinghouse Electric & Manufacturing Co.

The channels of distribution in the electrical industry are indefinitely marked with the trade beacons of trade organizations, proper trade differentials and a proper code of practice and ethics, supported by absolute knowledge of what each of these beacons mean to the captains of this industry and reminds one of a mariner who endeavors to pilot a ship through a river which was not clearly marked with safety beacons.

In considering this subject three important factors should properly enter into the discussion, the economic distribution, effective distribution and adequate distribution. The product to be distributed is made up principally of merchandising or resale electrical appliances and supplies and does not include, in its bills of lading, lighting or power apparatus.

The various channels of distribution in the past from the manufacturer to the consumer may be divided into the following groups: By the manufacturer direct; by the jobber-wholesaler; by the manufacturer's agent; by the central station; by the hardware merchant; by the dry goods store; by the drug store, and in some instances by various other merchants not strictly in the electrical supply business; and by the contractor-dealer.

The manufacturer has frequently made the mistake in the past of being allured by the temptation to obtain the middleman's profit and has taken small orders direct from the consumer, at an apparent profit. He has learned by costly experience however, that this so-called profit is wiped out by the cost of obtaining and handling the orders and the result is not only a net loss in money but a disturbed and unhealthy condition in the trade. It has in some instances taken years of experience to teach the manufacturers the wisdom of a policy of selling their merchandising product to the consumer through the middleman, recognizing the service rendered by the jobber and the contractor-dealer.

He has, in some instances, chosen the direct route to consumers in the past due to the uneconomic, ineffective and inadequate distribution through other channels and a hesitancy on the part of the middleman to create a sufficient demand for the goods manufactured and although a definite sales policy has been adopted by some manufacturers of selling direct and through the middleman at the same prices, their direct sales exceed all others by a large percentage notwithstanding the local influence of the middleman.

It is safe to assume, however, that the average manufacturer will welcome the day when it will be possible to economically and efficiently distribute his merchandising product exclusively through the electrical jobber and retailer. But, these channels are not yet deep or broad enough or sufficiently safe and efficient to warrant any manufacturer with a large sales organization to sell exclusively through them.

The jobber or wholesaler in the past, and in some instances at present, did a retail business in addition to the wholesale business and, in some cases sold to consumers without recognizing, in the form of a differential, the service rendered by the contractor-dealer. This practice is not only unethical but demoralizes the contractor-dealer's business to such an extent that it makes that class seemingly distrustful and quite naturally has a tendency to prevent his engaging in the retail business, hence retarding sales and expansion. In addition the jobber of the past has been somewhat like many manufacturers' agents and has shipped an order calling for a miscellaneous lot of goods direct from the various manufacturers because of not carrying a sufficient stock in his warehouse, causing delayed and expensive shipments. The jobber of today however, assembles all these goods in his own warehouse and distributes complete, in one shipment, frequently the same day the order is received, which is of great advantage to the contractor-dealer. Therefore, the jobber can be the natural, economic and efficient channel of distribution from the manufacturer to the contractor-dealer.

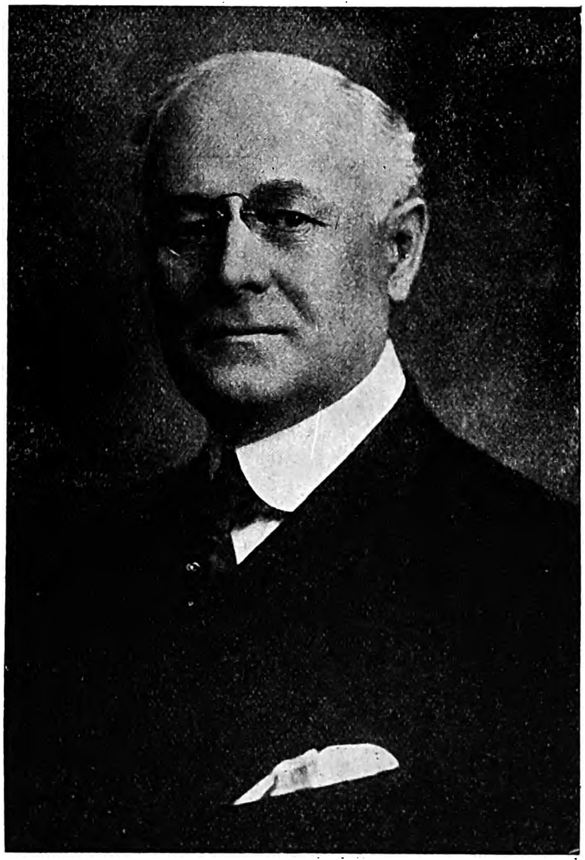
The manufacturers agents' policies vary. Some carry a small stock and ship and invoice customers. Others carry no stock and are simply order takers for the manufacturer and some sell indiscriminately to jobbers, contractor-dealers, and consumers, and should in reality be classed as salesmen for the manufacturer.

The central stations have been pioneers in the sale of and distribution of incandescent lamps and that channel was marked with beacons of free renewals and cut prices, alluring the industry not to a haven of safety but to a rock-bound coast of disaster. Now, the channel has changed to the jobber, contractor-dealer and central station, with the percentage clearly marked with beacons of ethical merchandising and intensive selling, producing absolute fairness in competition between the competing groups—and the contractor-dealer with a well-located attractive retail store now plays an important part in the channel of distribution of lamps from the manufacturer to the consumer. The flat iron, washing machine and vacuum cleaner and other household appliances were also introduced principally by the central station and it is believed that the central station on account of its organization, prestige, financial responsibility and desire to add kilowatts to its lines, will always be the logical pioneer and pilot the way for the jobber and contractor-dealer. It would be very unfortunate to the manufacturer and the consumer if the central station should go out of the retail business properly conducted on an ethical basis, for central stations will always carry the introductory or development expense of placing new devices on the market.

The hardware, dry goods, drug store, and kindred merchants have probably done more to advertise electrical merchandising products than other distributors, but in their advertising, like some central station advertising, the principal story is cut-prices. With their recognized business ability attractive stores and display windows and unquestionable financial standing, however, the call of this siren has been so alluring that it has wrecked many a manufacturer's ship in the channel of distribution to the consumer.

Each of these groups, however, creates and obtains a certain amount of business which ordinarily could not be obtained by strictly electrical concerns principally because these merchants make it easy for the housewife to obtain electrical appliances. Their stores are attractive, located in the shopping district frequented by ladies and in charge of an efficient sales organization, and they will continue to increase their electrical departments and sales and will attract the manufacturer as one of the efficient and economic channels of distribution, unless the contractor-dealer becomes alive to the situation and the necessities of the public and adopts such methods.

The beneficial results of a plan of scientific merchandising, practical trade co-operation and organization as advocated by Mr. Goodwin and which has been so ably supported by the electrical press, manufacturers, jobbers and central stations, will unquestionably result in making the specialized electrical retailer the dominating channel of distribution from the manufacturer to the ultimate consumer. The contractor-dealer has not until recently become a merchant for the reason that apparently all classes in the industry have looked upon him as a necessary evil rather than an economic necessity. All other classes in the industry have been cultivated to a high degree but the contractor-dealer until recently has been allowed to drift, unaided, uncultivated, and looked upon as a parasite, superfluous in the channel of distribution and, rudderless, without a beacon light to guide him, has been wrecked on the rocks of commerce. Because of these facts, and realizing there was no stability to the prices of merchandising appliances or wiring devices, he has not taken advantage of the opportunity presented and opened a sufficient number of attractive retail stores. The channel of distribution from the manufacturer to the consumer *via* the electrical dealer route therefore, has made it difficult rather than easy for the housewife to purchase electrical appliances.



Samuel Adams Chase.

Channels of distribution like rivers cannot be forced from the manufacturer to the consumer through uneconomic channels. However just as the channels of navigation in a river change from time to time due to natural elements which may be changed through the medium of engineering talent and modern machinery, so may the channels of distribution of electrical merchandise be changed by the application of scientific merchandising methods directed by the best thought and activity of the contractor-dealer. The author is firmly convinced that by an aggressive sales policy in co-operation with the jobber, coupled with active interest in his association and the most friendly relations with manufacturers, central stations, consulting engineers, builders and architects, the contractor-dealer will gradually become a dominant factor in the distribution of materials.

It is to be hoped that the time will come when every contractor-dealer will be a member and attend all state conventions and at these meetings representatives of manufacturers, jobbers, central stations, architects, engineers and the press will be included so that all can appreciate and understand the problems of the others, thereby establishing friendly and ethical relations, and facilitating distribution.

The trade seeks the channel of least resistance. The better business man the contractor-dealer develops to be, the more prominent the location of his store, the character of his store, the support which he gives to his trade associations, the manner in which he conducts his trade association, the character of officers of his association, and the conduct and manner of presenting his trade problems to the manufacturer or jobber all tend toward removing barriers and resistance and aid in directing the flow of trade through the contractor-dealer channel. The manufacturer is faced with a choice of channels for the distribution of his product. In one channel is the palatial department store, well managed, with unquestionable credit standing; in another, the central station and the jobber, and in another the contractor-dealer, who in the past has not always appealed to him in a favorable light. With the methods now being employed, however, with attractive retail stores, located conveniently for the buying public, intensive sales methods, improvement in organization, proper presentation of problems through able committeemen presenting forcible rather than arbitrary arguments, the contractor-dealer is every day commanding a higher respect from manufacturer, jobber and central station, and is causing them all to think, and to think hard, which must result, if they continue along these constructive lines, in causing an increasing percentage of business to flow from the manufacturer through the jobber-contractor-dealer channel.

In conclusion it is suggested that in the channel of distribution in which the contractor-dealer navigates, the beacons be labeled—organization, co-operation, ethical merchandising policies and determination. With these slogans properly applied there can be but one answer and that is the contractor-dealer ship will be the flag ship and lead the squadron through the channel of distribution from the manufacturer and jobber to the consumer.

New Appliances

Special Ampere-Hour Meter to Insure Proper Charging for Tractors and Trucks—Fan to Promote Kitchen Comfort

Locomotive Type Ampere-Hour Meter for Truck, Tractor and Locomotive Battery Charging.

The experience of the past few years in the operation of storage-battery trucks, tractors and battery mine locomotives has clearly demonstrated that the chief problem in the operation of these devices is the problem of the storage battery. Accordingly, the ampere-hour meter, which is the only device that automatically gives a true indication of the state of charge of the storage battery at all times and can be made to automatically terminate the charge at the proper time, is of special importance in this connection. A new locomotive type ampere-hour meter has just been designed by Sangamo Electric Co., Springfield, Ill., in order to meet the severe requirements as to overload and vibration experienced in this particular service.

Ampere-Hour Meter Control.—The ampere-hour meter, when installed permanently in the storage-battery circuit on the truck, tractor or locomotive, registers every ampere-hour which the battery discharges in driving the vehicle, and since the total battery capacity is indicated by the red "Empty" hand on the meter, the black hand indicates the remaining capacity left in the battery. The operator then knows at all times how much farther he can run the truck. When the battery is later put on charge the ampere-hour meter registers as the charge proceeds, operating in a direction reverse from that of discharge. When the battery has been fully charged the meter will register zero and make a contact within the meter which trips the circuit-breaker in the charging circuit.

Automatic Charging.—No battery is 100% efficient. More charge must be given than was taken out on the previous discharge, so there must be a certain amount of excess charge each time the battery is charged. This feature is automatically provided for in the locomotive type ampere-hour meter by means of a variable-resistor device, which causes the meter to run slower by any desired percentage on charge than on discharge for equal current flow. This automatically provides that the battery will be given any desired percentage of overcharge, for by the time the meter indicating hand gets back to the full charge position, all of the previous discharge plus a certain percentage of overcharge (depending upon the setting of the variable-resistor element) will have been put back into the storage battery. This feature is entirely automatic, and once the resistor has been set at the desired percentage of overcharge, no further attention need be given the device.

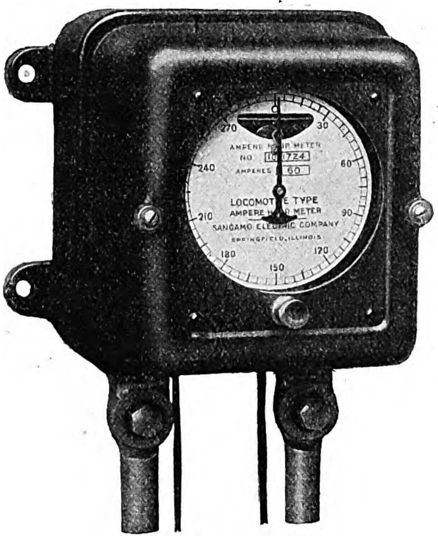
Special Features of Locomotive Type Meter.—The locomotive type meter, which has been especially designed to meet the severe requirements of mine locomotive and industrial truck service embodies several distinct improvements over previous Sangamo ampere-hour meters.

1. *Overload Capacity Increased.*—The locomotive type meter will carry 300% load continuously and 500% load for 3-minute periods without undue heating of any part.

2. *Meter Made Dust and Moistureproof* by means of improving binding posts, terminals and soft rubber gasket in case.

3. *New Type Contact at Zero.*—This is mounted entirely back of the dial and operates on cam principle instead of lever as formerly, thereby reducing the drag on meter and increasing reliability of the action of the contact.

4. *Modified Motor Element.*—Special treatment is given to both the armature disk and armature box interior which has reduced the formation of mercury dross to about ¼ of that formerly experienced. This will probably improve the meter operation very greatly and eliminate trouble due to meters being slow on account of dross.



New Type Ampere-Hour Meter for Battery Discharge and Charge and Terminating Latter at the Proper Point.

5. *New Type Variable-Resistor Element,* which is approximately eight times as effective as the resistor element formerly used. This insures great reliability of operation and increases the range of adjustment so as to provide a maximum of 50% overcharge where desired.

6. *Reset Made Dustproof.*

7. *Lock Washers* throughout and special rugged construction combined with mercury flotation of the rotating element, making the locomotive type meter immune from vibration and loads.

Ilg Electric Household Kitchen Exhaust Fans.

Comfort is an essential to efficiency in the home as well as the factory, store or office. The kitchen in the average home is the room that is most neglected as far as provision for comfort is made therein. This is one of the reasons why many housewives do not like to cook and also why domestic servants willing to cook are steadily decreasing in number. One of the most important aids to kitchen comfort is a proper electric exhaust fan to remove the hot, humid and often malodorous air so commonly found in the kitchen, especially when the latter is located in a portion of the building where natural ventilation is difficult or impossible. Even where the winds may have access to the kitchen window and door, they are an uncertain quantity and as likely to blow the kitchen odors and smoke into the other rooms of the house or apartment as to blow them out.

The Ilg Electric Ventilating Co., of Chicago, Ill., which claims to be the largest exclusive manufacturer of electric ventilating equipment, has made a special study of kitchen ventilation as a result of which it has developed an exhaust fan especially suited for this service. This fan is small, quite neat in appearance and quiet in operation. It is easily installed in the upper portion of a window, in a transom or special wall opening. Its current consumption is low enough to permit operating on the ordinary house lighting circuits. The motor is fully enclosed as a protection against heat and grease. The latter would quickly choke up the motor, cause overheating of it and result in possible fire. Like other Ilg fans, these exhaust outfits have a patented self-cooling feature, by means of which cool air is drawn through the motor enclosure and carried off with the general exhaust. This keeps the motor windings at safe operating temperature. The air drawn through the case being clean air, the windings are kept from being choked up.

Use of these Ilg kitchen exhausters has been found to promote comfort in the cooking, since the kitchen is kept from becoming hot, stuffy and malodorous. They also prevent the kitchen odors, fumes and smoke from entering the other rooms to the annoyance of other members of the family and guests, and by withdrawing them promptly they are also prevented from smudging and otherwise spoiling wall decorations, pictures, etc.

In order to assist its dealers in the sale of this fan the company has arranged a very attractive window display. This consists of a three-panel mounting, decorated to represents a kitchen interior in which a real fan can be mounted and operated in the dealer's window.

Trade Activities

Ohio Electric & Controlling Co. Appoints Representatives —Harrison Safety Boiler Acquires Monash Equipment

Edison Electric Apliance Co., Inc., Hughes Division, has issued a circular offering to dealers stereotypes of four advertisements on electric ranges so they may tie in their local newspaper advertising with the national advertising campaign now being conducted by the company. These are furnished in single, double or triple column size and provide space for the dealers' name.

Murray Iron Works Co., Burlington, Iowa, has appointed S. C. Orrell its Chicago district sales manager with headquarters at 1215 Conway building. Mr. Orrell was for many years identified with the Chicago office of Allis-Chalmers Manufacturing Co., later becoming Minneapolis district manager for the company. Mr. Orrell will prove a valuable addition to the staff of the Murray company.

Jewell Electrical Instrument Co., 1646-50 Walnut street, Chicago, is distributing a new 72-page catalog on electrical measuring instruments, which is one of the most complet catalogs dealing with this equipment ever published. The descriptive matter has been very carefully and accurately written, giving brief and comprehensive data and information on each instrument. All portable instruments are first described and illustrated, following which is the switchboard equipment. A feature of this catalog is the very complete and convenient set of charts in which each instrument is listed with all ranges of readings and prices. All shunts, transformers and multipliers are illustrated and described. Some 12 pages are devoted to full size reproductions of instrument scales, diagrams showing shunt dimensions, drilling dimensions and series transformer dimensions.

Electric Storage Battery Co., Philadelphia, Pa., recently received from a number of its customers, letters of testimony bearing evidence of the efficiency of the industrial electric truck. One of the firms that is using an industrial truck with an "Ironclad-Exide" battery states that six men who received an average pay of 42 cents per hour have been replaced by using one industrial truck of two-ton capacity. Another informs that in addition to the saving of labor, the trucks are hauling material from one place to another in less than one-third of the time formerly taken. These are but two of thousands of similar installations where the industrial electric vehicle has proven itself to be a most efficient transportation labor-saving equipment. However, the full efficiency of any industrial truck or tractor is only realized when it is equipped with the proper make and type of battery, and in this connection the "Ironclad-Exide" has rendered admirable service.

The Industrial Electric Furnace Co., 53 West Jackson boulevard, Chicago, now owns all patents covering the Snyder electric furnace, E. T. Snyder, formerly vice-president, having left the organization, effective June 1.

Harrison Safety Boiler Works, Philadelphia, Pa., has acquired the Monash line of pressure reducing valves and pump governors, formerly manufactured and sold by the Monash-Younker Co., of New York and Chicago. The purchase includes a stock of manufactured parts and valves, drawings, patterns, trade mark and good will. The Harrison Safety Boiler Works will manufacture and market the valves under the trade name "Cochrane-Monash," and will supply repair parts for valves now in use.

Illinois Electric Porcelain Co., Macomb, Ill., has issued a new catalog on electrical porcelain insulations. This contains 24 pages, for the most part full size sections and part elevations of various forms of porcelain insulators, standard porcelain electrical parts and special porcelain. Included among these are standard and split knobs, one, two and three-wire cleats, switch bases, ceiling buttons, strain insulators, pin bases, rack insulators, exterior and interior bushings, leading-in-tubes, pole-line screw-thread insulators and standard unglazed tubes. In connection with the latter an interesting table of numbers of tubes of various sizes in the standard barrel and gross weights of various tubes in a standard barrel are given.

Cutler-Hammer Manufacturing Co., Milwaukee, Wis., has given the title "Helps in Merchandising Electrical Appliances" to a new 16-page two-colored booklet because all the 1919 advertisements reproduced in it request the public to go to the electrical dealers. Last year the company had to postpone on account of war restrictions its second national advertising campaign on the C-H Seventy Fifty switch which is used on the cords of heating devices and many other electrical appliances. For the 1919 campaign the original advertisements have been increased in size and number and additional national media are being used. Reproductions of all the advertisements which have or will appear in the *Saturday Evening Post, Literary Digest* and *Good Housekeeping Magazine* this year, are shown.

In addition, several new and interesting helps for dealers have also been provided, such as a four-color lithographed window trim, street car cards, window and wall display cards, three or four two-color booklets which are imprinted for dealers' use, colored "movie" theater slides and eight little stickers for use on letters going forth from lighting companies, dealers and jobbers, contractors and others. Besides this, there are eight newspaper advertisements, complete electros of which can be had by the dealer. These newspaper advertisements play up strongly the use of electrical appliances of all kinds and point out the convenience to be secured when such appliances are equipped with the C-H Seventy Fifty switch. They will, therefore, increase interest in the use of all makes of household electrical appliances and when used by the dealer at the time the national advertising is appearing, will help to tie-up his store with the national publicity and increase his sales of electrical appliances of all kinds.

Belden Exhibit at Telephone Convention.—One of the most interesting exhibits of the recent United States Independent Telephone Association convention at Chicago was that of the Belden Manufacturing Co., 2300 South Western avenue, Chicago. A high-speed braiding machine for braiding wire and cordage was set up and operated during the three days of the convention, showing the process of manufacturing many different types of cordage and wire with silk and cotton braids. This was a very interesting novelty to many convention visitors. A motor-driven coil-winding machine, which the company manufactures for the trade and numbers of which are used in its coil-winding department, was in operation, making numerous coils wound with enamelled wire manufactured by this company which is well known under its trade name "Beldenamel."

The Ohio Electric & Controlling Co., 5900 Maurice avenue, Cleveland, Ohio, announces the appointment of the following firms as its representatives: The Iron & Steel Equipment Co., 1502 First National Bank building, Pittsburgh, Pa.; Williams Beasley Co., 343 South Dearborn street, Chicago; Linn O. Morrow, 707 Franklin Trust building, Philadelphia, Pa.; J. W. Dopp & Co., 18 Columbia street, Detroit, Mich.; Kelly, Powell, Ltd., 403 McArthur building, Winnipeg, Can.; Wonhan, Bates & Goode, Inc., Dominion Express building, Montreal, Can.; Shook & Fletcher Supply Co., Birmingham, Ala. The company has also appointed foreign representatives as follows: Wonham, Bates & Goode, Inc., 17 Battery place, New York City, London, Paris, Havana and Rio de Janerio; Mitsui & Co., 65 Broadway, New York, Japan, China, Philippine Islands and Honolulu, and Gustdv Neilson, A. S., Christiania, Norway, Sweden and Denmark.

Current News

Weekly Record of Construction Activities—Conventions

EASTERN STATES.

Rutland, Vt.—Western Vermont Power & Light Co. has been awarded a contract for furnishing electric energy for the operation of a large new plant at Fair Haven, Vt., manufacturing shirts. The plant is electrically operated throughout, and considerable power will be required for a large number of electric irons.

Boston, Mass.—In connection with the construction of a new four-story publishing building, at 240 Washington street, to be occupied by the Boston Globe Co., estimated to cost $100,000, considerable new electrical equipment will be required.

Chelsea, Mass.—Power Efficiency Corp., While building, Buffalo, N. Y., has submitted low bid to the Government, Navy Department, for the installation of the proposed heating system, etc., at the local naval station.

Gardner, Mass.—Gem Crib & Cradle Co., Main street, has recently broken ground for the construction of a new power plant at its works, to be used for factory operation. Heretofore power has been furnished by the Connecticut River Power Co.

Leominster, Mass.—Plans are under consideration by the City Council for an appropriation of $75,000, to be used for municipal improvements, including improvements in the street lighting system.

Worcester, Mass.—City Council has voted a loan of $50,000, to be used for construction work in connection with the new reservoir at Pine Hill for the waterworks system.

New Haven, Conn.—In connection with its proposed plant on Hallock avenue, the Seamless Rubber Co. will build a power plant for factory operation. The works will comprise three main buildings, each five-story, about 60x240 ft. It is said that the entire plant will cost about $1,000,000.

Waterbury, Conn.—A one-story power house, 35x60 ft., will be built by the American Brass Co. at a cost of $50,000.

Providence, R. I.—Atlantic Mills have awarded a contract to O. D. Purington & Co., Industrial Trust building, Providence, for the construction of a new three-story power plant about 46x98 ft. at its works at 120 Manton avenue. The structure is estimated to cost about $25,000.

Albany, N. Y.—Contract has been awarded to the General Electric Co., 527 West 34th street, New York, by Edward S. Walsh, State Superintendent of Public Works, for furnishing and delivering electric capstan and trolley hoists at various barge canal terminals, under Barge Canal Terminal Contract No. 113, at $14,090. Frank M. Williams, Telephone building, is state engineer and surveyor.

Brooklyn, N. Y. — Mergenthaler Linotype Co., 24 Ryerson street, has had plans prepared for alterations and improvements in its one-story boiler plant, to facilitate operations. Estimated cost $6000.

Brooklyn, N. Y.—Edison Electric Illuminating Co., 360 Pearl street, has filed plans for the erection of a new addition to its plant on 66th street, for increased capacity. Contract for the structure has been awarded to the Hamilton & Chambers Co., 1290 Broadway, New York.

Brooklyn, N. Y.—Bureau of Yards and Docks, Navy Department, Washington, D. C., is planning for a boat storage works at the Brooklyn navy yard, to cost about $45,000. The equipment will include two electric traveling cranes.

Buffalo, N. Y.—Robertson-Cataract Electric Co. will erect a six-story addition to its plant to cost $80,000.

Dansville, N. Y.—Power Specialty Co., manufacturer of steam and hydraulic specialties, is preparing plans for the erection of a two-story addition, to cost about $25,000.

Iroquois, N. Y.—Board of Managers of Thomas Indian School has awarded a contract to the Millenburg-Betz Machine Co., 110 Washington street, Buffalo, for the installation of new refrigerating equipment at the institution, to cost about $7325. Lewis F. Pilcher, Capitol building, Albany, is state architect.

Montauk, N. Y.—The Bureau of Yards and Docks, Navy Department, is taking bids on revised plans for the construction of the proposed power plant (Specification 3889) at the local naval station. C. W. Parks is chief of the Bureau of Yards and Docks.

New York, N. Y.—Considerable electrical equipment, including electric-operated traveling cranes, etc., will be installed in the new five-story building, about 125x100 ft., recently leased by Julius Blum & Co., 510-12 West 24th street, iron mouldings, etc. Extensive alterations and improvements will be made in the structure previous to occupancy by the company.

New York, N. Y.—New York Edison Co., Irving place and 15th street, has recently been awarded a contract for supplying electric service for all operations at the American Surety building, a 20-story office structure, at 100 Broadway. The structure will require current for 5000 lamps and 500 hp. in motors.

New York, N. Y.—Alpha Electric Co., Inc., 116 West 29th street, has leased property comprising about 22,500 sq. ft. of floor space at 151-155 West 30th street, for a new establishment, at an aggregate rental of $150,000.

New York, N. Y.—Reimers Manufacturing Co., 517 West 45th street, manufacturer of electric heaters, has leased property at 507-13 West 50th street, for a new establishment.

Potsdam, N. Y.—Dr. Thomas E. Finegan, deputy commissioner of education, Education building, Albany, has taken bids for the erection of a new boiler plant at the local normal school, including the installation of new heating equipment and electrical work.

Dover, N. J.—New Jersey Power & Light Co. has completed plans for the installation of new coal handling equipment at its new local plant. The company has recently been awarded a contract for furnishing electric energy for the operation of new motors installed at the municipal waterworks.

Merchantville, N. J.—Board of Public Utility Commissioners has granted permission to the Merchantville Water Co. to increase its rates for service, effective July 1.

Newark, N. J.—Murphy Heating Co. has filed notice of organization to operate at 51 State street for the production of heating devices. L. and K. Murphy head the company.

Newark, N. J. — Public Service Corp. has had plans prepared for alterations and improvements in its building at the foot of Hudson place, to facilitate operations.

West Orange, N. J.—Highland Electric Co., 10 Freeman street, has filed notice of organization to operate an establishment for general electric repair work. Frank Rotalo and A. Pettis, West Orange, head the company.

Summit, Del.—Work has recently been completed on the installation of a new electric lighting system throughout the Brandywine Summit Camp grounds, near Wilmington, and it is expected to inaugurate operations at an early date.

Wilmington, Del.—Sterling Electric Co. has filed notice with the Secretary of State of an increase in its capital from $10,000 to $100,000, to provide for general expansion.

Beaver, Pa.—Harmony Electric Co., with headquarters at Pittsburgh, has arranged plans for the merger of a number of electric light and power companies now operating in Beaver County under its present name. Application has been made to the Public Service Commission for approval.

Philadelphia, Pa.—Bids are being taken by the Niles-Bement-Pond Co., Mifflin and Meadow streets, for the construction of the proposed boiler plant at its works. The structure will be one story, about 44x60 ft.

Philadelphia, Pa.—Contract has been awarded by the Navy Department to the Enterprise Steam & Hot Water Heating Co., 600 North Howard street, Baltimore, Md., for the installation of new heating apparatus at the local navy yards.

Reading, Pa.—Metropolitan Edison Co. has recently commenced the construction of a second long-distance high-tension supply line to Lebanon, a distance of about 28 miles. The line will be equipped with insulation that will enable it to carry 66,000 volts, but operating voltage under present requirements will not exceed 33,000 volts, it is understood. The construction of this line will allow for the closing down of the generating plant at Lebanon, affording a saving in operating expenses of about $21,000 annually.

Titusville, Pa.—Titusville Light & Power Co. has arranged for the issuance of bonds for $15,000 to provide for general expansion. Notice has been filed with the Public Service Commission.

Zelienopel, Pa.—Large quantities of electrical equipment will be required in connection with the proposed construction of the new plant of the Universal Rubber Co., estimated to cost about $300,000. It is understood that the company is planning the construction of a second unit at a later date.

Cumberland, Md.—Western Union Telegraph & Cable Co. in conjunction with the Cumberland Division of the Baltimore & Ohio Railroad Co. has commenced work on the laying of underground cables for a new electric signal system, telephone and telegraph wires from the Queen City depot to the Viaduct tower, a distance of about three-fourths of a mile. The work is estimated to cost about $40,000.

Elkton, Md.—Town Council has recently completed negotiations with the receivers of the Maryland Water Co. for the purchase of its waterworks for a consideration of $35,375. It is understood that in connection with municipal operation of the plant, improvements will be made.

Hagerstown, Md.—Hagerstown & Frederick Electric Railway Co., operating five steam power plants and four hydroelectric stations, is negotiating with the city officials for the furnishing of electric current to the city for lighting purposes and for private utility by citizens. It is held by the company that this arrangement will afford an annual saving of a minimum of $10,000.

Lexington, Va.—Plans are being prepared by the Virginia Military Institute for the installation of two new 500-hp. boilers at the plant of the institution, estimated to cost $15,000. Carneal & Johnston, 707 Chamber of Commerce building, Richmond, Va., are engineers.

Norfolk, Va.—Columbia Peanut Co. desires prices on 80 to 100-hp. boilers and Corliss engines.

Clendenin, W. Va.—Kanaelk Coal Co. has had plans prepared for the erection of a new power plant at its local properties, in connection with other work. W. W. Whyte is president.

Taylorsville, N. C.—Plans are in process of formation by the Alspaugh Light & Power Co. for the construction of a new hydroelectric plant to be located about five miles from Taylorsville. The works will include the erection of a concrete power house, with dam, and a five-mile transmission system. T. C. Alspaugh is interested in the company.

Arlington, Ga. — Baker County Power Co. is understood to be considering plans for the construction of a new dam on Natchanny Creek, in connection with its proposed hydroelectric development.

Bowling Green, Fla.—Prices on 150-hp. boilers, 50-hp. engines and 50-kw. generators are wanted by the Bowling Green Manufacturing Co.

DATES AHEAD.

National Association of Electrical Contractors and Dealers. Annual convention, Milwaukee, Wis., July 15, 16 and 17. General manager, William H. Morton, 110 West 40th street, New York City.

Ohio Electric Light Association. Annual meeting, Cedar Point, Ohio, July 15-18. Headquarters, Breakers Hotel. Secretary, D. L. Gaskill, Greenville, Ohio.

Michigan Section, N. E. L. A. Annual convention, Ottawa Beach, Mich., Aug. 19-21. Headquarters, Hotel Ottawa. Secretary-treasurer, Herbert Silvester, Monroe, Mich.

Southeastern Section, N. E. L. A. Annual convention, Asheville, N. C., Sept. 17-19. Secretary-treasurer, T. W. Peters, Columbus, Ga.

International Association of Municipal Electricians. Annual convention, Chicago, Sept. 23-26. Secretary, Clarence R. George, Houston, Tex.

Association of Iron and Steel Electrical Engineers. Annual convention, St. Louis, Mo., September, 1919. Secretary, John F. Kelly, Empire building, Pittsburgh, Pa.

Washington State Association of Electrical Contractors and Dealers. Annual convention, Seattle, Sept. 11. Secretary, Forrest E. Smith, 205 Boston block, Seattle.

New England Section, N. E. L. A. Annual convention, New London, Conn., Sept. 22-24. Headquarters, Hotel Griswold. Secretary, Miss O. A. Bursiel, Boston, Mass.

National Association of Electrical Inspectors. Annual meeting, Springfield, Mass., Oct. 13 and 14. Secretary, W. L. Smith, Concord, Mass.

Illuminating Engineering Society. Annual convention, Chicago, Ill., Oct. 20-23. General secretary, Clarence L. Law, 29 West 39th street, New York City.

NORTH CENTRAL STATES.

Hamilton, Ohio.—An electric power plant is to be established at the Rockdale dam to furnish power for the Hamilton Furnace Co., which will double the capacity of its present plant.

Toledo, Ohio—The Fisher-Storey saw mill, recently destroyed by fire, will be rebuilt. The plant is to be motor driven, power being supplied from a power plant built as a part of the mill.

Fort Wayne, Ind.—Pennsylvania Railroad will erect new air compressor in its power plant. The new apparatus will have a capacity of 2700 ft. per minute. Address Assistant Foreman Hosterman.

Gary, Ind.—Dorman and Sykes Auto Sales Co. will build a $100,000 building, three stories, which will be the second largest business block in Gary.

Gary, Ind.—Revescz Home Building Co. will erect 16 apartment houses at a cost of $225,000, two six-apartment buildings to be erected immediately.

Indianapolis, Ind. — The Indiana Public Service Commission has authorized the Union Traction Co. of Indiana to issue $150,000 worth of three-year promissory notes, dated July 1, 1919.

Indianapolis, Ind. — Indianapolis Belt Railroad Co. will expend $20,000 at the Indianapolis stock yards, the first important improvement being the erection of a new building, 200x300 ft.

Indianapolis, Ind. — Indianapolis Cordage Co. will erect one-story warehouse, 140x200 ft., at cost of $30,000.

Richmond, Ind.—E. W. Steinhart Co., Indianapolis, will erect four-story concrete building to cost $125,000.

South Bend, Ind. — Studebaker Corp. has taken a permit for the construction of $700,000 factory building, 192x504 ft.

South Bend, Ind.—American Home & Investment Co. will erect forty-six new houses in this city.

Carlinville, Ill.—Macoupin county board of supervisors will install electric lights throughout the court house. Address Q. H. Bates, supervisor, Carlinville, Ill.

De Kalb, Ill.—De Kalb-Sycamore Electric Co. will erect a large cooling tower 80 ft. in height, and 12 to 15 ft. in diameter.

Mt. Auburn, Ill.—Wurl Electric Co. has applied for a permit to install an electric lighting system in Mt. Auburn, Ill., and to sell $5000 of its capital stock.

Elwood, Ind.—Sellers Kitchen Cabinet Co. has begun construction of four-story building, which will make the seventh building for this company. The State Construction Co. of Indianapolis has the contract. The new building will be of brick and structural steel.

Evanston, Ill.—The Illinois Public Utilities Commission has denied the right of the Chicago, Fox Lake & Northern Electric Railway to construct a suspended monorail railway between Evanston and the village of Palestine. The original petition was denied some months ago and the petition to reopen the case has also been denied. The company is authorized to cease taking subscriptions and from selling its one-year 7% gold notes.

Palmyra, Ill.—An order entered by the State Utilities Commission gives the Palmyra Light, Heat & Power Co. the right to construct and operate a transmission line from Palmyra to Waverly, and which is to extend to Modesto, for the purpose of furnishing electric light to consumers along the proposed route. In addition the company is given the right to issue first mortgage bonds in the aggregate of $8,000. Address Lewis M. King, president.

Petersburg, Ill.—An electric line is being provided between Springfield and Rushville by the way of Petersburg and Chandlersville. John Rosenwienkyle, 2154 North Racine avenue, Chicago, is promoter.

Urbana, Ill.—The Urbana board of local improvements has decided to resurrect the ornamental lighting proposition once started for the southwest part of Urbana, including the territory south of University avenue and west of Market street. City Engineer A. M. Danelly is now at work on plans for the system which is expected to cost about $100,000.

Villagrove, Ill.—The failure of the Central Illinois Public Service Co., to furnish power has started the organization of a company to build power plant. Address city clerk.

Adrian, Mich. — United Electric Manufacturing Co. has acquired the site of the Lion Motor Co. plant, on which it proposes to erect a $100,000 plant.

Lansing, Mich.—The question of issuing $65,000 in bonds for extending the light and water power service is being considered by the local authorities.

Appleton, Wis. — Wisconsin Traction Co., will extend its line to nearby towns. Work on the extensions to Hortonville has been commenced.

Saginaw, Mich. — The council has been petitioned to have street cars lines extended to new factory district. Address city clerk.

Stanwood, Mich. — Stanwood will have an electric lighting system. Six men of the town have organized a company and will put up a plant adequate to the needs of the town. Wires will be installed all over the town, both for residence and store use. The company was organized by M. D. Crane, E. L. Smith and others.

Davenport, Iowa — Linograph Co. will erect the first unit of its factory building to cost about $100,000. The new building will be 65x150 feet, four stories and basement. It is the first of three units which will eventually be connected with a corridor.

Newton, Iowa—Plans are in progress for electric plant. Archer & Stevens, 609 New England building, Kansas City, Mo., architects. Additional lights will be installed. Address city clerk.

Fulton, Mo.—Board of Managers of Westminster College has had plans prepared for the construction of a new electric power and heating plant at the institution, estimated to cost $30,000. Contract for erection has been awarded to Oscar Thomas, Sedalia, Mo.

Kansas City, Mo.—The $500,000 bond issue for extensions at the municipal light plant was ratified at a recent election. Extensions which will almost double the capacity of the plant will be made within a few weeks. The estimated cost of the improvement will be $407,000.

Wichita, Kans.—Another unit is to be built to the Kansas Gas & Electric Co.'s plant at Third and Kelley streets at a cost of $500,000. Plans for the building have been prepared and the contract for its construction has been awarded for the Phoenix Utility Co.

Lincoln, Neb.—Secy. Danielson of the state fair branch has petitioned the council to extend the city lights to the state fair ground.

Omaha, Neb. — Nebraska Power Co. has filed a first mortgage for $5,600,000, the entire issue having been bought by the Guaranty Trust Company of New York. Part of the proceeds of the mortgage will be used to pay off $2,000,000 of bonds now outstanding and the balance will be used to make improvements.

Madison, S. D. — Bonds to the amount of $100,000 have been voted for an electric light plant.

SOUTH CENTRAL STATES.

Louisville, Ky.—Fifty houses at a cost of $200,000 will be constructed in Louisville by the Consolidated Realty Co. The houses will average between $4000 and $16,000 each. It is estimated that 2500 houses are needed in Louisville.

Louisville, Ky.—L. C. Lashment, secretary and treasurer of Wadell & Son, engineers of New York and Kansas City, has arrived in Louisville to begin construction on the new electric railway which will connect Frankfort and Shelbyville. The last connecting link has been surveyed and it is planned to begin construction so that the road will be in operation by Jan. 1, 1920. A plan to bridge the Kentucky river at Frankfort has been abandoned and the present plan is to use a bridge already in use over this stream.

Louisville, Ky.—O'Connor Realty Co. will erect two-story concrete garage, 60x244 ft., to cost $50,000.

Columbus, Miss.—The council after hearing and carefully considering a report on the condition of the water plant by an expert engineer decided to purchase two auxiliary electrically driven centrifugal pumps. It is estimated the new equipment will cost $7000. Address mayor.

Alexandria, La.—$40,000 in bonds has been voted to improve street railway. Address mayor.

New Orleans, La.—The Navy Department is arranging for the construction of a large new power plant at the local Government site. It is understood that the proposed plant with equipment will cost in excess of $250,000.

New Orleans, La.—Plans are under consideration by the Board of Managers of the Charity Hospital for the construction of a large new power plant at the institution, estimated to cost, with equipment installation, about $90,000.

Kingsport, Tenn.—Holston River Power Co., Johnson City, recently organized, plans the construction of hydroelectric power plants on the Holston river, near Kingsport, to cost about $3,000,000. The company proposes to furnish electric power for industrial operations and other service at Kingsport, Johnson City, Bristol and other points.

Petersburg, Tenn. — City council has arranged for the issuance of bonds for $15,000 to provide for the municipal lighting system. G. C. Hart is mayor.

Conway, Ark.—Plans are being prepared by the city for extensive improvements and extensions in the municipal electric light plant. Estimated cost $50,000.

Fort Smith, Ark.—The Commonwealth Public Service Corp., which purchases electricity from a local company to supply all towns between Van Buren and Clarksville with power and light and which also supplies several coal mines in Franklin and Johnson counties with power, will erect a large central power station in Johnson county, in the vicinity of Clarksville. The plant will cost approximately $200,000. Steam turbines will be used to generate the power.

Afton, Okla.—City council has approved the issuance of bonds for $10,000 to provide for improvements and extensions in the municipal lighting system.

Comanche, Okla.—City voted $35,000 bonds for electric and water plant improvements . Address the mayor.

Newkirk, Okla. — Bonds to the amount of $185,000 have been voted by the City Council, a portion of the proceeds to be used for extensions in the municipal lighting system.

Abilene, Tex. — American Public Service Corp. will construct units of electric light plant to cost about $350,000.

Ennis, Tex.—The city contemplates installing an electric light plant. Address mayor.

Houston, Tex.—Mack Oil & Water Well Screen Co., Kress building, proposes to build a new plant, consisting of three reinforced concrete buildings, 100x200 ft., 75x100 ft., and 30x50 ft., at an estimated cost of $200,000. Much of the equipment will be operated by individual electric motors. J. O. Mack, manager.

San Antonio, Tex.—The council is preparing to expend $25,000 for fire and police alarm system. Address Mayor Bell.

WESTERN STATES.

Havre, Mont.—The Montana Public Service Commission in an order recently issued authorized the Montana Power Co. to discontinue service and abandon operation of its heating plant at Havre.

Sildix, Mont.—Amazon-Dixie Mining Co. will install an electric power plant in the near future. The power line will in all probability be run from Mullan. The property is a silver-lead product and has been doing extensive development work for some time.

Salt Lake, Utah—Lafayette Hanchett, representating the Dixie Power & Light Co., accompanied by Manager Woodhouse of the company appeared before the state road commission to continue negotiations looking to construction of an electric power line along the route of the Arrowhead trail, between St. George and Cedar City. The company seeks a way by which the state could undertake to construct the pole line and the company would furnish energy at the wholesale rate, to operate the mixers, rock crushers, pumping station, etc.

Mullan, Idaho—Amazon-Dixie Mining Co., at Sildix, Mont. about 11 miles from Mullan, Idaho, will install an electric power plant in the very near future. The power line will in all probability be run from Mullan.

Roseburg, Ore.—William Pellman, owner of the Roseburg light and water plant, is inspecting the properties with a view of making extensive improvements. The pumping and power plant will be improved and the entire system put in shape to accommodate Roseburg's increasing demands.

Kelso, Wash.—The contract for the new brick substation to be built in Kelso by the North Coast Power Co. has been let to N. A. Strand, Kelso, and construction work will be started immediately. The company is now rebuilding the line from Kelso to Kalama.

Tacoma, Wash.—The city will buy the Lake Cushman power site and build thereon a hydroelectric plant if the proposed bond issue of $300,000 is authorized at a special election to be held in July.

Glendale, Cal.—Bonds have been voted to improve water system, electric equipment will be purchased. Address city clerk.

PROPOSALS

Motor-Driven Ladder Truck.—Bids will be received until 10 a. m., July 11, by the Board of Public Works, Seattle, Wash., for one motor-driven 75-ft. automatic aerial ladder truck, two 100 and two 800-gal. capacity combination motor pumping engines and hose cars.

Lighting Fixtures.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until July 16 for installing lighting fixtures in the south building. Hygienic Service, United States Public Health Service, Washington.

Power Plant.—Bids will be received by the Water, Light, Power and Building Commission, Wells, Minn., until July 10 for the erection and completion of power plant building, concrete reservoir, and furnishing and delivering power plant equipment, in accordance with the plans and specifications of the Charles L. Pillsbury Co., engineers, 813 Metropolitan Life building, and Tyrie & Chapman, architects.

Electric Light System.—On July 11 bids for labor and materials required in the construction of an electric lighting system for the village of Church's Ferry, N. D., will be received, according to the plans and specifications which are on file in the office of H. A. Moe, village clerk, and also in the office of Earle D. Jackson, St. Paul, Minn. The work is divided into two parts, consisting of a brick and tile power house and furnishing and erecting two oil engines, necessary piping and accessories, two three-phase, 60-cycle, 2300-volt alternators with exciters, switchboard, etc., and furnishing and erecting poles for the electrical distribution in the village.

Electric Work.—Bids will be received by the supervising architect, Treasury Department, Washington, D. C., until 3 p. m., July 25, for furnishing materials for the construction of the United States Post Office, at Dawson, Ga., including materials for concrete, reinforced concrete, stone, granite, brick, structural terra cotta, structural steel, miscellaneous iron and steel work, composition roofing, slate roofing, sheet metal work, skylights, plastering, interior marble, sanitary slate, lumber, millwork, painting, glazing, hardware, plumbing, heating, electric work, etc., in accordance with drawings, specifications and bills of quantities attached thereto, copies of which may be obtained from the custodian of site at Dawson, Ga., or at the above office, in the discretion of the acting supervising architect. James A. Wetmore, supervising architect.

FOREIGN TRADE

[Addresses of firms referred to in these trade opportunities may be obtained by writing to the Bureau of Foreign and Domestic Commerce, Washington, D. C., or its branch and local co-operative offices. Request for each opportunity should be on a separate sheet and the file number

Electrical Supplies (29,748).—Drugs, chemicals and kindred lines; engineering and building materials, such as iron, steel, metals, heavy hardware, and machinery; electrical supplies for light, heat and power service, and for telephone and telegraph service, are required by a firm in Norway. Payments to be through New York and Norwegian banks. References.

Electrical Machinery (29,741).—The purchase of tubing for high pressure turbines and electrical machinery of all kinds for developing waterfall power is desired by a firm in a consular district of Spain. Quotations should be given f. o. b. New York. Terms, cash against documents. Correspondence may be in English. Reference.

Electric Power Plant (29,759).—The municipality of a city in Greece desires to receive proposals until Sept. 11, 1919, for the installation and operation under contract for a period of years, of an electric plant to furnish light and power to the city and its surroundings. Further information and terms of contract may be had on application to the Bureau or its district offices.

Motors, Dynamos, Electrical Apparatus (29,784).—An agency is desired by a manufacturer in Spain for the sale of cranes, elevating apparatus, gasoline, kerosene and crude-oil engines; mining machinery, machinery for the construction of public works; steam engines, electric motors, dynamos and electrical apparatus and supplies; complete material for aerial cableways; steel cables for traction and elevation; agricultural machinery and tractors. Correspondence should be in Spanish. References.

Electric Lighting Appliances (29,812).—The purchase and agency are required by a firm in Australia of all motor requisites, accessories, tires, cars, etc., novelties and specialty lines, electric lighting appliances for households, etc. Terms, cash against documents or 90 to 120 days after sight; also consigned stock to be paid as sold. Reference.

Electrical Goods (29,814).—A merchant from Peru who is in this country desires to be placed in communication with firms in view of securing agencies for the sale of electrical goods, agricultural machinery, hardware, etc. Reference.

Electrical Materials (29,815).—A wholesale dealer in Belgium desires to purchase and secure agencies for the sale of electrical materials of good quality. Correspondence may be in English. Reference.

Metal Filament Lamps and Insulated Cables (29,823).—The exclusive agency from manufacturers for the sale in India, Burma, and Ceylon, of electric metal filament lamps, ordinary and half watt, and electric insulated cables, is desired by a company in India. Reference.

Ice-making Machinery (29,809).—Ice-making machinery to be driven by oil engines or electric motors of 220-volt alternating current, suitable for manufacturing three tons of ice per 24 hours, is desired by a man in Costa Rica. Quotations should be given c. i. f. destination. Correspondence should be in Spanish. Payment, cash against documents.

Electric Vacuum Sweepers (29,810).—The purchase of electric vacuum sweepers is desired by a firm in Canada. Quotations should be given f. o. b. place of shipment. Terms, cash payment. To be shipped all rail. References.

INCORPORATIONS

Brooklyn, N. Y.—William C. Chapman & Co. Capital, $5,000. To manufacture electrical specialties. Incorporators: J. D. Murphy, W. C. and A. A. Chapman, 166 Brooklyn avenue.

Orange, N. J.—Wethling-Bakely Co. Capital, $100,000. To manufacture electrical appliances, etc. Incorporators: Edward Bakely, Livingston; and H. D. Wethling and A. D. Seymour, Orange.

Dover, Del.—Saw Tooth Power Co. Capital, $300,000. To operate a plant for the generation and distribution of electric energy. Incorporators: P. B. Drew, H. E. Knox and S. E. Dill, Wilmington.

Personal

Elliott Reid Made Sales Manager—C. McKew Parr Back from National Service — George Lockwood Passes Away

BENJAMIN C. PAGE has been appointed to the position of superintendent of the Sheffield plant of Fairbanks, Morse & Co., Three Rivers, Mich.

ALFRED M. BARRETT, Flushing, Brooklyn, N. Y., has been appointed Deputy Public Service Commissioner by Lewis Nixon, Public Service Commissioner, New York.

F. F. WINFREE has been appointed manager of the Sandpoint, Idaho, division of Mountain States Power Co. Mr. Winfree was formerly connected with the Richmond (Cal.) division of Western States Gas & Electric Co.

J. H. MORGAN, who recently resigned as manager of the local telephone exchange, has become associated with the Western Electric Co. installing farm lighting plants, with headquarters at Bentonville, Ark.

ELLIOTT REID, assistant to general manager of the Westinghouse Lamp Co., New York, has been promoted to the position of sales manager, effective July 1. In his new capacity Mr. Reid will be responsible for the commercial activities of the company in both large and miniature classes of lamps in domestic territory.

CLIFFORD M. HOLLAND, divisional engineer of the Public Service Commission, New York, has been appointed chief engineer to superintend the construction of the New York-New Jersey vehicular tunnel, estimated to cost about $12,000,000, by the New York State Bridge & Tunnel Commission, with headquarters at 115 Broadway.

C. MCKEW PARR, general sales manager for the Hart & Hegeman Manufacturing Co., Hartford, Conn., has rejoined the company after a year and a half in the national service. He was connected with the bureau of exports of the War Trade Board at Washington, and later was appointed a special representative of the Board with a commission as special assistant of the Department of State. He was also appointed vice consul at Las Palmas, Canary Islands, and at Barcelona, Spain, having also had missions in France and England.

LEONARD F. FULLER, chief electrical engineer of the Federal Telegraph Co., has resigned to become assistant manager of the Ohio Insulator Co., with headquarters at Barberton, Ohio. Mr. Fuller has been associated with the Federal Telegraph Co. during the period in which the Poulsen arc has taken a leading place in long-range radio communication, and much of the improvement in recent years contributing to their success is attributed to him. Mr. Fuller recently received the degree of Ph. D. from the Stanford University for his work in magnetic circuits in arc generators.

L. W. SCHNITZER, of the Ingersoll-Rand Co., is now manager of the pneumatic tool department of the company at Chicago.

H. W. STEELE, for five years superintendent of the gas and electric departments, El Reno division of Oklahoma Gas & Electric Co., has been appointed general manager of the gas and electric departments at Muskogee. Earl James of the Oklahoma City division of the company will succeed Mr. Steele at El Reno.

W. A. PIXLEY, general auditor of the Nebraska Telephone Co. and of the other companies of the Bell group having their headquarters in Omaha, Neb., has resigned and will devote his entire time to the Truck and Tractor Corporation of Omaha, of which company he is vice-president and general manager. Mr. Pixley has been with the Nebraska Telephone Co. for 27 years, during 14 years of which he has been auditor. Mr. Pixley has taken financial interests in the Truck & Tractor Corp. of Omaha. He is succeeded by F. L. Devereux of New York, formerly auditor of the long lines department of the American Telephone & Telegraph Co.

MAJ. J. B. JACKSON, after two years in the national service, has returned to his former position with the Commonwealth Edison Co., Chicago. While in France Major Jackson was in charge of the electrical design and construction throughout the S. O. S. territory, with headquarters in Tours. His work in this connection corresponded very closely with that of the Construction Division of the Army in this country, although he was confronted with many difficulties in securing the necessary material and apparatus which were not encountered in the work at home. He was formerly an illuminating engineer of the company and assisted in designing the lighting for the Edison building at 72 West Adams street, Chicago.

GEORGE ELLERY HALE, director of the Mount Wilson Observatory and foreign secretary of the National Academy of Sciences, who has been for the last ten years a Correspondent of the Academie des Sciences, Institut de France, has received the unusual honor of election as Associe Etranger, succeeding Adolph von Baeyer. The foreign associates are limited to twelve, and the high distinction has been held by only two Americans—Simon Newcomb and Alexander Agassiz. The National Research Council upon the presentation and acceptance of Dr. Hale's resignation as its chairman and the election of James R. Angell as his successor, created and bestowed in perpetuity upon Dr. Hale the title of honorary chairman in recognition of his services to the National Research Council and to science and research by indefatigable efforts that have contributed so largely to the organization of science for the assistance of the Government during the war, and the augmentation of the resources of the United States through the newly intensive cultivation of research in the reconstruction and peace periods that follow.

Obituary.

GEORGE LOCKWOOD, of Providence, R. I., one of the general managers of the National Lamp Works of General Electric Co., died suddenly in the hospital on Association Island on June 26, following an operation for appendicitis. He was born in Newark, N. J., and was a graduate of the Stephens Polytechnic Institute at Hoboken, N. J. Through his connection with Stephens Institute he became associated with John W. Howell, chief engineer of the Edison Lamp Works of General Electric Co., about 1890. For about four years he devoted himself to the manufacturing end of the lamp business, but subsequently engaged in the commercial end of the business in which he continued until the year 1898, and at that time he was employed by F. S. Terry to operate the factory of the Sunbeam Incandescent Lamp Co. at Des Plaines, Ill. In 1901 the Sunbeam Co., assisted by B. G. Tremaine, inaugurated the first activity which resulted in the formation of the National Electric Lamp Association, which subsequently was incorporated as the National Electric Lamp Co. and finally merged with the General Electric Co. Throughout the entire period of development Mr. Lockwood was active in creating and developing several branches of the National Electric Lamp Co. into sound business divisions, applying himself both to manufacturing and commercial problems. At the time of his death he was general manager of the Bryan-Marsh Division, National Lamp Works of General Electric Co., this division being one of the most important branches of the National Lamp Works.

The loss of Mr. Lockwood will be most keenly felt by the National Lamp Works, not only because of his ability to operate and manage a large and important branch of its business, but because of the great love and esteem for him held by every member of the organization. He leaves one sister, Mrs Alice Lockwood Olmstead of Des Moines, Iowa. He also leaves an uncle and aunt residing in New York City. The body will be taken to Newark, N. J., for interment. Mr. Lockwood was well known throughout the country and was connected with many of the electric and electric light organizations throughout the United States. "He was one of the strongest and best liked men in the electric light industry in the entire country," said Judge J. M. Woodward, of Cleveland, Ohio, attorney for the Electric Lamp Industry of the General Electric Co.

Electrical Review

WITH WHICH IS CONSOLIDATED WESTERN ELECTRICIAN AND ELECTROCRAFT.

VOL. 75—NO. 2. CHICAGO, SATURDAY, JULY 12, 1919. PAGE 47.

Central-Station Rates in Theory and Practice

First Article of the Series—Various Kinds of Costs—General Principles by Which Service Costs Can Be Determined—Application to the Cost of Electric Service

By H. E. EISENMENGER

This is the first article of a series to appear weekly throughout this volume. A general outline of the entire series was published in the last issue. Rates for electric central-station service are generally conceded to be more scientifically and equitably developed than for any other class of public utility service. The principles on which they are based are applicable to many other kinds of service and yet they are not well understood by many public authorities, by the public in general, and even by many electrical utility managers. Mr. Eisenmenger's articles will therefore be found of great value, especially at the present time when rates are in so many cases being revised.

PART I—THE COST OF ELECTRIC SERVICE.

1. The Cost of Commodities in General.

A. THE COST OF A CERTAIN QUANTITY. TOTAL COST AND UNIT COST.

SECTION 1. The term "cost" of a certain commodity[1] is by no means a well defined one and we must distinguish a variety of interpretations.

In the first place, the term "cost" always refers to some given quantity of the commodity and it is usually—though not always—understood from the context what quantity we mean. It may be the total quantity produced (sold, consumed, etc.) in a certain enterprise, for instance per year, or the quantity purchased or consumed by a certain consumer, or the quantity of a certain shipment, etc.

Primarily, as a rule, we have given the cost of the total quantity produced, mostly per year, and desire to know the cost of the quantities purchased by the various consumers, or of other quantities of the commodity. For this purpose it is necessary to reduce the cost to some unit quantity.[2]

The term "cost" means therefore the cost of a given quantity, which may or may not be the unit quantity. Thus the cost of coal may be said to be $1000, which may mean per year, or per shipment, or per voyage of a steamer, etc., or the same cost may be said to be $4, which would mean per ton.

To avoid such ambiguities, the cost of a certain quantity, other than unity (especially the quantity produced, sold, consumed, etc., by a certain enterprise during a year or other unit of time) will hereafter in these articles be called the "total cost" where necessary to distinguish it clearly from the "unit cost," that is, the cost per unit quantity.

Where we have a number of constituent quantities, for instance several classes of service, the cost of producing several of these quantities simultaneously will be called their "combined cost."[3] We can thus distinguish a total combined cost and a unit combined cost. If the constituent quantities comprise all parts of the quantity produced by the manufacturing enterprise, for instance in a year, the combined total cost will be called the "aggregate cost" in these articles. This is the entire (annual, monthly, etc.) cost of the enterprise.

The same distinctions as to the quantity of the commodity must be made in case of income, profit and price, so that we distinguish a total income, profit and price and a unit income, profit and price.[4]

B. COST INCLUDING OR EXCLUDING CAPITAL EXPENSES.

2. We can further distinguish different kinds of cost for the same commodity, or different meanings for the term "cost" as explained in the following:

The total annual cost necessary to maintain and run any enterprise, especially a manufacturing establishment, such as a central station, consists of two parts:

(a) The direct running expenses per annum which generally stop as soon as the enterprise shuts down, such as salaries, wages, fuel, raw materials, etc.

(b) Expenses which are the result of a certain capital being invested in the property of the enterprise.

[1] The term "commodity" is meant throughout these articles to designate anything that is being sold, whether physical goods, or the right to use them, or work, labor, service, etc.

[2] The unit to be chosen depends on the nature of the commodity. It may be, for instance, a unit of weight, length, area, cubic capacity, numbers (pieces, pairs, dozens), time, power, energy, weight-distance (ton-miles in transportation service), etc.

[3] The "combined cost" is not equal to the sum of the costs of the constituent quantities (see later).

[4] If the commodity consists in a service, the price per unit is frequently called the "rate"; electric service, for instance, may be charged "at the rate of" 10 cents per kilowatt-hour, just as we say, a train is running "at the rate of" 50 miles per hour.

This capital calls not only for interest but also for annual payments into funds for depreciation, etc.[5] These expenses remain the same whether the plant is working or not. They are not reduced if the plant reduces its output, but they are increased if the plant increases its output beyond its present capacity.

We can now call "cost" the aggregate of all of the above expenses under (a) and (b), assuming a fixed percentage of net return on the capital invested. This method is the obvious one where the capital has been raised entirely by bonds and therefore bears a fixed interest, as in the case of municipal plants. With this meaning applied to the term "cost," it is only necessary to cover the "cost" by the revenue, and no profit[6] is required to yield the expected return on the capital invested. If the gross revenue exceeds the total cost, the balance representing the profit must be applied to purposes not in direct connection with the enterprise, unless we can reinvest it for enlargements, etc.

Or we may understand the term "cost" in such a manner that it includes the running expenses (a) and only such of the capital expenses (b) as are actually a fixed percentage of the capital invested and independent of the earnings, that is, interest on bonds and on preferred stock, also depreciation charges, etc., but not the interest on the common stock ("dividend"). In that case it is necessary that the enterprise should yield more than the "cost." The variable excess of the income over cost, that is, the profit, is applied to pay the interest on the stock. That interest, the dividend, is therefore a variable percentage.

Or we may finally exclude *all* the capital expenses (b) from the amount covered by the meaning of the term "cost," so that we will have to pay out of the profit, first the fixed capital charges, such as bond interest and depreciation charges, and then apply the balance for the dividend.

Where the term "cost" is applied in these articles without further specification it will always be understood in this last sense.

In all these cases we can again distinguish a total cost of the establishment, for instance per year, and a unit cost as explained under Section 1.

C. Segregate Cost, Increment Cost, and Average Cost.

3. Another lack of definition in the term "cost" is that it may mean what will be called in these articles the "segregate cost," or it may mean the "increment cost" or the "average cost." The segregate cost of a certain portion of the total quantity produced by the enterprise is the amount it would cost to produce that fractional quantity only. The increment cost is the amount by which the aggregate cost of the enterprise is increased in consequence of the fact that the respective quantity is added to the quantity to be produced.[7] Both the segregate cost and the increment cost can be reduced to the unit produced.

[5] Interest, depreciation, and other capital expenses will be treated more fully in Sections 18 to 23.

[6] Profit is the excess of income over cost and the meaning of this term varies therefore as we apply the different meanings of the term "cost," as explained in this section.

[7] It is a general, and probably universal, truth that a larger establishment can—ceteris paribus—produce more cheaply per unit than a smaller one and an establishment of given size can produce more economically if it is producing at a rate corresponding to its full capacity than otherwise. If we have, for instance, a railway where the traffic is so small that not more than one or two trains are necessary in each direction per day, we have certain salaries for station masters, etc., to pay, just the same as if we had many more trains; a certain capital must be invested in the roadbed and buildings, independent of the number of trains running daily; the wooden ties will rot in the same time whether many or few, heavy or light trains are running over them, etc.

Supposing, for the sake of an example, that it costs

$ 600 to produce 500 units,
1000 to produce 1000 units,
1300 to produce 1500 units,

then the increment cost of 500 units over the cost of the first 500 units is $400, and the increment cost of 500 units over the cost of the first 1000 units is $300. The segregate cost of 500 units, that is, the cost of producing the said quantity by itself without simultaneously producing other units, is $600.

Both the increment and the segregate cost can be reduced to the unit. The increment cost per unit in the above example would therefore be $0.80 or $0.60, respectively,[8] whereas the segregate cost per unit would be $1.20.

We can finally also reduce the aggregate cost (see Section 1) to the unit, that is, we find the "average cost per unit." This would be in the above example in case of an aggregate production

of 500 units	$ 600/ 500 =	$1.20
of 1000 units	1000/1000 =	1.00
of 1500 units	1300/1500 =	0.867

D. By-Products.

4. Conditions frequently are not as simple as assumed so far. The first complication comes in where more than one commodity is produced by the respective enterprise. The same processes, activities, capitals invested, etc., which are necessary to produce one commodity, frequently automatically produce at the same time another one or several others. In the coal-gas business, for instance, the result of the process is not only gas, but also coke, tar, ammonia, naphthaline, etc. If one of the commodities is of paramount importance we can speak of a *main product* and of one or more *by-products,* in the sense of subordinating the latter to the main product. Or, if all the products are more or less of the same importance among one another, we can call them all by-products, meaning by-products to each other, in the sense of mutual co-ordination.

Now, the question arises: What portion of the total cost, or of any part of the total cost, is to be charged to every one of the by-products?

What portion of the annual cost of coal, for instance, is to be charged to the cost of the gas and what portion to the cost of the coke?

We cannot distribute the cost according to the number of the units produced of each commodity, because gas and coal are not measurable in the same units, and even if they were, it would not be possible to logically justify such a distribution of the cost. We might distribute the total cost according to the selling value of the totals produced of gas and coke and then, if the unit cost is required, further distribute each one of these subdivisions to the uint of gas or coal respectively. Or we may prefer some other way. Whichever method we choose, there will always be an arbitrary element about it.

It may be anticipated here that this does not apply to the *prices,* which are determined according to the value-of-service principle. This will be discussed in a later section on prices.

E. Products to Be Measured in More Than One Unit.

1. General Explanation.

5. Another complication in determining the cost per unit is encountered where the total cost consists of

[8] Frequently the conditions are such that we can assume the increment cost per unit to be constant for a wide range of the quantities of previously produced goods.

several portions or items in such a manner that the amount of each portion is determined by some other factor or element and each of these factors is measured in another unit. For instance, one portion or item may depend on the weight of the commodity produced (expressed in pounds or tons, etc.) and another one on the length of the same product (for instance in feet). Instead of theoretical explanations an example will make clearer what this means.

6. This example is the letter carrying service as furnished by the Post Office Department. The annual cost of the letter mailing service (excluding the charges on the capital invested) is composed of the two following main portions or items:

(a) The annual cost of transporting the letters, whether by rail, or street-vehicle, or on the shoulders of the postman.

(b) The annual cost of assorting and distributing the letters in the post offices.

The first item, like the cost of any other transportation service, can be assumed to be proportional to the number of ton-miles required per year, and in reducing the cost to the unit we have to use the ton-mile (or ounce-mile or some such unit). This item will therefore be constant *per ton-mile* (or ounce-mile). The second item is plainly the larger, the larger the *number* of letters is that is being handled per year and has practically nothing to do with the weight of the letters or the distance over which they are being carried, etc. The proper unit is the letter or a certain standard number (say, 100, 1000) of letters and this item will be *constant per letter.*

The total cost for any volume of service rendered during any period of time is therefore the sum of two items, one of which is the product of a constant figure × the number of ounce-miles required, whereas the other is the product of another constant figure × the number of letters carried. This applies to any volume of service, to individual letters as well as to a given mail bag filled with letters, etc. The result of the computation will be correct, no matter whether we have big, fat manuscripts or thin, little notes and whether they travel from New York to San Francisco or into the neighboring town only.

2. The Use of a Smaller Number of Elements Simplifies the Computation, but Reduces the Accuracy.

7. The question of the average unit cost of letter service will therefore be answered as: So much per ounce-mile plus so much per letter. We can, however, also refer the total cost of letter service to one of the two above elements only and ask: How much is the average cost per letter? Or: How much is it per ounce-mile? This is easily figured out, but if we try to apply it to a given letter or portion of service (mail bag) it will furnish correct results only if in that letter (bag of letters, etc.) the ratio of the ounce-miles to number of letters happens to be the same as in the entire service over the whole year. If we apply, for instance, the average figure per letter to a very thin letter traveling over a short distance, the computation will furnish too great a value because we figure the cost as if the letter would require a greater number of ounce-miles than it actually does. Conversely, if we apply to such a letter the average figure per ounce-mile the result will be too small, etc.

3. The Use of a Greater Number of Elements Enhances the Accuracy, but Complicates the Computation.

8. We have now obviously a certain inaccuracy, not only if we reduce the cost to a single one of the items, but also in the case where we use both of the above items (cost of transportation and cost of handling) since these items are not really the only ones (as has been assumed so far) which have a bearing on the cost of service, even though they are the most important ones. We have to correct, therefore, the statement made above in Section 6 and say: "The first item (a) is *practically* constant," or "nearly constant," or "does not vary much" per ounce-mile, and the same correction applies to item (b) per letter or per 1000 letters, etc.

We can, therefore, increase the accuracy by increasing the number of "elements" or "items" (cost of transportation and cost of handling in the above example) which we choose to consider for the computation of the cost. We might use, for instance, three items: (a) the cost of transportation between railway stations or ports (per ounce-mile); (b) the cost of transportation within the distance of a given post office, that is, from the letter box to the post office, between the post office and the railway station and from the post office to the addressee (per ounce-mile); and (c) the cost of handling the letter.

Whether we select from the indefinitely large number of these elements one, two, three, or four, etc., and where we draw the line between the most important ones and those of lesser importance, is to a certain degree a matter or abitrary judgment, and the decision will have to be guided by considerations of practicability. *The larger the number of elements we choose, the greater will be the accuracy and the smaller will be the deviations in the individual case.* At the same time the computation will become more complicated. We have to strike in this case (as in so many others) a happy medium, and steer a safe course between the Scylla of complication and the Charybdis of inaccuracy.

4. Increasing the Accuracy With a Given Number of Elements by Subdividing the Customers Into Classes.

9. We can, however, with a given number of elements chosen, increase the accuracy with less complication in the following way. We subdivide all the customers or all the cases in which the respective business is transacted, into a number of classes or groups, selected in such a manner that the unit cost of each one of the considered items—that is, of ounce-mile and letter in our case—is most nearly constant for all customers or parts of business within each group, but varies from one group to another. For instance, we might classify the letters according to the distance over which they are carried into local, interurban or domestic, and international letters. Then the answer to the questions, "How large is the cost per letter?" or "How large is the cost of transportation per letter?" will be more accurate, that is the individual deviations from the average will be much smaller. The average cost per local letter will be one figure, per interurban another, and per international a third one. Or we might classify the letters according to their weight: or according to the location of the addressee into the three classes of rural, suburban and business district letters. The transportation charges for the rural letters will be higher than in the other classes because the letter-carrier has to walk a longer distance from the post office and between the houses, etc. We may, of course, also combine two or more of these classification systems and differentiate heavy and light rural letters, heavy and light suburban letters, etc.

Employing this principle, we can increase the accuracy with less inconvenience than when we employ an additional item.

II. The Cost of Electric Service in Particular.

A. The Three Elements of Cost.

10. The problem of properly expressing the unit cost of electric service can be solved in an entirely analogous manner to that previously described.

Just as we can say, the cost of letter service is so much per ounce of letter, we can also say electric service costs the central station, for instance, 3 cents per kilowatt-hour. That would mean that it costs 3 cents to furnish the current for burning a 100-watt lamp for ten hours or for obtaining one horsepower during one hour at 74.6% motor efficiency, etc. This is certainly a very clear and simple statement of the unit costs, but unfortunately it does not tell us much, unless we know the exact conditions under which the current is being furnished. It tells us no more than if we hear that it costs the Post Office Department one cent, or some such figure, to transport, handle and deliver a letter or one ounce of letter, without any statement about the distance over which the letter is to be carried or about the weight of the individual letter, etc. Yet we frequently read statements of the cost of electric power in terms of kw-hr. They are worth anything only if the special conditions of the case are known. They give over-all averages only. It may cost the same central station ½ cent per kw-hr. to serve one customer and 10 cents or more to serve another.

In accordance with what has been shown in the example of the letter service, we would have to have a large number of elements which have a bearing on the cost of the commodity selected, in such a way that a certain portion of the total annual cost of the central station is proportional to the number of units per annum of one of the elements, another portion to the number of units of another element, and so on. In order to avoid too great a complication and to get practicable results, we generally limit the number of these elements to three, and more or less neglect the rest as they are of lesser importance. More accurately speaking, we average the small remaining part of the total cost which is not proportional to any of the three items of cost, *somehow* into the three items.

(The reader should keep in mind that we are at present dealing with the cost to the central station and not yet with the systems of charging the consumer.)

The three items for the computation of the cost are:

(1) An item proportional to the number of kilowatt-hours generated or sold.[1] This item is therefore constant per kilowatt-hour. It is called the kilowatt-hour cost or *energy cost.*

(2) An item proportional to the maximum number of kilowatts[2] loading the central station. This item is therefore constant per kilowatt; since the maximum power in kilowatts is called the maximum demand, this item is called the *demand cost.*[3]

(3) An item which is caused by the mere fact the consumer *is* a customer of the central station. This item is independent of the amount of service required by the customer, as the second item in the example of the letter-mailing-service cost (assorting the letters) was independent of the weight of the letter and of the distance over which it had to travel. This item of central-station cost is proportional to the number of customers and is constant per customer. It is called the *customer cost.*

These three items will be discussed more in detail in the following installment.

Insert 1—(Appendix to Section 10).

Explanation of the Terms "Horsepower," "Kilowatt," "Kilowatt-hour," Etc.[4]

If a weight is lifted up by some force it requires "mechanical work" to do this, and if it is lowered mechanical work is set free. Work is measured in foot-pounds, which means the unit of work is the foot-pound. A foot-pound is the work necessary to lift one pound one foot high. To lift 1 lb. 2 ft. high 2 ft.-lb. are necessary, and to lift ½ lb. 2 ft. high, evidently one-half of that amount is necessary, namely 1 ft.-lb. In the same way we can say, one foot-pound is the work necessary to lift 10 lb. 1/10 ft. high, or 1/100 lb. 100 ft. high, etc. It is seen from these examples that the work is given by the product, force × distance.

The rate at which work is being done is called *power*. Power is the work done *per second*. It could be measured in foot-pounds per second, but this unit is inconveniently small for the purposes of the engineer and therefore a unit has been chosen which is 550 times greater, or which, in other words, amounts to 550 ft.-lb. *per second*. It is called the *horsepower* (hp.). A horsepower is, therefore, the power of one pound falling 550 ft. *every second*, or, for instance, 100 lb. falling 5.5 ft. every second. Conversely, 1 hp. would be required to lift 100 lb. 5.5 ft. every second. A water fall, for instance, which pours 880 cu. ft. (55,000 lb.) of water *every second* over a head of 100 ft. would, if harnessed, be able to produce 10,000 hp. (provided that no power would be lost in the turbines).

The electrical engineer uses other units besides the horsepower: the *watt*, which is about 0.738 ft.-lb., and the *kilowatt*, which is 1000 times as great as the watt. A kilowatt is, therefore, the work done by 1 lb. falling 738 ft. *every second*. One kilowatt = 738/550 = 1.342 hp. and one horsepower = 550/738 = 0.746 kw. The kilowatt, the watt and the horsepower are, therefore, different units for the same thing, just as the mile, the inch and the kilometer, or the dollar, the cent, and the shilling are different units for the same thing.

One kilowatt produces 738 ft.-lb. every second, or 2×738 =1476 ft.-lb. in two seconds, 2214 ft.-lb. in three seconds, etc., and 7380 ft.-lb. in 10 seconds. We can also obtain the same work of 7380 ft.-lb. from 10 kw. and then it will take us only one second, instead of ten. We see that the work is given by the product of power × the time during which the power is being applied.

We have thus been moving in a circle. We have seen that if a certain work has to be done within a given time—

[1] Not all the kilowatt-hours generated are sold. Some of them are used for the home consumption of the central station and others are lost in the transmission to the consumers. But the kilowatt-hours generated and sold can be assumed to be proportional to each other and it does not make any difference whether we assume the energy generated or sold to be the basis of the computation of cost and, in the first case, whether we include the home consumption or not, as long as the units are consistently understood in the same manner. Where it comes to the computation of cost as a basis for the price to be charged to the costumers it is evident that the energy sold is to be taken into consideration only.

[2] The non-technical reader whose ideas about the difference between the meanings of the terms "kilowatt" and "kilowatt-hour" are not quite clear is referred to Insert I.

[3] Some of the readers who are not familiar with electrical engineering may find it useful to have the difference made clear between the first and second item in plain though quite unscientific terms as follows: Imagine a lighting installation with lamps all of the same size. Item (1) of the cost, the energy cost, is proportional to the number of kilowatt-hours, that is, in this case to the number of lamp-hours. (The term "lamp-hours" means the sum of the burning hours of the individual lamps.) Item (2), the demand cost, is proportional to the maximum number of kilowatts (or, what amounts to the same thing, to the maximum number of watts) drawn by the consumer at any time, that is, in our hypothetical case proportional to the maximum number of lamps burning simultaneously. Thus, 100 lamps burning for 20 hours would contribute five times as much to the demand cost as 20 lamps burning for 100 hours, but they would contribute the same amount to the energy cost. On the other hand, 100 lamps burning for 80 hours would cause the same demand cost as 100 lamps burning for 20 hours only, but they would cause four times the energy cost.

[4] The object of this appendix is not to give a scientific explanation of the terms "kilowatt" and "kilowatt-hour," which are so frequently encountered in central-station and rate practice and which are not always fully understood, but to give the commercial man a clear working insight of what is meant by these terms. It deals, therefore, rather with examples than with definitions, and scientific exactness of expression is sacrificed for brevity and clearness.

for instance, a second—this means a certain "power." And now we see that if a certain power is applied for a certain length of time the result must be again mechanical work.

The work done by one horsepower every second is called a horsepower-second and that done by a kilowatt every second is called a kilowatt-second. According to the preceding paragraph a horsepower-second and a kilowatt-second are units of mechanical work just as the foot-pound. Indeed the horsepower-second equals 550 ft.-lb., as is easy to understand, and the kilowatt-second equals 738 ft.-lb.

Similarly, the work done by one kilowatt during one whole hour is called a *kilowatt-hour.* A kilowatt-hour is evidently 3600 times as big as a kilowatt-second, because an hour contains 3600 seconds. A kilowatt-hour has, therefore, $3600 \times 738 = 2{,}656{,}800$ ft.-lb. In exactly the same manner we can talk about a horsepower-hour, which is $3600 \times 550 = 1{,}980{,}000$ ft.-lb.

It is also clear that we can obtain one kilowatt-hour either by using one kilowatt for one hour, or two kilowatts for one-half hour, or 60 kw. for one minute, or 1/10 kw. for 10 hours, etc.

Electrical work is generally not called "work" but "energy."

It is important for the student of electric rates to get the difference between kilowatt and kilowatt-hour quite clearly fixed in his mind. The following may prove helpful. A salary of $100 per month is not the same as a capital of $100. The relation between the two is the same as between the kilowatt and the kilowatt-hour. A salary is *the rate* at which a man gets his money. It is money *per month,* measured in dollars *per month,* just as the kilowatt is *the rate* at which work is being done (energy being supplied), measured in foot-pounds *per second.* If we multiply salary by months we get a certain amount of money, which may be capital, and if we multiply kilowatts by hours we get work or energy, kilowatt-hours. Thus $500 per month during two months results in the same amount of money as $100 per month during ten months, namely $1000. Just so 5 kw. for two hours result in the same work as 1 kw. applied during 10 hours, namely 10 kw-hr. or 26,568,000 ft.-lb.

Power (kw.) corresponds to..........Salary (earning power), $ per month.

Work or energy (kw-hr.) corresponds to........Capital (accumulated salary), $.

Just as the power is the rate at which work is being done or consumed, so velocity or speed might be defined as the rate at which a distance is increased or decreased. The speed of a ship, for instance, is the rate at which the ship is moving away from a certain point (or towards it) and it is measured in (nautical) miles per hour, just as the power is measured in foot-pounds per second. The velocity of one mile per hour is called "one knot." Now the term "one knot" does *not* mean "one mile." The expression sometimes heard, "a speed of twenty knots per hour," is nonsensical. The knot is a certain speed, a rate of progress in miles per hour and a mile is a certain length, a certain total progress, so to speak, irrespectively of time. Instead of "one mile" we could also say "one knot-hour," although the term is not customary. Just so the kilowatt or watt or horsepower is a certain power, or rate at which work is being done or consumed, corresponding to the knot, and the kilowatt-hour or watt-hour or horsepower-hour, corresponding to the "knot-hour," is a certain work *irrespective of time*,* and can be measured, for instance, in foot-pounds.

Kilowatt, watt or horsepower means the rate at which an engine or some other device is generating or consuming work. An engine is running at 1000 hp. at a certain moment, a ship is using 5000 hp. for its propulsion at a certain speed, an electric generator is putting out 2000 kw., an electric furnace is consuming 5000 kw. at a given moment. Frequently, however, the terms kw., etc., are used to denote the maximum or the normal output which a generating device (engine) is capable of supplying or a consuming device (lamp, motor) is capable of consuming, just as the term "speed of a steamship" may mean either the speed at which the ship happens to be running at the moment to which one is referring, or the term may mean the maximum or the normal speed of the ship. So the terms kilowatt, horsepower, watt, etc., may also be used to denote the size of an engine or other device. We talk of a 10,000-kw. generator and of a 250-watt incandescent lamp. We talk of a 200-hp. boiler, meaning a boiler which, if normally operated, gives just enough steam to produce 200 hp. in the engine which is run from the boiler.

To summarize: Kilowatt-hour means *work* or *energy;* kilowatt means the *rate* at which work is being done and in a secondary meaning the term kilowatt denotes the capacity of machinery, etc. We can get the same number of kilowatt-hours with a *large* number of kilowatts operating for a *short* time or with a *small* number of kilowatts operating for a *long* time.

(To be continued.)

* Although the term "hour" occurs in the denomination.

THE FUTURE OF ELECTRICITY SUPPLY IN ENGLAND.

The Incorporated Municipal Electrical Association, whose summer conventions have been conducted under the clouds of war and therefore in a very restricted manner for the last few years, resumed the normal character of its proceedings at the three-day meeting held at Ipswich and Felixtowe on the East Coast of England from June 18 to 20. The subjects before the convention were: "The Application of Whitley Committee Recommendations to the Electric Supply Industry" (Alderman W. Walker); "Electric Transmission" (discussion opened by S. L. Pearce, city electrical engineer of Manchester); "The Assessment and Rating of Electric Supply Undertakings" (Bailie W. Smith).

The president for the year is F. Ayton, city electrical engineer of Ipswich, and chairman of the English Electric Vehicle Committee. In his inaugural address at the meeting, Mr. Ayton said that in achieving victory in the war, electric supply engineers and their undertakings had played no small or unimportant part. Public electric supply had been fundamental to the production of munitions of war in huge quantities. Now they were on the eve of momentous changes in the organization of the electric supply industry. Whatever might have been the effects of the war in other directions, posterity would concede that, as concerned the electrical industry, the war did good by bringing the British nation to recognize first, the importance of electric supply, and secondly, the general inefficiency and the drawbacks of the present methods of electrical generation and distribution, and to take active steps towards improvement.

The difficult conditions of war time were followed by the easing off in output that came from the signing of the armistice, which afforded, in some ways, a rather welcome relief. That event, however, brought upon them at least one new difficulty of a serious character in the considerable falling off in the industrial demand and the consequent decline in revenue. "This," said Mr. Ayton, "is, of course, but a temporary condition which will right itself so soon as our industries can be re-established upon a normal peace footing, labor difficulties be composed, and the galling restrictions on export trade removed. Nevertheless, the reduction in revenue which has resulted, and which it was, of course, impossible to foresee when our estimates for the year were framed, has placed a number of undertakings, whose output was largely for industrial power, in a somewhat serious financial position. The incidence of the fuel and lighting order has also been responsible for a not inconsiderable reduction in revenue from private residence and other consumers coming within the purview of its restrictions."

In regard to the Government Electricity Supply Bill now before Parliament, President Ayton said that the association had advanced certain criticisms and recommendations and if the bill was altered as it desired in matters of detail, the important principle of public control being adhered to and safeguarded, there was little doubt that the carrying out of its provisions would be of immense benefit to the nation, and in particular to the electric supply industry.

Problems of Power Transmission at 220 Kilovolts

Field for 220 Kilovolts—Design Features of Line and Apparatus — Excerpts from Paper by A. E. Silver Before A. I. E. E.

THE dependence of industrial progress upon an adequate supply of electrical power, together with the vital need for a rational policy of conservation of the country's fuel resources, points to a probable early demand for transmission of large blocks of power from distant energy sources—coal fields and water powers. Two hundred and twenty kv. is suggested as a logical voltage for such high-capacity, long-distance transmission.

The Field for 220-kv. Power Transmission.

Visualization of the demands of this evolution points to the need of trunk electric transmission service of a capacity and range of greater magnitude than thus far developed or required. Increasing distances and increasing quantities of power require an increasing voltage for economic transmission. The quantities and distances involved in the broad field outlined in the preceding paragraph pass beyond the economic range of existing transmission voltages. The practical working out of this next step in the transmission art is a problem now definitely facing the engineer and manufacturer.

Two hundred and twenty kv. appears a logical choice for the next step in the transmission voltage schedule, because, from an appraisal of the general situation, a voltage of this order is considered adequate for the immediately pending needs of the industry and commensurate with expected growth in transmission service demands for a considerable period. Its suitability to a variety of conditions and the probable extent of its use would assure it a place in the schedule of transmission voltages which commercial needs are rapidly standardizing. Furthermore, such a voltage, while representing a step beyond present usage sufficient to afford a distinct economic advantage, does not reach so far into uninvestigated fields but that the problems of development and design can be approached with full confidence of early commercial solution.

The particular numerical value of 220,000 is in accord with the well established practice of standardization in multiples of 11,000. In some instances, it may be an incidental convenience that this voltage is the double of the extensively used 110 kv.

An illustration of the advantage for long transmission distances of 220 kv. over the highest present system voltage, 150 kv., is given in Figs. 1 and 2. This comparison is based upon a transmitted load of 500,000 kw. The same relative advantages will obtain for larger loads, and, above a certain minimum, for smaller loads.

The field of 220 kv. is not broad. Its economic application is primarily to large blocks of power and long transmission distances. It is in no sense a panacea for transmission problems generally. It presumably will infringe to some extent upon the present fields of the lower transmission voltages, but will by no means tend to supersede their use, in fact it will considerably enlarge the field of usefulness of such secondary transmission voltages as 66 kv. and 110 kv. It is not a universally suitable medium for extensive interconnection of power systems.

Power from steam-electric stations in the coal fields or from large hydroelectric stations would advantageously be transmitted over 220-kv. lines to terminal substations at important load centers or at the hubs of secondary transmission networks serving industrial areas. The introduction of transmitted power, in amounts limited only by the load demands, will constitute a strong stimulus to expansion of these networks. Power equalization between load centers might frequently best be accomplished through extension of these secondary transmission lines. Interconnection at 220 kv. would be expected only where the equalizing duty reaches a large magnitude, where there is no existing secondary transmission system suitable to serve as a basis for inter-connecting lines, or where interconnecting 220-kv. lines might function also as a supplementary or important reserve link in a main 220-kv. trunk transmission system.

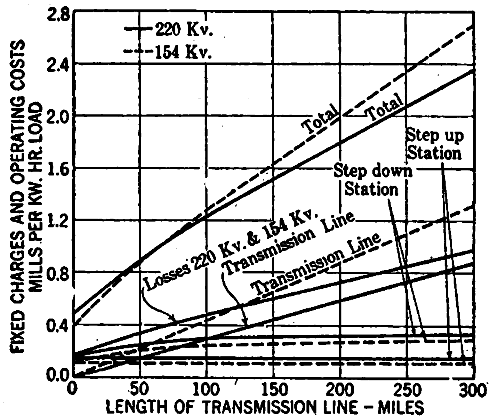


Fig. 1—Economic Comparison of 154-kv. and 220-kv. Transmission—Fixed Charges and Operating Costs—Seven Lines 154 kv. and Four Lines 220 kv.—500,000 kw. Delivered.

Costs and losses include those of lines, step-up and step-down, substations and synchronous condensers.

Costs of line per mile, 154 kv. $20,000, 220 kv $23,500—all costs based on early 1919 prices.

Size of conductor 92,900 cm. steel—716,000 cm. aluminum.

Losses based on 0.95 load factor and 0.85 power factor delivered load.

Cost of energy 5 mils per kilowatt-hour.

Fixed charges and operating expenses of transmission lines 13 per cent, substation 15 per cent.

Voltages high side of transformers, receiver end 150 kv. and 200 kv., sending end 170 kv. and 225 kv.

The initial investment in a 220-kv. system, including as essential elements the step-up and step-down stations, will be of such magnitude that there will be a strong inducement to utilize the investment as nearly continuously as practicable, thus reducing the unit transmission cost of energy supplied. The relegation of existing stations to partial operation or reserve service will be gradual, and, even when transmitted power becomes the main reliance, presumably it will usually prove more economical to maintain local stations for reserve and short peak load service than to provide necessarily expensive transmission capacity for such short periods of actual use.

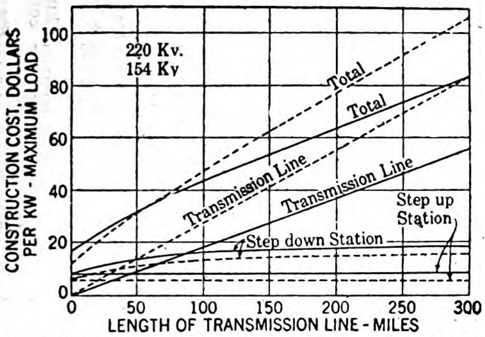


Fig. 2—Economic Comparison of 154-kv. and 220-kv. Transmission—Construction Cost—Seven Lines 154 kv. and Four Lines 220 kv.—500,000 kw. Delivered.

Costs include those of lines, step-up and step-down substations and synchronous condensers.
Costs of line per mile 154 kv. $20,000, 220 kv. $23,500—all costs based on early 1919 prices.
Size of conductor 92,900 cm. steel—716,000 cm. aluminum.
Voltages high side of transformers, receiver end 150 kv. and 200 kv., sending end 170 kv. and 225 kv.

It is assumed that even an initial 220-kv. system would be laid out on a basis of two or more main generating stations connected to load centers by a number of circuits. The load per 220-kv. circuit has been assumed to be from 100,000 kw. to 125,000 kw. A lower load per circuit than 100,000 kw. would entail a considerable sacrifice of the economy obtainable through use of 220 kv. No discussion is offered as to the maximum economic load per 220 kv. circuit since in any initial system the number of circuits would be determined from considerations rather of reliability insurance or load distribution than of maximum inherent economy. Where the studies involve a specific transmission distance, 250 miles has been assumed for purposes of illustration. The frequency of a 220-kv. trunk transmission system should be 60 cycles. Transformer connections, at all installations, should be grounded Y for the 220-kv. windings.

Corona formation and corona loss enter as a significant factor in the design of transmission lines at 220 kv.

Apparently the choice of conductor materials and types for 220 kv. service is limited, at least from the standpoint of immediate availability, to three alternatives, (1) aluminum with steel core; (2) copper with steel core; (3) all copper.

For equal conductivity, the relative physical advantages of the three types of conductors may be summarized as follows:

Aluminum-steel vs. copper-steel

1. Less corona loss, due to larger diameter
2. Skin effect presumably approximately equal
3. Greater area exposed to wind loading, hence, greater transverse tower strength and greater clearances required
4. Less tensile strength, hence more limitation upon height and spacing of towers
5. Less weight (unimportant)

All-copper vs. composite cable

1. More corona, greater than either of above
2. All material effective as a conductor
3. Skin effect more serious in larger sizes, owing to high priced material in the core
4. Less area exposed to wind loading
5. Less total tensile strength than either of above
6. Less weight than copper steel
7. Homogeneity of material, hence certain advantages in construction, more positive assurance of durability and higher scrap value

For the purpose of developing tower designs, a cable of 716,000 c.m. of aluminum and 93,000 c.m. of steel has been used in the studies.

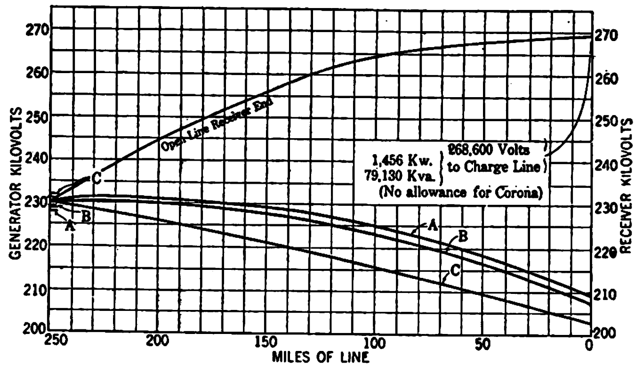


Fig. 3—220-kv. Transmission Line Characteristics—Relation Between kw., kv., p f. and Condenser kv-a.—Conductor—450,000 cm. Copper—308,200 Steel.

CALCULATION ASSUMPTIONS.

Steel core copper conductor—450,000 cm. copper and 308,200 cm. steel—20 ft. horizontal spacing.
Constant receiver volts—200,000 (low side receiver transformer—includes transformer drop).
Constant generated volts—230,000 (high side generating transformer).
Loads—delivered at 75 per cent power factor.
Transformer bank of 50,000 kw. capacity with—resistance 0.5 per cent—reactance 12.0 per cent.
Two banks of transformers in parallel at each end of line.
Losses include those of line, transformers and synchronous condenser.

RESULTS.

Curve	Rec'r kw.	Cond'r kv-a.	High voltage, 250 mile line: Receiver kv.	Receiver % p. f.	Generator kv.	Generator % p. f.	Equiv. low voltage gen. kv.	% p. f.	Losses (excl. corona loss) kw.	%
A	0	*49,000	209.0	* 0.18	230	† 5.48	227.9	† 5.56	2,704	....
B	50,000	† 7,600	207.2	*78.24	230	†96.89	228.6	†97.70	2,691	5.4
C	100,000	†81,600	202.9	*98.80	230	*99.97	231.7	*99.51	11,843	11.8

Note: *Indicates lagging quantities. †Indicates leading quantities.

The operating characteristics of a 220-kv., 250-mile line are illustrated by Fig. 3, which shows a copper-steel and an all-copper conductor the relations between power transmitted, generator, receiver and line voltages, power factor, condenser load and resistance losses.

A study of the relative economy of various sizes and types of conductors is shown in Fig. 4, with explanatory data in the accompanying table. This study shows, for a load of 100,000 kw. per circuit delivered at 0.75 power-factor and at load-factors of 60%, 75% and 90%, that the combined annual costs of such items of the transmission system as would be materially affected by the size and type of the conductor, *i. e.*, interest, taxes and amortization charges on cost of conductor, annual value of lost power on the line due to resistance and corona and of power absorbed by transformers and condensers. The curve falling lowest on the scale, at any number of years which may be assumed as the life of the line, represents the most economical of the conductors considered.

This curve is presented merely as an example of the general method followed in studying conductor economy. It does not represent the degree of refinement which would be warranted in making final determination of the economical conductor for an actual 220-kv. installation. Other items for which allowance should be made in such a study are the effect of conductor size and type upon cost of line structures and insulators, and the possible scrap value of the conductor. Amortization should preferably be calculated by the annuity or "sinking fund" method rather than by the simpler straight line method. Obviously, in any case great refinement in the technical assumptions is not called for until reasonably close values can be assigned to cost of conductor materials, for which the market will presumably be unstable for some time to come, to the equivalent costs of the power losses, and to the percentages to be employed for return on investment, taxes, etc.

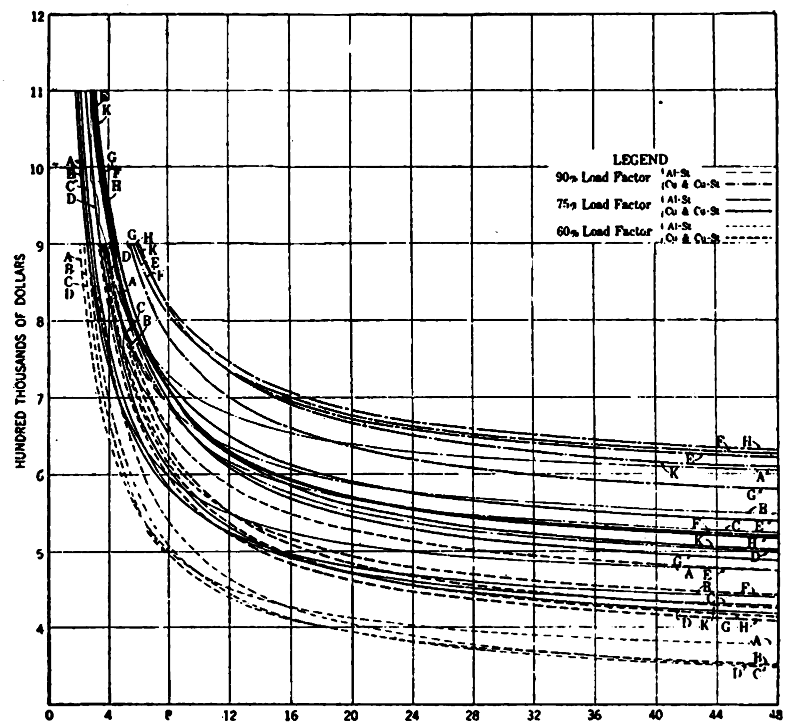


Fig. 4—Economic Comparison of 200 kv. Transmission Conductors—Annual Cost Curves—250 Miles, 100,000 kw. Single Circuit Line. (See table for explanatory data.)

Data Relating to Economic Comparison of 220-kv. Transmission Conductors.

(See Fig. 4.)

Annual Cost Curves for 9 Different Cables at 3 Load Factors.

1. Annual cost curves are plotted, dollars as ordinates, years as abscissas, and show the annual cost for any period up to 48 years. This is explained as follows:

Annual Cost Includes:
1. Depreciation expressed as first cost divided by number of years chosen.
2. Yearly interest and taxes taken as 8% of first cost.
3. Annual value of lost power taken as 5 mills per kw-hr.

First cost includes only cost of finished aluminum-steel cable at 44.9 ct. per lb. for aluminum and 12.2 ct. per lb., for steel f. o. b. factory. First cost of finished copper or copper-steel cable @ 27.7 ct. per lb. for copper and 12.2 ct. per lb. for steel f. o. b. factory. All other items of construction costs have been eliminated as not materially affecting the relative positions of the curves.

Lost power includes line I^2R, transformer I^2R, condenser loss and Corona loss.

2. Cable Data.

Curve designation.	Kind of cable.	First cost.	Alum. or copper,	Steel.	Total of cable.	Alum. or copper.	Steel.	Diam. of cable.
A	Al.-St.	$1,175,700	605,000	78,000	683,500	54	7	0.952
B	Al.-St.	1,362,800	716,000	92,900	808,900	54	7	1.036
C	Al.-St.	1,513,500	795,000	103,100	898,100	54	7	1.092
D	Al.-St.	1,814,000	954,000	123,700	1,077,700	54	7	1.196
E	Copper	1,764,800	500,000	....	500,000	37	..	0.814
F	Cu.-St.	1,733,300	450,000	105,000	555,000	30	7	0.857
G	Cu.-St.	1,924,400	500,000	116,600	616,600	30	7	0.904
H	Cu.-St.	1,790,200	400,000	274,000	674,000	54	37	0.946
K	Cu.-St.	2,011,700	450,000	308,200	758,200	54	37	1.004

No type of insulator yet developed demonstrated its ability to give adequate, or even reasonably satisfactory results on high-voltage lines. It is believed, however, that practicable 220-kv. insulators can be obtained from present established types.

It should be noted that a string of 15 standard units, with the necessary connecting pieces and fittings, will be nearly 9 ft. long. Such a length of insulator obviously involves great expense in obtaining the necessary tower clearances and heights and it is also the determining feature in fixing conductor separation. This serves again to call attention to the need of more efficient and suitable insulators. An improvement in insulator design which would justify shortening the string, in addition to improving the electrical characteristics of the insulator itself, would enable material saving in tower costs. A wholly new insulator, having no greater length than necessary to insure requisite air clearances from conductor to support, say 4 or 5 ft., would enable a correspondingly greater and a very significant saving in tower costs. Such an insulator at moderate price might readily open the door to a variety of new types and arrangements of supporting structures.

Two methods are recognized as offering relief from this excessive concentration. The first is the grading of the insulator units used in the string. This would be accomplished by making up the string of units of two or more distinct types, differing in size or diameter or in some other feature which would cause them to have different condenser capacities, those with the larger capacities being placed nearest to the conductor. A second method of relieving this excessive concentration of stress consists in installing below or around the disk nearest the conductor suitably designed metallic shields or rings. The effect of such shields in improving the stress gradient may be even more marked than that of grading the insulator units.

In general either grading or shielding or a combination of the two appears to be feasible. Neither would appear to require any very elaborate investigations and tests to determine effective designs free from possibility of secondary complications of any moment. The conditions with the 15-unit string of standard units are so unsatisfactory that probably some alleviating measures should be adopted. Of the two described, probably grading could be developed to a point ready for actual use most quickly and with least experimental investigation. It is wholly possible that a considerable grading effect might be worked out through selection from present commercial types of disks.

A feature of the insulator situation which complicates the question of voltage stress distribution and which will have some effect upon methods of carrying out remedial measures is the fact that in order to obtain adequate mechanical strength, as will be discussed later, two or three strings of standard disks must be used in parallel at suspension points, and proportionately more at tension points.

The belief is widely entertained that arcing horns or rings or other discharge devices are of sufficient benefit to warrant their use. They would fulfill several functions, the first and primary function being to protect the insulator from the destructive heat of an arc. Other functions are protection of the conductor from the possible burning by a high-power arc, and reduction of the likelihood of insulator puncture. The suggestion has been offered that, with a line operating near the corona limit, high-voltage surges at high frequency, representing usually small amounts of energy, tend to dissipate themselves in corona, corona dissipation of energy being more rapid at high frequencies. In any event it is believed improbable that a line sufficiently well insulated to withstand low-frequency high-power disturbances is likely to encounter trouble from high-frequency disturbances.

The long economic life which presumably a 220-kv. line would represent causes durability of material to assume even greater importance than in present practice, so that for most localities wood construction would not be economical, even assuming that the requisite strength for the heavy loads could be secured without resorting to unduly short spans. Therefore, the conventional rigid steel tower has been adopted as the most available for construction in the immediate future, and a series of standard towers of different strengths, adapted to safe and economical use under varying conditions of span lengths and angles, are considered according to the growing practice in heavy line construction.

Features of Station and Equipment.

For 220-kv. transmission and generation certain salient features become important. For instance, design for such large capacities and high voltage centers around one cardinal principle, simplicity and intrinsic strength of equipment, rather than flexibility and external protective measures. The number of buses should be reduced even to a rudimentary form, superfluous oil switches should be eliminated, and spare or reserve units need not be provided. Of course, the complete omission of reserve equipment is predicated on adequate reserve capacity being available in local generating stations and on the high standard of construction formerly emphasized.

Considerations of simplicity in station arrangement and of economy in operation favor, in general, transformers of the largest size permitted by the conditions of each installation or by limitation of manufacture. At the present stage of the art the manufacturers advocate that transformers be not attempted beyond 50,000 kv-a. to 60,000 kv-a. for three-phase units, or beyond 35,000 kv-a. to 40,000 kv-a. for single-phase units. As to choice between three-phase and single-phase units, from the standpoint of simplicity and cheapness of installation, three-phase units would be preferable. At generating stations operating and economic considerations strongly favor making generator and transformer equipment an integral unit.

The large sizes of installations involved in a 220-kv. system, together with the necessity for careful attention to maintaining insulation strength and transformer reliability generally, will not improbably result in the abandonment of cooling the oil in each transformer and gravity circulation of oil through the windings in favor of forced oil circulation and external cooling. Short-circuit current values at 220 kv. are not extreme, and in a 220-kv. circuit-breaker the large clearances and switch openings necessarily required by the high voltage contribute directly to giving the rupturing capacity required by the current to be handled. Two types of circuit-breakers have been offered by manufacturers for 220-kv. high-duty service. One type consists of a massive circuit-breaker, each phase in one tank of heavy boiler plate, with two breaks in series for moderate duty and four breaks in series for heavy duty. The other type consists of two breaks in series per tank, one such tank being used for conditions of moderate duty and two tanks in series for heavy duty.

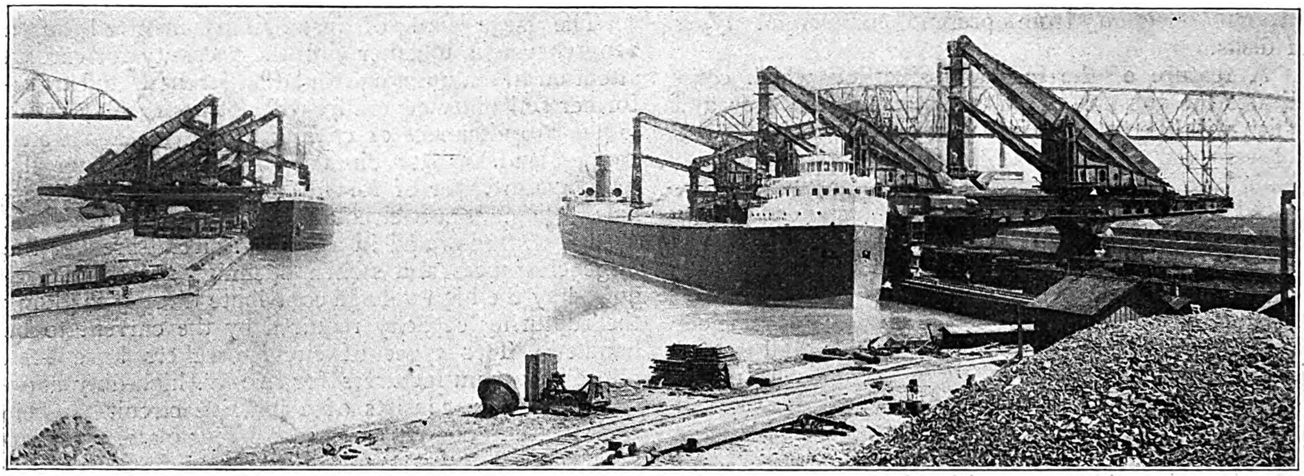
Substation layout rated at 220 kv. will be influenced largely by the particular local conditions of each installation. The usual type will probably serve to step down from 220 kv. to a secondary transmission voltage, such as 66 kv. or 110 kv. In such cases it will generally be necessary to have a primary and a secondary bus system—at 220 kv. a simple bus with sectionalizing circuit-breakers; at secondary voltage, where greater flexibility would seem desirable, probably a ring bus. Owing to the high-current values which would obtain at the secondary voltage, it appears advisable to provide sectionalizing reactors in this bus. It should be kept in mind that the large condenser capacity will aggravate short-circuit conditions.

The station and substation arrangements which have been proposed are predicated upon a relay system which may be depended upon for insuring that a faulty piece of apparatus, transmission line or low-voltage feeder will be cut out correctly, promptly and in such a manner as to avoid interruption to the other elements of the system.

Construction Cost.

The following estimates, based upon 1919 prices, capacities of 200,000 kw. and above and 220 kv, are intended to give an indication of the installation cost of construction carried out along the lines of the assumptions and recommendations in this paper:

Step-Up Substation.	
Outdoor transforming and switching structures and equipment (220-kv. apparatus and connections only), installations and indirect expense, per kw..	$8 to $9
Step-Down Substation.	
Outdoor transforming and switching structures and equipment (does not include low-tension feeder bus or feeder switching equipment), synchronous condensers of capacity for length of connected lines, building, control equipment, installation and indirect expense, per kw.	$15 to $20
Transmission Lines.	
Single circuit-steel towers-suspension insulators:	
Towers, per mile ... $8000	
Insulators and hardware, per mile ... 2800	
Conductors and ground wire, per mile ... 5000	
Special structures, per mile ... 1000	
Right-of-way, per mile ... 3000	
Indirect expense, per mile ... 3700	
Total, per mile ... ——	$23,500
Total Cost 220-Kv. Transmission.	
100 miles, per kw	$40 to $45
200 miles, per kw	60 to 65
300 miles, per kw	80 to 85



Eight Electrically Operated Ore Unloaders at Ashtabula, Ohio—These Docks Have an Unloading Capacity of 76,000 Tons of Ore Per 24 Hours, Equal to Cargoes of Six of the Largest Ore-Carrying Vessels.

Unloading Ore Quickly and Cheaply

How Iron Ore Is Unloaded from Lake Steamers by Means of Electrically Operated Automatic Ore Unloaders—Description of Modern Unloading Machine

MOST of the iron ore used as the basis of our immense iron and steel industry is obtained from the rich ore deposits near the southern and southwestern shores of Lake Superior. Iron ore is very heavy and the distance from these mines to the blast-furnace plants ranges from several hundred to over a thousand miles, consequently transportation by rail would be very expensive. Therefore, practically all of the ore is shipped by water, the Great Lakes affording a very convenient waterway for this purpose. Large, special ore steamers are used for this service. Since navigation is limited to about seven months per year on account of ice in the northern lakes, this means shipping all the ore intensively during the open season and every facility is utilized to load the vessels quickly, sail them as quickly as possible without stop to the unloading point, unload them quickly and return them for another trip.

Through the development of efficient and powerful loading and unloading machines, the cost of handling the ore and the time that the vessels are tied up at the Lake Superior loading docks and the various unloading ports have been very greatly cut down. The loading and unloading machines are electrically operated for the most part and therefore are of much interest to electrical men. Probably the highest development achieved in this line of machinery is in the unloader illustrated and described herewith. It is the product of the Wellman-Seaver-Morgan Co., Cleveland, Ohio. Over 50 of these machines are in use on the Great Lakes unloading ore steamers.

The automatic unloader shown in the accompanying illustrations is unique in design and has proved through many years of service to be one of the most successful devices for unloading ore cargoes from lake steamers that has ever been devised. Although of immense proportions, the design has been simplified and the control perfected to such a point that the machine is a marvel in delicacy of control and operation.

Description of the Unloader.

The unloader consists of a main framework mounted on wheels which travel along the runway rails which are located approximately as shown in the views herewith. The main framework extends back to the rear runway over a temporary storage pile where the ore can be discharged, if desired. Between the front and rear runways, space is provided for railroad tracks where ore-carrying cars are placed under the machines and loaded with ore for transportation to the furnace plants. The girders of the main framework form a support for runway rails on which a trolley travels. This trolley supports a balanced walking beam, from the outer end of which a stiff bucket leg depends. At the lower end of this leg is the bucket, which is operated by machinery located on the walking beam. All horizontal movements of the bucket are accomplished by means of moving the trolley backward and forward on the girders. The vertical movements of the bucket are accomplished by the operation of the walking beam. The forward portion of the beam being out of balance, the bucket descends by gravity as soon as the brakes of the hoisting mechanism are released.

The hoisting mechanism controlling this operation is located in the enclosed house at the rear end of the walking beam. Ropes from the winding drums of this mechanism pass around sheaves located in the rear end of the trolley and are anchored to the rear end of the walking beam.

In addition to the main parts of the machine which have been described, there is also a receiving hopper located at the forward end of the main framework and between the main girders; this is provided for the purpose of receiving the ore discharged from the bucket. The capacity of this hopper is about three full bucket loads and its purpose is to act as a balancing point for the ore between the bucket and the cars or storage as the case may be. The bottom of the hopper is provided with outlet gates and the contents are discharged as required into a larry which runs on an auxiliary track suspended from the under side of the main girders.

The larry, after receiving its load from the main hopper, moves to a point so that its contents can be discharged either into the cars standing on the railroad tracks beneath the main span of the girder or into a temporary storage pile under the cantilever at the rear of the machine. The ore so placed in this temporary stock pile cannot be reclaimed by means of these machines, as their function is solely one of unloading the cargo from the ships.

Machines of this type have been made in two sizes, the smaller size having a capacity of 10 tons and the larger size (such as is shown in the illustrations) having a capacity of 17 tons in the bucket shells. The machines shown here are electrically operated throughout and their speeds are regulated so as to operate through a complete cycle in about 50 seconds.

Some idea of the capacities of unloading by this method may be derived from a record which was made in Ashtabula, Ohio, by eight machines of this type having a capacity of 15 tons each, unloading seven boats having a total capacity of 70,000 tons in 22 hours actual time.

At other points, four machines working in boats having capacities up to 13,000 tons have unloaded these cargoes in about 3 hours and 25 minutes.

Method of Operating.

The operation of the machine is as follows:

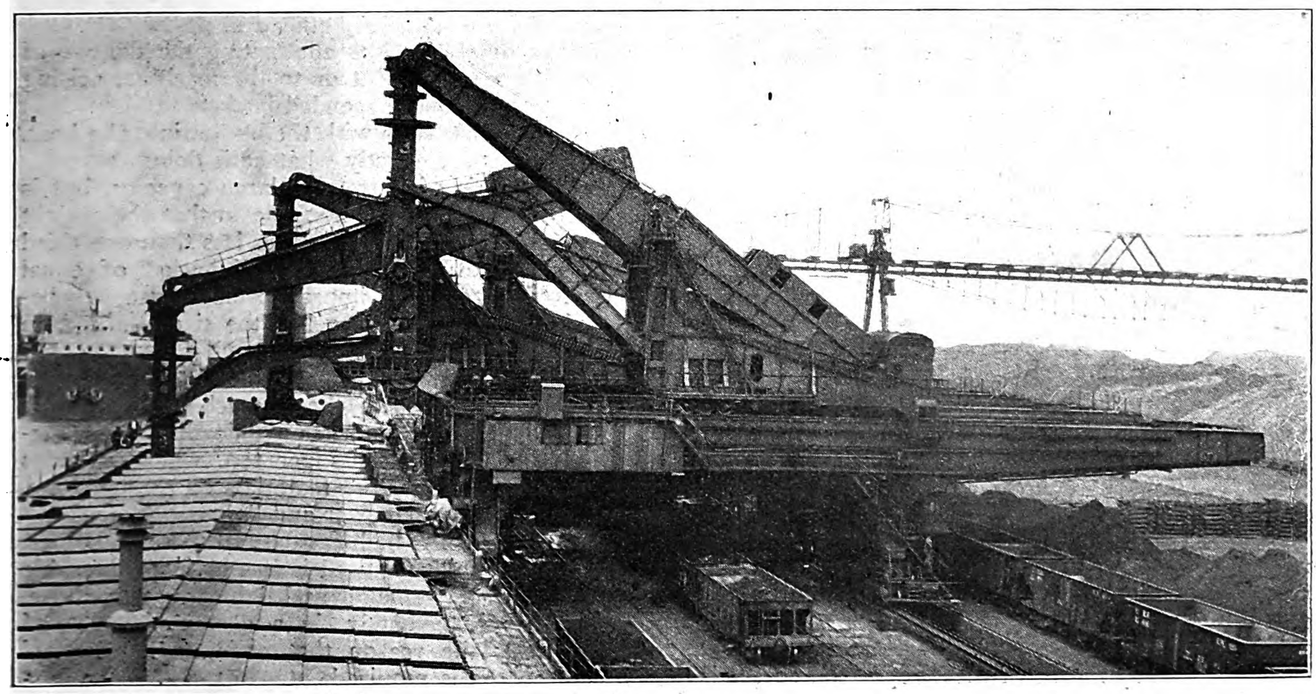
After the boat has been placed alongside of the dock, the machine is moved opposite one of the hatches and the bucket is lowered through the hatch into the ore. After filling the bucket, the walking beam hoist mechanism is put in operation and the bucket hoisted out of the boat. At the same time, the trolley is traveled back so that the bucket is brought over the main hopper between the girders and the main framework and its contents are discharged into this hopper. The bucket is then immediately returned to the boat for another load. The ore in the main hopper is discharged into the larry which has been brought to a point directly underneath the discharge gates of the hopper. The larry hopper is filled and the larry is moved over the desired discharge point and the gates of the larry hopper are opened discharging the ore as required. The larry hopper is provided with scales so that the contents are accurately weighed and recorded. In this way a car can be loaded to its allowable capacity and an accurate record kept of the amount of ore so discharged into the car, thus eliminating the necessity for the use of track scales and reweighing.

If railroad cars are not available for immediate shipment, the larry is traveled to a position on the rear of cantilever and its contents discharged into a temporary storage pile, from which it is usually reclaimed for shipment or storage by means of a bridge, located on the runway at the rear of the unloader.

Only two operators are required for the entire operation of one of these machines. One of the operators, whose station is in the bucket leg directly over the bucket shells, controls all of the motions of raising and lowering the bucket, of traveling the trolley back and forth, and moving the machine along the dock from one hatch to another. The second operator is stationed in a cab on the larry and from this station he controls the movement of the larry, the operation of the larry gates, and the weighing of the ore.

The bucket shells are each made of a single piece of plate formed to the shape as shown in one of the views. These bucket shells are usually provided with manganese-steel cutting lips which are essential to resist the abrasive action of the ore. The bucket shells themselves are carried on heavy cast-steel arms mounted on rollers traveling in guides in the fixed portion of the lower end of the bucket leg. The position of the operator who controls the operation of the bucket, etc., as previously described, is also shown in this view. It shows the bucket in operation in the hold of a modern ore carrier after most of the ore has been removed and the balance of the ore has been scraped into position so as to be handled by the bucket.

The motor for operating and closing of the bucket is located in the machinery house at the back of the

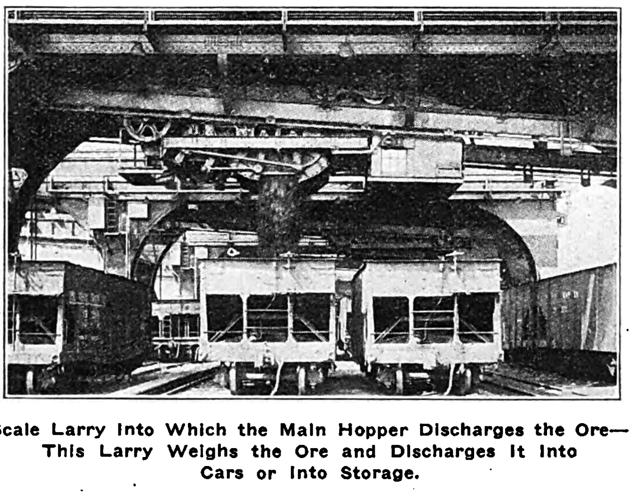


Part of the Seven Ore Unloaders at the United States Steel Corporation's Docks at Conneaut, Ohio.

walking beam. Ropes from this bucket-closing mechanism are carried through the walking beam and the bucket leg and attached to a power drum in the bucket leg directly over the operator. This power drum is geared to the closing chain drums, one of which is shown on this photograph. The bucket is closed by rotating the drums in the proper direction. The bucket is opened by reversing the motor and the bucket shells are forced open by means of an opening chain located in the center of the bucket leg between the two closing chains.

In addition to the vertical movement, which is given to the bucket leg by means of the walking beam, it also has a motion of rotation around its vertical axis. This is accomplished by means of ropes attached to a segment on the bucket leg itself, the ropes being carried back in the walking beam to a rotating mechanism which is located adjacent to the bucket-closing mechanism. The bucket leg itself is carried on a roller bearing which is attached to the top end of the leg. This motion is introduced for the purpose of turning the bucket at right angles to the hatchway in order to secure as great a reach lengthwise of the boat as possible, thus the bucket is enabled to reach out under the hatches and remove ore which is not directly beneath the hatch opening. The distance from point to point of the bucket shells when open is approximately 21 ft.

The scale larry, into which the main hopper discharges, has a capacity of between 35 and 45 tons and two larry loads are intended to constitute a full carload of ore. The arrangement of the discharge gates of the larry is clearly shown in one view. They are suspended from the sides of the larry frame and operated by connecting rods which attach to cranks, also connected to the main larry frame, these gates being operated by means of a small motor which is carried at the rear of the larry. The gates are so arranged that all or a portion of the contents of the larry may be discharged. The hopper of the larry is suspended in the larry frame on scales so that the contents of the larry may be wholly or partially discharged and be accurately recorded.



Scale Larry Into Which the Main Hopper Discharges the Ore—This Larry Weighs the Ore and Discharges It Into Cars or Into Storage.

The mechanism for moving the larry back and forth on its track is also located on the larry and consists of winding drums upon which ropes are wound, the end of the rope being attached to the rear end of the cantilever on the main framework. The larry track is inclined by means of these ropes and descends by gravity.

Electric Motors and Control.

As previously stated, these machines are usually electrically operated throughout. In some cases, however, machines of the same general type have been made to operate by steam and hydraulic cylinders, water being supplied to the operating cylinders by means of a steam accumulator which furnishes water at a pressure of 1000 lb. per sq. in. The electrically operated machines are usually designed for a 220-volt direct current. Alternating current is never used. The motors required for the equipment of one of these machines are as follows:

Beam hoist..............	1 motor, 275 hp.
Bucket closing...........	1 motor, 120 hp.
Bucket rotating..........	1 motor, 25 hp.
Trolley travel............	1 motor, 120 hp.
Hopper gates............	1 motor, 100 hp.
Longitudinal travel.......	1 motor, 100 hp.
Larry travel.............	1 motor, 150 hp.
Larry gates..............	1 motor, 40 hp.

The control equipment for these motors is of the magnetic switch type throughout, having master controllers in the operators' cabs in the bucket leg and on the larry.

Electric current is supplied to these machines by means of insulated conductor rails running the length of the main runways. The current is collected from these rails by means of pickup shoes and distributed to the various portions of the machine. A similar collecting device is also employed for supplying the main current to the trolley. Conductor rails are attached to the main framework of the machine and the current collected from these rails by means of pickup shoes attached to the trolley.

Economies and Other Advantages.

Many points of superiority claimed for the Wellman-Seaver-Morgan ore unloader, which are not found in other systems of unloading are:

The design is very heavy; there is little to get out of order, resulting in low maintenance cost per ton of material handled.

Control is accurate and positive, and manual labor is reduced to a minimum.

The bucket is positively guided in passing through the hatches of ships, thus eliminating the danger of damage either to the boat or to the machine, arising from the use of rope-suspended buckets.

The operator travels with the bucket into the boat, and can always see exactly what he is doing.

The bucket is of extremely large capacity, but is so suspended from the walking beam that the weight resting on the tank top of a boat is less than one-third of the weight of a rope-suspended bucket of equal capacity. In fact, it is impracticable to use a rope-operated bucket of anything like the size attained on these unloaders.

One particularly important point is the extremely low cost obtainable with these machines. Records extending over long periods show unloading cost ranging from 2½ to 4½ cents per ton, which includes superintendence, labor, and materials on the machine, as well as the cost for power and light.

On account of the high capacity of these machines, the number of units required is less by a considerable margin than of any smaller and lighter type machine, which results immediately in a decreased cost of operation, for the reason that a fewer number of skilled operators is required.

Again, on account of the extreme reach of the bucket, it is possible for the machine to discharge a very much higher percentage of a ship's cargo than can be accomplished by ordinary rope-operated buckets. The bucket can be rotated at right angles to the hatch and reach out for ore which would be entirely inaccessible to an ordinary bucket.

It can be conclusively shown in plants where large tonnages are to be handled that there is a distinct saving in first cost, as well as a yearly saving in the cost of operation, over any other type of machine.

Unloader Leg and Bucket at Work in Hold of a Modern Ore Vessel—Leg Can Rotate in a Circle, Allowing Bucket to Reach Out in All Directions, Taking Out as Much as 97% of Cargo Without Shoveling—Note Position of Bucket Operator Directly Above Bucket.

This unloader is not a combined machine. It is an unloader, pure and simple, and does its work well.

STREET-LIGHTING PROBLEMS OF LONDON, ENGLAND.

Review of War-Time Restrictions—Now That These Are Removed, the Whole Street Lighting Should Be Improved.

Just before the outbreak of war a plea was made by the then president of the English Illuminating Engineering Society for the treatment of the lighting of the city of London as a whole and on a uniform basis. Leon Gaster, in opening a discussion on June 24 of this year before the same society, repeated the plea, because in view of the concerted action taken by street-lighting authorities throughout London during the war the moment was ripe for asking for a continuation and extension of such co-operation in the future. The suggestion was advanced that an advisory committee should be formed on which the Illuminating Engineering Society, the London Safety-First Council and the chief authorities interested, should be represented, in order to prepare recommendations for the lighting of London on a uniform basis and in accordance with commonly acceptable principles.

Reviewing the experience of the past five years, Mr. Gaster divided the treatment of street lighting in London during the war into three distinct periods: (1) A progressive and somewhat indiscriminate diminution in light by reducing the number of lamps lighted, and restricting the pressure of electricity or gas supplied to them. (2) A period when further diminutions were made by masking lights so that only a narrow cone of light was shed on the roadway in the vicinity of lamps. (3) The period when the authorities, acting on expert advice, substituted diffused lighting, by coating a portion of the lanterns with white distemper. The last of these methods helped to eliminate the objectionable contrasts in brightness and produced a more uniform effect. Immediately after the armistice a fourth period was entered upon, the restrictions relating to screenings being withdrawn and pre-war lighting rendered permissible, subject to 50% reduction in the interests of economy.

The public was naturally inclined to a restoration of pre-war conditions, but profit should be derived from the experience of war time by securing improvement as well as restoration after all restrictions were withdrawn on the signing of peace. From this experience two points standing out prominently were these: (1) The value of diffusing appliances in lessening glare and excessive contrasts in brightness; (2) the desirability of uniformity in practice as regards the principles of street lighting throughout the entire Greater London area.

The speaker referred to the relation of lighting to traffic. He showed figures indicating the effect of diminished lighting in increasing accidents. The London "Safety First" Council had emphasized the planning of street lighting in such a way as to avoid extreme contrasts in illumination in passing from a side street to a main street, or in passing from one borough to another. It had also emphasized the following points: The provision of special lighting to facilitate the guidance of traffic at important crossings, dangerous turns, etc.; the provision of light at regular stopping places for vehicles.

Mr. Gaster expressed the opinion that one of the best peace mementoes would be the placing of the light of London on a more satisfactory and uniform basis. Among other measures the permanent lighting by concealed lamps of public monuments serving as mementoes of the war might be suggested.

In considering general problems in street lighting it was held that much remained to be done in the design of fixtures, especially for use with the gas-filled lamp, which would doubtless be largely used for future street lighting. The distribution of light needed special care, but there was general agreement that the greater part of the light should be directed on the roadway, where it was chiefly needed. Street-lighting requirements were now quite different from what they were a few years ago, in view of the great increase in the volume of traffic and the high speed of motor vehicles.

On the question of the co-ordination of public and external private lighting, the speaker said that a difficulty in street lighting was the darkness of surrounding surfaces, which prevented good diffusion of light, occasioned sharp shadows, and accentuated the glare from light sources seen against this dark background. These conditions might be improved by co-ordination between public and private lighting. If suitably shaded and diffused, such external privately installed lamps would yield valuable assistance to street lighting. Municipalities might consider co-operation with consumers in main thoroughfares, allowing a concession in charges if requirements as regards uniform procedure in equipping lamps were adopted. Similarly, the appearance by night of important streets and squares would be much improved if some light, not necessarily a large amount, were allotted to the illumination by concealed lamps of public buildings, national monuments, etc. Another important factor was the illumination of nameplates for streets, and the more general use of mildly illuminated plates indicating the nature of buildings would also be helpful.

THE INDUSTRIAL LIGHTING EXHIBIT AT N. E. L. A. CONVENTION.

Important Demonstration of Poor, Fair and Good Factory Lighting at Atlantic City Exhibition.

One of the features of the lighting exhibit under the auspices of the Lamp Committee and the Lighting Sales Bureau at the recent National Electric Light Association convention in Atlantic City, which attracted considerable attention was the novel industrial lighting demonstration. An entire room was fitted up to represent a small machine and repair shop, containing a lathe, drill press, grinder, sewing machine, and Ford truck chassis and engine. One half of the room was painted dark gray above the working-plane, and black below, while the other half was flat white above, and green below. Three separate and independent systems of lighting were installed to show poor, fair, and good practice.

The poor lighting system consisted of four 50-watt bare carbon lamps on drop cords, one 100-watt clear-bulb Mazda C lamp on a drop cord over the bench at the darker end of the room, and one 40-watt Mazda B lamp on a long extension for working under the machine chassis. The intensity provided averaged 0.8 ft-cdl., which is far below that required by any of the state lighting codes. Such an installation, shown in Fig. 1, is typical of the practice in many shops where inefficient carbon lamps and high-candlepower Mazda C lamps without reflectors are commonly used.

The fair system of lighting, Fig. 2, is intended to show the result of an attempt to increase the illumination intensity without particular knowledge of good lighting. Two 150-watt Mazda C bowl-frosted lamps in deep bowl porcelain-enameled reflectors were used to provide the general lighting, and three units with similar reflecting equipment but smaller lamps were suspended on drop cords over the benches for local lighting. The lamps used for this purpose were two 60-watt Mazda B lamps and one 100-watt Mazda C. Such a system provides something like 2 to 3 ft-cdl. intensity and would meet the requirements of a state code. However, it does not provide for the best shop efficiency.

The good lighting system represented an installation designed to give "productive intensities." General illumination at more than double the intensity provided by the fair system was supplied from eight 150-watt Mazda C lamps in RLM dome reflectors. Four of these lamps were bowl-frosted, and four were equipped with opal caps. In connection with this installation, the sewing machine was fitted with a suitably shielded 10-watt Mazda B lamp, to show a possible need for local lighting when sewing on dark goods. On the other hand, this general overhead lighting system showed conclusively that no local lighting as required in the poor system was needed for a workman repairing an automobile engine.

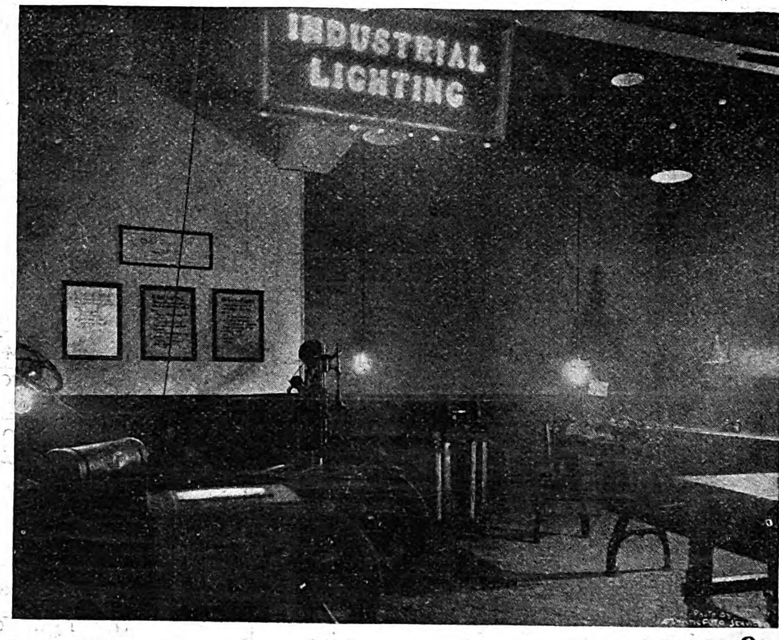


Fig. 1.—Deep Shadows and Gloom Prohibit Good Work Here.

During the exhibit a large model of a foot-candle meter was kept on the automobile chassis, to effectively show the change in intensity which occurred when the various systems were substituted one from another. The dual system of wall finish gave a convincing demonstration of the effect of white paint to increase the utilization of light and produce more cheerful surroundings.

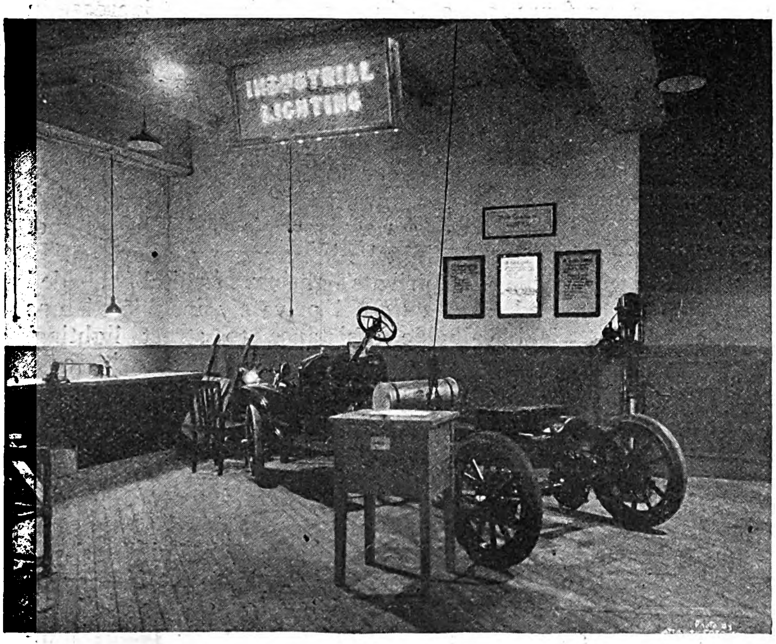


Fig. 2.—Some Improvement, But Shadows Are Still Deep.

SWEDISH DEVELOPMENTS IN THE USE OF ELECTRIC POWER.

Electrification of All Railways Being Undertaken—Demand for Appliances and Equipment Increasing.

Probably in no other country in the world, with the possible exception of the neighboring state of Norway, is there more intensive development in progress in the utilization of electrical energy than in Sweden.

There is in Sweden a remarkable tendency to apply the use of such power to every phase of the economic life of the country—to industry, to public utilities, to State and privately-owned railroads, to agriculture and to home life in remote districts as well as in the cities. The importance of the development is out of all proportion to population. Sweden's population is less than that of New York City, and is widely scattered over an area of 173,000 square miles, broken by mountains, and extending within the Arctic Circle.

Sweden possesses some coal, but it is not of the highest quality, and the supply is inadequate for domestic needs. Her immense forests are her greatest present source of national income, but the day has passed when wood fuel can be broadly and economically employed. War markets afforded great incentive to the expansion of old and new industries, yet the difficulty and cost of importing raw materials, especially coal, created a handicap which would have been insurmountable but for the driving power at hand in the Swedish lakes and streams. The value of existing and future development of this tremendous national asset has been emphasized by bitter experience.

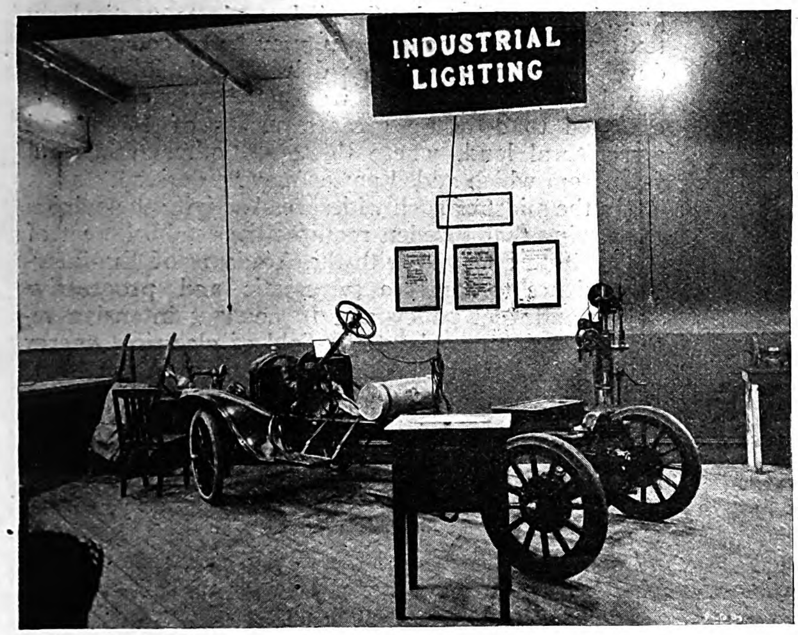


Fig. 3.—Note the Absence of Dense Shadow, the Definition of Detail, and the Cheerful Atmosphere Under a Properly Designed System.

Great strides were made during the war, and greater developments are planned. Sweden has seen a new vision of industrial and commercial greatness, but the past four years' experience has brought home to her the weakness of her position so long as she is dependent upon imported fuel. The solution lies in a full utilization of her magnificent "white coal" resources, the development of which is proceeding on a remarkable scale. There is no desire to repeat the war experience of running her railroads on wood, 40,000,000 cubic meters of which was consumed in 1917, or upon imported coal at 175 crowns ($46.90) per ton, the price in October, 1918. Power, comparatively cheap, abundant, and available with little regard to conditions abroad, will assist immensely in realizing the industrial and commercial possibilities.

The amount of water power normally available in Sweden may be conservatively set at 5,000,000 hp. Such a figure places her above any other country in Europe in this respect, with the exception of Norway. Water power has been used in her industries for centuries, and before the outbreak of war produced more than one-half of the mechanical power in the country, the total consumption exceeding 1,000,000 hp.

The demand for electrical energy has not been confined to any particular branch of industry. The call has been universal from the great iron mines of Norrland, within the Arctic Circle, to the extreme South, where power is already being transferred to Denmark by cable and still greater export is planned. The electrification of the railroads has already commenced and it is to be pushed as rapidly as possible. It is felt that trains must be made more rapid and the locomotives more powerful, to attain higher average speed rather than a greater maximum speed. In many cases of long hauls, as for instance, Stockholm to Kiruna, it is believed electric operation will cut the running time in half.

In 1915 the Government requested the Railway Department to make a thorough investigation and report on the question of electrification. The report, only recently completed, states that in view of the desirability of extending the existing system, the abnormal cost of fuel, and the greater efficiency and economy possible, the introduction of electric service is essential. It is estimated that the work will require ten years and it is proposed that separate conduits be established for lighting along the railways and for the distribution of power to agriculturists. It is felt that electrification would be profitable even were water power not available, since coal can be utilized in a steam power station with far greater efficiency than in the locomotive. Peat and inferior coal could also be used if necessary.

It has been estimated that the saving in fuel alone during the last four years, if the system had been electrified at the outbreak of war, would have equalled the entire cost of installation. Railroad coal, which cost $20 per ton in 1917, had risen to $46.90 per ton in October, 1918. The fuel item alone in the latter year amounted to nearly 70% of the entire cost of running the State lines in 1917, and largely accounted for the net deficit resulting from gross revenues never before approached in Swedish history.

Electrification has already been applied with a high degree of success. The first attempt on a large scale, aside from the electric street railways of such cities as Malmo, Göteborg, and Stockholm, was on the Kiruna-Riksgränsen line in Norrland, well within the Arctic Circle. This line is 93 miles long and carries annually a heavy tonnage of iron ore. Single-phase current at 80,000 volts is sent from the Government power stations at Porjus to four transformer stations along the line, of which the first is 87 miles and the last 160 miles distant. The voltage is stepped down to 15,000, at which voltage power is supplied to the contact device.

The freight locomotives in this case weigh about 100 tons and the passenger locomotives about 70 tons: A normal freight train includes 2 electric locomotives and 41 cars of 46 tons each, a total weight of 2000 to 2100 tons. Normal speed for freight is 18½ m.p.h. and the maximum 31 m.p.h. Maximum speed for passenger trains is 62½ m.p.h. In the first year of operation the road transported 1,104,000 tons of ore, barely one-third of its normal capacity. In spite of this low traffic, a distinct saving over steam operation was scored.

For the electrification of railways seven main sources of power are available: Lagan; the Indal, Ume and Dal rivers, the power plants on the Lule river, the stream of Motala and the Göta river. Many of the existing installations are already fully loaded. Trollhättan, one of the two great State power undertakings, has been several times enlarged and now yields 150,000 hp. with a normal supply of water. It is said, however, that it will be fully loaded in 1921, though a complete system of water-economy and the regulation of Lake Vänern may increase the capacity to 300,000 hp. The Vargön Fall and Lilla Edet, also on the Göta river, are expected to yield 40,000 hp. and 65,000 hp. respectively. The first installment at Lilla Edet, to yield 26,500 hp., is already in process, the works being so planned that extensions can be made when needed.

The Motala works are being equipped for an initial yield of 10,000 hp. The Lule river has been estimated to be capable of producing 600,000 hp. The great Government plant at Porjus, which already supplies current for the Kiruna-Riksgränsen line in Noorland, will require its maximum capacity to meet projected railway and large-scale industrial demands in that territory. Works at Harspränget, also on the Lule, are planned on a basis of 150,000 hp., and the same river affords other falls worth harnessing.

It is further proposed to link up Trollhättan and the power system of East Sweden, called the Alvkarleby system, to permit a more complete utilization of all power generated in these widely separated regions. The State owns the important falls at Vargön and at Tyttbo, on the Dal, and it is proposed to harness them soon, as well as to regulate the level of Lake Vänern and undeveloped sites on the Dal. Other falls, such as those at Kerseforsen in the Lagan and Ljungsfallen on the Motala river, are being held in readiness to assist in the electrification of the railroads.

New power works completed during 1917 comprised about 65,000 hp., including a third instalment at Trollhättan of 26,500 hp. Works begun during 1918 called for 90,000 hp., including 25,000 hp. additional at Porjus. Stockholm has just begun to receive power from the new station near Untran, which cost the city about $8,000,000. The installation will deliver about 14,000 kw. and is said to effect a saving of $4,000,000 annually in coal. The transmission line has a voltage of 100,000, greater by 30,000 volts than the previous pressure.

The Torpshammer Aktiebolaget is building a new power plant at Torpshammer (Sundsvall) to develop 30,000 hp. to supply the growing industries at Svärtik. While a new company, with headquarters at Norrkoping and a capital of $800,000, it expects to effect a more efficient distribution of the energy already available to certain districts in Oestergotland. Still another power station is projected at Agnas, near Bjursholm in the county of Vasterbotton. The company involved has a capital of $26,800, but no information is available as to the capacity of the installation. The marked tendency of Swedish industries toward consolidation is instanced by the recent formation of the Aktiebolaget Bergalagens Combine Power Control, a combination of 33 of the largest power producers of central Sweden. The purpose of this body is at present said to be rather the more complete utilization of the existing productive capacity of its members than the construction of new stations.

It is interesting to note the growing effort to provide electric power throughout Sweden for other than industrial requirements. The Railway Department's report upon the electrification of the roads recommends the distribution of power to argiculturists, while the whole question of the electrification of country districts has now been taken under detailed consideration by Royal Commissions, by county councils and by various agricultural societies. The councils in particular have been urged to take a more general interest in those districts particularly suited for the spreading of information and the formation of the necessary organizations. It is hoped that by such means, coupled with the creation of free ports and the improvement of the existing canal system by which many inland industrial centers may be stirred to greater activity and made accessible to ocean shipping, home markets for Swedish products, particularly textiles and household goods, may be extended. The development of electrically driven roads in northern Sweden, where immense iron mines are located, is expected to open up great stretches of forest and agricultural land, where there are other important falls from which added power may be derived.

In the midst of such widespread activity the opinion is growing that Sweden requires the establishment of an Institute affiliated with the Academy of Engineering Science to draft a systematic and progressive power and fuel policy and to conduct intensive research work throughout the field of electrical energy and its application. This movement apparently has the hearty support of the press and the Water Power Commission.

The latter body, granted $2,200,000 in 1918, asked an additional $268,000 for the purchase of further sites, etc., the same amount for the current year, and $690,000 for 1920, to be used in the construction of new power stations and the improvement of existing plants. Apparently the appropriations sought had reference to the new stations planned at Tyttbo and Umea and extensive improvements at Norrforsarna and Sorforsarna Stations.

To foster such development as has been outlined above the Swedish Government has recently created the State Water Power Loan Fund and the State Power Transmission Loan Fund, with yearly grants of 2,000,000 kroner and 1,000,000 kroner respectively.

The stated purpose of the first fund is to permit loans up to two-thirds of the cost of harnessing waterfalls belonging either to the State or to private individuals and for the regulation of water levels; the last is for loans to co-operative associations for the building of distribution systems and power-transmission wires. It was found, however, that the appropriations were insufficient, since applications under the Transmission Loan Fund soon reached 6,000,000 kroner. The Board of Trade and the Board of Agriculture, in a joint memorandum, have asked that the sums available be doubled during 1919 and 1920 in order to permit greater assistance in the electrification of the country districts.

The above indicates something of the magnitude of existing and projected hydroelectric development in Sweden. Progress during the war would have been even more rapid but for the difficulty of importing finished equipment and raw materials required for domestic manufacture of turbines, dynamos and other machinery. Such articles as lamps, fuses, switches, electric motors, and numerous other items had been almost exclusively imported from Germany. The electrical industry, for a long time very important in Sweden, expanded as greatly during the war as the shortage of raw materials would permit, but the sudden accession of interest in electrification and industrial expansion throughout the country has created a great demand for mechanical and electrical appliances of all kinds.

The production of the heavier types of machinery required is an important industry in Sweden, but the drop in her German imports in many allied lines has been seriously felt.

Heretofore, Sweden has paid heavy toll to Germany for her lack of direct shipping connections with outlying countries. Plans now being formulated will bring Swedish ports into direct and regular communication with this country and the new policy of her big men is predicated upon the cultivation of closer commercial and financial relations with the United States.

The rapid development of the electro-metallurgical and chemical industries in Sweden is reflected in the following table:

Year.	No. Plants.	No. Kilowatts.	Value Product (Kroner).
1904	8	9,000	4,500,000
1908	10	13,500	7,500,000
1911	14	25,000	11,000,000
1913	22	60,000	20,000,000
1915	36	78,000	31,000,000
1917	75	128,000	55,000,000

Prior to the war our part in supplying electrical equipment to Sweden was almost nil. The following figures show the importance of the trade from the German standpoint. It is only in the past two years that our share has grown appreciably and it would appear to be entirely up to the American exporter of these commodities whether the figures rise to new heights or fall back to their old level.

GERMAN EXPORTS TO SWEDEN.

	1909	1910	1911	1912	1913
Electric Cables	$1,023,000	$1,021,000	$752,000	$565,000	$500,000
Electric Appliance for Illumination, Transmission of Power, etc.	188,000	262,000	334,000	340,000	481,000
Electric Incandescent Lamps	340,000	329,000	513,000	373,000	406,000
Electric Meters, Registers, etc.	99,000	151,000	189,000	217,000	261,000

U. S. EXPORTS TO SWEDEN.

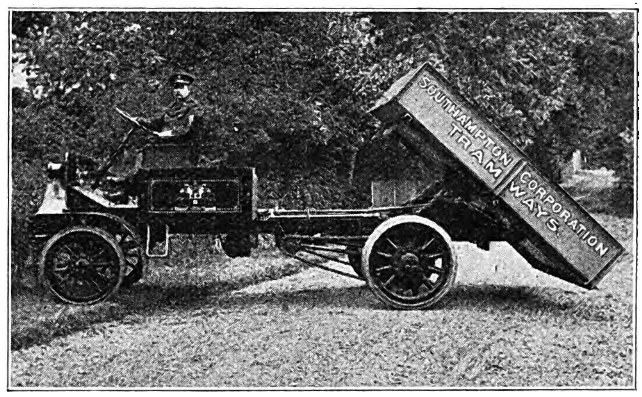
	1913.	1914.	1915.	1916.	1917.
Batteries	.....	$ 569	$ 3,809	$ 537	$ 8,540
Dynamos or Generators	48	.....	.....	1,168	17,359
Ins. Wire and Cables	.....	1,253	535	1,276	29,406
Meters, other Meas. Instruments	.....	.....	2,000	1,858	1,150
Motors	5,298	1,400	6,400	711	11,000
Transformers	.....	30,113	.....	.....	.....
All other	5,500	10,700	19,000	31,500	88,500

In spite of the handicaps of the war period, Swedish private enterprise and the purchasing power of the people have increased, and her labor situation appears more favorable than that of her neighbors. A period of temporary depression must follow the speculation and rapid expansion of the war years, but Sweden's future for the long pull never appeared brighter than at present.

STORAGE-BATTERY DUMPING WAGON FOR SOUTHAMPTON TRAMWAYS.

The accompanying illustration shows a 2-ton electric battery dumping or tip wagon that is in use on the municipal electric tramway system at Southampton, England. It is employed for permanent way and general carting work. It was introduced during the earlier years of the war and our picture which was then on the way to the ELECTRICAL REVIEW was intercepted by the British postal censor and in due course found its way back to our British correspondent. It is not apparent on the face of it what secret intelligence the said censor imagined the picture was intended to convey, but as the press postal censorship was recently withdrawn, we are now enabled to leave the reader to solve the riddle.

W. T. Robson, general manager and engineer of the tramways, tells us that the vehicle has been in daily service for three years without a break and is still running satisfactorily. Writing to our correspondent in August, 1916, Mr. Robson said that there was ample



Southampton's Battery Truck Dumping.

evidence to show that a considerable financial saving would result. In reply to an up-to-date inquiry, he says: "We have not worked out any recent costs, but I may say that the vehicle has displaced three horses, carries out all our own carting work, and in addition we are able to loan it for the benefit of other departments to a very great extent indeed."

The chassis is of the ordinary G.M. 2-ton type and the battery equipment consists of 60 type A8 Edison cells. An electric tower wagon of similar type had previously been put into service with equally good results.

FRENCH MARKET FOR ELECTRICAL GOODS.

Prior to the war a considerable amount of electrical goods was imported from Germany by French dealers in competition with other dealers handling French-made goods. It is thought that most of the inquiries in this line now come from the former class of dealers, who have lost their connections and who, naturally, have no claim on French manufacturers already represented. The French houses are more nearly fireproof than American houses and the same precautions do not have to be taken, so that American dealers exporting to France will have to furnish French patterns in several fittings that differ essentially from American practice. Among the more common instances will be: Bayonet sockets instead of screw sockets, tumbler switches instead of snap switches, sheet-metal tube with crimped joint and lined with treated paper instead of heavy metal conduit. This light conduit employs sleeve unions instead of screwed joints.

There have been inquiries regarding the conduit mentioned above, which is scarce in France at present. Other inquiries refer to: Multipolar snap switches, flush-type push-button switches, all fittings requiring hard rubber in their manufacture, high-candlepower low-voltage incandescent lamps for motion picture machines.

Editorial Comment

Index to Volume LXXIV Ready

THE index to Volume LXXIV of the ELECTRICAL REVIEW, comprising the 26 issues from January 4 to June 28, 1919, inclusive, is now ready for distribution. A copy will be sent to any subscriber upon request to the publishers.

Caution in Institute Changes

NUMEROUS changes in the activities of the American Institute of Electrical Engineers were discussed at the recent Lake Placid convention, as reported in this issue. These matters should be given most careful consideration and no hasty decisions arrived at without knowing that they meet the wishes of the great mass of the members and are for the good of the Institute. We urge special caution respecting any changes in the Institute's publications and doubt the wisdom of radical action on this matter.

Burglar Alarms Needed

AS LONG as we have inadequate police protection, crooked criminal lawyers, spineless judges and juries, we may expect a recurrence of raids on banks, paymasters and jewelers by daring automobile bandits. These victimized interests must therefore safeguard themselves as best they may. An excellent help in this line is a reliable burglar alarm. The bandits depend on their automobile for a quick escape. A speedy alarm is therefore an essential to their capture. A loud alarm sounded during the raid is likely to scare the criminals before they can effect their robbery, as has happened on several occasions where banks were equipped with reliable alarms. Electrical contractors can therefore aid the community by installing such alarms.

Economical Ore Handling

ONE of the principal reasons why the American iron and steel industry has forged ahead so rapidly is its very extended use of labor-saving machinery, nearly all of which is now being electrically driven. The use of motor drives in rolling mills and around blast furnaces and open-hearth furnaces has been frequently discussed, but the use of electricity in unloading ore vessels, while little less spectacular, is not so well known. In an illustrated article in this issue we describe the construction and operation of some gigantic electrically operated ore-unloading machines that have proven extremely economical in service. With two operators, one of these machines does the work that formerly took a small army of shovelers and barrow or truck pushers, and the work is done very expeditiously. In one case eight machines unloaded seven ore vessels totaling a load of 70,000 tons of ore within 22 hours. Such performances as these obtained through efficient, powerful machines electrically driven will keep our iron and steel industry in the forefront in the international competition for business in spite of high wages to the operatives.

Electric Brass Furnaces

FOR many years considerable attention has been devoted toward reducing the high loss of volatile metal that occurs in melting brass and cuprous alloys. One of the ways of reducing this loss, the latest and best, is to use the electric furnace instead of furnaces employing coal, oil or gas.

The huge demands for brass and its alloys created by the war resulted in effort being concentrated upon evolving a furnace that would do away with the extravagant waste of zinc in the process of producing castings and alloys. Out of this has come the electric brass furnace of today, of which there are a number on the market.

The electric brass furnace, like the steel furnace, represents a good load-factor and a comparatively heavy load. The capacity of the brass furnace is smaller than the steel furnace in units made so far, and there are many reasons why they may be expected to always remain so. There are many foundries scattered over the country—and we have often said before that the foundry is the one place where the electric furnace ought to be—where brass can be melted electrically with a big saving in zinc loss and all that goes with it.

Handling Competing of Merchandise

THE article by Mr. Thomas J. Casey in this issue contains some very interesting suggestions for the electrical contractor who is considering the establishment of a retail store. The recommendation that dealers do not handle competing lines of merchandise is well taken as the tendency in merchandising in the electrical industry is decidedly along these lines. Manufacturers are finding it desirable to give exclusive sales rights to jobbers who do not handle competing stocks, and likewise many jobbers are giving serious consideration to the policy of entering into agreements with dealers in different localities to represent them exclusively.

Electrical dealers can do no better than adopt the successful policies of the manufacturers and jobbers and benefit from their experiences.

It is well known that electrical appliances require intelligent selling, but little opportunity is given the salesman to exercise intelligent selling if, as in the case of a flatiron, the final choice between from one to a dozen different makes must be left to the customer. In spite of the great progress that has been made, the average housewife knows very little about electrical appliances. If a prospective purchaser enters a store for the purpose of buying an electric iron and asks the salesman which is the best, he is placed in a very difficult position if his house handles several different makes of the same size. It is far more satisfactory from every standpoint and undoubtedly productive of less confusion to be able to answer that one make has been selected as the most satisfactory for their customers and endeavor to make a sale on this basis. If the customer desires a particular make of product it can either be secured or it is better to have the customer go elsewhere.

The most successful retailers in other industries have almost universally adopted this policy of handling non-competing lines. It would be well for electrical merchants to give serious consideration to this matter.

The Progress of the Contractor-Dealer Association

ANYONE who has kept in touch with the activities of electrical contractor-dealers as reflected through the workings of the National Association of Electrical Contractors and Dealers cannot help but be impressed with the substantial progress that has been made by this branch of the industry during the past two years. Largely through the efforts of Mr. William L. Goodwin and his loyal supporters the electrical contractor has been rejuvenated, and today is also a progressive dealer rapidly adopting all of the modern principles of merchandising.

There are still many electrical contractors who refuse to advance and who were apparently satisfied with the chaotic conditions that existed a few years ago. And there are still so-called electrical dealers who maintain that the distribution of electrical merchandise should be confined to them, although they make practically no effort to modernize their business and keep abreast of the times. These same contractors and dealers are usually the first to complain of competition from central stations and others and to demand the same liberal treatment from manufacturers and jobbers. Needless to say, these contractors and dealers are the ones who most need the Association and it is hoped that the influence of the forthcoming convention at Milwaukee will reach out to these men.

In his notable address at the New Orleans convention two years ago Mr. Goodwin among other things pointed out that there is strength in numbers and that if the contractor-dealer fraternity desired to arrive at and maintain its place in the industry, it must build up a strong organization. The National Association of Electrical Contractors and Dealers has justified itself from every angle, and it will undoubtedly be but a short time before membership in the Association will characterize a contractor-dealer as one worthy of a place in the industry.

Service Costs and Rates

WHEN central-station service was in its infancy there was no knowledge of what it cost to furnish it and the rates established for it were set arbitrarily at such figures as were believed to insure at least a fair profit. For a great many years this condition continued, central-station companies making little or no attempt to ascertain what it cost to serve different classes of customers and often not knowing till the end of each year whether a profit or deficit had resulted from the year's operations. As a consequence of setting rates chiefly by guesswork, there were frequent discriminations not only between different classes of customers, but also among the customers of each class.

This condition was true likewise in the case of other utilities and was one of the causes that led to the adoption of commission regulation of public utilities. As such regulation has developed during the last dozen years it has been instrumental in bringing about a complete change in the making of utility rates. Instead of setting these arbitrarily without any consideration of the actual cost of rendering the service and charging as much as it was believed the customer would stand without quitting the service, it is now usual to make a careful analysis of the costs and then set the rates so that no class of customers is served at a loss and so that there is left enough margin over the cost to insure a reasonable return on the investment. Therefore, before discussing how rates shall be fixed it is necessary to study how the costs can be analyzed to show the various elements of cost affecting each class of service.

It is this order of treatment that has been adopted by Mr. H. E. Eisenmenger in his series of articles on "Central-Station Rates in Theory and Practice," which begins in this issue. Although part of this first article may seem elementary, it is necessary to know the fundamental principles before their application can be intelligently considered. These fundamental principles can be applied to any kind of utility service; for instance, the author shows their application to postal service—a branch of utility service that is claimed to be greatly in need of cost analysis. A preliminary study of the principles as applied to electric rates is also made in this installment, which will be carried out in detail in future articles of the series, which are to appear weekly, as announced in our last issue. We believe that, as we then stated, our readers will find these articles not only timely but highly informative. An introduction to the series written by Mr. S. E.

Doane, chief engineer of the National Lamp Works, with whom Mr. Eisenmenger was associated for some ten years in rate researches and investigations of similar central-station problems, has unfortunately not been received in time to be included at the beginning of the series. It will be inserted in due time, however, without seriously affecting the continuity of the articles. It is hoped, in fact, that it will add interest to the articles and emphasize the importance of thorough consideration of the subject.

Automatic Telephony Coming to Rescue

TELEPHONE companies are facing a problem of rapidly increasing difficulty in connection with maintaining their operating organizations in efficiency and strength. This is especially true of the larger cities. To train an operator to take care of her work properly and efficiently has usually required special instruction for several weeks or even months, and the large telephone companies have for many years been compelled to maintain, at considerable expense, operators' schools for training the large number of beginners continually needed to replace recurring gaps in the operating force.

There are several reasons for the forming of these gaps as soon as they are filled. One of the principal ones is that men readily appreciate a pleasant voice and courteous attention when it comes via wire, so much so that many even confirmed bachelors have fallen victims to the frequently unintentional charmer. In short, the percentage of marriages among telephone operators is probably higher than among any other class of gainfully employed young women. Strangely, however, this is not true of telephone operators in several other countries, for in a number of European countries it has become customary to keep spinsters and widows at operating work until they reach the ripe age of 70 or thereabouts. American operators' schools have perhaps been too efficient in developing in the girls not only courtesy and alertness but also amiability and poise.

Another reason for the gaps among operators is that most companies have not been able to pay very high salaries for the services of the operators, so that these remained on the alert for opportunities in other occupations that brought greater remuneration. Other girls found the work too strenuous for their nervous temperaments. The companies have tried to make the work less exacting and, by giving frequent rest periods and furnishing pleasant rest rooms and lunch rooms, have done their utmost to develop the welfare of the girls as well as their interest and pride in their work. But the gaps are no sooner filled than they open again so that there is a continual procession of girls training, working a short time and quitting. Needless to say, this high labor turnover is an expensive burden to the operating department and incidentally accounts very largely for justifiable complaints of poor service.

On top of these difficulties, which have become aggravated during the war because of the tempting salary offers in numerous other occupations, have recently come concerted demands for higher compensation, culminating in a strike in at least one city—Boston.

Over 25 years ago some of these difficulties were foreseen in the earliest inventions that aimed to replace the human element in telephone operating by means of automatic machinery. During the intervening years there have been great advances in automatic telephony. Several systems have been developed, of which at least one has come into quite extensive and successful use. The service rendered by the "girlless" 'phone is surprisingly prompt, free from wrong connections and cutoffs, and satisfactory in every way. It has been shown that there is no feature of telephone service that cannot be furnished through the automatic instrument; long-distance, information and emergency calls can be handled by a small number of operators. Foreigners unfamiliar with our language and people with impediments in speech can secure their connections much more readily than with a manual system. The perfected automatic telephone exchange equipment is a marvel of invention on a par with the linotype machine or printing telegraph and equally with these ingenious mechanisms a striking achievement in labor-saving apparatus.

It is not surprising, therefore, that the executives of the largest telephone companies have at last turned to automatic telephony to rescue their operating departments from their increasingly desperate situation. It has been understood to be the new policy of the large Bell companies to change over to automatic equipment those exchanges that have the heaviest traffic, incidentally making other rearrangements of offices, cables, etc., as would promote economy. It is not right to assume that these companies did not recognize the advantages of automatic telephony many years ago. They had a peculiar situation to face in that many millions of dollars of investment were tied up in their manual switchboards and the sudden change to automatic would mean not only losing much of this capital through discarding of the manual equipment, but also necessitate securing great amounts of new capital to purchase the automatic apparatus.

Now, however, because of the increasing cost of manual service, the economy in operation from adoption of automatic service will be greater and it becomes financially expedient to change over, since this economy will within a reasonable time offset the interest on the additional capital investment. Consequently, we shall see more and more use of the automatic telephone in our large as well as medium sized cities, this being but another instance of the use of electrical machinery to replace more and more costly and fickle manual labor—a development that is making rapid headway now and will continue to accelerate in the future.

Current Events

Plans for Contractor-Dealer Meeting—American Institute Discusses Organization—Trumbull Electric Changes Hands

LARGE ATTENDANCE EXPECTED AT MILWAUKEE CONVENTION.

Arrangements Completed for Nineteenth Annual Convention of National Association of Electrical Contractors and Dealers—Comprehensive Program of Papers.

Final arrangements have been completed for the nineteenth annual convention of the National Association of Electrical Contractors and Dealers, which will be held at the Hotel Pfister, Milwaukee, Wis., during the week of July 14. As previously announced in the ELECTRICAL REVIEW, Monday and Tuesday will be taken up by meetings of the Executive Committee, the first general session being on Wednesday morning. An address of welcome will be made by Gov. E. L. Philipp of Wisconsin and Chairman C. W. Peet will respond. An address on "Co-operation in Business" will be made by Frank B. White, of the National Agricultural Publishers' Association, and Frank Stockdale will speak on "Keeping Up with Rising Costs" at the afternoon session on Wednesday. The meeting on Thursday will be held at Waukesha Beach, the principal address being by W. L. Goodwin on "Merchandising Opportunities." A number of interesting reports and addresses dealing with various phases of contractor-dealer activities have been arranged for Friday.

The entertainment includes a reception and dance at the Hotel Pfister on Wednesday evening, sports and games at Waukesha Beach on Thursday afternoon, and an informal dinner on Friday evening. Announcement has been made that there will be special entertainment features for the ladies.

W. H. Morton, general manager of the Association, anticipates the largest attendance in the history of the organization.

CLOSING SESSIONS OF A. I. E. E. CONVENTION EMBRACE MANY SUBJECTS.

Discussions of Papers, Publication of Periodicals and Changes in Activities Some Topics.

The concluding sessions of the A. I. E. E. Convention at Lake Placid (the first two days' sessions were presented in last week's issue of the ELECTRICAL REVIEW) comprised discussions of papers and the making and discussion of proposals to change the existing mode of issuing Institute publications and broaden the activities of the Institute.

TRANSMISSION AND DISTRIBUTION TOPICS RECEIVE DISCUSSION.

After the presentation of the Transmission and Distribution Committee's report by E. B. Meyer on Thursday morning a spirited discussion on the dissipation of heat from cables and its effect on insulation took place. W. A. Del Mar spoke of the urgent need for specifications for paper and varnished cambric insulation. He recommended a study of the relative current-carrying capacities of cables in duct and earth. D. W. Roper emphasized the necessity of determining whether cables come up to A. I. E. E. specifications. P. M. Lincoln said that local conditions are so important that this problem devolves more upon the operating rather than the manufacturing company, and co-operation between the two is needed.

R. W. Atkinson said that copper temperatures may be determined when duct temperature, sheath temperature, cable load and characteristics are known. Professor Clark urged that funds be furnished to enable research to be carried on that will enable insulators of higher standards to be produced. C. P. Martin advocated that a standard method of testing high-tension insulators be adopted by the Institute.

H. R. Summerhayes pointed out that excessive heating of a few seconds from short-circuit currents may have a serious effect upon insulation. Colonel Jewett, of the Western Electric Co., spoke of research on insulating materials now being carried on under the auspices of the National Research Council. The success of this venture depends almost entirely upon the co-operation obtainable from the manufacturing and operating companies concerned. Dr. Steinmetz stated that, in his opinion, porcelain does not age; but it is the unequal expansion and contraction of the composite parts, namely, cement, porcelain and metallic pins, with temperature changes that is the seat of trouble in causing insulator deterioration. C. S. MacCalla told of an interesting experience of the Central Colorado Power Co. A large number of link insulators are used on the 100,000-volt lines. With this type of insulator, as distinguished from the cement-pin type, after correcting for failures from lighting, failures due to aging were only one-tenth of 1%.

The papers on "High-Tension Single-Conductor Cable for Polyphase Systems" and "The Dielectric Field in an Electric Power Cable" by W. S. Clark and G. B. Shanklin and R. W. Atkinson, respectively, were discussed by H. W. Fisher, Standard Underground Cable Co.; W. A. Del Mar, Electric Cable Co. and Habirshaw Electric Cable Co.; Philip Torchio, New York Edison Co.; D. W. Roper, Commonwealth Edison Co.; H. L. Wallau, Cleveland Electric Illuminating Co.

W. A. Del Mar presented a diagram showing electrical lines of force and heat flow around both sector-type and circular three-conductor cables. This showed that dielectric stress is about 15% greater in the round than in the sector type cable. The heat resistance from conductor to air is about 3% less for the sector than for the round conductor cable. The current-carrying capacity will be, therefore, from 1 to 2% greater than that of the round conductor cable.

Philip Torchio thought that Messrs. Clark and Schanklin were mistaken in saying that three-conductor cable is less advantageous than single conductor. Single-conductor leaded cables have a number of disadvantages, namely, the higher voltage impressed in the sheath with undergrounded sheath and the high charging current when the sheath is grounded. H. L. Wallau gave specific data as to sheath current and reduced voltages.

A. E. Silver's paper on the subject of "Problems of 220-Kv. Power Transmission," excerpts from which appear in this issue, brought out considerable discussion, the consensus of opinion being that such a voltage was practical, and that conditions already exist where systems similar to those proposed could be adopted.

W. S. Murray, formerly electrical engineer of the New Haven Railroad and conservation engineer for the government, in the discussion referred to a superpower line which is proposed between Washington and Boston to serve a territory measuring about 450 miles long by 150 miles wide as a concrete opportunity for application of 220 kv.

A. F. Bang said 220,000-volt transmission lines without spare transformers is considered unwise. He favors single-phase transformers in preference to large three-phase transformers for this service. He also questioned whether external cooling of transformers is justified in every case.

F. W. Peek, Jr., expressed the belief that a line built according to the plan outlined in Mr. Silver's paper would be more reliable than present 33,000-volt lines, and that link-type insulators will overcome most objections to insulators.

J. F. Peters spoke of several factors which being of no consequence at low potentials become serious in the design of high-voltage apparatus, one of which was electrostatic field. Short-circuit stresses will be less severe on high-tension transformers because of the greater magnetic leakage.

A number of speakers favored grounding the neutral of Y-connected systems. Others taking part in the discussion were Philip Torchio, New York Edison Co.; H. B. Dwight, Canadian Westinghouse Co.; A. F. Bang, Pennsylvania Water & Power Co.; S. Warren Mauger, R. M. Spurck and F. F. Brand, General Electric Co.; G. I. Gilchresh and R. P. Jackson, Westinghouse Electric & Mfg. Co.; J. C. Clark, Stanford University; C. F. Harding, Purdue University.

Technical Committees to Have Wider Field of Activity.

Wilfred Sykes, chairman Board's Committee on Technical Activities, stated in his report that the technical committees might to advantage do more than arrange for the presentation of papers, that is, in addition collecting and correlating data, formulating rules, etc. As this sort of work requires considerable time, it would be necessary for committee members to hold office for a longer period of time than one year, as at present. This line of thought was continued by Dr. Steinmetz, who said that the chief value of committees is to supply extensive reviews of developments in their special branches of science or applied science, in such form that it is get-at-able. He made mention of the reports of the N. E. L. A. and the Association of Edison Illuminating Companies, stating that such reports are much more desirable than individual papers. The presentation of individual papers should be made to assist final committee reports, which ought to be more full than is now generally the case. Such a scheme of things would broaden engineers. Only workers should be retained on committees.

Prof. Karapetoff suggested that a research committee be established to act as an intermediary between the National Research Council and the A. I. E. E., taking up individual problems that come up before the technical committees. As the best work is done by individual geniuses rather than by committees, Prof. Karapetoff thinks it inadvisable to dispense entirely with individual papers. David B. Rushmore said that one of two purposes is open to the A. I. E. E. One is to supply every electrical engineer with information he wants. The other, to allow specialists to form separate organizations. The question, therefore, is whether the Institute should enlarge its activities and become an inclusive body or confine its attention to those engineers who are not specialists and become a residual body. He suggested that section chairmen recommend eligible committeemen stating their connections and abilities for work. The performance of each committeeman should be recorded, that the inactive members may be dispensed with. L. W. Chubb offered an alternative method, namely, to select each chairman from the preceding committee, choosing the remaining members on the basis of their former activity.

Discussion Centers Round Development Committee's Report.

The presentations made by the Development Committee in which it was proposed to modify and extend the present activities of the Institute, received a large amount of discussion. Calvert Townley, chairman, pointed out that the principal proposals comprised the substitution of the present monthly proceedings by an engineering periodical; the creation of geographical sections, each represented by a vice-president; rotation of monthly meetings instead of holding them at New York City; federation of local engineering for better co-ordination under national council; holding of regular engineering congress, and decentralization of work. It is proposed to eliminate the publication of Institute papers other than those presented before the general meetings, and papers presented before sections will be abstracted. Articles of general engineering interest and abstracts of papers presented before allied associations will be included in the publication that has been proposed to substitute for the monthly proceedings.

In the discussion on this matter of the Institute periodical, the consensus of opinion seemed to be against doing anything that would tend to lower the present high standard of the Institute's status and its publications. Dr. Steinmetz said he would very much regret seeing either the size or the quality of the Proceedings changed after having retained their present form for 35 years. The proposal to change the form of periodical instead of the publication as issued by the Institute would undoubtedly lower the prestige of the Institute, while soliciting advertising would have many drawbacks. Without adopting the radical steps proposed, it was his opinion that a portion of the $18,000 now expended in binding the transactions could be saved in other ways.

Mr. Vincent, who was supported by Prof. Clark, suggested that it would be better to increase the revenue rather than to curtail the expenditure in the way proposed. He suggested that this might be done by elevating the membership of those persons now below the rank to which they are entitled. Prof. Clark suggested that the cost of binding the transactions should devolve upon the members. L. T. Robinson pointed out that the Institute papers are the most interesting part to many members at present; that young engineers do not have to be attracted by popular articles; and that it was not the intention of the proposed Institute organ to parallel the work of existing engineering periodicals. Mr. Chubb expressed it as his opinion that it would be a great pity to change the present type of technical papers. He failed to see how popularized or generalized papers would be able to supplement present technical ones if a monthly periodical is to be maintained.

Prof. Karapetoff, speaking very strongly, said it would be suicidal for the Institute to adopt any course with a downward trend. The present high standing of the Institute should be maintained. Popularized and generalized information is well taken care of by the present engineering publications that are alike available to everybody. If a publication such as the Development Committee proposed was to be issued, it would have to compete with technical papers now issued by skilled and shrewd business men whose business is publishing and who are equipped with stable and liberal personnel. Dr. Steinmetz pointed out that papers presented before the Institute should be of the highest calibre. Mathematical and theoretical papers are the ones which give prestige to the Institute and permanent value to the Transactions. Inventions, discoveries and developments; theoretical and experimental investigations; and the operation and installation of equipment should also be subjects for discussion so long as they represent the forward step. He suggested that it would be of immense benefit if all papers of affiliated societies could be made available in condensed form. Papers might be accepted on the basis of their abstract value.

A vote was then taken to accept the proposals regarding an engineering publication, as submitted by the Development Committee. President Adams, Philip Torchio and others expressed themselves as being strongly opposed to the inclusion of advertising matter in the Institute's Proceedings.

C. G. DU BOIS NOW PRESIDENT OF WESTERN ELECTRIC COMPANY.

Succeeds H. B. Thayer, Who Retires After 33 Years to Become President of American Telephone & Telegraph Co.

At a meeting of the Board of Directors of the Western Electric Co. held on July 1, Charles G. Du Bois was elected president of the company to succeed H. B. Thayer, who has resigned after 38 years of service to assume the presidency of the American Telephone & Telegraph Co., as announced in our issue of June 28. Mr. Thayer was elected chairman of the Board of Directors of the Western Electric Co.

Mr. Du Bois was born in 1870. After his graduation from Dartmouth College in 1891, he joined the Western Electric Co. in New York City as a clerk in the accounting department, and in 1896 he was appointed chief clerk at the New York office. In 1898 he was elected secretary of the company with offices at Chicago. This work carried with it a general supervision of the entire accounting system of the Western Electric Co.; and in this connection Mr. Du Bois was largely instrumental in working out and securing the adoption of the company's first pension plan.

Shortly after assuming the duties of secretary, Mr. Du Bois was also made supervisor of branch houses. This carried with it the opening of a large number of distributing houses, which are now a part of the company's organization.

In 1907 Mr. Du Bois was transferred from the Western Electric Co. to the American Telephone & Telegraph Co. as its comptroller. In this capacity he inaugurated and supervised a new and comprehensive system of accounting for the Bell Telephone System. In 1917, shortly after the entry of the United States into the war, he went to Washington to serve as comptroller for the American Red Cross. After systematizing the Red Cross accounting work and organizing a department to carry it on, he resumed his duties with the company.

On Oct. 1, 1918, Mr. Du Bois rejoined the Western Electric Co. as vice-president, which office he held until his accession to the presidency. Mr. Du Bois' long association with Mr. Thayer in the administration of the company insures a continuity of policy and methods in the conduct of the business.

Chas. G. Du Bois, the New President.

H. B. Thayer, Retiring President.

TRUMBULL ELECTRIC REPORTED AS SOLD TO GENERAL ELECTRIC.

Trumbull Electric Manufacturing Co., of Plainville, Conn., to Form Part of General Electric System—Plant to Be Enlarged.

According to a reliable Hartford, Conn., newspaper, control of the Trumbull Electric Manufacturing Co., Plainville, Conn., has been acquired by the General Electric Co. The capital stock of the Trumbull company has been $500,000 and its surplus about as large. It is stated that the General Electric Co. will increase the capital, enlarge the plant and greatly extend its business.

The Trumbull Electric Manufacturing Co. is one of the best known manufacturers of switches, panelboards, switchboards and other electrical supplies. It has been very successful since its modest beginning in 1899, when the three brothers, John, Henry and Hugh Trumbull, opened a small factory in an abandoned barn in Plainville; the capital invested was about $250 and six or seven workmen were employed. Within a year the company replaced its wooden factory with a more pretentious brick building and increased its employes to about 40. At present the plant consists of two large four-story buildings with a connecting building of the same height. It is the principal industrial establishment of Plainville and has employed about 500 workers at the time of maximum activity during the war.

Of the Trumbull brothers, Hugh sold his interest in the company several years ago and organized the Trumbull Automobile Co., Bridgeport, Conn. He lost his life in the sinking of the *Lusitania* by a German submarine on May 7, 1915. During the last five or six years Henry Trumbull has been in poor health and has more and more retired from active participation in the business, which has devolved almost entirely upon John Trumbull. The secretary of the company is Stanley Gwillim, who has been associated with it for some 15 years.

WESTERN CENTRAL STATIONS COMPLETE POWER DEAL.

Pacific Power & Light Co. to Tie In to Large Transmission System of Montana Power Co.

According to recent press dispatches, the Pacific Power & Light Co., at Yakima, Wash., has completed arrangements with the Montana Power Co. by which the former will tie in to the big transmission line of the latter company at Lind. This connection will practically double the capacity of the Pacific Power & Light Co.'s plant.

The transmission line of the Montana Power Co. extends from near Billings, Mont., to Seattle, Wash., one of the longest in the world. The transmission voltage is 110,000 volts, which will be stepped down to 66,000 volts for use by the Pacific Power & Light Co. It is expected that during the height of the irrigation season the demand will be about 20,000 hp.

RAILROAD ELECTRIFICATION IN CHICAGO TO BE BEGUN.

Illinois Central to Electrify Suburban Lines First—Part of Big Lake Front Improvement Project.

Railroad electrification in Chicago, the largest railroad center in the world, is likely to begin within a few years in accordance with an agreement concluded by the Illinois Central Railroad, the South Park Commission and the Railway Terminal Committee of the Chicago City Council. The Illinois Central suburban lines are to be electrified throughout within 7 years, the remainder of its trackage north of Twelfth street within 10 years, and all the rest of its passenger and freight tracks within 15 years. The ordinance covering this matter relates to it only as one feature of a very extensive improvement, providing, among other things, for filling in a stretch of Lake Michigan about six miles long by one-half mile wide just east of the railroad tracks, this filled section to form an outer boulevard and parkway connecting Grant and Jackson Parks. The railroad's right-of-way will be widened and it will be relieved of the need of protecting the shore line along its tracks. A new terminal depot, to accommodate several other railroads also, is to be built by the Illinois Central south of its present Park Row station, which will be torn down and its site added to Grant Park. Numerous incidental improvements to be made by the railroad will make its total expenditure for the entire project in the neighborhood of $88,500,000. The South Park Commission will expend about $30,000,000 for the park improvements.

Conspicuously located on the lake shore, the Illinois Central Railroad's Chicago terminal lines have been attacked for many years because of the smoke and cinders emitted in front of one of the best residence and hotel districts in the city. Improvement associations, women's clubs and other organizations have sought to force electrification of these tracks. An outcome of this was a movement for railroad electrification throughout the city, involving a total of about 4000 miles of single track. This was dropped some years ago after an exhaustive report by a special commission showed the expense to be extremely high. The Illinois Central negotiations indicate that the city's electrification policy will be to bring about electrification not on a wholesale scale through a general ordinance but by means of special contract ordinances with the individual railroads as opportunity offers. The present ordinance needs the formal approval of the City Council and the Federal Government, which is assured in each case, according to the most reliable reports.

CO-OPERATIVE COURSE IN ELECTRICAL ENGINEERING TO BE GIVEN.

Massachusetts Institute of Technology and General Electric Co. Arrange Five-Year Course.

An electrical course is to be conducted by the Massachusetts Institute of Technology in co-operation with the General Electric Co. and will afford a distinctive training for the technical and executive responsibilities of the manufacturing industries. The course will cover a period of five years, of which the first two are to be identical with the old and well established course in electrical engineering at the Institute, and the last three are to be divided between instruction at the Institute in Cambridge, Mass., and experience associated with instruction at the West Lynn and other works of the General Electric Co. The work of the final year of the course will be of advanced nature, with emphasis laid on the problems of administration, the design and development of the engineering projects, and in creative work such as research. The training at the works of the General Electric Co. is laid out and will be conducted with a view to the maximum educational value and is intimately correlated with the instruction at the Institute.

The co-operative training which occupies the last three years of the course will be entered upon by the new class on October 6, of this year. The successful completion of the course will lead to the degree of Master of Science. The number of men who may be admitted each year is at present limited to forty, and candidates for admission are subject to the approval of both the Institute of Technology and the General Electric Co. Students who have successfully completed the first two years of the electrical engineering course of the Institute of Technology are eligible to enter this co-operative training, and well qualified students who have completed the substantial equivalent at other institutions are also eligible for admission.

While students are at work at the General Electric Co. plants they will receive regular compensation but are to be under supervision of teachers and their work in the shops is to be supplemented by conferences with works department heads in which technical and administrative problems arising at the works will be discussed.

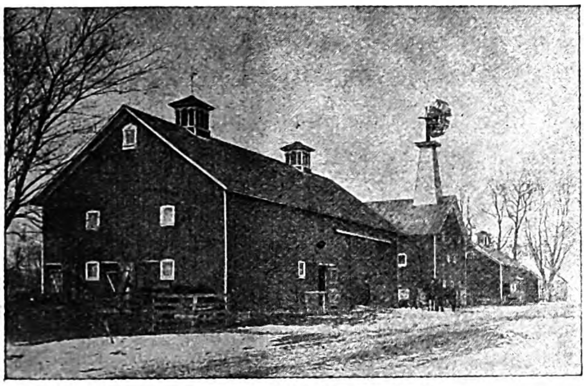
Commercial Practice

Model Farm Electrification—Hospitality of Dayton Utility —Summer Sales by Mail—Summer Appliance Sales

ELECTRICITY HELPS PROGRESSIVE IOWA FARMER.

J. W. Oltrogge, Near Readlyn, Makes Varied Uses of Current Purchased from Distributing System.

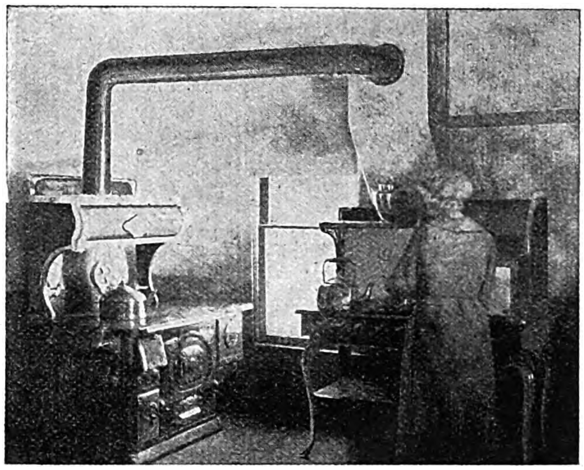
Farmers in Blackhawk County, Iowa, demonstrate emphatically that the use of electricity is just as much a matter of economy and convenience to them as it is to the millionaire in his "model farm." Farmers in this neighborhood on farms of all sizes have electricity lighting their house and buildings, pumping water, grinding feed, and running the dairy machinery. One of the most complete installations is that of J. W. Oltrogge, who lives near Readlyn.



Barns and Stables Electrically Lighted, As Are All the Farm Buildings.

As will be seen from the illustrations, Mr. Oltrogge's buildings are all of first-class construction, and are electrically lighted throughout. Over the door of his garage is a lamp which lights the walk from house to barn, and is controlled from four points. Thus there is no need of a lantern, as the light can be turned on at the house, and extinguished on reaching the barn. In the barn is a 7½-hp. Westinghouse motor driving a Bowser feed mill. Experience has shown just where to set the slide gate in the feed-chute so that the mill gets just enough unground oats and corn, and so it runs without attention. Nearby is a 1-hp. motor belted to a shaft formerly driven by a windmill. This shaft runs outdoors to a pump which delivers to a concrete tank from which pipes run to various watering troughs. One of these troughs which serves the beef animals, is placed in the wall of a shed so that it can be reached from without or within. Formerly there was trouble with this freezing, but Mr. Oltrogge has put in a little electric immersion heater, taking 500 watts, which effectively keeps the water ready to drink. Since there are about 150 head of cattle the saving of this device is obvious. The motor-driven feed cutter, too, means no hauling of feed over heavy roads, and no shortage of ground feed at any time.

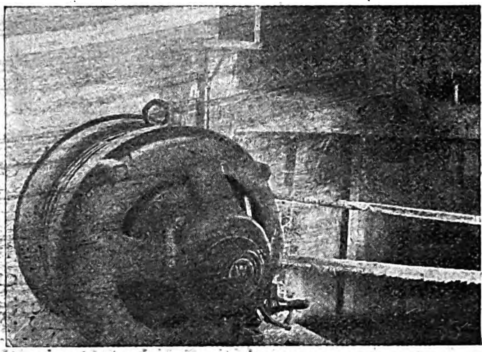
A Light Over the Garage Door Makes It Easy to Go About at Night.



An Electric Range Replaces Coal in the Kitchen.

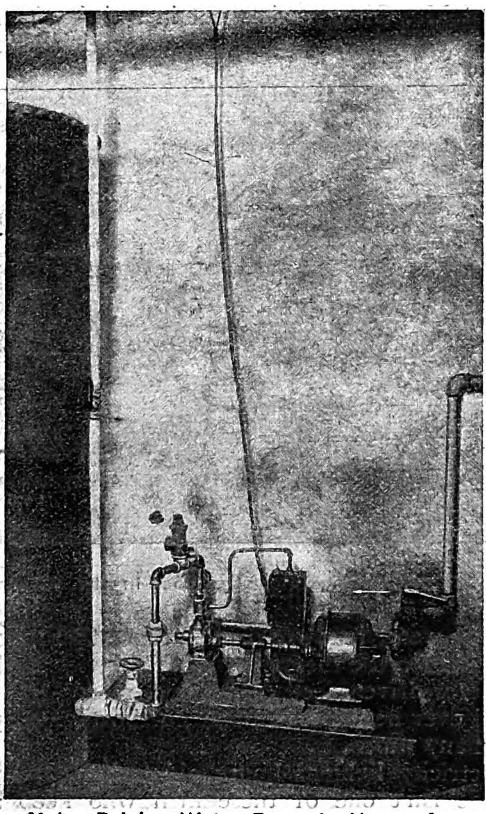
Electricity lightens household tasks too, and Mr. Oltrogge isn't one of these men who keep all the conveniences for himself. His house is well lighted throughout, and has a complete plumbing installation, supplied by a small rotary pump driven by a Westinghouse ⅓-hp. motor. This pump delivers into a 3-ft. by 6-ft. pressure tank. In the laundry is a combined washing machine and wringer driven by a ¼-hp. motor. In summer Mrs. Oltrogge's kitchen is always cool for she uses an electric range. This has three heating units on top and an oven underneath. In winter, too, there is no fear of fuel shortage, and no delay should the range fire go out. Other household equipment is an electric flatiron, a sewing-machine motor, and an electric vacuum cleaner. In the garage is a motor-driven grinder which keeps tools sharp.

Mr. Oltrogge has a farm of 320 acres, on which he usually feeds 150 head of cattle and 300 hogs. His electricity bill totals $8 to $10 per month. Current



A 7½-Hp. Motor Drives Feed Cutter.

is purchased from Tegtmeier Brothers, who operate a 2300-volt distributing system. As is customary in this community, each user pays for his share of whatever line connects with the nearest distributing line. He also pays for his transformer (in this case a 7½-kw. unit) and protective devices. Tegtmeier Brothers install the meters. The rate for current



A ⅓-Hp. Motor Driving Water Pump in House, for Farm and House Services.

decreases with the amount used, thus making it easy for the farmer to run several motor-driven devices. By their aid it is possible for Mr. Oltrogge with the help of one boy, to take care of his stock during the winter alone and in the summer to concentrate his time on really productive work. The saving from this is very high, reducing not only the cost of farming, but the work of catering to farm hands. The farm of Mr. Oltrogge is one where the housewife's work is reduced to a minimum.

DAYTON COMPANY'S HOSPITALITY ENJOYED BY 1400.

The Dayton Power & Light Co. held its eleventh annual picnic Friday, June 27, at Overlook Park. It was by far the best picnic ever held by the company. The events during the afternoon were thoroughly enjoyed and a large number of prizes were awarded.

The ball game between the power stations and the office and sales teams was a very exciting contest and was won by the office and sales, score 7 to 6. The F. M. Tait loving cup was awarded to the office and sales, they securing the greatest number of points in the different contests.

The O. H. Hutchings loving cup was awarded to Earl Compton of the meter department, as being the best all around athlete.

Dancing until 11:30 finished out the day. Music was furnished by the Park Orchestra. The committee in charge was Charles Garman, Burt Taylor, Frank Jones, Joe Gunzelman, W. L. Andrews, Richard Wuichet, Frank Kendig, Carrie Daum, Ralph Scherer and Fred Lewis.

JULY TO BE SEASONAL OPPORTUNITY FOR FLATIRON CAMPAIGN.

With a reduction in electric light rates effective July 1, and a reduction in the cost of the Western Electric 6½-lb. flatiron from $6.50 to $4.90 as incentives—in which the hot weather also is a powerful ally—the Duquesne Light Co., has set out to sell 2500 electric irons during the month of July.

During July, 1917, the company during a similar campaign sold 1776 flatirons. This year they will not be satisfied unless it sells 2500. Every employe is asked to attempt to sell at least one iron, which if they succeed, assures the campaign "going over the top." In the publicity being accorded the campaign special emphasis is being placed upon the fact that the electric flatiron is ideal for the summer months when the temperature is high and the air humid. The cut in price and the lower energy rates are also being featured. The campaign is in charge of P. H. Simon, manager, Electric Shop, Duquesne Light Co.

ELECTRICITY IN AGRICULTURE GIVEN IMPETUS IN ENGLAND.

The recently issued annual report of the British Conjoint Board of Scientific Societies contained further reference to the proposal of the Committee on the Application of Science to Agriculture that the Board of Agriculture should grant funds for designing, constructing and testing practically an electrical tractor and certain other agricultural machines. On the occasion of a deputation to the permanent secretary it was urged upon him that big electrical developments were to be expected both in the supply of motors for homestead purposes and also upon the land. Sir Daniel Hall gave a sympathetic hearing and agreed that much was to be expected in agricultural operations from the future use of electricity but he thought the time inopportune. If manufacturing firms would set about the design so as to be ready at a later and better moment he would deal with the matter then. Sir John Snell presented a development scheme for the supply of electric power to the farms of a district at Bridlington in Yorkshire, which contained 1177 farms of various sizes.

Operating Practice

Cleanliness of Turbogenerators — Dielectric Losses of Cables — Oil Switch Explosions — Rates of Steam Making

SPARKS AS WELL AS ARCS CAUSE TURBO-GENERATOR FIRES.

Cleanliness Precaution Against One Form of Fire.

Short circuits internally have resulted in turbogenerators catching fire and destroying themselves. Proper relay protection so that a machine in trouble is quickly isolated and the air supply shut off do much to prevent internal fires starting, or if started, from spreading.

However, not all fires are due to heavy-current arcs. Many result from dust and dirt that has collected in the windings, this accumulation of combustible material acting as tinder to a spark. A spark may occur from a number of causes. On the other hand, a spark will probably do little damage if the surfaces of the windings are clean and free from such materials as oil, dust, grease and pieces of cotton waste, etc., which are combustible and may be inflammable. It is well to take precautions against internal turbogenerator fires. It is well to furnish means for fighting these fires should they take place. But it is also well to make some effort to keep the machines clean internally by conditioning the air—which also increases the capacity of the machine—and by not allowing cotton waste and lint to be used for wiping purposes around these machines. By following these simple precautions sparks will create little hazard.

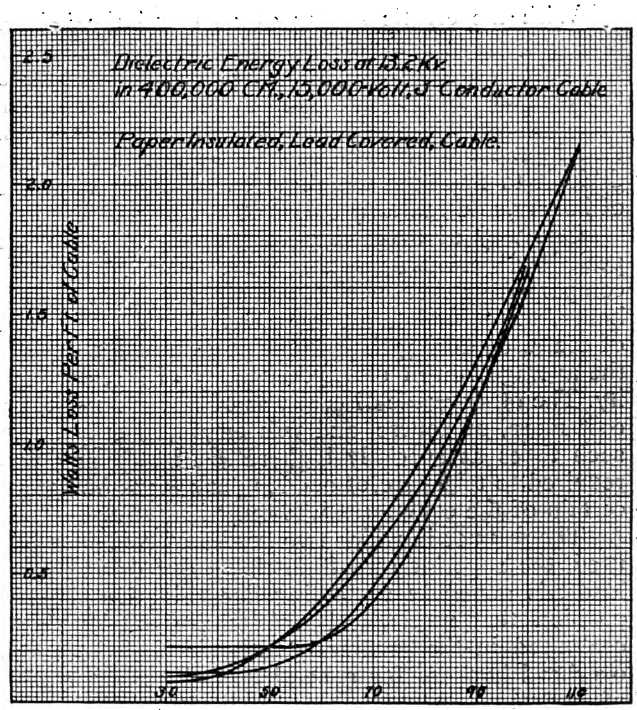
CLAUSE IN CABLE SPECIFICATIONS CARES FOR DIELECTRIC LOSSES.

Maximum Dielectric Loss with Temperature Increase Guaranteed.

Much attention has been given the matter of underground cable rating of recent years because of the growing importance of this phase of transmission and the effect that cable failures have upon life of cables, reliability of service and investment required to give reserve and safe capacity.

It is well known that at the higher potentials, the decrease of dielectric resistance with increasing temperature is such that above a certain temperature, the dielectric losses due temperature are such that although load current ceases, the resistance of the dielectric is such that the losses due the potential through the dielectric are sufficient to cause eventual breakdown resulting from the cumulative effect of temperature upon dielectric strength. One way in which this increasing dielectric loss can be prevented is by keeping within the safe dielectric temperature range. Another method employed is to exceed this limit when necessary and then disconnect the cable from the potential until the cable cools off.

The dielectric properties of a cable decide the safe operating temperatures of that cable and determine at what temperature the cumulative effect of the dielectric loss will cause dielectric failure. One large central-station company has already added clauses to its underground cable specifications requiring cable manufacturers to submit with their bids a table or curve guaranteeing values of dielectric loss that will not be exceeded under various temperature conditions. With this data on hand, and with the help of a temperature



Curves Showing Watts Loss Per Cable-Foot at Different Temperatures. Paper-Insulated, Lead-Covered, 15,000-Volt, 3-Conductor Cable. Applied Potential of 13,200 Volts.

survey made of the cable duct routes, it is possible to very closely determine the safe loading of the various cables, in this way obtaining full safe current densities and at the same time reduce cable breakdowns and service interruptions from this cause to a minimum.

OIL FUMES MENACE TO OIL CIRCUIT-BREAKERS.

After repeated operation, such as may occur in closing a circuit several times on a short-circuited line, oil circuit-breakers sometimes blow up. This happens with circuit-breakers operating not only at the higher voltages but also at potentials in the neighborhood of 2300. The cause of these explosions, while they may sometimes be due to the breakdown of the switch bushings, is usually that an oil vapor has collected above the oil, and this, becoming ignited, has resulted in the explosion and the tearing off of the oil-switch tank.

The collection of oil vapor can be prevented by maintaining a circulation of air above the oil level; this is done in one instance by the use of a vent or valve, which closes before the switch opens. However, for those circuit-breakers where provision is not specially made to prevent the collection of oil vapors, it is a wise measure to refrain from closing them more than necessary in quick succession on short circuit. In any case it is well to examine switch contacts after the switch has repeatedly functioned in rupturing heavy currents.

FACTORS INFLUENCING RATES OF STEAM MAKING.

Partitional Hoppers, Stoker Arrangements and Mechanical Draft Are Involved.

By W. H. De Muth.

With the erratic supply of coal and the inferior and dirty grades available during parts of the war, came many innovations aiming to overcome some of the difficulties involved. One of the greatest difficulties was due to the high dirt and non-combustible content in the coal, a condition that made it extremely difficult to maintain the required steaming capacities of boilers, and radically curtailed overload capacity.

One way of overcoming this situation during the peak load periods that take place almost daily for a comparatively short period, namely, for about 1½ to 2 hours, was to maintain two grades of coal. The grade of coal used during the greater portion of the day was the average run of coal, presumably of inferior quality. The other grade of coal was of better quality, and cost more, of course, and was employed only during such times as specially high rates of steaming were required to take care of sudden peak loads or because certain of the equipment was out of service.

The manner in which two grades of coal have been used, the superior coal for helping out during heavy loads, is generally something like this: On the supposition that mechanical stokers are employed, the coal used in the greater quantity is loaded into the overhead hoppers for general use. The better grade of coal, costing more, more difficult to obtain, and used only for short periods of time, is dumped on the boiler-room floor. A pile is "spotted" at each stoker, in the middle of the boiler-room aisle. When the sudden demand for steam comes on, or just as it is about to come on, the firemen commence shovelling the coal from the floor into the bins immediately above the stokers.

The above practice is followed by many small companies, and also by one of the largest utilities in the country. But the policy is not altogether the best one to follow, as can be shown by the following.

Two-Part Coal Hopper Has Merits.

At best, in most generating stations only a few of the total boilers installed are required to be supplied with the higher grade of coal. Instead of dumping this coal upon the boiler-room floor in front of these boilers it would be very much preferable to have subdivided coal hoppers—hoppers with compartments in them, for a certain number of the boilers installed. One of these compartments of each hopper could be smaller than the other, if the use of the more expensive coal is not large compared to the use of the inferior grade of coal.

This arrangement has the very real advantage that the good coal is available for any emergency immediately on notice irrespective of men available or maintaining a reserve of firemen, the boiler-room floor is not littered up and difficulties as to moving the coal and dispatching the coals do not occur. With the divided coal hopper both grades of coal can be handled efficiently; both grades of coal are on hand ready for immediate use without calling for any additional outlay of labor.

Two Types of Stokers Instead of Two Grades of Coal.

However, there is another way of obtaining higher steaming rates than by adopting two grades of coal. Using two different coals complicates plant layout, bookkeeping, labor and the keeping of station data. Moreover, coal deliveries become more complex and station performance is entirely dependent upon two different coal deliveries instead of one, a condition that in this case does not improve reliability but tends to reduce it.

A better way of changing the steam-making capacity of boilers than to resort to two different grades of coal is to employ two different types of stokers. Doing this means that the rates of combustion are changed instead of changing the calorific value of the fuels. Use of two different types of stokers seems to be the scientific method of enabling existing stations to take care of peak loads and emergencies when inferior grades of coal only can be obtained.

For illustration, take a typical example. Many plants are equipped with chain-grate stokers, a type of stoker that employs natural draft, although be it said there are several forms of this stoker now on the market that utilize mechanical draft. A chain-grate stoker is well adapted to burning certain coals. But it also is not able to increase its rate of combustion above a certain limit, about 250%, without getting into trouble and resulting in loss of economy. On the other hand, the underfeed type of stoker is able to go from normal to 300 and even to 400% of rating on short notice and for periods of time that are usually sufficient for the ordinary emergency. A station containing chain grates and underfeeds is flexibly adapted to handle change in coal and change in load.

The use of two types of stokers has many advantages. At the same time such an innovation necessitates considerable expense and takes time. There is still another practice that may be adopted in some cases and one that while being less expensive initially and less radical than the use of two different types of stokers, is also flexible in results. Reference is made to the use of mechanical draft under some of the existing stokers.

A stack is the least flexible way imaginable of controlling draft. One is placed unmercifully at the mercy of climatic conditions. If sufficient draft is furnished to take care of high ratings, by the design of the stack, air infiltration and waste of coal are to be expected at normal loads. On the other hand, a stack designed "close" will be found to introduce serious limitations when higher rates are urgently needed. Mechanical draft makes one independent of the weather and largely immune from troubles incident to varying grades of fuel. It answers immediately to the demands for higher rates of steaming. The most efficient and economical arrangement is that where natural draft can be utilized during normal and light loads and mechanical draft during the heavier loads and forced ratings.

Contracting-Construction

Wiring Ampere-Hour Meter for Tractors — Banks Need Burglar Alarms — Trade Acceptances in Building Work

CONNECTING CHARGE-CONTROLLING AMPERE-HOUR METER FOR TRUCK.

Use of Special Trip Conductor in Charging Plug and Cable to Terminate Battery Charge Automatically.

Success in the use of electric industrial trucks and tractors depends chiefly on the care that is given to the storage batteries that furnish the current for operation. Of special importance is it to charge the battery completely after it is wholly discharged and yet not prolong the charge excessively after it is time to cut it off; because this means not only waste of energy, but may damage the plates on account of the violent gasing from heavy current at the end of charge. If the truck or tractor has not been heavily used when it comes time to charge it again it will not require as much charge as one that was in continuous use during the day. Consequently there are apt to be various states of discharge among the trucks put on charge at the end of the working day and these trucks should each receive a charge proportioned to the service it rendered since it was last charged.

Doubtless the best way to insure this is to provide on each truck, tractor or industrial battery locomotive an ampere-hour meter with zero contact point. Such a meter has the added advantage that it permits the driver to see at a glance just how many ampere-hours of useful charge he has left in his battery at any time while in service so that he is not likely to run it to exhaustion and be stalled at an unfavorable point. Ampere-hour meters for this service are built so that they record how many ampere-hours have been discharged while the truck or vehicle is in operation. When the outfit is put back on charge the indicating hand proceeds to move back to zero, but at a slower rate than during discharge; this is to compensate for the inefficiency of the battery—that is, because it needs to have more energy put back into it than was taken out during charge. Usually about 15% more charge is needed, in the case of lead-type storage batteries, than was obtained on discharge, although this percentage is usually adjustable within certain limits to permit of an occasional extra long overcharge.

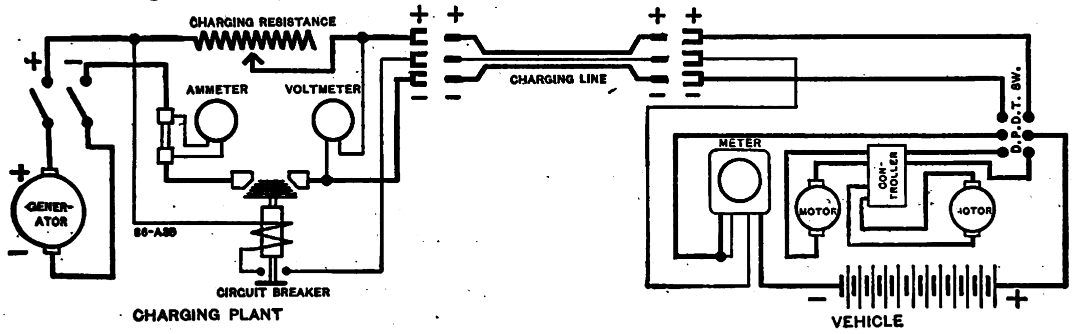
The connection by which this automatic cutoff is obtained is shown in the accompanying diagram. The heavy circuit connected to the meter is the series charge or discharge circuit. Two lighter wires also are connected to the meter. These form part of the potential or shunt trip circuit of the circuit-breaker on the panel of the charging plant. One side of this shunt circuit is connected just below the meter to the opposite side of the main circuit from that to which the other end of the breaker's trip coil is connected. The other light wire in the meter leads to a contact that is tripped when the indicating hand returns to the zero point. When the needle so returns it opens the trip circuit and the breaker then opens the charging circuit. The breaker also serves as a no-voltage cutoff.

In connecting this meter it is necessary to use a three-pole charging plug and charging cable; one wire in the latter and one terminal in the plugs and receptacles may be somewhat lighter, since it serves merely to carry a very small current. The diagram also shows the general method of connecting up the entire charging and vehicle circuits. The diagram was prepared by the Sangamo Electric Co., Springfield, Ill., which has just put out a new type of ampere-hour meter of rugged construction for truck and tractor service, a detailed description of which was published in our issue of last week.

BANK ROBBERIES SHOW OPPORTUNITIES FOR INSTALLING BURGLAR ALARMS.

Electrical Contractors Can Come to Relief of Smaller Bankers Who Are Being Victimized by Automobile Bandits—Requirements of Reliable Alarm Systems.

Numerous bold robberies of banks in the smaller towns and in the outlying parts and suburbs of large cities have again called attention to the need for installation of reliable electric burglar-alarm systems. Only a few years ago, at a time when there was a similar epidemic of handit raids, the Illinois Bankers' Association recommended to its members that they install a good alarm system in each of their banks, since it had been shown that this served in several



Wiring Diagram of Typical Installation of Automatic Charge-Controlling Ampere-Hour Meter on Battery Trunk, Showing Circuit-Breaker on Charging Panel Controlled by Meter Contact at Full Charge Point.

cases to scare the robbers before they could seize any booty and caused them to turn and flee in order to escape capture; in other cases it led to capture or shooting of at least part of the gang while they were attempting to escape. Only a week ago a case occurred in Chicago in an outlying bank in which a gang of automobile bandits attempted to hold up the bank, which was well equipped with burglar alarms. The alarm was set off by one of the tellers pushing one of the numerous push buttons without attracting any attention and ringing of the gongs aroused the neighboring merchants as well as scared the would-be bank raiders so that the latter hastily concluded to flee if they were to escape almost sure capture or death.

Some years ago the opportunity for reliable contractors installing dependable alarm systems was pointed out in these columns. It is not necessary to dwell on the value of such systems to banks not otherwise well guarded. Any contractor with a good reputation in the community can readily convince his own banker, if not other bankers of the town, of the importance of having a good alarm system as a safeguard against loss and of not trusting to luck in warding off a bold attack.

A dependable system means, first, a closed-circuit system, because any open-circuit alarm can be too readily put out of order by cutting of the wire at any point on the circuit. As an additional precaution the wiring of the battery and bell sections of the system should be in conduit to prevent tampering. All push buttons, of course, must be of the closed-contact type and be well distributed throughout the establishment so that no matter where the tellers or clerks may be when the raid is attempted or how few attendants there are in the bank at the time it will be possible to operate a button easily and without attracting attention. Obviously, the buttons must be located so that they will not accidentally be pushed, as that would cause needless and annoying alarm.

All alarm bells and gongs should be of big size and continuously ringing type so as to sound a vigorous and prolonged alarm. Preferably, one of them should also be installed in front of the bank, this being a weatherproof gong, of course; this outside gong will serve to arouse the neighbors. If it is not easily possible to connect the system to the police headquarters, it should at least be possible to arrange one, two or more telephones so that the receivers will be pulled off their hooks readily; then the telephone operator will hear the commotion and notify the police, constable or sheriff of the town.

Banks are not the only places that need such protection. Paymasters' offices in factories and other plants, jewelers, stores and other establishments where money or valuables are likely to be kept need similar alarm systems.

TRADE ACCEPTANCES COVERING BUILDING OPERATIONS.

Federal Reserve Board Not in Favor of Extending Acceptances to Cover Labor Alone in Building Contracts.

The Federal Reserve Board has received various inquiries with reference to the right of the various parties concerned in building contracts to draw trade acceptances against each other for the purpose of financing the different steps in the process of building.

The Board finds it difficult, if not impossible, to answer any general hypothetical questions with reference to this subject because of the fact that the elements necessary to determine the eligibility of various trade acceptances depend largely not only upon the general nature of the business which they finance, but upon the technical terms of the contract covering the particular transaction out of which they grow. There does not seem to be any doubt that a trade acceptance drawn by a manufacturer or material man upon a builder is eligible for rediscount as a trade acceptance, for that comes clearly within the terms of the Board's definition of such an instrument. It is equally clear, however, that if the nature of the contract under which the building operations are being conducted is such that the contractor, for instance, does not get title either to the materials furnished or to the building as it is being erected, he cannot properly make a trade acceptance of a draft drawn upon him by the subcontractor or builder, because of the fact that he has not been the purchaser of goods sold within the meaning of the Board's regulations.

It is apparent that building contracts vary so greatly in different localities and are always so intricate in their nature that it is impossible to promulgate any general ruling as to the possibility of the use of the trade acceptance to finance structural work and other building operations in general. Each case would have to be determined upon the facts as ascertained in the light of the contract under which the operations are being conducted.

If the drawer of the draft has sold "goods" to the drawee, the drawee may properly accept, and the draft thus accepted would constitute a trade acceptance, if otherwise in conformity with the Board's regulations; but it should be noted that labor in itself is not considered "goods" within the meaning of these regulations. The Board has ruled, however, that a draft drawn to cover the purchase price of goods sold, plus the cost of installing those goods, may be eligible for acceptance as a trade acceptance. (See Federal Reserve *Bulletin* of April, 1918, page 310.) At this time, however, the Board is not inclined to extend the scope of its definition of the word "goods" to include labor alone.

It should be understood of course, that nothing in this ruling should be construed to imply that a note or bill of exchange, the proceeds of which have been used or are to be used for the payment of wages or for services rendered, is not eligible for rediscount. It is merely intended to indicate that in order to constitute a specified preferred class of eligible bills of exchange specially designated as trade acceptances, the transactions out of which the acceptance grows must be one involving the sale of "goods" within the meaning of the Board's regulations.

This ruling is issued with the understanding that trade acceptances should not be used so as to extend the usual and customary terms of credit.

CODE RULES FOR SIGNALING SYSTEMS TO BE REVISED.

Members of the National Fire Protection Association and others interested are notified that the regulations governing the wiring of signaling systems are under revision and if they have any ideas to offer should communicate them to Ralph Sweetland, chairman of the Committee on Signaling Systems, 141 Milk street, Boston, Mass. These regulations refer especially to Rule 85 of the National Electrical Code.

Contractor-Dealer

Timely Aids to Fan Sales — Mr. Casey Gives Valuable Merchandising Suggestions — Experience of Some Dealers

USEFUL IDEAS IN SELLING ELECTRIC FANS.

Timely Hints for the Dealer Derived from the Experience of the Hydro-Electric Power Commission of Ontario.

The electric fan is an article which can be used the year around for many services other than the services for which it was originally developed, and the public is gradually learning more and more to use the fan at all seasons. This fact has been emphasized in many issues of the ELECTRICAL REVIEW and we are glad to see it being taken up by other electrical papers. For instance, the *Bulletin* of the Hydro-Electric Power Commission of Ontario says, as an aid to uniform heat distribution in winter the electric fan is almost as valuable as it is to prevent discomfort from the heat in summer. It can be used for drying clothes, photographic plates, vegetables, etc.; for driving steam and odors from the kitchen, refrigerator, closets, etc.; for keeping the frost from show windows, and dozens of other services which make it an article of year-around utility.

From a sales angle, however, the fan is still a seasonable proposition, and can be sold to the best advantage during the one or two hot months of the year only. After the purchaser has obtained his fan, he will use it for many of the extra services for which it is suitable, but in 99 cases out of 100 the appeal which makes the sale and the only one which will do so is the hot-weather-comfort appeal, and, curiously enough, this appeal is effective only right at the time when the prospect is actually experiencing the discomfort of hot weather.

The heat of one day is forgotten the next, provided a cool breeze has sprung up to dissipate the heat, and when one hot day or week has ended in a cool wave, apparently no one ever expects to experience another. So sensitive are fan sales to weather conditions, in fact, that, other things being equal, the sales of fans from day to day will fluctuate in exact ratio to the fluctuations of temperature.

When warm weather is present, every possible means of placing the message of fan comfort before the public should be utilized to the limit. The sales helps furnished by the fan manufacturer should be employed so that every possible user of a fan will get the message in some form. Newspaper advertisements, movie slides, window displays, mailing folders, all available advertising helps should be held in readiness, so that they can be put to work on the first hot day.

These advertising helps should, of course, be supplemented by personal and telephone calls, where the prospects are best for sales. Lists of such prospects should be made up in advance of the fan weather, so they will be ready for use when the hot weather breaks and a hot spell starts in.

Lists should be made up of homes where there are small babies and invalids. These can be compiled from news items in the press and from birth records. Such prospects could be covered by telephone calls. A tactful reference to the value of a fan as an aid to convalescence or as a comfort to the little one, with an inquiry as to whether the prospect would like to have one sent for trial, will bring many trial requests at small expense, and once the fan gets into such homes on trial, the results it shows will usually make the sale.

Small offices, such as the doctor's, dentist's, lawyer's, architects and others, can also be solicited by telephone. A cheery reference to the heat and a request to permit a fan to be sent over to demonstrate how much better the work will go with its help, will usually result in a sale.

Hospitals are excellent prospects, as the fan is a real aid to quick convalescence during hot weather. When the hospital board cannot be influenced by direct salesmanship, often they can be sold through indirect methods. For example, a fan sold or loaned to one private patient in the hospital will make such a strong contrast between the room where the fan is used and others not so equipped, that doctors and nurses will be strongly impressed with the value of fans, and their remarks will help put the message across with the management and directors.

Wherever the fan can be shown in operation, it is always in itself the best possible fan salesman. A demonstration is better than the best verbal arguments of the best salesman. During hot weather the store should be equipped with fans in operation, so that no person can come into the store for any purpose without getting a demonstration of fan comfort. Price tags, counter signs and folders should be arranged about, so as to invite a direct inquiry from the caller before he leaves the store.

The passers-by on the street can be reached in a similar way by having a fan in operation just outside the window or door, so that it directs a breeze toward the sidewalk. A sign near the fan, such as, "If you enjoy this breeze, take it with you. Come inside for particulars," or something of this nature, should be used to clinch the sales message of the fan.

If sales policies will permit it, fans should be sent out on trial at every opportunity. However, in doing this it is very important that they be sent at the right time. On a cool day a fan sent out on trial is effort wasted. On a severely hot day, it nearly always means a sale, as mighty few people are willing to give the fan up when they are enjoying its use.

It is also well to emphasize the low current consumption of the fan by pointing out that it uses no more current than an ordinary incandescent lamp, and that it will not add a noticeable amount to the monthly current bill. Many people imagine, because a fan makes a great stir and commotion in the air, that it must use a lot of current. This impression should, of course, be corrected.

Better Merchandising—Its Methods and Advantages

Why Electrical Contractors Should Open Stores—Value of Service as an Advertisement—Advantages of Part-Payment Plans—Selling Hints

By THOMAS J. CASEY

Vice-President, Hurley Machine Co., Chicago.

ONE of the greatest problems confronting the electrical industry at the present time is the need for more and better retail stores conducted by wideawake ethical merchants with a reasonably good understanding of electricity and modern business practice. This lack of stores besides not offering any encouragement to the use of electrical appliances in the home, is so great that it makes it difficult rather than easy for the self-convinced customer to purchase them.

And this condition naturally suggests the question, "Why shouldn't electrical contractors conduct retail stores for the sale of electrical appliances in conjunction with their contracting business?" The writer has never heard one real satisfactory reason advanced in answer to this question nor does there appear to be any.

The profits from a properly conducted retail electrical establishment are surely as great, or greater, than those of electrical contracting and in addition are much more reliable and stable and are not subject to seasonable conditions. This is proven by the fact that many contractors who engaged in the retail business simply as a matter of convenience for their customers have since practically discontinued contracting. However, as the amount of detail supervision in connection with a store is small when compared with contracting both can usually be conducted without interference or overtaxing the owner's efforts.

One objection that is often raised is that the contractor is not a salesman. If this were true, how does he obtain his contracting business? Doesn't it require better salesmanship and the customer's confidence to a greater extent to secure a wiring contract which is more expensive than an electric appliance and which becomes a permanent part of the customer's home and cannot be exchanged or thrown out? And having thus obtained the customer's confidence by installing satisfactory wiring, is there any reason why he should not capitalize this confidence by selling the appliances to be used in connection with the wiring also? The time has passed when people had their homes wired for lighting only. On the contrary, lighting is becoming a secondary consideration to be enjoyed as a by-product to the many other conveniences and helps that electricity makes possible. The contractor is the logical man to furnish these appliances for he already has the customer's confidence and it is his duty to assist the customer in getting the greatest return on the wiring investment.

Thomas J. Casey.

Starting the Store.

In starting the store there are several features that should be carefully considered. The first and most important perhaps is the location. This, of course, is determined largely by local conditions but it should be convenient to the trade and situated so that it can be easily located. In choosing a store special attention should be given to the available show window space and its prominence as compared with those of the adjacent stores.

Next comes the selection of stock. Very often this is done in a half-hearted manner, only a few appliances being purchased at a time, these being of the smaller and cheaper grades. This seldom makes for success nowadays, for the public demands service and will trade only where they can get what they want when they want it. The dealer, therefore, should have a sufficient stock to supply the demand immediately and this should be of a good, dependable quality if he intends to continue in business.

The third feature of the store is its arrangement and attractiveness. The most important part of this is the window displays. The show window is the

ity. After apparently exerting every effort to sell merchandise, they find that the people will not buy electrical goods sufficiently to warrant their keeping in business. Upon investigating, however, it is found that in practically every instance the dealer himself is at fault and when another dealer opens a store in the town with the same or a similar line of merchandise he invariably meets with the success that the first could have achieved had he used the right methods.

When a dealer is confronted with this difficulty, therefore, he should first analyze his own methods and business rather than rebuke the community in which he lives and from which he derives his living. In far too many cases his own estimation of the community can be blamed for his difficulties, for, above all, a dealer to be successful must have faith in his community and try to be its foremost booster. Another recourse which the dealer has in such instances is to appeal to the manufacture or supply jobber who will often be able to solve the problem for him.

A Timely Newspaper Advertisement That Brought a Flood of Orders.

Advantages of Part-Payment Plans.

Another feature which should not be neglected in the conduct of a successful retailing business is the part-payment or installment plan. A great many merchants object to such methods, feeling that it lowers the standing of the store and places their business on a level with the cheap installment house. This contention is exaggerated for, although most inferior goods are on the installment plan, it does not necessarily follow that all goods sold by such methods are inferior. Nor will they reduce the standard of the establishment in the minds of its wealthier patrons because the installment idea has become part of our life nowadays and no matter what a man's financial position may be, he employs it to some extent at least, for example, in paying his rent, etc. Such methods have been employed for years by many of the most reputable concerns, notably in the sale of pianos and talking machines, where the great success that has been achieved is largely the result of the part-payment plan.

The reason for this feeling among the well-to-do class in particular is easily explained. The majority of men give their wives a fixed weekly or monthly allowance from which they are to pay all expenses of running the home, and it is a source of satisfaction to the wife to make this go as far as possible. To make a cash payment for an appliance from this allowance or to save for it before purchasing is a difficulty which the installment plan solves. In addition the part-payment plan makes possible the immediate purchase of goods from the amounts ordinarily carried when customers are seized with the impulse to buy. Such plans should be arranged on, quite easy payments, however, which means that the average monthly payment on articles selling for around $100 should not be more than $10.

The added expense of such plans should be borne by the customer in the form of a slight additional price. Dealers should not be timorous about making such charges for the customers expect to pay them and are skeptical of the value of the goods if they don't have to.

Another advantage of the part-payment plan is that it brings people into the store. Many of the large department stores spent great sums in advertising goods which they sell at little or no profit, simply to attract customers to their places of business, realizing that they will undoubtedly purchase other goods before leaving. When a dealer sells an appliance or device on the installment plan he makes it necessary for that customer to come into his store a certain number of times that he would not have done otherwise, which not only gives the dealer an opportunity to sell him other appliances but makes him more familiar with the dealer, his store, salespeople, and methods which encourages further patronage.

Sales Hints.

A common fault among electrical dealers is that while they earnestly endeavor to advertise and display their goods to the best advantage, they leave the goods to sell themselves in the store or employ poor methods of selling. This was demonstrated in a western city not long ago.

The dealer in this place was apparently exerting every effort to sell merchandise but with only fair success. His advertising was faultless, his store neat and attractive, he employed the most approved business methods, and a good force of salespeople, but still he did not improve. One of the devices he was not very successful with was the electric washing machine. These were prominently displayed in his store near the entrance, where everyone entering and leaving could not help but notice them. Upon investigation it was found that while a great many people paused to examine these machines, none of the salespeople ever paid attention to them. A salesman was therefore delegated to try to sell those customers who appeared interested but only a little better success was obtained.

Then the salesman's methods were studied. When a customer paused at the washing machine he would approach with the inquestion, "Are you interested?" Invariably the answer was "no" and the customer walked out. The question in itself suggested that answer and also gave the customer the impression that she was not to look unless she intended to purchase. The fallacy of such methods is apparent. The salesman was instructed to approach the prospects in this manner, "Madam, if you will stand here I'll show you how this machine operates." The customer would unconsciously stand as requested and become more and more interested as the demonstration proceeded. By such methods the dealer's sale of washing machines was increased from barely 15 a month to more than 75 and a similar increase was noticed throughout the store.

Another valuable method is to group appliances that naturally suggest each other by their uses. For example, if during a sale the electric toaster is especially featured, an electric percolator or hot plate or similar appliance should be prominently displayed with the toaster. Or if an iron is featured it should be displayed on top of a washing machine or near an ironer. In this way the salesman in explaining the feature merchandise has an opportunity to demonstrate the others. This often results in the purchase of both, if not at the same time at some later date.

Advantages of Carrying But One Line of Merchandise.

In the writer's opinion it is a mistake for any dealer to carry more than one line of merchandise. By doing so he not only tends to confuse his customers but he is prevented from using his most forceful methods on any of his lines.

For example: A customer enters a store carrying several competing lines of vacuum cleaners, all priced about the same, and in the customer's mind, one as good as another. The customer is confused as he cannot tell which is the best purchase, and the salesman hesitates to center his efforts on any one make for fear of conflicting or condemning some other make that the customer may have secretly decided upon before coming to the store. Furthermore, if the salesman endeavors to push one make too strongly the customer is very apt to think that the profits of that particular make are greater than any other and he therefore can only point out the faults of the various types. In any event, the customer is impressed with the fact that some vacuum cleaners have faults and shortcomings and these probably exist in all of them and decides not to buy.

If on the contrary, the customer goes to a store handling only one line, the salesman can point out the good points of that particular make rather than its poor features without fear of conflicting with any other make. He can explain that this particular type is absolutely the best on the market, in his opinion, otherwise he would not carry it. He can concentrate on that machine, show its operation and advantages and in all probability will make the sale.

However, the dealer should select a line that he can depend on to meet his claims for it, for such a sale carries with it the dealer's recommendation, if not his guarantee, and he is held responsible for its performance. If the machine satisfies, the dealer can feel certain of that customer's future patronage; if not, his store has lost caste as well as the device.

WHAT CAUSES BLACK SPOTS IN POWER WASHING MACHINES.

Very often women using power washing machines complain of black spots that appear on the clothes that have been washed. These spots are very difficult to remove and usually are found only on the clothes that are washed last, although they may also be found all through the wash.

Many dealers, when customers complain of these spots, blame the soap that is used, but this is usually wrong. The trouble is that the washer is filled too full of water which works into the bearings and loosens the lubricating oil there, causing it to run into the tub, and this causes the spots. The reason the spots are noticed more often near the end of the wash is that the water in the tub, having cooled during the wash, is heated when hot water is poured in without any of the cold water being drawn off.

MAKING CUSTOMERS APPRECIATE VALUE OF DEALER'S SERVICE.

Novel Plan Adopted by Contractor-Dealer to Compare His Service with That of Mail-Order Firm.

It is often a difficult matter to make customers appreciate the value of the service rendered by the local contractor-dealer as compared with the large mail-order house. However, one dealer in a small western city seems to have found a very effective means of keeping trade from going to the mail-order firms, according to a recent account in *Contact,* the Westinghouse Electric & Manufacturing Co.'s publication for its dealers.

This contractor-dealer purchased one of the irons sold by the mail-order firm which he displayed, in the original package, on the counter beside his regular stock of irons. When a prospective purchaser would mention the mail-order iron and its price, he would offer to sell her this iron at the same price as the mail-order house charged, but would insist that the customer purchase it in the package, without opening it. the same as he would purchase it by mail. In this way the value of the service rendered by the dealer was plainly shown, and although he has had the mail order iron for some time and has brought forth this argument very often, it still remains unpurchased and has proved a very profitable investment for the dealer.

HOT-WEATHER APPLIANCE SALE BY MAIL.

A hot-weather drive on toasters and household irons is being conducted by the Public Service Co. of Northern Illinois in all of the communities it serves. A choice of two irons and two toasters is given the prospect and the appliances are being sent out on the basis of a 10 days' free trial. If retained the price is paid in monthly installments.

An attractive mailing card printed in two colors and giving illustrations and full details of the appliances has been sent to every customer. A self-addressed return post card is provided for the customer, the idea being to conduct the campaign entirely by mail.

LAMP SALE EXPERIENCES IN NEW YORK CITY.

It has been found in New York City that under proper conditions more incandescent lamps can be sold by the central stations, jobbers, dealers and manufacturers than the central stations were able to dispose of under their renewal or combined sale and renewal policies.

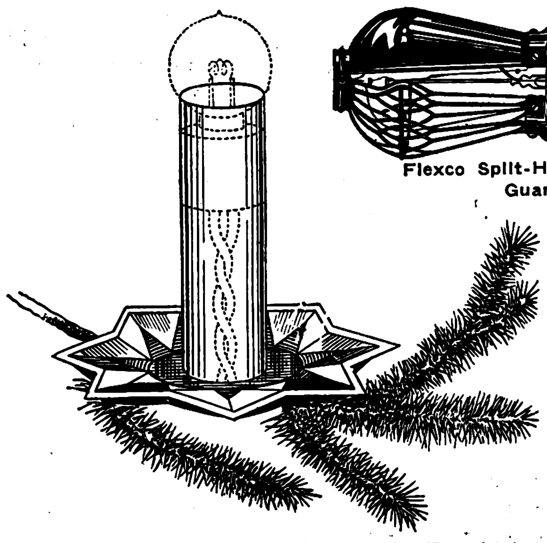
New Appliances

Candle-Sticks for Tree Lamps—Tungar Outfit for Private Garages — Portable Lamp with Reflector — Quad Heater

Van Christmas Tree Candle-stick.

It is still quite a long time to next Christmas but wise dealers prepare during the summer for the sale of winter goods. The large demands for Christmas tree lighting sets last year are likely to be very greatly exceeded this year since we are now quite definitely out of the war and decided prosperity is gradually looming ahead. It is therefore the part of prudence to think of the demands of the next Christmas season and prepare for the same in ample time

Many purchasers of electric tree lighting outfits have expressed a desire to have the electric lights, if possible, resemble the old candle for sentimental reasons only. This has been made possible by the development of a candle-



Christmas Tree Candle-stick for Electric Tree-Lighting Sets.

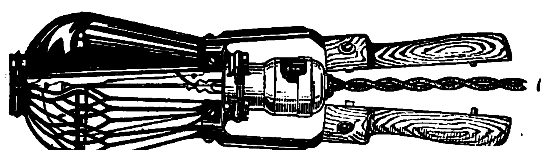
stick especially suited to the electric lights usually provided for tree lighting. It consists of a white tube mounted on an ornamental candle tray or reflector on the bottom of which is a spring clip for fastening the outfit to the limb of the tree. These trays are made in four colors, red, blue, green and gold. The candle-sticks are sold in sets of 8, there being two of each of the four colors in each set.

These candle-sticks are easily installed. The lighting outfit is first strung on the tree, then the lamps are unscrewed from their sockets (one at a time) and the sockets pushed up through the tube of the candle-stick to just come flush with the top; the lamp is now screwed back into the socket and the candle-stick complete with lamp is finally fastened to the limb of the tree by the spring clip at the bottom.

The effect is very pleasing, reproducing the old-fashioned candle lighting effect without its fire hazard and inconvenience. Many of these candle sets were used last Christmas and created very favorable comment as well as a demand for more of them. They are made by C. B. Van Antwerp & Co., 26 West Lake street, Chicago, Ill.

Portable Inspection and Trouble Lamp with Reflector and Guard.

One of the highly efficient conveniences for everyday use in factories, mills, machine shops, foundries, garages, power plants or shops of any kind, is the new Flexco split-handle reflector portable lamp guard, a product of the Flexible Steel Lacing Co., Chicago, Ill.



Flexco Split-Handle Portable Lamp with Guard and Reflector.

In every plant there are innumerable places which make the need of an efficient portable electric light imperative. In engine pits, under machines and automobiles, in warehouse pits and other places not lighted under ordinary circumstances the Flexco split-handle portable carries the light safely and conveniently. This new product eliminates fire hazard because it does away with the careless use of torches and lighted matches in out-of-the-way places where a light is often needed.

The three advantages of this ingenious contrivance—(1) taking the light where wanted because it is portable, (2) protecting the bulb from breakage, (3) reflecting the light away from the eyes of the user and toward the work to be illuminated—make it a very valuable convenience for every shop and plant where light is needed in many unusual places.

The guard is made of expanded steel, well coated with tin. The split handle is adjusted by means of screws, and it hinges with the guard as a base. It clamps over the socket of an extension or drop cord without rewiring. The cord runs through the grooves in the split handle.

This contrivance is another of the popular products of the Flexible Steel Lacing Co., manufacturer of Alligator steel belt lacing, Flexco and Flexco-Lok lamp guards and "High Duty" fasteners for conveyor and elevator belts.

New Private-Garage Type of Tungar Rectifier.

A new size Tungar battery-charging rectifier has been developed by the General Electric Co., Schenectady, N. Y., for charging storage batteries from an alternating-current circuit.

It has been designed especially to meet the requirements of the automobile owner who desires to charge his starting and lighting battery at home, or in a private garage. Special effort was made to make this device as simple, compact and efficient as possible.

This Tungar outfit will charge:

1 three-cell battery at 5 amperes, 2 three-cell batteries at 3 amperes, 3 three-cell batteries at 1½ amperes, 1 six-cell battery at 3 amperes.

It operates on a standard 115-volt, 60-cycle, alternating-current lighting circuit.

The essential parts consist of a Tungar bulb for rectifying the current, and a transformer for reducing the voltage. Both are contained in a sheet-metal case of attractive design.

This Tungar rectifier operates on exactly the same principle as the other rectifiers of this type.

The operation is very simple. Set the Tungar on the floor, on the running board of the car, or hang it on the wall. Connect the direct-current leads to the battery with the spring clips which are provided and screw the attaching plug into a convenient lamp socket. The Tungar starts charging immediately. It has been approved by Underwriters' Laboratories, and can be safely operated over night without attention.

New Radiant Air Heater of Quad Type.

American Electrical Heater Co., Detroit, Mich., has added to its line of air heaters a new design known as the "American Beauty Quad." It is an amplification of its twin radiant heater but has four units, two on each side of the standard and superposed over each other. Each unit is rated at 330 watts, making the total 1320 totals. Each pair can be controlled separately. Each unit has its own reflector that can be adjusted within a certain angle.

Since each of the reflectors is of circular outline and approximately parabolic shape, it makes a very efficient means of directing the heat to a considerable distance. Each reflector being separately adjustable, the entire combination affords a convenient means for either projecting the heat over an area or concentrating it at a desired point.

Trade Activities

Holtzer-Cabot Electric Holds Sales Convention—Francis Vaughn Manufacturing Organizes — Special Literature

Electric Furnace Construction Co., Philadelphia, Pa., has received an order for an electric furnace for the manufacture of ferro-alloys for Spain, by the Sociedad Espanola de Construccion Naval, the advisory committee of which consists of the firms of Sir W. G. Armstrong Whitworth & Co., Vickers, Ltd., and John Brown & Co. It is said that this is the first furnace of its kind to be erected in Spain for converting their own natural ores into ferro-alloys.

The Cutler-Hammer Manufacturing Co., Milwaukee, Wis., in the Independence Day issue of the C-H Messenger, the house organ of the company, devotes numerous pages to photographs and names of C-H men who served their country during the recent world war. The list includes nearly 300 names and of this number eight men made the supreme sacrifice. This number of the C-H Messenger is gotten up in an attractive manner and is carried out in the national colors.

The Electric Hoist Manufacturers' Association, New York City, has issued a very interesting and instructive booklet entitled "Facts for Operators of Electric Hoists," discussing the care and use of electric hoists. This was prepared by the engineering committee and is available to all interested by applying to W. C. Briggs, secretary of the association, 30 Church street, New York City. A new booklet on track, supports, current conductors, etc., will be issued soon by this organization.

Francis Vaughn Manufacturing Co., Milwaukee, Wis., has been incorporated with a capital stock of $50,000 to manufacture electrical and other devices, instruments and appliances. Francis Vaughn, 271 31st street, head of the new enterprise, is senior partner in the firm of Vaughn & Meyer, consulting engineers of Milwaukee and Wausau, Wis., and Minneapolis. He is also business director of the Milwaukee School of Engineering and a leader in electrical affairs in Milwaukee as well as throughout Wisconsin.

R. A. Nuttall Co., Tractor Department, Pittsburgh, Pa., is distributing a booklet devoted to the subject of "pedigreed" gears and serves to better acquaint tractor owners and prospective owners of the need of scientifically designed and constructed gears and will prove helpful in making the selection of a tractor. It contains considerable information on the subject, explaining clearly the difficult work that tractor gears must perform and points out the causes of gear troubles and inefficiency, how inefficient gears waste power, etc. The booklet covers 16 pages and is replete with illustrations.

Duparquet, Huot & Moneuse Co., 108-114 West 22nd street, New York, manufacturer of French ranges, kitchen equipment, utensils and furnishings, has ready for distribution to the trade a new 88-page catalog dealing exclusively with heavy-duty electric cooking equipment for the hotel, restaurant, cafe, factory, club, hospital, steamship, yacht, mansion, sanitarium or kindred institutions.

Moran & Hastings Manufacturing Co., 16-18 West Washington street, Chicago, is sending out a circular on "Raymo" adjustable fixtures designed especially for the office, storage room or factory. Over 1700 of these fixtures have been installed and are meeting the rapidly increasing demand for efficient lighting units. The fixture, heat deflector and fitter are finished in roman gold; the husks, arms and studs are finished in white enamel, presenting a very attractive appearance.

Automatic Electrical Devices Co., Cincinnati, Ohio, has issued Bulletin 615 dealing with the Ogden automatic metallic drum controller (Type NS) for use on storage battery industrial trucks, tractors and locomotives. This type of controller, which was described in our issue of June 28, was designed to meet Government specifications for use in munition plants and the like. It was produced in enormous quantities for use by the War Department. Now that these orders have ceased the company is in a position to furnish these controllers for general commercial use. The bulletin describes the details of construction and the numerous advantages of this type of controller, which has been built especially to withstand the severe service to which this type of equipment is subjected.

Sales Convention and Outing of the Holtzer-Cabot Electric Co. — The sales convention of the Holtzer-Cabot Electric Co. was held recently at the home office and factory in Boston. E. R. Harding, vice-president, with four of his Chicago executives, were present, besides the branch managers and other salesmen from various cities. Several important items were discussed each day, including many new and improved devices which were demonstrated by the engineering staff. These meetings have been productive of so much good that it is planned to have them four or five times a year. As the various territories present different aspects of merchandising, the free interchange of opinions is of great assistance to all the selling staff.

The convention was closed by a week-end stay at South Yarmouth on Cape Cod, about 80 miles from Boston. Personally owned automobiles carried a party of 21 both ways along the ideal Massachusetts roads. The opposing teams in all games and contests were captured respectively by E. R. Harding, vice-president, and T. W. Ness, sales manager. All the honors, however, seemed to go to the Westerners. Mr. Harding's team carried off the prize for the bowling tournament by a very close margin. Mr. Harding also took first prize in catching the largest fish. The hard-fought baseball game also went to the Chicago men, although the fans from Washington and New York made a very good showing. The courtesy of Messrs. Schirmer, Sr. and Jr., was extended to the whole party; their two beautiful country homes on the shore were given over entirely for the accommodation and entertainment of the visitors, a courtesy that was much appreciated.

Signal Systems Division of the Holtzer-Cabot Electric Co., Boston.

Current News

Weekly Record of Construction Activities—Conventions

EASTERN STATES.

Portland, Me.—Considerable electrical and mechanical equipment will be required for the proposed plant to be erected near Portland, by the American Can Co., 120 Broadway, New York, N. Y. Bids for the new plant are now being asked. The structure, with equipment, is estimated to cost about $300,000.

Lynn, Mass.—The Board of Water Commissioners has arranged for the erection of a new electric pumping plant at Hawkes Pond, near Saugus, Mass., to cost about $15,000.

New Bedford, Mass.—Considerable electrical equipment, including motors, industrial control apparatus, etc., will be installed in the new mill to be erected by the Fairhaven Mills. The structure will be two-story, located on Coggeshall street, and is estimated to cost $100,000.

Putnam, Conn.—The Nightingale-Morse Mills, Putnam, Conn., manufacturer of textiles, has awarded a building contract to the H. Wales Lines Co., 134 State street, Meriden, Conn., for the construction of a new hydroelectric power plant to cost about $80,000. The structure will be used for works operation.

Westerly, R. I.—A power plant for works operation will be installed by the Rhode Island Silk Co., in connection with the construction of a new mill, estimated to cost about $125,000. The power plant will be one-story, about 40x40 ft.

Albany, N. Y.—The state authorities are having plans prepared by State Architect Lewis F. Pilcher for power and boiler plant improvements at a number of state institutions. The work will include a new boiler plant at the Potsdam Normal School, Potsdam, to cost about $100,000; new boilers, stokers and ash handling equipment at the Central Islip State Hosptal, Central Islip, to increase the capacity of the present plant at this location, with cost estimated at $135,000; new generators at the Brooklyn State Hospital, to increase the present capacity, to cost about $15,000; new boilers and auxiliary equipment at the Oneonta Normal School, Oneonta, to cost $10 000; and a new pumping plant at Sing Sing Prison, Ossining.

Brooklyn, N. Y.—Brooklyn Rapid Transit Co., 85 Clinton street, has acquired property at the corner of Kent avenue and South Sixth street as a site for the erection of a new electric power station. The property was held at about $350,000.

Brooklyn, N. Y.—Mergenthaler Linotype Co., 24 Ryerson street, has completed plans for extensions and improvements in its boiler plant to increase the present capacity.

Brooklyn, N. Y.—Long Island Lighting Co. has been granted permission by the Public Service Commission, Second District, to issue bonds for $180,000 and stock for $80,000, the proceeds to be used for extensions and improvements in its plant and distributing system.

Buffalo, N. Y.—Robinson-Cataract Electric Co., 151 West Mohawk street, has awarded a contract to the Turner Construction Co., Prudential building, for the erection of its proposed six-story works building at 128-130 South Elmwood avenue. The structure will be 45x115 ft., and is estimated to cost $100,000.

Glens Falls, N. Y.—Arrow Grip Manufacturing Co. is planning a new two-story plant to cost $150,000 and is to be equipped for the manufacture of patented grips to secure automobile chains in place.

Middleport, N. Y.—Western New York Utilities Co., Inc., is extending its power line to Barker, a distance of 13 miles.

New York, N. Y.—A new indirect electric lighting system and other electrical improvements will be made by the South & Central American Commercial Co., Inc., in the portion of the building at 119-121 Pearl street, recently leased for a number of years at a rental of about $100,000 for a new establishment. The company will occupy four floors at the new location.

New York, N. Y.—New York Edison Co., 130 East 15th street, has filed plans for the erection of a two-story building, 25x75 ft., at Hester and Norfolk streets, to cost about $35,000.

New York, N. Y.—Public Service Commissioner John H. Delaney has made application to the Board of Estimate for an appropriation of $520.000 to provide for the expense of the Public Service Commission for the new quarter to begin July 1. This is an increase of about $43,000 over the amount granted for similar purposes for the quarter just ended.

New York, N. Y.—The Up-State Public Service Commission has passed an order authorizing the Long Island Lighting Co. to issue $180,000 5% 25-year first mortgage bonds, and $80,000 in common stock. The proceeds of the securities to be used exclusively for construction and betterments. Address E. J. Phillips, 50 Church street.

New York, N. Y.—An electric traveling crane, motors and other electrical equipment will be installed in the new works of Julius Blum & Co., manufacturere of steel tubing, shafting, etc., 532-40 West 22nd street. The company is now located at 510-12 West 24th street, and has secured a long lease on the five-story building at the new location. Alterations and improvements will be made before removal.

Ossining, N. Y.—The Catholic Foreign Mission Society of America will build a new power plant at its local institution. A mechanical laundry plant will also be installed.

Pierrepont Manor, N. Y.—Northern New York Milk Co. will install boilers, electric power motors and an ammonia ice plant in connection with the milk station, evaporating plant and milk shipping station, which it plans to build. Estimated cost, $200,000. Address F. P. Redfield, Adams.

Atlantic City, N. J.—Considerable electrical equipment will be required for the new hotel to be erected by the Ritz-Carlton Co. at Illinois avenue and the Boardwalk, on the site adjoining the Hotel Traymore. The structure will be 12-story, with about 800 sleeping rooms and baths, and is estimated to cost $3,750,000, exclusive of site, which is valued at about $1,000,000. The electrical work will include boiler and refrigerating equipment, mechanical laundry apparatus, fixtures, ornamental lights, etc. The new hotel will be erected by Cramp & Co., Denckla building, Philadelphia, Pa., building contractors.

Long Branch, N. J.—The War Department, Washington, is arranging for the purchase of the present site of Camp Alfred Vail at Little Silver, near Long Branch. The property includes about 450 acres, and the consideration is estimated at $125,000. The department has a number of buildings at this location at the present time, and proposes to use the site for an extensive radio station for research and experimental work.

Newark, N. J.—Electrical service at the proposed Essex Mountain Sanatorium, now in course of erection by the Board of Freeholders, is estimated to cost about $30,000, including the installation of apparatus, fixtures, etc.

Newark, N. J.—In connection with a two-story and basement addition to its plant for increased capacity, the Seton Leather Co., 62 Verona avenue, will build a new one-story boiler plant, about 40x40 ft. The entire improvement is estimated to cost about $40,000.

Phillipsburg, N. J.—The City Council in conjunction with members of the local Merchants' Committee, is considering plans for extensions and improvements in the street lighting system. It is proposed to install new standards along South Main street, from Jersey to Jefferson streets, in the business section, and to make similar installations in other sections.

Pompton Lakes, N. J.—The new municipal electric power plant has now been placed in operation under regular service. The borough for some time past has been purchasing electric energy from E. I. du Pont de Nemours & Co., the service being rendered from the electric power plant at its local power works.

Succasunna, N. J.—The Township Committee, Roxbury Township, has awarded contracts for lighting the streets of the district to the New Jersey Power & Light Co., Dover; and the Mills Brook Electric Light Co., Netcong. The companies will commence the immediate construction of new pole lines for the installation; about 100 lights will be furnished by the New Jersey company and 55 lights by the Mills Brook organization. A terminal for each utility company will be located at Landing. The roads to be lighted include the main highways from Kenvil to Succasunna, to Ledgewood and to the Lower Flanders Road. The contract calls for the completion of the work and the inauguration of service early in August.

Trenton, N. J.—Electric pumping equipment and other electrical apparatus will be installed in the proposed sewerage disposal plant now being planned by the City Commission. The plant will have a disposal capacity of about 25,000,000 gal. of sewerage every 24 hours. The first unit is estimated to cost about $500,000.

West Orange, N. J.—Considerable electrical and mechanical equipment, including electric motors, lighting fixtures, switch controls, etc., will be required for the new junior high school to be erected by the Board of Education. The structure will be three-story and basement, and is estimated to cost $290,000. Guilbert & Betelle, 665 Broad street, Newark, are architects.

Altoona, Pa.—An electric power plant, ice-manufacturing plant, mechanical laundry and other departments for general service will be erected by the Le Roy Hotel Co., in connection with the complete rebuilding and remodeling of its hostelry. Considerable electrical apparatus, including fixtures, ornamental lights, etc., will also be required for the structure. The new hotel is estimated to cost $600,000. Walter Frieling, Hutchinson building, Altoona, is architect.

Easton, Pa.—To increase the capacity of its local plant, the Pennsylvania Utilities Co. has perfected plans for the installation of three new boilers at its local power plant. One of the units will be 1000 hp. and the other two, each 650 hp. They will be provided with auxiliary operating equipment, including Westinghouse type underfeed stokers.

Homestead, Pa.—Homestead Gas & Electric Co. has received a contract for electrical work and equipment in the new produce building now in course of erection on Seventh avenue, by G. T. Debolt.

Meadville, Pa.—Fire recently destroyed the local car barns of the Northwestern Pennsylvania Railway Company, including electrical and mechanical equipment, with loss estimated at $64,000. It is understood that the structure will be rebuilt.

DATES AHEAD.

National Association of Electrical Contractors and Dealers. Annual convention, Milwaukee, Wis., July 15, 16 and 17. General manager, William H. Morton, 110 West 40th street, New York City.

Ohio Electric Light Association. Annual meeting, Cedar Point, Ohio, July 15-18. Headquarters, Breakers Hotel. Secretary, D. L. Gaskill, Greenville, Ohio.

Michigan Section, N. E. L. A. Annual convention, Ottawa Beach, Mich., Aug. 19-21. Headquarters, Hotel Ottawa. Secretary-treasurer, Herbert Silvester, Monroe, Mich.

Southeastern Section, N. E. L. A. Annual convention, Asheville, N. C., Sept. 17-19. Secretary-treasurer, T. W. Peters, Columbus, Ga.

International Association of Municipal Electricians. Annual convention, Chicago, Sept. 23-26. Secretary, Clarence R. George, Houston, Tex.

Association of Iron and Steel Electrical Engineers. Annual convention, St. Louis, Mo., Sept. 22-26, 1919. Secretary, John F. Kelly, Empire building, Pittsburgh, Pa.

Washington State Association of Electrical Contractors and Dealers. Annual convention, Seattle, Sept. 11. Secretary, Forrest E. Smith, 205 Boston block, Seattle.

New England Section, N. E. L. A. Annual convention, New London, Conn., Sept. 22-24. Headquarters, Hotel Griswold. Secretary, Miss O. A. Bursiel, Boston, Mass.

National Association of Electrical Inspectors. Annual meeting, Springfield, Mass., Oct. 13 and 14. Secretary, W. L. Smith, Concord, Mass.

Illuminating Engineering Society. Annual convention, Chicago, Ill., Oct. 20-23. General secretary, Clarence L. Law, 29 West 39th street, New York City.

Philadelphia, Pa. — Hess-Bright Manufacturing Co. is having plans drawn for a two-story addition, 40x100 ft.

Philadelphia, Pa.—The Bureau of Yards and Docks, Navy Department, is planning for extensive additions to the different buildings at the League Island Navy Yard. The Senate has voted to increase the appropriation for the work from $1,500,000 to $3,800 000, making available sufficient funds to carry out the proposed plans. The work will include a new central power plant with electric distributing system, estimated to cost $500,000; a new machine shop for light manufacturing to cost $400,000; new pattern shop, $400,000, and machinery and equipment, including electrically operated apparatus, with improved facilities for handling guns, armor, structural steel, turrets and other items used in connection with shipbuilding and ship fixture work. In the industrial buildings to be erected a large quantity of electrically operated machinery with individual motor drive will be installed. The Bureau has also arranged for the completion of the drydock now in course of erection at a total cost of $4,700,000. Electric cranes, hoisting, handling and conveying machinery will be used in connection with the operation of this dock.

Pittsburgh, Pa.—In connection with its welfare operations for employes, the Westinghouse Electric & Manufacturing Co., East Pittsburgh, is building a new two-story and basement lunch room, 100x240 feet, to cost about $40,000.

Pittsburgh, Pa.—Duquesne Light Co. will build a new condenser plant and switching station at Carnegie, near Woodville, Pa., to cost about $10,000.

Reading, Pa.—Metropolitan Edison Co. has arranged for the remodeling of its former power station at Lebanon into a modern substation for service in this district. The station will be tied in with the new No. 2 high tension line now in course of construction between the main power plant and Lebanon, extending from Reading. This line will provide considerably increased capacity throughout this district.

York Haven, Pa.—York Haven Water & Power Co. is preparing plans for a one-story machine shop, 45x65 ft., to cost $25,000.

Wilmington, Del. — Hall Radio Corp., Chicago, Ill., a Delaware corporation, has filed notice of change of name to the Hall Research Corp.

Wilmington, Del.—The King Street Improvement Association, recently organized for the betterment of this business thoroughfare, is planinng for the installation of new electric light standards on the street. The association is negotiating with the Board of Street and Sewer Directors for the improvement. Charles Topkis is president of the association.

Baltimore, Md.—Eastern Rolling Mill Co. has awarded a contract to the General Electric Co., New York, N. Y., for electrical equipment for its proposed works near the Bayview Asylum, Eastern avenue road. Contract for furnaces has been given to George J. Hagan & Co., Pittsburgh. The present plant is estimated to cost about $1,000,000 and will be devoted to the production of steel plates for automobile body manufacture, fenders, etc. It is said that later extensions, now contemplated, with machinery and equipment, will cost about $500,000. J. M. Jones is president.

Clearspring, Md.—Local citizens are organizing a company to construct and operate a distributing system for furnishing electric light and power throughout this section. It is proposed to render service at a cost of about 10 cents per kw-hr. Negotiations are under way with the Hagerstown & Frederick Railway Co. to furnish power at high voltage from its hydroelectric power plant on the Potomac River at Dam No. 5. A local substation will be erected to cut down the high-tension electric energy for commercial service.

Indian Head, Md.—The Bureau of Yards and Docks, Navy Department, Washington, has under advisement the remodeling and extension of the power plant and will receive bids for electrical machinery.

NORTH CENTRAL STATES.

Lebanon, Ohio.—An election will be held to vote on the question of issuing $120,000 electric light bonds. A complete new plant is necessary. Address village clerk.

Mansfield, Ohio.—Plans are being

prepared in the New York office of Henry L. Doherty & Co. for the erection of a new 10,000-kw. turbine at the company's central power station at Melco, 11 miles southeast of Mansfield, which when completed will duplicate the present plant and double the capacity. The new improvement will cost $350,000 and work will begin in 30 days.

Anderson, Ind.—Remy Electric division of the General Motors Corp. has adopted a new working schedule. A 48-hour week will be adopted and the employes will receive the same pay as they now receive for fifty hours. The men will work in two shifts, "A" employes working from 6:45 a. m. to 2:45 p. m. and "B" employes working from 3 p. m. to 11 p. m. About 3100 employes are affected by the new working hour schedule.

Indianapolis, Ind.—The merger of the Indianapolis Street Railway Co. with the Indianapolis Traction & Terminal Co. has been approved by the Indiana secretary of state and the charter has been issued. The former company has been operated by the Indianapolis Traction & Terminal Co. under a leasehold for a number of years. The capital stock of the new company will be $7,500,000. Directors include Henry Jameson, Charles S. Becker, Walter J. Ball, W. T. Durbin, R. K. Willman, H. C. Thomson, J. A. McGowan, John J. Appel and Robert I. Todd.

Kendallville, Ind.—Both Kendallville and La Grange are considering the sale of light and power to South Milford, Ind.

Chicago, Ill.—Cole Storage Battery Co. has acquired a building at 2435-39 Indiana avenue for the establishment of a new plant. The structure will be remodeled to accommodate the new works at a cost of $10,000.

East St. Louis, Ill.—Fire partially wrecked the plant of the local electric light and power company, causing a complete suspension of business and industrial activity in the city, as well as in Belleville, Alton, Edwardsville and other nearby cities. Repairs were rapidly made and service resumed. The fire was caused by oil on a switchboard becoming ignited and starting a blaze.

Peoria, Ill.—Davenport, Springfield & Southern Railway Co. is the name of the new transportation company that is being organized for the purpose of building an electric railroad, connecting the various towns between Davenport, Springfield and Metropolis. H. R. Campbell is chief engineer.

Vienna, Ill.—The council is planning to install an up-to-date power plant. Address city clerk.

Burlington, Iowa.—A special election is to be held to decide on construction and maintaining municipal light distributing system. Cost, $30,000. Address city clerk, E. P. Weinstein.

Davenport, Iowa. — White Lily Washing Machine Co. is building an addition to its plant to consist of two units. The extensions will cost about $165,000.

New Hampton, Iowa.—Northeast Iowa Power Co. received permission to construct a seven-mile electric light transmission line south from Fredericksburg. All farmers on the line voted to install the line.

Oelwein, Iowa.—Albert E. Green, Detroit, Mich., through his attorney, L. G. Hard, Dubuque, Iowa, has purchased the plant of the Oelwein Gas & Power Co. for $25,000. The property was sold by Lee McNeeley, clerk of the United States Court, who had been appointed special master by Judge Henry Reed. The Oelwein Gas & Power Co. has been involved in litigation for several months, the plant having been closed for failure to pay off its bonds. Mr. Green held the bonds and was successful in securing it. He expects to dispose of the plant.

Caruthersville, Mo.—Plans are being prepared by Black & Veatch, engineers, for the complete reconstruction and extension of the water and electric light systems.

Kansas City, Mo.—Black Steel & Wire Co. has completed plans for the erection of a new steel plant at its wire rope mill. This plant will consist of two furnaces for making steel ingots, together with electrically driven rolling mills and attendant machinery for the manufacture of steel ingots and rolling into wire road bars and shapes. The plant will have a capacity of 100 tons a day. W. E. Moore & Co., engineers.

Norborne, Mo.—Water, Light & Transit Co. has purchased the Norborne fuel, light and ice plant and is planning to furnish the Norborne lighting system with power by a transmission line from Carrollton.

Sikeston, Mo.—Election to vote $90,000 in bonds for proposed municipal light plant was defeated.

Springfield, Mo.—Springfield Gas & Electric Co. will construct an electric power plant to cost about $100,000.

St. Joseph, Mo.—J. W. Squires, Kansas City, Mo., has been commissioned to draw the plans and specifications for the improvements and extensions to the municipal light plant. He will begin at once with the preliminaries. A contract will be drawn allowing him 5% of the outlay for his services, which will amount to $25,000. Actual work will be begun this fall and the work will take between a year and 15 months.

Green Bay, Wis.—The city contemplates an ornamental lighting system on streets. Clarence A. Gross is on the committee.

Duluth, Minn.—The council adopted Commissioner P. G. Phillips' resolution for a better lighting system. The Duluth Edison Electric Co. will replace arc lights with new units, and will install eight lights to the block.

Minneapolis, Minn.—Sales Department of the Minneapolis General Electric Co. during the week ended June 20 secured 320 new electric light and power customers with 188 kw. of lighting and 265 hp. in motors, which includes contract for 150 hp. additional with the Washed Sand & Gravel Co. and 50 hp. with the Phoenix building displacing a steam plant operating the elevators. New business connected to the company's lines shows an increase of 106 customers with 94 kw. of lighting and 46 hp. in motors. A gain of 19% is shown in electric energy output over the corresponding week last year.

Tyler, Minn.—The village council is considering the purchase of additional equipment for municipal electric light plant.

Chanute, Kans.—An election will be held soon to vote $65,000 bonds for extensions and improvements in the electric lighting system. C. G. Wood, city clerk.

Hiawatha, Kans.—New pumps and other improvements are planned for the water system. Estimated cost, $25,000.

Hudson, Kans.—The city will vote on the question of issuing $15,000 in bonds for building a transmission line. E. R. Arnold, city clerk.

Kansas City, Kans.—The council is planning to expend $50,000 in improving city light plant. Howard R. Payne, city clerk.

Sharon Springs, Kans.—Engineers Black & Veatch, 507 Interstate building, Kansas City, Kans., are preparing plans for an electric light plant. Harry H. Wheeler, city clerk.

Springhill, Kans.—The electric light plant built five years ago has been closed and current will be furnished from Olathe, a distance of 10 miles from Springhill.

St. John, Kans.—The city is having plans prepared for building and extending the waterworks and electric light plant, for which $50,000 have been voted. Burns & McDonald, Interstate building, Kansas City, Mo., engineers.

Wichita, Kans.—The city permit has been granted for another unit for the Kansas Gas & Electric Co. plant to cost $275,000.

Minden, Neb.—Election to vote $35,000 bonds for lighting plant will be called in the near future.

Phillips, Neb.—Bonds have been voted for the erection of an electric transmission system by Grand Island Power Co. Address village clerk.

Pierre, S. D.—C. V. Seastone of Mead & Seastone, engineers, employed by the Hydroelectric Commission to make a preliminary survey of the Missouri river, has been here for the past ten days and has had a force of his men at work. The engineers will go over the entire river, and by a system of elimination determine the site which complies with the statutory requirements for the place where most power can be developed for the least money and where the current generated can be transmitted to every part of the state.

Watertown, S. D.—Engineer Lewis C. Larson, 18 Hendon avenue, St. Paul, is preparing plans for an electric light and power plant at an estimated cost of $175,000. Brown Mathier, city auditor.

SOUTH CENTRAL STATES.

Springfield, Ky.—Springfield Water & Electric Co. plans to change the plant to alternating current system and install panel switchboard, alternators, engines, etc. H. W. Mayfield, engineer, 298 W. Oak street, Ludlow, Ky.

Fort Smith, Ark.—Commonwealth Public Service Corp. will erect in the near future a large central power station in Johnson county near Clarksville. The plant will cost $200,000. Steam turbine engines will be used to generate the power.

Okemah, Okla.—Election to vote $23,000 bonds for waterworks improvements and $50,000 for electric light improvements, carried.

Tulsa, Okla.—According to Fred W. Insull, president of the Public Service Co. of Oklahoma, a new central power station will be erected for the purpose of generating and distributing electrical energy throughout the territory tributary to and within a radius of 50 miles of Tulsa. The station will be one of the steam turbine type and built to burn either coal or oil, the first of the units to consist of 8000 kw.

Dallas, Tex.—A chain of electric flour mills with a capacity each of 50 barrels daily is the plan of the Mutual Milling Co. recently organized here with a capital stock of $100,000. The concern has taken over a mill at Frisco, has built a new one at Grapevine and has had one in operation here for six months. It purposes to erect several more in Dallas and nearby towns. R. S. Fisher, president.

Dallas, Tex.—Dallas Power & Light Co. will build a substation here. The company has been granted permission by the city commission to construct a high-tension power transmission line in the proposed substation.

Luling, Tex.—The board of commissioners has been petitioned to call an election to vote on issuing $75,000 bonds, the proceeds to be used in constructing a municipal electric light plant and waterworks system here.

Sherman, Tex.—Plans have been submitted to the city commission for the erection of a power and light plant which will cost $650,000.

Waco, Tex.—O. A. Ryfle of Houston is promoting the organization of the Waco-Temple Interurban Railway Co. for the purpose of constructing an interurban electric railway between Waco and Temple, about 125 miles via the route that is proposed. Other men interested with Mr. Ryfle in the project are J. F. Wright, S. J. McGlasson, E. G. Van Zand and J. L. Davidson, all of Waco.

WESTERN STATES.

Grover, Colo.—A $34,000 bond issue has been voted for waterworks, etc.

Toledo, Ore.—The Fisher-Storey sawmill recently destroyed by fire is to be motor driven, power being supplied from a power plant built as a part of the mill.

Manti, Utah.—An election will be held to vote on the question of issuing $25,000 electric light and power bonds. Address city clerk.

Seattle, Wash.—Seattle has appropriated $1,000,000 for improvements and betterments in the street railway department and to enlarge the Cedar river power plant. The appropriations were for $500,000 for the railway system and $430,000 for the lighting plant.

California City, Cal.—The Bureau of Yards and Docks, Navy Department, has authorized the construction of an electric power plant at the naval coaling station to cost about $20,000. Officials at the Mare Island navy yard, Vallejo, will be in charge.

NEW PUBLICATIONS

Electrical Characteristics and Testing of Dry Cells.—The Bureau of Standards, Department of Commerce, has issued Circular No. 79 entitled "Electrical Characteristics and Testing of Dry Cells." This publication covers 44 pages and is divided into five sections. The first section is devoted to a brief discussion of the development of the dry cells and the succeeding chapters deal with the theory and construction of the dry cell; sizes and kinds of dry cells; electrical characteristics of dry cells; and testing dry cells. An appendix giving specifications for dry cells is included.

The Ultra-Violet and Visible Transmission of Eye-Protective Glasses is the title of Bulletin No. 119 issued by the Bureau of Standards and prepared by K. S. Gibson, assistant physicist, and H. J. McNicholas, assistant physicist of the Bureau of Standards. This paper presents a report upon the investigation undertaken by the Bureau on spectral transmission of glasses, and deals with the visible and ultra-violet transmissions. Under this investigation 82 samples of eye-protective glasses were studied in regard to their transmission of ultra-violet and visible radiant energy. Four different methods were used to obtain the desired data, part of the work being done in the physical laboratory of Cornell University and part at the Bureau of Standards. A brief summary is given of the good or bad qualities of the various kinds of glass in comparison with colorless glass as regards protection against ultra-violet radiant energy. A brief elementary discussion is given, explaining the meaning of terms used in spectrophotometry and illustrating how to compute the transmissions for thicknesses other than measures. Sample transmission curves are given with all values plotted, illustrating the kind of agreements and disagreements obtained on the different instruments.

PROPOSALS

Electrical Equipment.—The Board of Education, Buffalo, N. Y., is taking bids for electrical equipment, including motors, control apparatus and other industrial appliances for use in the vocational schools during the coming year. Headquarters of the Board are at 1401 New York Telephone building. William D. Fisher, secretary.

Electric Passenger Elevator.—Bids will be opened in the office of the Supervising Architect, Treasury Department, Washington, D. C., at 3 p. m., July 31, for the remodeling of an electric passenger elevator in the United States post office, court house and custom house at Providence, R. I., in accordance with the drawings and specification, copies of which may be had at the above office in the discretion of the supervising architect. James A. Wetmore, acting supervising architect.

Electrical Fixtures, Etc.—Bids will be received July 28 for furnishing all materials and doing all work necessary to complete the installation of electrical fixtures, lamps, shades, etc., in accordance with plans and specifications for building A. B. C. D. and E. bridge and tower, the industrial arts and power plant group, gymnasium and stadium group of the East Side High Public School building located at Erie and Madison roads, at Cincinnati, Ohio, in accordance with plans and specifications on file at the office of C. W. Handman, business manager, 511 West Court street, Cincinnati, Ohio.

Drills, Press, Pumps.—Bids will be received by the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., for 175 electric portable drills, 9/16 inch, 110 volts, universal motor, to be delivered at South Brooklyn, N. Y. (Schedule 4147); a miscellaneous quantity of electric portable drills, two speeds, 125 volts, direct current, delivery at the Philadelphia navy yard (Schedule 4175); one motor-driven trimming press, delivery at Puget Sound, Wash. (Schedule 4172), and 16 main boiler feed turbine-driven pumps for battleships Nos. 49, 50, 51, and 52, and spare parts, delivery at Mare Island, Calif., Norfolk, Va., and Brooklyn, N. Y. (Schedule 4161).

INCORPORATIONS

Mt. Auburn, Ill.—Wurl Electric Light Co. has been incorporated with a capital of $5000, to operate an electric light plant.

Newark, N. J.—Newark Electric Repair Co. Capital, $50,000. To operate a local electrical equipment manufacturing and repair plant. Incorporators: J. S. Jaehnig, L. W. Jaehnig, Newark, and F. H. Walsh, East Orange.

New York, N. Y.—Challenge Storage Battery Corp. Capital, $50,000. To manufacture storage batteries. Incorporators: G. D. Davis, S. and B. Apostuloff, 123 Manhattan avenue.

New York, N. Y.—Multiple Electric Products Co. Capital, $250,000. To manufacture and deal in electrical appliances. Incorporators: J. H. Wallace, Yonkers; E. Frankel, 700 West 179th street, New York, and Andrew C. Knoeller, Jersey City, N. J.

Personal

Bertram Smith Becomes President Automatic Electric Devices—Vinton L. Staley Joins Electric Products Company

J. P. DAVIS, purchasing agent of the Belden Manufacturing Co., Chicago, has been elected second vice-president of the Purchasing Agents' Association of Chicago.

L. J. DRIGGS, construction engineer of the Pennsylvania Public Service Co., at Phillipsburg, is now construction engineer of the Citizens' Light, Heat & Power Co., Johnstown.

FRED B. GROSS, after 20 months' service overseas with the 77th Division, has been honorably discharged and has rejoined the Plant Engineering & Equipment Co. as advertising manager at the new offices at 192 Broadway, New York City.

LIEUT. LINUS G. KNAPP, formerly employed with the Rochester Railway & Light Co., as statistician, has returned to civil life after twenty-two months' service in the army, and is now in charge of the auditing department of the Genesee Light & Power Co., Batavia, N. Y.

J. W. McCABE, who until recently was assistant manager of sales for the Chicago Pneumatic Tool Co., Buffalo, N. Y., has been appointed special representative for the company's foreign trade department and will depart shortly for an extended trip throughout the Orient, Philippine Islands and Australia.

LOUIS MARSHALL REAM, Thompson, Conn., who has been engaged in the inspection of wire for the Government at Washington during the war, has been discharged from the service and resumed his duties as assistant superintendent of the South works of the American Steel & Wire Co., Worcester, Mass.

FOSTER CALLAHAN, recently a first lieutenant of Field Artillery in the United States Army, has returned to civil life as representative in several southeastern states of the Safety Insulated Wire & Cable Co., New York. Mr. Callahan formerly covered this territory in another connection and is well known in the electrical industry.

E. T. COOK, formerly a well known electrical contractor, has joined the sales force of the San Francisco branch of the Trumbull Electric Manufacturing Co. Previous to joining the Trumbull company, Mr. Cook was for 16 months overseas with the 26th Engineers, and while in service rose to the rank of master engineer, senior grade.

SAMUEL F. JOOR, a well known consulting engineer of Chicago, has joined the American Steam Conveyor Corp., Chicago, in the capacity of sales engineer. Mr. Joor has had wide experience in the conveyor field, at one time being western manager and sales engineer of the Jeffrey Manufacturing Co. and previous to that time affiliated with the Link-Belt Co.

BERTRAM SMITH has tendered his resignation as assistant vice-president and general manager of the Edison Storage Battery Co., to become president and general manager of the Automatic Electrical Devices Co.. Cincinnati, Ohio. In severing his connection with the former company Mr. Smith terminates over twenty years' service in the storage battery industry, having been secretary and treasurer of the Old National Battery Co., which marketed the "Sperry plate." After its absorption by the United States Light & Heating Co., he was for a number of years manager of the western territory with headquarters at Chicago. In 1913 he resigned to become assistant manager of the Edison Storage Battery Supply Co., on the Pacific Coast, with headquarters at San Francisco, and two years later was appointed manager of the Detroit sales district of the Edison Storage Battery Co., Orange, N. J. In this position Mr. Smith established a record for the sale of Edison batteries. In September, 1918, he was promoted to the position of assistant vice-president and general manager, and continued in this capacity until his recent appointment with the Automatic Electrical Devices Co.

Bertram Smith.

GEORGE H. WARING, for the past two years general manager of the Utah Gas & Coke Co., Salt Lake City, has been elected to the office of vice-president and assistant general manager of the American Public Utilities Co., Grand Rapids, Mich., and will have general supervision of all the plants and properties owned by that concern and Kelsey, Brewer & Co. He is one of the foremost gas engineers in the United States and an all around public utility operator of wide experience with a very successful record. Mr. Waring was born at Cement, Bartow county, Ga., in 1871, and was graduated from the Alabama Polytechnic Institute in 1890 with the degree of Bachelor of Science. He entered the gas business in 1892 as cadet assistant to the superintendent of the gas company in Atlanta, Ga. In 1895 he joined the construction engineering force of the United Gas Improvement Co., and superintended the rebuilding of the gas plant at Kansas City, Mo. From 1910 to 1917 he served as vice-president and general manager of the Consolidated Railway & Lighting Co., Charleston, S. C., resigning that position to accept the appointment of manager of the Utah Gas & Coke Co. Mr. Waring was a charter member of the American Gas Institute, the Illuminating Engineering Society and other organizations.

GEORGE ELTZ, after resigning his commission in the navy, has returned to the research laboratory of the Western Electric Co. Mr. Eltz was associated with naval aviation radio.

R. E. BURGER, president and general manager of the Richland Public Service Co. of Ohio, has tendered his resignation to become chief engineer of Henry L. Doherty & Co., public utility operators, New York City.

VINTON L. STALEY, formerly connected with the General Electric Co. as district sales manager of the Edison Lamp Works at Pittsburgh, Pa., has become associated with the Electric Products Co., Cleveland, Ohio, in the capacity of sales engineer. During the war Mr. Staley held a commission as lieutenant in the Chemical Warfare Service, being stationed at Nela Park, Cleveland, Ohio. Since leaving the service he has been connected with the Powdered Coal Engineering & Equipment Co., Chicago, as sales engineer.

EVAN F. JONES has been appointed president and general manager of the Clinton-Wright Wire Co., Worcester, Mass., a merger of the Wright Wire Co., Worcester and Palmer, Mass., the Morgan Spring Co., Miller Wire Cloth Co., National Manufacturing Co., Worcester, and Clinton Wire Cloth Co., Clinton, Mass. Mr. Jones was formerly purchasing agent of the International Harvester Co. in Chicago and later was connected with the Birmingham Steel Co., Birmingham, Ala. About 11 years ago he removed to Worcester, Mass., when he accepted the appointment of general manager of the Morgan Spring

CHARLES W. COLLIER, who for the past 18 months has been overseas in the national service, has returned to this country and has resumed his advertising work in the publicity department of the St. Louis Brass Manufacturing Co., manufacturer of the Brascolite and various other well-known lighting units. Up to two months ago Mr. Collier was in France with a hospital unit attached with the British, and during that time has had various opportunities to study the French and English methods of printing and newspaper production. Mr. Collier was formerly assistant secretary-treasurer of the St. Louis Advertising Club, and later advertising manager of Kline's.

Electrical Review

Vol. 75. No. 3. CHICAGO, JULY 19, 1919 Three Dollars a Y

NC-4 ELECTROSE EQUIPPED. © Edwin Levick, N. Y.

TRADE ELECTROSE MARK
REG. U.S. PAT. OFF. & FOREIGN COUNTRIES.

Louis Steinberger's Patents

INSULATION
"MADE IN AMERICA"

Medal and Diploma received at World's Columbian Exposition, Chicago, 1893

INSULATION
"MADE IN AMERICA"

Medal and Diploma received at World's Fair, St. Louis, 1904

Hats Off To The Navy

ELECTROSE INSULATORS—

FIRST TO CROSS OCEAN IN AIR

Standard of the World for High Frequency Currents Used by UNITED STATES NAVY and ARMY, and the Wireless Telegraph and Telephone Companies.

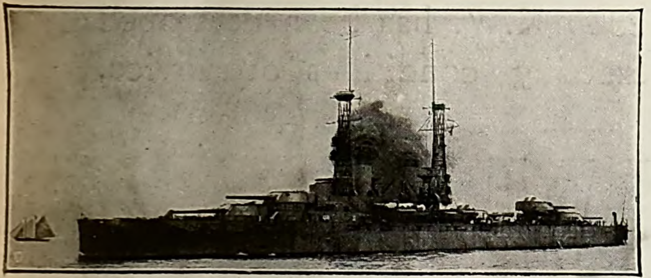
"By courier, coach and sail-boat, it took days for the news of Waterloo to reach London. During Lieut. Commander Read's flight to Halifax, Assistant Secretary Roosevelt in Washington sent a radio message to NC-4, of whose position in air he had no knowledge. In three minutes he had a reply."—*Extract from New York World, June 3, 1919.*

SOLE MANUFACTURERS

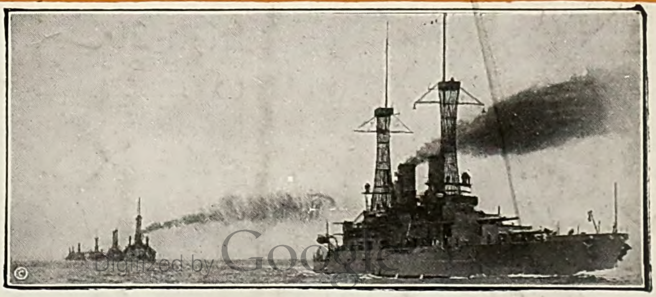
ELECTROSE MFG. CO.

60-82 WASHINGTON STREET
66-76 FRONT STREET
27 YORK STREET
1-23 FLINT STREET

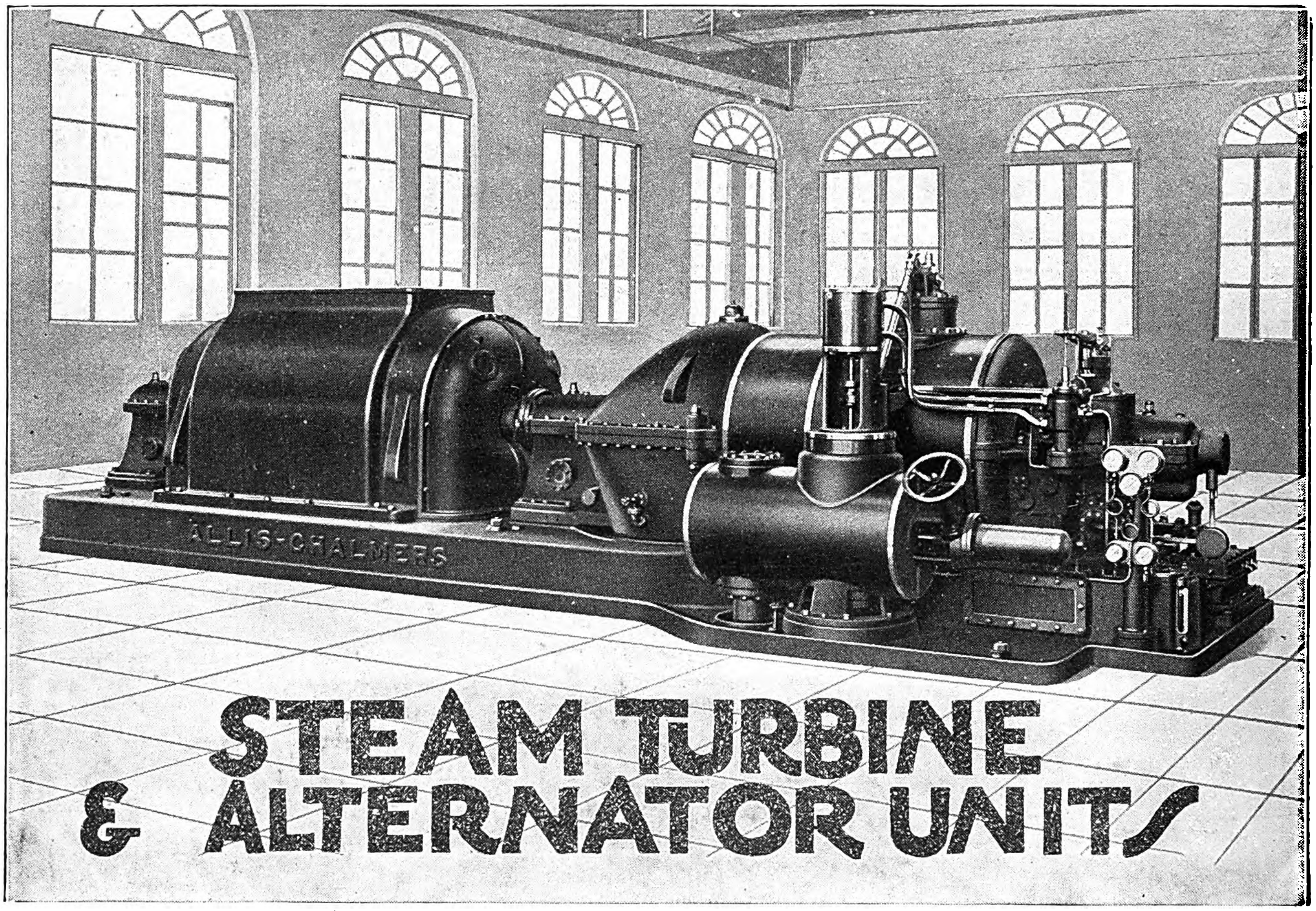
BROOKLYN, N.Y., AMERICA



U. S. S. Texas—ELECTROSE Equipped.



U. S. S. South Carolina Leading Two Divisions—



of the horizontal reaction type

Allis-Chalmers Steam Turbine and Alternator units have earned an enviable record for efficiency and reliability, and the fact that a large proportion of our output is for customers already using our equipment indicates the operator's confidence in our apparatus.

The units are of the straight reaction type, possessing many special and desirable features.

A complete line of standard units ranging in size from 200 K.W. to 12500 K.W. has been developed to meet the most exacting conditions of service.

ALLIS-CHALMERS
MILWAUKEE

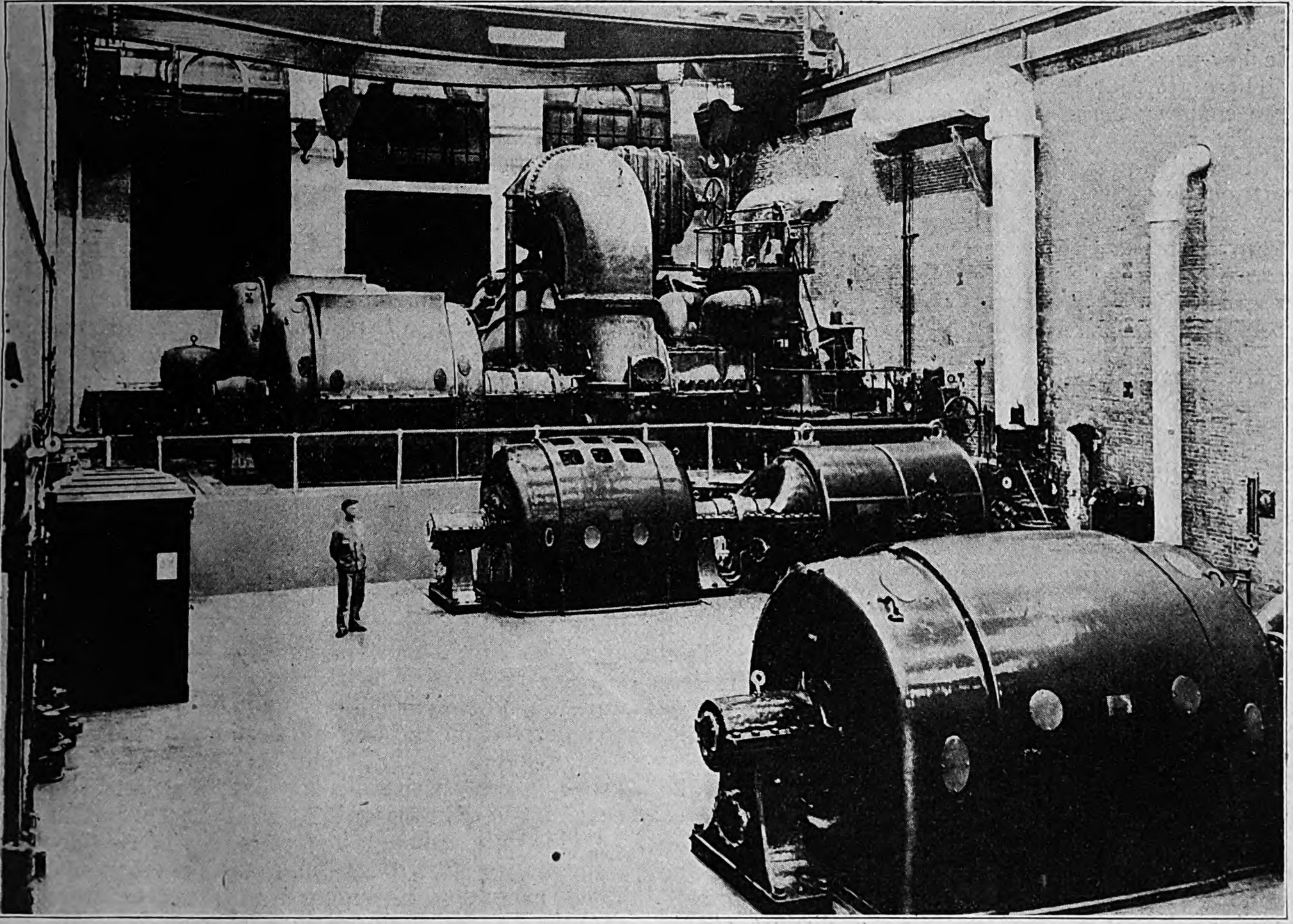
ALLIS-CHALMERS

Milwaukee. Wis. U.S.A.

Electrical Review

WITH WHICH IS CONSOLIDATED WESTERN ELECTRICIAN AND ELECTROCRAFT.

VOL. 75—No. 3. CHICAGO, SATURDAY, JULY 19, 1919. PAGE 91.



45,000-Kw. Westinghouse Turbogenerator Operating in Station of Narragansett Electric Light Company, at Providence, R. I.

The 45,000-Kw. Turbine-Generator Set at Providence

Huge Cross-Compound Unit of the Narragansett Electric Light Co.—Unique Features of the Two Turbine Elements

THE Narragansett Electric Light Co., at Providence, R. I., recently put into operation a 45,000-kw. turbogenerator unit. This machine is of the cross-compound double-unit type, consisting of a high and low-pressure turbine, each connected through a flexible coupling to its own generator, having a capacity of 22,500 kw., and mounted on separate bedplates supported on foundations lying parallel to each other. The generators are arranged to feed separately or together to the main bus.

This type of turbine is very successfully exemplified by the three 30,000-kw. units installed a few years ago in the 74th street station of the Interborough Rapid Transit Co., New York City, and which have attracted a great deal of attention.

DETAILS OF THE TURBINES.

Steam enters the high-pressure turbine through suitable governor-controlled valves, passes through this single-flow element, out through an exhaust on the top, and is conducted by means of a receiver pipe overhead to the middle of the double-flow low-pressure turbine alongside, where it divides, flowing in opposite directions through low-pressure blading, then down through the exhaust chambers into two Westinghouse LeBlanc jet condensers of the latest type.

The energy given up by the steam at full load is equally divided between the high- and low-pressure turbines, the generators dividing the load in half; at lower loads a greater proportion is carried by the high-pressure element.

The unit was designed to operate with a steam pressure at the throttle of 200 lb. with 100° F. superheat and a vacuum of 29 in. in the exhaust. The generators have a capacity of 23,750 kv-a., at 11,000 volts, 3-phase, 60 cycles and 0.95% power-factor. The high-pressure element has a speed of 1800 r. p. m., the low-pressure element of 1200 r.p.m.

There are four bearings to each unit, a flexible pin type coupling being used to connect the turbine and generator.

The high-pressure turbine is of the single-flow reaction type throughout, of simple, rugged construction; all parts coming in contact with high-pressure steam are made of cast steel, while the exhaust chamber and other parts not subjected to high temperature or stresses are of cast iron. The pressure in the high-pressure cylinder varies from a maximum of about 200 lb. at the inlet to atmospheric pressure in the receiver pipe at full load.

The high-pressure end, or steel part of the cylinder, is composed of two steel castings, 5 ft. 10 in. inside diameter and 1¾ in. thick, while at the joint thickness gradually increases until it merges into a flange 3 in. wide, tapering to the outer edge. The 2¼-in. diameter bolts are spaced about one-third of the way from the inside edge, and 6 in. between centers. These bolts, or studs, as they really are, are tapped alternately into upper and lower flanges registering with suitable bosses on the companion flange. This method permits of a closer spacing of bolts, removing less metal, and produces a stronger flange than by any other means. No gasket is used, the joint being scraped to a surface.

The four rings containing the blades are not an integral part of the main cylinder, but are made of separate castings jointed in the middle, resulting in simplicity of construction, freedom from strains, and the absence of those difficulties inherent in a complicated steel casting, besides being a distinct aid in manufacturing as the machine work is not all done on one piece, but can be divided among different machines, and finally assembled when each piece is completed. These rings are clamped in place, again saving expensive work on the main castings.

The high-pressure cylinder is supported on three points, one under the governor, or thrust end, and one on each side of the exhaust, near the center line, thus insuring against distortions, or a possibility of misalinement, due to differential expansions between the turbine and generator supports from unequal temperatures.

The high-pressure spindle consists of a hollow steel drum about 3 ft. in diameter, carrying most of the blading, there being two blade rings of larger diameter on the one end, and corresponding dummy rings, or balance pistons, on the other. The spindle ends are pressed into the drum and are secured with tee-headed shrink links, which are themselves held in place by the blade and dummy rings. The spindle parts are made from ordinary carbon steel. There are 24 rows of blades in the high-pressure turbine, ranging in size from 1-in. blades, 4 in. long, to 1¼-in. blades, 9½ in. long. These blades are unusually strong and rugged. The maximum mean blade speed is 470 ft. per second.

The steam passes out through an exhaust at the top of the cylinder into a 66-in. receiver pipe leading over to the low-pressure turbine. A similar exhaust which connects through an automatic relief valve to the atmosphere is provided directly below. A gate valve is placed in the receiver pipe, in case it is necessary to operate either turbine alone, the high-pressure turbine running non-condensing, under control of its own governor, or the low-pressure turbine, on steam admitted through a 14-in. throttle from the high-pressure line. This is connected in step electrically with some other unit in the system.

The low-pressure element is of the straight double-flow reaction type. The steam entering at the top through the above mentioned receiver pipe, passes around the spindle in an annular chamber of ample proportions, and enters the low-pressure blading, there being 8 rows in each end, ranging from ¾-in. blades 6 in. long, to 1¼-in. blades 18 in. long. The low-pressure cylinder rests on four supports applied near the center line on each side of the exhaust chambers. It is free to expand by sliding axially on these supports, the turbine being anchored to the inboard generator pedestal. A system of radial and axial stays in the exhaust chamber produces extreme rigidity, minimizing the possibility of distortion, or sympathetic vibrations.

The low-pressure spindle is composed of a central hollow drum, rigidly secured to the spindle ends. Upon each of these ends are mounted two disks carrying the low-pressure blades, the maximum mean velocity of which is only 515 ft. per second. Cast steel is used for the blade rings. Phosphor-bronze blades are used throughout, except the last three rows in the low-pressure, which are forged steel. The low-pressure cylinder is entirely of cast iron, composed of a center section and two end sections, bolted and spigoted together, and all split horizontally. The three upper pieces are handled as one, the vertical points never being disturbed.

This unit, although it does consist of two separate elements, is started the same as any other machine. Field excitation is supplied to the generators, the throttle on the high-pressure element is open, and slowly brought up to speed, the low-pressure generator operating as a motor, and coming to speed in step with the other. The two machines as a unit can then be synchronized, and placed on the line, remaining in step, and properly dividing their load.

Condenser Equipment.

The condenser equipment for the above turbine consists of the largest condensing apparatus in the world. The condenser unit is composed of two separate and distinct low-level jet condensers, which can be operated together, or separately, if necessary. If the temperature of the injection water is low enough to warrant it, a workable vacuum can be maintained by only one condenser. These condensers are connected to form a single condensing apparatus by means of an exhaust connection, ample in area to permit operating either condenser alone, when necessary.

The same water level is maintained in each condenser by the use of a water-equalizing connection between one pump body and the other. This is an absolutely necessary feature, and it is provided in order to maintain a constant submergence over the center line of each pump, to provide sufficient head to force water into the runner under vacuum. This water-equalizing connection is so constructed that no surges occur between the condensers, it being made in the form of a toe, the bottom of which forms a reservoir. A baffle running almost to the bottom prevents surging. An air-equalizing connection is provided to maintain the same air pressure in each condenser. If both are in operation, the valve may be either open or closed, but it has been found by trial that if only one condenser is in operation, the valve must be open in order to have the same air pressure in each.

The condensers are equipped with geared turbine-driven pumps, running at 500 r. p. m. instead of 700 r. p. m., which latter is standard. This was necessary owing to the limited headroom in the basement. These pumps are able to operate with a submergence of 50 in. above the center line of the pump shaft, while 72 in. is necessary with a 700 r. p. m. pump. This resulted in a saving in headroom of 22 in.

In starting up this condenser it is necessary to use a priming pump. The main turbine is operated non-condensing, or with a slight vacuum, until sufficient vacuum is obtained for the condenser to lift its own water.

The Narragansett Electric Light Co. has found it convenient in winter time, when the temperature of the injection water is very low, to operate only one condenser of the twin outfit, and still maintain the vacuum desired, thereby cutting the cost of operation in half. In cutting the condensers out, it is only necessary to close the discharge and injection valves to the condenser not in operation and to operate the other independently.

The twin condensers used with the above 45,000-kw. turbine require 18,000,000 lb. of condensing water per hour. 9,000,000 lb. in each condenser. In addition to this 15 per cent more is required for the operation of air pumps.

BEACON LIGHTING EFFECT FOR TRAVELERS INSURANCE TOWER.

A Total of 56 Projectors to Produce Very Striking Beacon at 34th Floor Level.

One of the questions that has been a frequent subject of conjecture among watchers of the new building of the Travelers Insurance Co., Hartford, Conn., was answered a few days ago when it was learned there would be a beacon near the top of the tower which would rival in brilliance and radiative power the beacons in other of the world's famous tall buildings.

Plans relative to the lighting features of the Travelers tower have been made and unmade many times since the erection of the building was begun, but the plan of the beacon has been definitely settled upon. Anyone who can catch a glimpse of the work going on just above the limit of the stonework may see what is going to be put there.

Next above the limit of the stonework, at the thirty-fourth floor level, and below the gilded ironwork which surmounts the tower, there is being built a row of windows running in close continuity around the four sides of the superstructure. Each window is about 4 ft. high and 1 ft., 4 in. wide.

Suspended inside these windows will hang 36 400-watt projectors, 8 to each side and one in each corner, and 8 200-watt projectors, two in each corner on either side the large corner projector. These projectors will throw the light in every direction outward through the windows, so as to give the appearance of a continuous band of brilliant light circling the top of the tower and shining out from it.

Another feature of the tower lighting will be the illumination of the interior of the observation balcony by 12 hidden projectors. Current for all the projectors will be carried into the tower from the city lighting system. It is supposed that the beacon and balcony will be lighted every night, once they are ready for operation. From present appearances, it would seem that the work on the superstructure would not be completed for several weeks yet, possibly not until late summer or early autumn.

DEDICATION OF THE BUREAU OF MINES LABORATORIES.

New Laboratories, Shops and Experiment Station at Pittsburgh to Be Formally Dedicated.

The Bureau of Mines announces that during the week of Sept. 29 the new million dollar laboratories and workshops in Pittsburgh, Pa., will be formally dedicated. High officials of the Government, together with the governors of the principal mining states and the leaders in the mining industries and miners' organizations, will be present to take part in the dedicatory ceremonies. A feature of the dedication will be a great national Safety-First meet, teams of miners from all over the country competing for cups and medals. There will be contests in rescue and in first aid to the injured, and as there is immense rivalry between the teams of the different mining companies, it is expected that these contests will take at least two days for decision. On Sept. 30 the elimination contests will begin at Forbes Field in Pittsburgh, and will continue until only the winning teams are left for the final championship contests, which will take place on Oct. 1 immediately after the elimination trials are completed.

The different laboratories of the Bureau have been completely equipped for the investigation of the various problems relating not only to greater safety, but also to greater efficiency in the mining and metallurgical industries. Visitors will be invited to the electrical and mechanical workshops, and laboratories of the Bureau and also to the petroleum, gas and coal laboratories, the testing gallery of the mine safety section, and the industrial gas-mask division. Another point of interest will be the experimental mine of the Bureau at Bruceton, Pa., twelve miles from Pittsburgh, where an actual explosion of coal dust in the mine will be staged for the benefit of those attending. At the experimental station there is also to be shown a complete exhibit representing the mining and metallurgical industries of the country.

MORE SIGNS FOR SALINA.

Santa Fe avenue will assume the earmarks of Broadway on a small scale at the end of the calendar year, the Salina Light, Power & Gas Co., of Salina, Kansas, has announced, making public its plans for increasing the number of electric signs in the city.

Lamps totaling 29,500 burn in electric signs until midnight daily. The show windows over the city burn nightly 750,000 watts of electricity. The four-sided "Tea Table Flour" sign of the Weber Milling Corp., largest in the state, measuring 48 ft. by 38 ft. on each side, will be lighted shortly. The sign being erected for the Southwest Motor Car. Co. will be lighted in the near future.

Central-Station Rates in Theory and Practice

Second Article of Series—Cost Analysis of Electric Service—Energy Cost and Demand Cost—Some Features Determining Demand Cost—Load Curve and Load-Factor

By H. E. EISENMENGER

This is the second article of a series to appear weekly throughout this volume. A general outline of the series was published in the issue of July 5 and the first article appeared in the issue of July 12. It gave a discussion of costs in general and introduced the subject of cost of electric service in particular. The present article begins the discussion of the three principal elements of this cost, which will be continued through several other installments before the subject of the price of the service (rates) can be intelligently taken up.

PART I.—THE COST OF ELECTRIC SERVICE—(Continued).

II-A. The Three Elements of Cost.

1. The Energy Cost.

SECTION 11. Every kilowatt-hour generated or delivered requires a certain amount of steam—at least in case of steam prime movers—and with that of fuel and water. In other words, the total costs of fuel and water increase with the number of kilowatt-hours generated and can be roughly set proportional to the latter so that we have a fixed unit cost of fuel and of water per kilowatt-hour. The items of fuel and water do not appear in hydroelectric plants; but in all central stations, whatever their prime motive power be, we have the cost of lubricating oil which increases with the size of the generator running, with the number of generators running and with the number of hours they are running. In other words, for a given central station the cost of the lubricating oil increases with the number of kilowatt-hours generated and can be roughly set proportional to the latter so that here too we have a fixed cost per kilowatt-hour. The same applies to the cost of attendance to the generators and the switchboards, to repairs and a number of other items.

This part of the cost, the energy cost, is also called sometimes, though not entirely correctly, the operating cost. We will see that a part of the real operating cost may belong to the "demand cost" (to be discussed in Section 24) and, conversely, the kilowatt-hour cost includes costs which are not operating cost. But, on the whole, roughly speaking, the kilowatt-hour cost and the operating cost are more or less identical.

12. As indicated previously in the example of the letter carrying service, we can establish a distinction in the amount of the energy cost per kilowatt-hour between various classes of customers. The most important one of the possible subdivisions into classes would probably be according to the distance of the customer's location from the generating station, inasmuch as generally a larger portion of the energy is lost in transmission if the energy has to be transmitted over a greater distance. We would be justified in saying that those customers who are located further away from the generating station cause a greater energy cost per kilowatt-hour than those who are located nearer the station and we might find the numerical values by methods similar to those to be shown later. But this distinction according to the location is rarely, if ever, made in practice.

Other variations in the amount of the energy cost per kilowatt-hour will be mentioned later (especially in Section 53) after the necessary fundamentals (load-factor, diversity-factor, etc.) have been discussed.

13. Let it be stated here—although that statement ought to be unnecessary for the careful reader—that the "energy cost" or "kilowatt-hour cost" is something entirely different from the "cost per kilowatt-hour." The cost per kilowatt-hour is the total annual cost of the central station divided by the number of kilowatt-hours generated (or delivered, or sold, as the case may be) anually, and is given in *dollars per kw-hr.* or *cents per kw-hr.* The kilowatt-hour cost (or energy cost), on the other hand, is a certain portion of the central station's total annual cost, corresponding roughly to the annual operating cost. It is given in *dollars per year.* Usually we reduce the kilowatt-hour cost to the kw-hr. generated or sold annually and thus arrive at the *kw-hr. cost per kw-hr.* or *energy cost per kw-hr.*, which is given in dollars per kw-hr. or cents per kw-hr. The kw-hr. cost per kw-hr. is a fraction of the total cost per kw-hr. By multiplying the kw-hr. cost per kw-hr. by the number of kw-hr. consumed annually by a certain consumer, we get the annual kw-hr. cost of that customer as a part of his total annual cost.

It is important to keep these distinctions between the kw-hr. cost and cost per kw-hr. in mind to avoid confusion.

2. The Demand Cost.

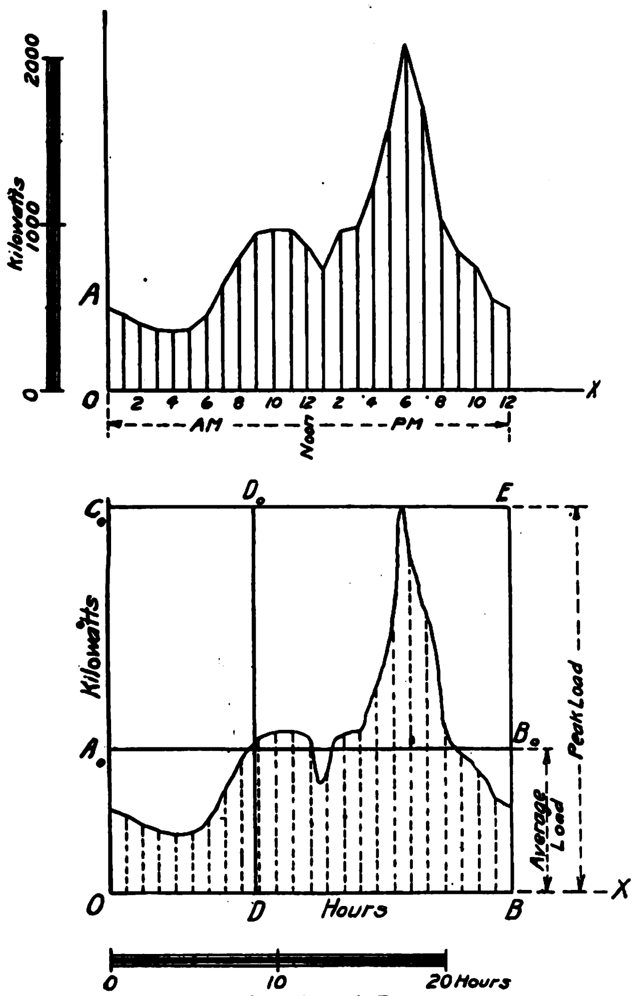
14. The second item to be discussed is the *demand cost*, that is, the part of the total cost which is practically proportional to the maximum demand in kilowatts or watts.

A. THE TOTAL DEMAND COST OF THE PLANT.

1. Capital Invested.

15. Suppose, for the sake of a simple example, that a central station has to deliver 24,000 kw-hr. a day with constant load on the generators all day; that means 1000 kw-hr. in any one-hour period of the day. To supply this, our generators, apparatus, lines, etc., have to have a capacity of 1000 kw. The load-factor[1] is 100%. If, however, these 24,000 kw-hr. would have to be delivered in six hours, for instance in the time between 4:00 p. m. and 10:00 p. m., again with constant load during these hours, the load of the central station will reach 4000 kw., because 4000 kw. × 6 hr. = 24,000 kw-hr. The capacity of the central station will, therefore, have to be four times as great as in the first case, or 4000 kw. instead of 1000[2]. Now a central station of 4000 kw. will cost, though not four times as much, still a good deal more than a 1000-kw. station. The same applies to the transmission and distribution lines, transformers, etc.

16. As a rough approximation we can say that the capital invested is proportional to the capacity of the central station in kilowatts. It should not be forgotten that this is an approximation. It is a well



Figs. A and B.

known fact that as the central station grows, the cost of the equipment per kilowatt goes down. Larger plants can use larger generating units than smaller plants and such units are not only cheaper to manufacture per kilowatt, but they occupy also less floor space per kilowatt, thereby reducing the cost of the building construction, etc., per kilowatt. The same applies to switching apparatus, etc. Moreover, even generating units of the same capacity have been becoming cheaper as the engineering sciences advance.

But as long as we remain within certain upper and lower limits of size near the present plant capacity, also when we do not apply our approximation over a period of too many years, we can assume the capital invested in the generating plant to be proportional to the capacity. If the central-station capacity has grown very much, especially if the manufacturing conditions have changed in the meanwhile, the factor of proportionality will have to be changed; there will be less capital invested per kilowatt in the generating station.

17. Similar considerations as have been explained for the cost of the power plant will also apply to the transmission lines, transformers, etc., so that we may say with a certain degree of approximation that the cost of these parts also is proportional to the peak load of the central station[3].

We thus arrive by a series of approximating assumptions at the result that the total capital invested in the generating plant, lines and transformers is proportional to the peak load of the central station[4].

Insert II—Appendix to Section 15.

Explanation of the Terms "Load Curve" and "Load-Factor."

A.—Load Curve.

Step off on a horizontal line *OX* in Fig. A, 24 equal sections, each one representing one hour of the day. From the end of every one of these sections draw a vertical line upwards and step off on these, beginning at their respective intersection with *OX*, the load in kilowatts of a certain central station at that particular hour, using some arbitrary scale, for instance 1 in. = 1000 kw. If, for example, at 12 o'clock midnight the load is 500 kw., step off ½ in. vertically from the point *O*, thus reaching point *A*. Do the same thing for every full hour of the day (1 o'clock, 2 o'clock, etc.). Joining the point at the upper end of each vertical with both its neighbors to the right and left by a straight line we get a continuous series of straight lines. We are not restricted to entering the loads at the full hours only. We can enter them in the same way for any intermediate time; as quarter hours, minutes, etc., and the series of lines will then more and more approach in any desired degree a steadily curved line (Fig. B).

This curve is called the *load curve* of the central station for the respective day. The load curve can, of course, also be extended over any other interval of time, but usually a 24-hour interval is chosen for reasons of convenient representation. This curve shows clearly at a glance how the load varies within the day. Where it is high above the horizontal axis *OX* the load is large and vice versa. The high parts of the curve are called the peaks and the low parts the valleys. The highest peak represents the peak load, hence the name of the latter.

In exactly the same manner we can draw a load curve for any individual customer or any group of customers.

The general shape of the diagram, Fig. B, is typical for what we can expect in an average central station on an ordinary winter day. Beginning at midnight we see the load is comparatively low, naturally so, because most of the customers have shut off their current entirely. The load is mostly street lighting and street-car service, provided that the latter is not furnished from the street-railway company's

[1] Readers who are not thoroughly familiar with the meaning of the terms "load-factor" and "load curve" should first read Insert II, which gives an explanation of these terms so essential for the understanding of the following sections.

[2] This is not strictly correct, since there must be a certain reserve capacity for breakdowns of a generator set, and the reserve capacity will obviously in general be a greater percentage of the total capacity where we have a small number of generating units than where we have a large one, that is, it will be in general a greater percentage for smaller capacities. But, as a whole, the approximating assumption that the capacity of a central station is proportional to the maximum load of the central station is justifiable.

[3] This implies an additional simplifying assumption, because it is evident that the cost of the lines and transformers depends also on local conditions, that is, on the location of the customers, etc., but, on the whole, in a given locality we can say, that the variable portion of the cost of the lines and transformers will increase roughly in the same percentage as the maximum load on the central station.

[4] These assumptions are, briefly recapitulated, the following:
1. The capacity of the power house is proportional to the peak load.
2. The capital invested in the power house is proportional to the capacity of the power house.
3. The capital invested in the lines, transformers, etc., is proportional to the peak load.

These and the other approximations, to be discussed in the following, will be put together in diagrammatical form at the beginning of Insert IV—"Approximations."

separate power house. A few late birds who are still up at midnight go to bed by and by and the load reaches a minimum until the first early risers turn on their lights. The demand for this kind of lighting rises until daylight comes and then it may decrease. At that time, however, the factories begin to work, drawing a rather heavy power demand. Such stores and offices as need artificial illumination in daytime turn on their lights and thus we get an increase in the load during the earlier part of the forenoon. The motors in the factories which consume a considerable portion of the power generated are then shut off temporarily during the noon hour and accordingly we see a valley in the load curve at noon. At about 4 or 5 o'clock in the winter time the electric lights are turned on everywhere and we get the highest peak of the day. Soon after that time stores and offices close, causing a rapid falling off of the curve.

Of course the daily load curves of central stations differ from each other quite considerably according to the season of the year and to the local conditions[1].

The load curve gives us more information than simply whether the load at a particular time is high or low. The area under the load curve is a direct measure of the number of kilowatt-hours delivered, in other words, it is proportional to the energy delivered (or consumed, respectively). To understand this let us begin with a simple case. A central station is assumed to be delivering 1000 kw. uniformly during 24 hours of the day. Then the number of kilowatt-hours delivered during the day will be 24,000. The load curve will be a rectangle, the height of which is 1 in. (if measured in the scale selected above for the purpose), that is, 1000 kw. The base of the rectangle is, of course, a length representing 24 hours. Since the area of the rectangle is given by the product of base and height, or in our case by $24 \times 1000 = 24{,}000$, we see that in this simple case the area under the load curve is equal to the number of kilowatt-hours. The same will be true not only for a 24-hour period, but also for any other period of time. For instance, if we have 100 kw. during ½ hour, the resulting energy is $100 \times \frac{1}{2} = 50$ kw-hr. and at the same time the area under the rectangle, which is the load curve in this case, is also $100 \times \frac{1}{2} = 50$ units.

If we have different loads in successive periods of time of equal length, for instance, the load changing every 15 minutes, Fig. C, the load curve will be a number of rectangles arranged side by side and the total number of kilowatt-hours will be the sum of the kilowatt-hours delivered (or consumed) in the various periods. The area under the load curve will be the sum of the areas of the individual rectangles. Therefore, in this case also the number of kilowatt-hours is given by the area under the load curve. Now, if in a load curve of that kind the rectangles become narrower and narrower, at the same time increasing in number so that the total horizontal length of the diagram remains constant, the same law will always hold good, no matter how short the periods of time are.

Now we can disintegrate the area under *any* load curve into a number of narrow high rectangles and their aggregate area will equal the area under the original curve the more exactly the larger the number of the rectangles and the smaller consequently their width (Fig. D). We can make the error smaller than any desired limit (however small that may be) by making the rectangles numerous enough. Therefore, we can also say quite generally that the area under any shape of load curve is proportional to the number of kilowatt-hours, that is, to the energy. The unit area is a rectangle with the base, 1 hour, and the height, 1 kw.; it corresponds to 1 kw-hr.

B.—LOAD-FACTOR.

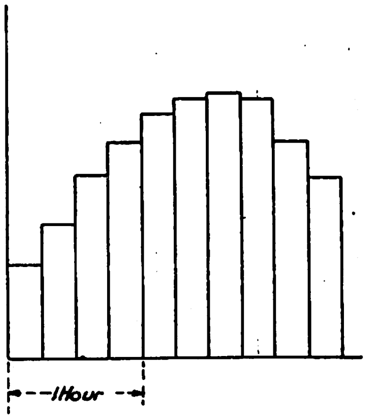
The easiest way to arrive at a conception what the term *"load-factor"* means seems to be to start from the "average load" (or, as it also may be called, the "average power") of a certain period. That is, a load of such size that, if uniformly and without change supplied by the central station (or drawn by the consumer, as the case may be) over a certain period, it results in the same number of kilowatt-hours as are supplied (or consumed) under actual conditions during that period.

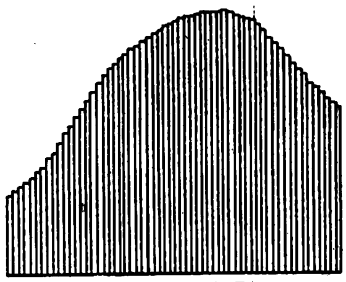
If we transform the area under a given load curve into a rectangle OA_0B_0B (Fig. B), having the same base, OB, as the load curve, the height OA_0 of that rectangle is the average load during the period over which the load curve extends. The reason why this is so is easy to see: This load, OA_0, if supplied during the period OB, results in the number of kilowatt-hours given by the area of the rectangle OA_0B_0B, which means it results in the same number of kilowatt-hours as have been actually supplied or consumed, which means it is the average load.

a.—First Definition of Load-Factor.

The ratio $\frac{\text{average load}}{\text{peak load}}$, or, in other words, $\frac{\text{average power}}{\text{maximum power}}$, is called the *load-factor* of the central station (or consumer, or group of consumers) for the given period of time. It is usually given in per cent. The load-factor belonging to the load curve Fig. B would, therefore, be the ratio, $\frac{BB_0}{BE}$ or 37%. This would be the daily load-factor of a certain day, because the load curve extends over one day. In practice, however, the load-factor is much more frequently referred to either the year or the month, so that we have a yearly or a monthly load-factor.

Since the load curve extending over a month, not to say a year, with its numerous large fluctuations, is a very complicated curve and it is impossible to find a convenient





Figs. C and D.

scale for its practical use, the following definition—which in effect is identical with the above— is preferable.

b.—Second Definition.

If we multiply the numerator and the denominator of the above ratio by the number of hours of the whole period (month or year) the value of the ratio is not changed but the ratio takes another form. The average load multiplied by the period over which it extends is, according to the definition of the average load, equal to the number of kilowatt-hours actually supplied (or consumed). The peak load multiplied by the same period is the maximum number of kilowatt-hours which could possibly be supplied (consumed) with the given maximum power in that period, that is, the number of kilowatt-hours which would be the result of the maximum amount of power applying during the whole period. Therefore, the load-factor can be also defined as a percentage expressing the ratio of the energy actually supplied (consumed) to the energy which could be supplied (consumed) in the same time if the maximum load was utilized during the whole time.

The load-factor according to this definition can be easily determined. The actual number of kw-hr. is determined by an ordinary integrating watt-hour meter, and the energy in kw-hr. which could be supplied (consumed), if the maximum load was utilized during the whole time, is

[1] Fig. L. (Insert VII) will show the load curve of a December day and of a June day of the same central station. It shows how the evening lighting peak in June not only is smaller (due to less commercial lighting) but also comes much later than in December.

simply found as the product of the maximum load in kw. by the length of the time over which the load-factor is to be taken, in hours. The maximum load can be found by an instrument known as a demand meter (to be described in Section 140 and Insert XVI).

c.—Third Definition.

Finally, we can also assume that the actually supplied (or consumed) energy has been produced by the maximum load uniformly and steadily applied. It will require a certain period of time until the energy is thus supplied and the ratio of this time to the total time over which the load-factor is taken (one month or one year) is also equal to the load-factor, as can be easily shown graphically (see below). The load-factor is then expressed in terms of "hours per year" or "hours per month," respectively. A load-factor of 10% can therefore be expressed as a load-factor of 876 hours per year (since the year has 8760 hours) or as a load-factor of 73 hours per month (since the average month has 730 hours), depending on whether the load-factor in question is a yearly or a monthly one.

The graphic representation of and proof for this third form of definition of the load-factor is given by transforming the area under the actual load curve into a rectangle of the same area with the maximum load as height. This rectangle OC_0D_0D (Fig. B), therefore, is equal to the energy actually supplied (or consumed); the large rectangle OC_0EB represents the maximum energy which could possibly be supplied (consumed) in the given period with the given maximum power OC_0. The ratio of the rectangles is the load-factor according to the second definition given above of the load-factor. The ratio of these two rectangles is also given by the ratio $\frac{OD}{OB}$, therefore $\frac{OD}{OB}$ is the load-factor.

Where the maximum load is replaced by one of its substitutes (as will be shown in Section 141 *et seq.*, of the main text—"Substitutes to Approximate the Measured Maximum Demand") the load-factor can also be based on one of these substitutes, notably the connected load instead of on the actual maximum load.

(*To be continued.*)

PROPOSED TUNNEL BETWEEN DENMARK AND SWEDEN.

Electric Railway Line to Connect the Two Countries Through the 31.5-Mile Tunnel.

It appears that the Channel Tunnel between France and England has a rival in a tunnel which it is now proposed to construct from Copenhagen, Denmark, in order to make connection with Sweden, states *The Electrician,* of London, England. The main line from Copenhagen, it is suggested, might connect across a harbor dam with the island of Amagar, the tunnel being entered on the eastern coast of the island, while another adjacent island (Saltholm) would serve as a convenient starting place for sinking shafts and tunnelling in two directions. The total length of the line, which will have four intermediate stations, will be 31½ miles, the actual length of tunnel below the surface of the sea being 11 miles.

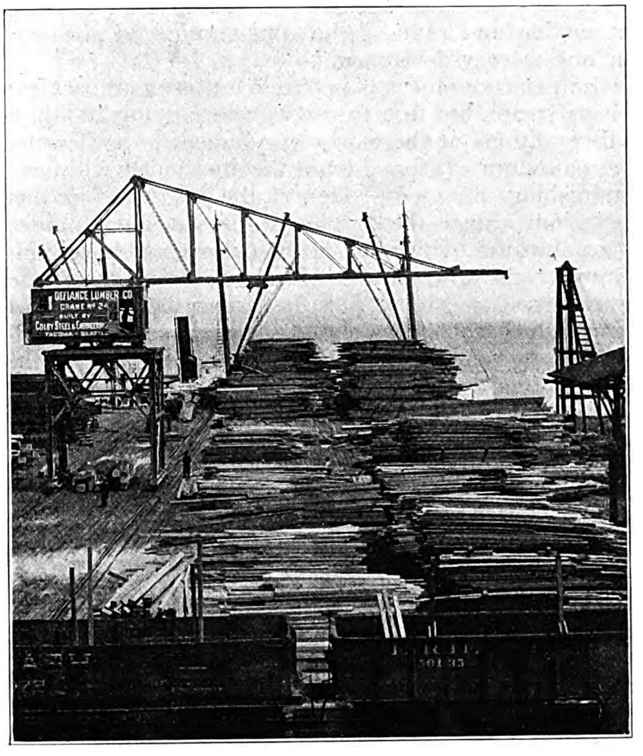
The line is to be supplied electrically from a power station on the isle of Amagar. Initially there will be only a single track, but ultimately two tracks will be available. The bore of the tunnel will be 20 ft. 6 in. The pre-war estimated cost was about $25,000,000.

FLOOD LIGHTS AID IN FIRE-FIGHTING.

At a recent demonstration conducted by the fire department of Dundee, Scotland, it was shown that flood lighting has valuable possibilities as an aid to fire-fighting at night. A floodlight projector mounted upon a tripod frame and equipped with a 1000-watt Mazda C lamp was used. By means of the powerful beam it was possible to identify a fireman working at a height of 400 ft. Although in many cases the light from the fire itself provides sufficient illumination to guide the firemen, very often the members of the department are compelled to work in comparative darkness, which is not only a serious drawback to effectiveness in their work but constitutes a serious life hazard under these conditions. The projector that was used can be operated from a small generator mounted upon the fire engine or it can be supplied from any available central-station circuit. The projector is easily portable.

ELECTRIC REVOLVING BOOM CRANE FOR HANDLING LUMBER.

Facilities for the rapid and economical handling of lumber from sawmills to storage and from the latter to ships or cars, have reached a high stage of efficiency in the use of the revolving gantry crane with horizontal boom, operated by either alternating-current or direct-current motors. A crane of this type lately installed at the mill and shipping dock of the Defiance Lumber Co., Tacoma, Wash., made by the Colby Steel & Engineering Co., Seattle, has 5 tons capacity and is



Electric Crane in Use Handling Lumber.

operated by a 35-hp. motor. The mechanism for the hoist and crane movements is made up of one unit in the cab. By this means the boom revolves in a complete circle, and the operator is able to travel the crane on the track, move the boom in either direction, hoist or lower the load and travel the trolley in or out, all at the same time. Other cranes of this type of 5 tons and 10 tons capacities are in use at shipyards on Puget Sound, where rapid handling of material is required.

ELECTRIC TRUCKS MAKE THEMSELVES KNOWN IN NEW YORK CITY.

Of the total number of trucks in operation in New York City, 10% are said to be propelled electrically. In round figures, there are about 33,000 trucks in operation, those using storage batteries numbering 3288. Before the next year, the number of electrics will be considerably augmented.

The Still Engine — A New Prime Mover

Utilization of Fuel and Cooling Medium Features of the Engine—High Thermal Efficiency and Low Unit of Weight Are Other Valuable Properties — Special Applications

THE Still engine is an engine capable of using in its main working cylinder any form of liquid or gaseous fuel hitherto employed; it makes use of the recoverable heat which passes through the surfaces of the combustion cylinder, as well as into the exhaust gases, for the evaporation of steam, which steam is expanded in the combustion cylinder itself on one side of the main piston, the combustion stroke acting on the other side. It increases the power of the engine and reduces the consumption of the fuel per horsepower developed.

Its primary object is not to use the waste heat for raising steam, but first to use it in improving the thermal conditions of the working cylinder, and so ensure the maximum efficiency from the fuel burnt within it, diminishing, as a consequence, the heat lost in that operation. Since the maximum efficiency is obtained by combustion of the fuel in the cylinder and the minimum by the evaporation of the water in the steam generator, it is evident that the larger the quantity of steam which can be generated per horsepower developed by the combustion cycle, the lower must be the heat efficiency of the whole machine.

Internal-combustion engines are kept cool by the circulation of cold water around their cylinders; the heat thus absorbed causes a rise in temperature of the water as it travels through the jacket, so that the cylinder is subjected to temperature differences and heat stresses, which are an abiding source of trouble and difficulty to the designer.

In the Still engine the jacket and cooling water form part of the circulating system of a steam generator, which may be an integral part of the engine, or external to it. The cooling water therefore enters and leaves the jacket at a constant temperature, regulated by the pressure of the steam, the cooling being effected by converting the water into steam without raising its temperature. Excluding the radiation losses, which are kept low by lagging, all the heat which passes through the walls is thus usefully recovered in the water as steam. The temperature of the cylinder wall is uniform over the whole of its exterior surface, and the heat lost to the cooling water at each stage of the cycle—compression, combustion and expansion—is diminished.

During compression, owing to the walls being at steam temperature, the incoming charge picks up heat, instead of losing it, during the greater part of the stroke, an advantage of the greatest value to the heavy oil types of Still engines, where an air charge is taken in at the full out-stroke, and is compressed to a pressure where its increased temperature ensures the certain ignition and combustion of the fuel which is injected into it.

During combustion and expansion, the uniform and higher mean temperature of the walls reduces the heat lost to the jacket water. Some of the heat thus economized adds to the useful work on the piston, the balance passing out in the exhaust gases for recovery.

Steam from Waste Heat.

After raising their quantum of steam, the exhaust gases are employed in preheating all the water required for the steam generated in the jacket water and in the generator. Trials at full efficiency over long periods and steady loads show terminal stack temperatures as low as 150° F. The heat efficiency of the combined cycles is therefore exceedingly good, with an initial temperature of over 2000° F., and a final exhaust to atmosphere at 150° F.

The quantity of steam capable of being generated from the "waste heat" depends upon the efficiency of the combustion cycle, and on the load. Years of experimental work have proved that the weight of steam recovered may vary from a maximum of about 7 lb. per b. hp-hr. developed by the combustion cycle of a four-stroke constant-volume engine, at full load, to a minimum at light loads which is hardly measurable and which only balances the loss due to radiation.

The steam recovered is a by-product, is limited in amount, its value depending upon the efficiency of its employment. This is carried out in a logical manner. Instead of being expanded in external auxiliary engines, with their thermal and mechanical losses, it is

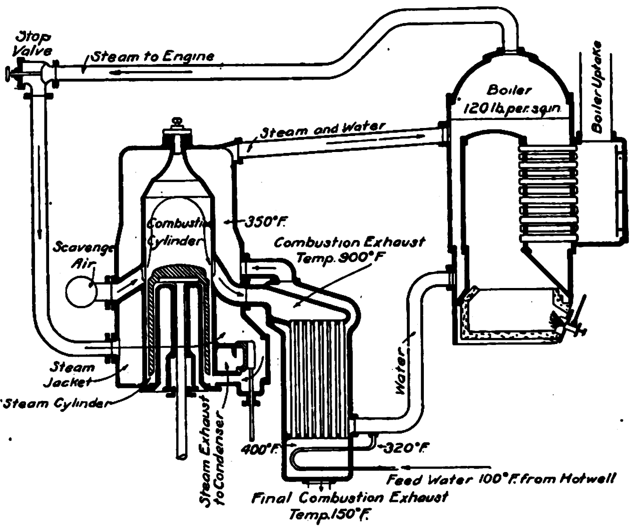


Fig. 1.—Schematic Diagram of the Still Engine.

returned to the combustion cylinders of the Still engine and is expanded on the opposite side of its main piston, one stroke being performed by steam and the other by combustion.

Among the results obtained it may be mentioned that (1) the mechanical efficiency of the whole engine is higher than that obtainable in a normal engine of similar type; (2) the steam, expanding as it does in a cylinder hotter than itself, gives an indicator diagram larger than that theoretically obtainable under ideal conditions in an ordinary steam engine; (3) 29% of additional brake-horsepower is added to the shaft of the engine, without increase in the fuel consumption (steam not condensed); (4) 40% is added with condenser used (air pump separately driven); (5) the initial horsepower due to steam appears as brake-horsepower added to the shaft, all the mechanical losses having already been accounted for in measuring the combustion brake-horsepower.

The average m.e.p. from the combustion stroke was 90 lb. per sq. in. The steam evaporated by the "waste heat" gave 14 lb. per sq. in. m.e.p. on every return stroke, equivalent to $90 + 28 = 118$ lb. per sq. in. m.e.p. in a normal four-stroke engine.

In trials carried on the frictional loss at 65° F. was nearly twice that when the jacket water was at 212° F., the maximum obtainable. In other trials carried on by Still the jacket water was maintained at a constant temperature of 320° F.

By admitting additional steam generated by fuel under the boiler, the steam m.e.p. was raised to 72 lb. per sq. in.: the total m.e.p. was, therefore, equal to $90 + 144 = 234$ lb. per sq. in. m.e.p. in a normal four-stroke engine.

The first experimental engine constructed was a two-stroke engine capable of developing 590 b.hp. from three cylinders at 400 revolutions, bore 8 in. It was a high speed engine, designed with special regard to obtaining data about the recovery of steam from waste heat in jacket and exhaust. It was first operated on town gas of 540 B.t.u. and subsequently converted for oil fuel. Its efficiency was not high, owing to its being a two-stroke engine with a short stroke, but its consumption per brake-horsepower was 15 cu. ft. per hour (31.3% efficiency), a very promising result.

The outbreak of war prevented much progress being made in the design and construction of gas engines, but the results achieved give great promise of

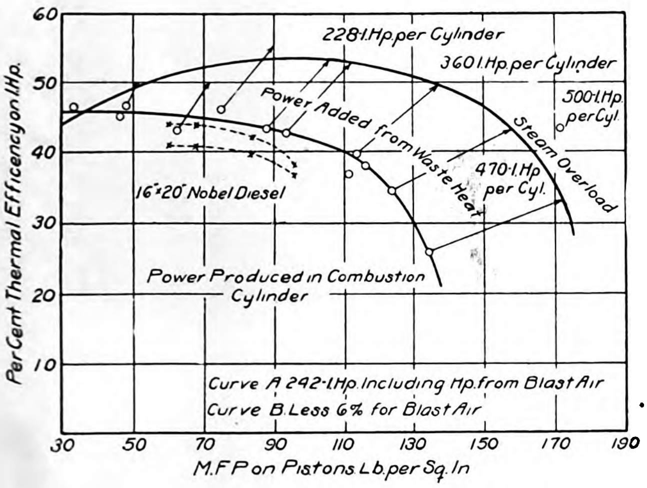


Fig. 2.—Diagram Showing Thermal Efficiency of 13.5 in. by 22 in. Still Engine of the Two-Stroke Opposed Piston Type. Shale Oil Used as Fuel.

future development, for with a combustion indicated efficiency of 36%, radiation 4%, boiler loss 10%, there remains 50% for recovery; allowing 10% efficiency for the steam cycle, a gain of 5% is assured, and the total indicated efficiency of the engine will not be less than 41%. If 20% efficiency is obtained from the steam cycle, as appears possible, the total indicated efficiency will be 46%.

A gas engine which can give a brake thermal efficiency 30% better than its predecessors and which, by governor control alone can meet any demand up to and over 100% overload, while maintaining a good efficiency at that increased output, cannot be neglected.

The Diesel engine relies for ignition solely on the temperature reached by compression of its air charge. On starting, this is carried out in a cold cylinder with a direct loss of heat to the walls during the whole of the compression stroke. A compression pressure of 500 lb. per sq. in. is necessitated to overcome this heat loss. This high pressure increases the cost of construction and upkeep, and, since the maximum explosion pressure capable of being reached in a closed vessel may reach six times the pressure contained in it, the whole design and weight of the engine is detrimentally affected. Its brake thermal efficiency of 30 to 32%, coupled with 20 years of intensive development in all lands, has, however, placed it at the head of all combustion engines in commercial operation using heavy oil fuels.

The Still oil engine starts with the cylinders and pistons preheated. The air charge, from the moment it enters into the cylinders, picks up heat from the containing walls and continues to do so during at least 70% of the compression stroke. The result is that the temperature necessary for firing with certainty the first injected charge of fuel is reached with a compression pressure 50% less than that required in a Diesel engine. This fact is far reaching in its importance, for it gives to the designer great elasticity and freedom of application, for a Still heavy oil engine can be designed for constant pressure or constant volume, or both can be employed in the same engine by correct timing of the fuel injection. It claims for its combustion cycle an efficiency higher than that of the Diesel, less weight and space per horsepower, and for its combined cycle an efficiency not less than 20% higher than any prime mover which uses fuel as its source of heat.

A unit of this type has been subjected to many long and varied tests by representatives of various governments, as well as to constant research work under severe conditions. Its best consumption of fuel (Admiralty shale oil) has been as low as 0.302 lb. per b.hp. (scavenge pump not included), over a test of one hour's duration under normal waste heat conditions. It developed 330 b.hp. for six hours at 360 r.p.m. (a single cylinder) under waste heat conditions. The thermal brake efficiency from below quarter load to full power is maintained at approximately 40% over the whole range.

Engines of this type operating at 120 r.p.m. with a cylinder 22 in. diameter by 36-in. stroke, giving 4200 s.hp. on two shafts, with all auxiliaries and water, would approximate 600 tons. A geared turbine plant in a similar ship would weigh 20% more and would consume approximately 2000 tons more fuel for a double journey lasting 1000 hours.

HARNESSING OF WATER POWER IN MEXICO TO GO AHEAD.

The Mexican government is planning to make a complete survey of all available water-power sites and to estimate the amount of energy which may be generated. Original concessions granted Americans and other foreigners were cancelled by the Carranza government.

Comparison of Mechanical Stokers

Classification of Mechanical Stokers—Salient Features of the Different Stokers — Influence of the Stoker Upon Draft, Combustion Chamber, Etc. — Part II.

By ROBERT JUNE

Mechanical Engineer.

AS HAS already been shown in the preceding articles, the advantages of the mechanical stoker over hand-firing are as follows:

1. Even and continuous firing of the automatic stoker, as compared to the intermittent action of hand-firing.
2. Practically constant and uniform supply of air which can be controlled to some extent to meet actual operating conditions, as contrasted with the wide variations in air supply occurring in hand-firing, with constant opening of fire doors, and varying depth of fuel bed.
3. Continuous and automatic cleaning of fires, leading to better over-all efficiency.
4. Large savings in labor, due to fact that one man can take care of 2000 hp. of stoker-fired boilers, as compared to 250 to 500 hp. of hand-fired.
5. Saving in fuel cost through ability to burn lower grades of coal than can be handled to good advantage with hand-firing.
6. Practical insurance of smokeless operation.

Overfeed Stokers.

Overfeed stokers are of two types—front-feed and side-feed. To the first type belong the Roney, Wilkinson and Acme stokers; to the second type, the Detroit, Murphy and Model.

With the front-feed stoker, the grate, which is arranged in a series of steps, slopes at a considerable downward angle from front to rear. Coal received from the hopper is coked under a short suspended arch and is then fed forward and downward by the rocking action of the movable grates, aided by gravity. The clinker working forward, is emitted at the bottom, being crushed by rolls in some types of installations. For convenience in handling, the dumping grate is frequently divided into several sections.

Front-feed stokers possess the important advantage of permitting easy passage of air through the fire so that complete and efficient combustion is readily secured. On the other hand, their combustion is such that if boilers must be continuously driven at high ratings, the grates may become overheated. In order to avoid this danger of burning, with possible necessary renewal of grates, engineers usually prefer other types of stokers, if it appears probable that boilers must be operated above 200% rating for considerable periods of time. Front-feed stokers used either natural or forced draft.

The side-feed or "V" stoker receives coal from two magazines, located on each side of what, to all intents and purposes, is a Dutch oven. At the bottom of the magazines are coking plates against which the grates, which are inclined at a steep angle toward the center of the furnace, rest at their upper ends. As the coal leaves the magazine, from which it is fed alternately and intermittently, it rests for a short time upon the coking plates. At this point the volatile gases are largely driven off, being mixed with air which has been pre-heated by admission through the arch over the fire.

As combustion proceeds, the fuel travels slowly down the inclined grate toward the clinker grinder, receiving the requisite amount of air through the grates to complete the process of combustion by the time the lower portion of the grates, where the ash and clinker are automatically removed.

The speed at which the stoker boxes push the coal into the grates is of course subject to easy regulation. The grates, being protected at their upper ends and actuated at their lower ends, agitate the fuel bed to a constantly increasing extent as combustion proceeds, thus permitting free admission of air and assuring complete combustion. In stokers of this type the clinker grinder can be adjusted to operate with reference to the amount of ash and clinker in the coal, irrespective of the action of other parts of the mechanism.

For boilers of moderate size, operated at 200%

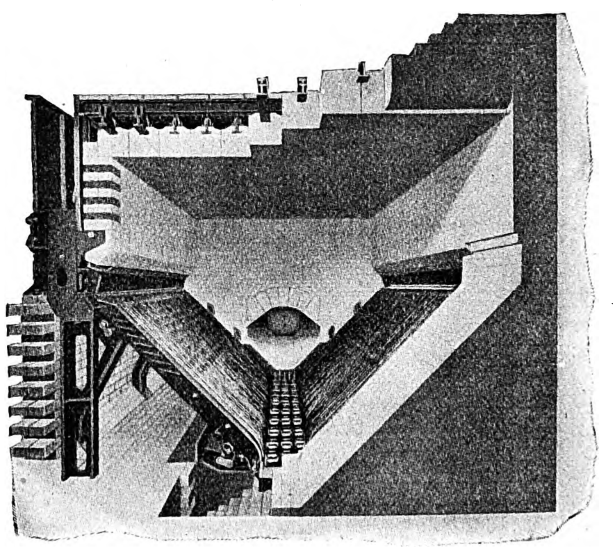


Fig. 1.—Overfeed Type of Stoker.

rating or less, the side-feed stoker makes a desirable and economical installation. It has the advantage of possessing a decidedly larger coking area than other types of stokers, and as its combustion area is likewise very large, it is possible, with careful manipulation, to secure complete and practically smokeless operation. Natural draft is the rule with this stoker.

The Down-Draft Furnace.

While the down-draft furnace is not to be strictly classed as a stoker, since its use involves hand-firing, it nevertheless deserves consideration, since it performs certain of the functions of the mechanical stoker; that is to say, as compared to ordinary hand-firing, it permits the use of lower grades of fuel, assures practically complete combustion, and what is extremely important in many installations, smokeless combustion.

The down-draft furnace consists of two separate grates, one above the other, the upper grate being formed of a series of tubes, opening at their ends into steel drums or manifolds, through which the water of

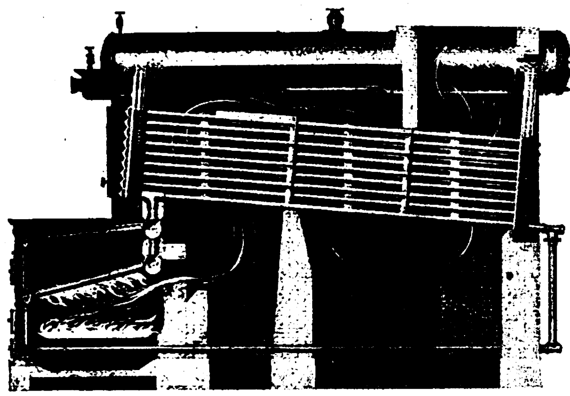


Fig. 2.—Down-draft Type of Stoker.

the boiler circulates, whereas the lower grate is formed of ordinary grate bars. The firing doors are near the top of the furnace and the upper grate only is fired. This grate, it should be noted, slopes upward at a sufficient angle to assure rapid circulation.

A division wall at the back of the furnace prevents the gases from going rearward, hence the draft is downward through the fuel bed, and the volatile matter, as it is evolved, passes directly between the grates into the combustion chamber. The lower grate is fired entirely by coked coal falling through the tubes of the upper grates. As the flames from the lower grate arise, they meet the down-coming gases and the process of combustion is completed.

An objection sometimes raised to the down-draft furnace is that it "cannot be forced above rating," but this is not strictly true as it can be driven to nearly if not fully the same extent as a hand-fired furnace. When installed under conditions within its limitations, it is more economical and satisfactory than hand-firing.

The Under-Feed Stoker.

Among the best-known underfeed stokers are the Taylor, Westinghouse, Type "E," Riley, Jones and American.

The under-feed stoker is the stoker for large installations and exceedingly high ratings. Indeed, so completely has it pre-empted this field that it is unusual to go into a large central station or high-duty large boiler power plant of any sort, built within recent years, and find other types of stokers installed.

There are a number of reasons for this. First of all, the under-feed stoker is adapted to all grades and sizes of free-burning bituminous coal. Next, it is essentially a forced-draft stoker since it operates with restricted air openings, and very deep fires. The forcing capacity is almost unlimited, instances being known where this stoker has been driven to over 400% rating.

Sufficient combustion-chamber space is the principal consideration in making under-feed stoker installations, as with this stoker it is necessary to elevate the boiler a very considerable distance above the floor. Coking arches or plates are dispensed with entirely. The principle of the under-feed stoker is that of a steam-driven ram, which forces the fresh coal into a large receiving retort, contained within the furnace, and from there up under the fuel bed.

The Jones stoker consists of nothing whatever except this retort, or a series of retorts, depending upon the size of the boiler. There are no grate bars and no ashpit, just a blazing pile of coal, continually fed with new supplies pushed up from below. Air is admitted through hollow blast tiles at the upper edges of the retort. Ash and clinker form chiefly on the dead plate between the retorts and are removed by hand at intervals of a few hours. Automatic control of air and fuel supply is secured, definite proportions of each being admitted as the steam pressure tends to rise or fall.

In the Type "E" stoker the retort has a reciprocating sliding bottom which carries the coal forward. It is delivered uniformly from front to rear by auxiliary pushers, and as it rises in the retort, is distributed to the sides of the furnace by means of rocker bars, so set as to slope both ways from the center of the furnace toward the side walls. The progress of the burning fuel and also of the ash and clinker is thus from the center to the sides of the furnace. As the action of the rocker bars is slightly up and down, clinker is kept from forming in large pieces. Dump trays at the side permit cleaning by the act of throwing a single lever.

More elaborate than other underfeed stokers, the Taylor consists of a series of alternate retorts and tuyeres, sharply inclined toward the rear of the furnace. Each retort is fitted with two rams—the upper for pushing the green fuel inward and upward, the lower for forcing the fire toward the dump plates at

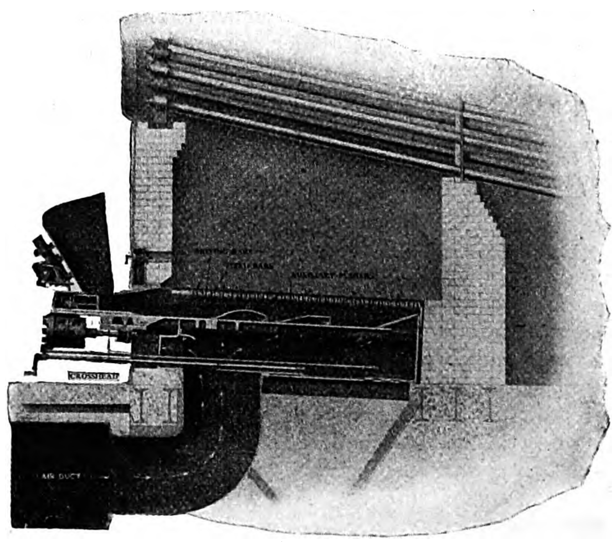


Fig. 3.—Underfeed Type of Stoker.

the rear. The dump plates referred to are hung on the rear of the wind-box. They are controlled from the front of the furnace. This stoker may be operated efficiently and smokelessly at the heaviest known overloads, hence it is frequently found in the largest plants. Stoker and blower are operated by the same engine and power required for this purpose is from 2.5 to 5% of steam generated, making it probably the highest steam user among the stokers.

The Riley is a multiple-retort stoker, the distinctive feature of which is that the sides of the retort reciprocate relative to the bottom. This arrangement results in the fuel being moved at a uniform rate out of the retort and across the ash supporting plates

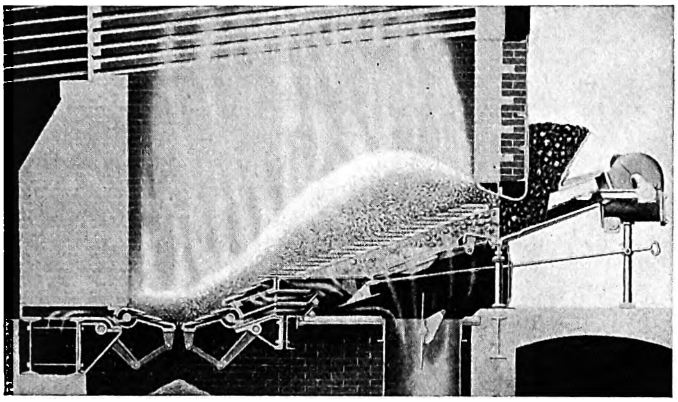


Fig. 4.—Cross-Section Showing Fuel Bed With Underfeed Stoker.

until it is discharged through adjustable openings next to the bridge wall.

Points to Remember Regarding Stoker Operation.

The following are a few of the points to remember regarding stoker operation.

1. Draft must be under close control at all times.
2. Keep air vents open.
3. Look out for air leaks, particularly after making adjustment.
4. Make frequent flue-gas analyses.
5. Keep side walls clean of adhesions.
6. Do not stop stoker long with hopper full of coal.
7. In chain grates make adjustment of gate and speed if fire tends to withdraw from gate or run over end
8. Coking coal may require slice bar.
9. In washing out boiler, do not get water on arches or brickwork.
10. Do not pull dead plates entirely clear of ash.
11. Keep ash-pit cleared out.
12. Have all necessary maintenance work attended to promptly.

Summary.

It has been shown that the chain-grate stoker is suitable for boilers of good size up to 250% and that its important characteristic is that the grates must be designed for the fuel burned. It has been shown that the overfeed stoker is particularly suitable for medium sized installations up to 200% rating. The down-draft furnace, particularly for small boilers operated at non-excessive ratings, offers a comparatively inexpensive substitute for certain functions of the mechanical stokers. And, finally, the underfeed stoker has been placed as the apparatus for large boilers, operated at extremely high ratings.

TRANSFER OF GUATEMALAN ELECTRIC PLANT TO AMERICAN COMPANY.

German Plant Taken by Government and Leased to American Interests—Extensions Proposed.

The electric lighting and power plant of Guatemala City (Empresa Electrica de Guatemala) was granted a 30-year concession some 25 years ago for electric lighting and power service in the city of Guatemala. The enterprise has always been a German institution, and more than 90% of the stock was held by the Deutsche Bank of Berlin. By executive decree No. 742 of October 16, 1918, this property was taken over by the Guatemala Alien Property Custodian and by later decree was declared forfeited to the Guatemala Government and nationalized. By executive order this property has now been leased to Henry W. Catlin, No. 71 Broadway, New York, for the term of 10 years, at a cash rental of $40,000 per annum, together with the option of extending the lease for an additional like period. The Government concession under which the old company operated has been extended for the life of the contract and any prorogation. The lessee also becomes the preferred bidder in any future sale of the property.

The plant was erected by the Siemens-Halske Co. (Berlin), and is hydroelectric, with a present capacity of 2000 kw. at 4000 volts three phase alternating current, which is transmitted from the power station at Palin, 28 miles distant from Guatemala City. This is reduced at the local station to 1000 volts for primary distribution over the city. The house service is 120 volts. The entire pole line, both transmission line and for city distribution, is made of 9 and 10-in. I-beams. Some 16,000 incandescent lamps, 280 open arc street lamps, and 2000 hp. in motors are served.

Before the earthquakes of 1917-18 about 30,000 incandescent lamps were connected.

The leasing company also acquires the right to an incompleted additional water power and central station at San Luis, about 6 miles from Palin, the present operating station which, when completed, will give an additional 3000 kw. This additional power will probably be completed promptly by the leasing company, as there is much demand for additional light and power service in that city. It is a common thing to see advertisements of electric motors for sale, "with right of electric service," and at the offices of the company are many applications for power awaiting their turn. The plant as it stands today has an estimated valuation of $1,000,000, and the cost of completing the auxiliary station is estimated to be in the neighborhood of $300,000.

IMPROVEMENTS IN POWER PLANT AT ST. JOSEPH, MO.

New Condensing Turbo Unit—Oil-Burning Equipment—Other Rehabilitation of the Plant.

Improvements in the plant of the St. Joseph Street Railway, Light, Heat & Power Co., St. Joseph, Mo., which will amount to approximately $1,000,000, have been started. Excavations are now completed. The improvements are to include a 12,500-kv-a. turbine-generator complete with surface condensers and auxiliary switchboard equipment. This new unit alone is able to take care of all of the city's present requirements and 20% additional, which includes both light and power and leaves the entire old installation to take care of further increases in the future. Workmen are relocating two 440-hp. boilers and are installing two additional boilers of 1000 hp. each. A complete new arrangement of boiler-feed pumps and accessories will be made. A complete oil-burning system will be installed throughout the plant, which will do away with coal entirely. This includes a 30,000-barrel fuel-oil storage tank, with 800 ft. of track for the supply of oil. Two new steel stacks will be constructed, one 16 by 225 ft. and the other 12 by 225 ft.

NEW PLANT FOR MANUFACTURING RADIO APPARATUS.

Brief Description of the New Kilbourne & Clark Factory at Seattle, Wash.—Motor Drive Throughout.

By W. A. Scott.

A brief outline of the new factory of the Kilbourne & Clark Manufacturing Co., of Seattle, Wash., will be of interest because in it there are exemplified the most advanced facilities for constructing and testing radio apparatus, and because of the world-wide demand for the company's products. Wireless equipment of the Kilbourne & Clark design, which was developed a few years ago, won its way to favor almost at the beginning, with none to challenge its efficiency. During the war its production was increased with great rapidity to keep pace with the tremendous demand for radio apparatus for new ships of war and commerce, and to supply the facilities for operating wireless stations on land, both in the United States and in allied and neutral countries.

This strictly American industry, to which great impetus was given because its product was a war essential, found at the close of the war that a national and international demand had developed for its apparatus.

The new plant at Seattle, designed and equipped to meet the requirements of this specialized industry, was completed and put in operation within the last three months. The building made up of four interconnected structures, is well shown in one of the illustrations presented herewith. It is constructed of reinforced-concrete walls, and wooden floors laid upon concrete slabs, with roofs of saw-tooth type to afford the best possible daylight and ventilation; the roofs are of mill construction, a part of the framework being supported by timber columns.

The main shop building, an interior view of which is given, is 100 ft. wide and 300 ft. long, having a 24-ft. ceiling. The lengthwise direction of this shop structure is north-south.

The three wings built at right angles to it extend easterly toward Whatcom avenue on which the plant fronts. The center wing, as is shown in the illustration, constitutes the office building, which is 60 by 60 ft. The south wing, 60 by 100 ft., is the laboratory and engineering building; and the north wing, 60 by 100 ft., is the stock and storage building. By referring to the exterior illustration it will be noted that there are parkings in front of and on both sides of the office building, and that the north and south wings come out flush to the sidewalk adjoining the paved street.

Electricity for Motive Power and Testing.

Electricity is utilized for all power requirements and testing operations. Energy is supplied from two outdoor 100-kv-a. transformers at the rear of the main shop building, being transmitted at 220 volts through lead-sheathed overhead cables to the main switching panels in the shop. The power load is not a heavy one, as most of the driven machines and tools are for comparatively light work in which precision and speed are the essential requirements.

The 43 Wagner motors installed are practically all alternating current, operating at 220 volts at different speeds, although there are no variable-speed motors.

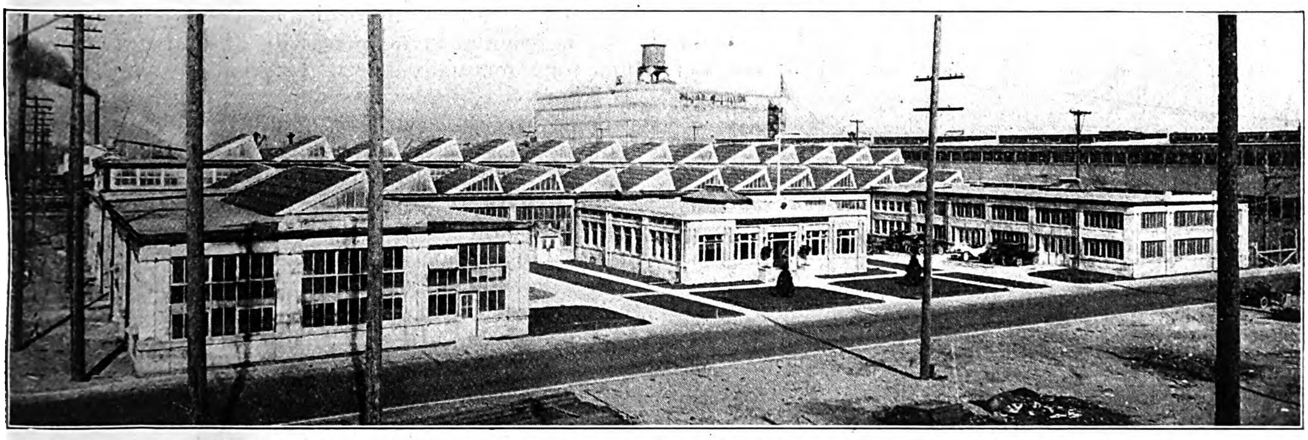
It will be observed, by reference to the interior view of the main shop, that the most of the lathes, drills and milling machines are operated in groups by motors hung from the ceiling. These motors are of 5-hp. and 10-hp. capacities, leather belts being used for transmitting power from the motors to line shafts and for connecting the latter to the tools and machines. There are, however, a number of lathes and other tools of the heavier class which are driven by 10-hp. and 15-hp. individual motors, each set upon the floor and connected to the driven machine by a short leather belt. Some of the heavier tools thus operated consist of a Cleveland automatic lathe, and three Revette lathes.

An interesting feature of the shop work is seen in the tool-making department, where motors of light capacity and high speed, with leather-belt transmission, are required in driving special machines in groups. Here precision tools and devices are made which are adapted to the work in manufacturing wireless apparatus.

In the speedy production of parts required in assembling radio equipment there is maintained a systematic routing of work through the factory, and the mechanical and electrical installations were arranged with that system in view. The thorough inspection methods established are applied to all stages of the manufacturing.

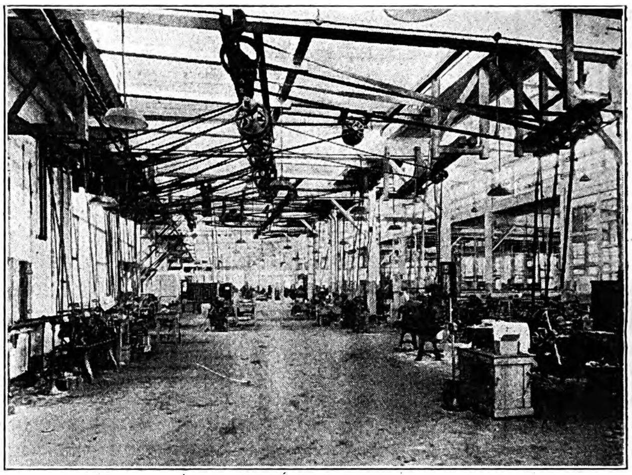
The raw materials used in wireless apparatus consist of steel, brass, copper, aluminum, and insulating material, the last named consisting chiefly of Bakelite-Dilecto, a trade name for a special kind of condensation product of excellent insulating and mechanical properties.

The laboratory is equipped with the latest types of



General View of the New Plant of the Kilbourne & Clark Manufacturing Co. at Seattle, Wash. In Plan View the Buildings Form a Large Letter E.

View of Part of the Laboratory and Testing Department for Development and Testing of Radio Apparatus.



Interior View of the Main Shop Building of Kilbourne & Clark Plant.

instruments and appliances for testing out radio apparatus before shipments or deliveries are made. Many standard and special instruments are also required in research work. As direct-current energy is required in testing part of the apparatus, a 25-kw. motor-generator set was installed in a compartment adjoining the laboratory and testing room, to convert alternating to direct current. This consists of a Wagner motor and a Westinghouse generator. In one of the illustrations is given a view of the laboratory and testing department.

An engineering organization is maintained, not only to make inspections and tests, but to conduct research work and to produce new and improved designs along the lines of the radiotelegraphic development. In this connection there is operated an electrical blue-printing and drying department for the rapid production of shop drawings.

Illuminating Facilities.

The buildings are wired throughout in conduit, providing outlets for high-intensity, glare-free general lighting. The main shop building is illuminated by 110 of the 200 and 400-watt Mazda C lamps, spaced 12 ft. apart, and equipped with Ivanhoe Reflecto-Cap units. The laboratory is served by 100-watt lamps and reflectors of similar type, while the offices are illuminated by 150-watt Mazda C lamps in Perfeclite semi-direct fixtures. Other parts of the plant are lighted by 100-watt units with steel dome reflectors. but without diffuser caps. Except in a few special cases no local lamps are required for machines and tools.

Provision is made for an electric overhead crane of 31-ft. span in the main shop, but which has not yet been installed.

THE AUTOMATIC SUBSTATION FROM AN ECONOMIC STANDPOINT.

How Electric Railways with Light Traffic Can Save Money by Installing Attendantless Substations.

The tendency in the development of modern electrical apparatus is to utilize more and more the automatic features which are proving to be important factors in extending its use. Probably no recent development has created more general interest or possesses more economic possibilities than that of the automatic substation for electric railways, especially interurban.

The automatic substation usually consists of a synchronous converter, a bank of transformers and three or four switchboard panels, on which are mounted electrically operated switches, relays and instruments. It is really almost uncanny in what it will do when the trolley voltage falls below a predetermined safe value. Without human aid the converter starts up and reaches synchronism and assumes its share of the total load on the line. If the load increases to a point dangerous to the converter, it immediately shuts itself down and the line switches all open. If a converter bearing should overheat, instantly a relay operates and the converter shuts itself down. If the load on the line drops to a point where the converter is not required, it automatically comes to rest. It will go through this cycle of starting and stopping just as often as the line conditions make it necessary, it being possible to start up, close all switches, open all switches and stop the converter twice per minute.

Naturally, since such power is at instant call without an attendant at the station certain limitations exist which react to counterbalance the good qualities of automatic switching but they in no way destroy the great commercial advantages of such switching.

A competent engineer must inspect the apparatus weekly and the station must be cleaned up three or four times a month. One engineer could inspect a great many stations on a regular schedule, so this item will add but a trifling labor charge. The cleaning up can be done by ordinary car-barn labor.

The original investment will, of course, be greater than for a manually operated station of equal capacity.

There may be increased hazard to the equipment, although results thus far obtained indicate that the equipment is better protected by automatic switching than by hand switching.

Automatic switching is more complicated than hand switching, but on close acquaintance it becomes quite simple.

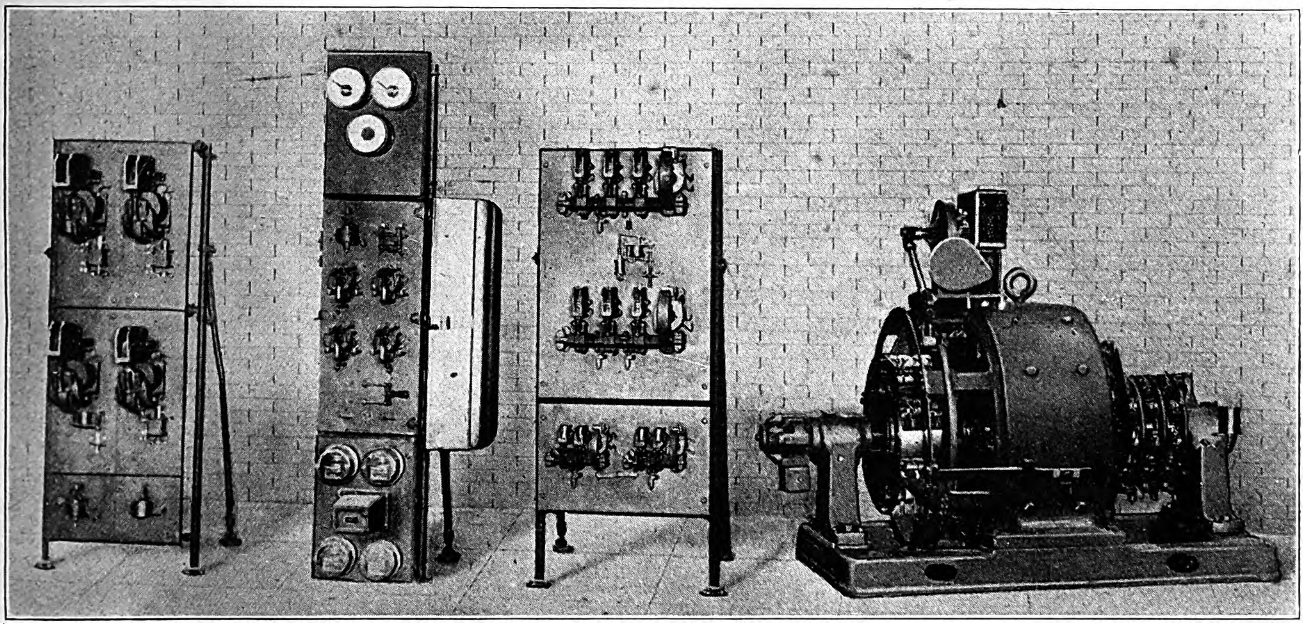
Feeders must be applied with great care to save trolley wires which drop to the ground from annealing.

Since there are no operators to transfer high-tension lines in case of trouble these lines may in certain cases have to be arranged for automatic installations. It may be possible to handle this high-tension switching by remote control.

The economic features which offset the foregoing disadvantages are so great that they leave a heavy balance in favor of the automatic switching. The fact that automatic substations require no attendants should itself effect an economy of $2500 per station, allowing two men per station for hand switching. The absence of attendants leads directly to a second marked advantage, the elimination of labor difficulties. This is an important factor under the present disturbed condition of labor generally and the uncertainties of the future.

Since the automatic station shuts itself down when power is not required, the saving in energy will amount to a considerable item. No-load losses are thus eliminated, which is particularly advantageous on interurban lines where the power requirements are intermittent.

There is also a reduction in feeder loss as the substation can be located exactly where needed without reference to labor operating cost. By relocating or increasing the number of substations enough feeder copper can be saved on many propositions to pay for a great proportion of the cost of automatic switching.



Typical Automatic Substation for an Interurban or Other Light Electric Railway.

There is invariably a reduction of electrolysis due to absolutely correct location of automatic stations, thus reducing the return circuit in length and in losses due to drop.

Experience thus far indicates that reliability of operation will be increased. Considering the ability of the best operators that can be secured and the introduction of the ever varying "human element," the automatic switching should prove by far the more reliable method of operation.

Maintenance has been very low in those cases which have been under operation. This charge will drop exactly in the proportion, that inspection and cleaning of apparatus is kept up and with experience will doubtless drop to a very low value.

Summing up, there is do doubt but what the automatic substation is here to stay and its economic features demand consideration whenever the installation of a new substation is projected. The following table shows typical economies from such an automatic substation:

TYPICAL ECONOMIES OF AUTOMATIC SUBSTATIONS.

Headway between cars	Hours	1	2
Length of line	Miles	25	25
Number of substations		3	3
Capacity of substations	Kw.	300	300
Distance between substations	Miles	10	10
Schedule speed	M.p.h.	25	25
Length of operating day	Hours	20	20
Total substation hours (manual operation)	Hours	60	60
Total substation hours (automatic operation)	Hours	32	20
Running-light loss per station	Kw.	15	15
Energy saved per day (automatic operation)	Kw-hr.	240	600
Energy saved per year (automatic operation)	Kw-hr.	153,300	219,000
Value of energy saving at 1 cent per kw.-hr.		$1,533	$2,190
Labor saving per year (6 operators at $70 per month)		$5,040	$5,040
Total saving per year		$6,673	$7,230
Total investment automatic control—3 stations		$1,800	$1,800
Interest, insurance, maintenance, depreciation, taxes—15%		$2,700	$2,700
Cost of inspection per year		$ 500	$ 500
Total annual charges		$3,200	$3,200
Net annual saving		$3,373	$4,030
Return on investment, per cent		18.7	22.4

CUSTOMER OWNERS HELP SAVE PLANT.

Recently the Minnesota Valley hydro plant of the Northern States Power Co. experienced the highest stage of water on record. Nearly five feet of water was spilling over the dam and the tail water rose to 19 feet, flowing into the plant through the windows and doors. C. D. Hunt, manager of the Southwest Division of the company, reports the following as to what transpired:

"The farmers living in the vicinity of the plant came to our rescue at midnight and faithfully manned the pumps for 48 hours until other means could be employed to lower the water in the generating room of the old part of the plant. It is significant that nine of the farmers who came to our rescue were stockholders in the company. These farmers left their work for 48 hours to assist in the work of saving the plant."

COAL SAVING DUE TO DAYLIGHT SAVING.

During the daylight saving season last year, the Edison Electric Illuminating Co. of Boston saved 4420 long tons of coal because of the extra hour of daylight utilized by turning the clock one hour forward. The decrease in kilowatt-hours from this cause was 5,000,000, representing a loss of revenue of about $350,000.

Editorial Comment

Daylight Saving to Stay

PRESIDENT WILSON'S veto of the Congressional attempt to repeal daylight saving and the failure of the House to pass the measure over his veto settles the fate of this summer-time practice probably for another year. The only avowed opponents of the practice are the farmers who must engage help to work their fields. Apparently they are an influential lot, for they quite readily awed Congress to meet their wishes. We are convinced, however, that the great majority of the country's citizenship is heartily in favor of daylight saving every summer. Electric lighting companies are sufferers from it, but almost without exception they are glad to bow to what is manifestly for the public good.

Machinery Must Replace Emigrants

NOW that peace is here, swarms of aliens are leaving this hospitable land and going back to their native abodes with their pockets swollen with American money earned during their profitable sojourn among us. The great majority of these emigrants have not assimilated our ideas or customs or even our language. Their departure is therefore in one respect no serious loss to our country. But it is a substantial loss to our labor supply. To what extent immigration will replace emigration is very uncertain. There is one certainty, however. It is that machinery will have to be called on more and more to do work that is now done manually, so that the remaining labor will be more effectively applied. Increased use of machinery means more electric motors for driving it and more electric power for keeping the motors running. The electrical industry is ready to do its part in this case just as it has done in relieving the emergency in household work since servants became scarce.

Higher License Fees for Contractors

CHICAGO'S proposed new ordinance governing the licensing of electrical contractors which is reviewed elsewhere in this issue may at first appear to be a rather stiff and expensive proposition calling for a needless outlay which must be borne by the electrical contractor. However, when the conditions existing are understood it surely seems justified. There are at present many journeymen carrying licenses while working for legitimate contractors who compete with their employers for work. In addition, there are many others, such as the maintenance men in large plants who carry on a lively contracting business in the evening and during their other spare hours.

In view of these facts, therefore, it is not surprising that the contractors themselves favor the ordinance and wish to see it become a law. The classifying of licenses is another good feature of the proposed ordinance, for there is no reason why a manufacturer who only has repairs and alterations made in his own equipment should pay the same license fee as the general contractor who does all kinds of electrical work.

A Highly Efficient Engine

ON other pages of this issue are given some of the principal features of the recently developed Still engine, which has aroused a great deal of attention in Great Britain. This unique prime mover deserves as much attention in other countries. Its most important feature is the very high thermal efficiency attained, this being 40% or over. An indicated thermal efficiency of as high as 46% seems probable in future developments of this engine. These high efficiencies are obtained through the combination design of this unit.

Primarily it is an internal-combustion engine whose cylinder-cooling water is kept practically at or just above the boiling point, the steam thus formed being used either in another cylinder or on the other side of the main cylinder to help develop power. Thus the water carries away the heat and utilizes it effectively instead of wasting it as usual. The heat in the exhaust gases is used to preheat the circulating water, so that the gases are discharged at as low as 150° F. Although the engine does not seem to be a very simple one in construction it has very promising possibilities and we expect to see it outdistance the Diesel engine at least.

Keep Food Prices From Soaring

FURTHER increases in the prices of many foodstuffs are offered as the excuse for demands for further wage increases, for increased prices for a variety of commodities and for a reluctance to buy necessities. The net result is a check to the steady expansion of business. Advanced prices in one line react on other lines and there is produced a seemingly endless cycle of continued advances. This is not wholesome to business or industry nor to the country as a whole. A check must be put to it.

Since food prices receive the principal blame, let this be the line to be prevented from further inflation. In view of the fact that food supplies and food distribution will remain abnormal for about a year on account of the inability of Europe to get squarely back on its feet before that time, all attempts at profiteering in foods, cornering of food supplies and unscrupulous speculation in this line should be dealt with as vigorously as they are being treated in France and Italy. Public utility service is firmly under public control. Is food less essential, so that it should not be controlled? Stop the food profiteer, so as to stabilize wages and prices of commodities and thus permit commerce, industry and labor to supply the wants of the world.

Electric Lighting Needed Still More in Summer Resorts

VACATION time is here with its hegira of city folks to the country, seashore and mountains. The hot and sweltering city is gladly left behind for the pleasure of the big outdoors and the relaxation of simple, rural life. And after a few days of this simple life some of its shortcomings force themselves on the average city person who dislikes to do without the more essential conveniences of modern urban life. If the resort at which he is stopping is one of those that were almost universal up to a few years ago, he misses electric lighting probably more than any other utility to which he is accustomed.

The reason for this is obvious. Electric light is the most safe and convenient kind of illumination. Oil lamps, acetylene or gasoline lights are far from being its equivalent. They are very hazardous under any conditions and especially so in the wooden buildings still so very common in summer resorts, even among the more expensive ones. Electric lighting permits dispensing entirely with matches, a fruitful source of disastrous fires. The competing types of lighting mentioned above are also by no means as convenient, comfortable or healthful, especially on a very hot or sultry evening.

In the last few years considerable headway has been made in providing electric lighting in summer hotels and cottages. Where resorts are quite close together they are now frequently served from the lines of some neighboring central station. In other cases where a number of hotels or private houses are clustered into a small community that is itself remote from any regularly established central station or transmission line, it has become the practice to install a self-contained lighting plant of such size as to serve the community. In still more cases of isolated resorts it has become quite common to put in a lighting plant of the farm-lighting type with storage battery to carry the load of the late night hours.

These installations of electric lighting in summer resorts, whether they be any of the types referred to or modifications thereof, are proving to be very popular, especially if their capacity is large enough to also permit the use of small portable appliances, such as hair curlers, fans for very hot nights, travelers' flat-irons for pressing ladies' dress accessories, etc. There is much room for installation of more of these electric lighting systems in the resorts that are still trying to get along with other methods of lighting that are not only obsolete but seriously endanger the lives of their guests.

Real Co-operation in the Electrical Industry at Last

CO-OPERATION, such as has been long desired and talked about as a necessary adjunct to the electrical industry, was demonstrated for the first time in a national way at a conference called by the Executive Committee of the National Association of Electrical Contractors and Dealers in Milwaukee on Monday of this week. On this occasion the various branches of the industry were called together to discuss and develop the Bureau of Education and Research which has been organized by this association. In addition to the representatives of this association there were present the authorized representatives of the Associated Manufacturers of Electrical Supplies, the Electrical Supply Jobbers' Association and the National Electric Light Association and the electrical press.

The picture presented by these men gathered together to discuss a national proposition of vital importance is surely evidence that the co-operation idea has at last taken root in our industry. Nor did they gather merely to discuss co-operation, as is generally the case, but for the purpose of developing and starting a co-operative effort for putting real co-operation into effect.

The Bureau of Education and Research is an elaborate and extensive plan for promoting the sale and use of electric apparatus. The idea of the plan, as explained in an earlier issue of the ELECTRICAL REVIEW, consists of an educational campaign to be carried on among the contractor-dealers of the country by which it is expected to materially increase the sale of electrical appliances and improve the conditions among the trade. However, in order to accomplish its purpose a fund had to be established which the contractor-dealers' association was not able to finance from among its own members. Its officers, therefore, called upon the other branches of the industry for assistance which resulted in the conference.

After considerable discussion a fair and equitable plan was devised by which all branches of the industry contribute to the support of the movement. The expense of the national work is to be borne by the manufacturers of electrical appliances in proportion to the amount of sales obtained through the efforts of the members of the National Association of Electrical Contractors and Dealers. The expense of the local propaganda is to be borne by the local jobbers, the central stations and the larger contractor-dealers in like proportion.

Aside from the importance of this plan, however, the principal feature is that for the first time in its history all the branches of the electrical industry got together on a national proposition, thrashed it out on an equitable basis and really did co-operate. For this reason, especially, it is hoped that the plan will prove a tremendous success and encourage future activities along similar lines.

Current Events

Big Electrical Conventions at Milwaukee and Cedar Point —Electric Railway Investigation Bringing Out Real Facts

WORK ACCOMPLISHED FEATURE OF CONTRACTORS' NATIONAL CONVENTION.

Great Enthusiasm Displayed by Members at Opening Session in Milwaukee on Wednesday.

A very striking feature of the opening session of the annual convention of the National Association of Electrical Contractors and Dealers, which was held at Milwaukee on July 16 to 18, was the large amount of work that has been accomplished by the association during the past year and which has been developed to a point where it can be put into effect during the ensuing year. Although the association has been organized for many years, several radical organization changes were made in it during the past two years, the development of which was greatly restricted by the prevailing conditions during the war. However, since the armistice was signed the association has been actively engaged along many lines for the benefit of its membership and the amount of work which it has accomplished is truly remarkable.

The energy and enthusiasm of the members present was evidenced by the lively discussions which took place after each address during the opening sessions and which it is seemed would take place during the remainder of the convention. Over 400 members registered from all parts of the country and, in addition, there were a very large number of representatives of electrical manufacturers, supply jobbers and other electrical interests present who took an active part in the proceedings.

The meeting was opened by P. C. Burrill of the Herman Andrae Co., of Milwaukee, chairman of the Wisconsin State Association of Electrical Contractors and Dealers. In his address Mr. Burrill described the industrial conditions which exist in this country at the present time and which create a great demand for the services of the electrical contractor-dealer. The contractor, however, must do his best to serve the public if he is to reap the benefits of this opportunity.

Mr. Burrill then turned the chair over to W. Creighton Peet, of New York City, chairman of the National Association, who introduced Cornelius Corcoran, acting mayor of Milwaukee. Mr. Corcoran in his welcoming address to the assembled members dwelt upon the features of that city and also upon the patriotism which its citizens had demonstrated during the war. He urged those present as business men to take a more active part in the political affairs of their communities and stated that this was the best means of improving local conditions.

Mr. Peet, in reply to Mr. Corcoran's address, described the work which has been done and which is being done by the National Association. Among the principal features of this work is the Bureau of Education and Research, which has now been fully worked out and which will be put into operation in a very short time. Another feature is an agreement which has been practically completed with the Morris Plan Banks through which the members of the association can secure the necessary financial aid to enable them to sell appliances and wiring on part-payment plans. In addition, the Architects' Committee, the Code Committee and the Insurance Committee have also been particularly active.

During the past year, Mr. Peet stated, the membership of the National Association has been increased 35%, which is the largest increase ever made in one year by the association. This was accomplished in spite of the very unsatisfactory conditions that existed in construction work during this time. However, in order for the association to accomplish the best results it is very desirable not alone that this increase be maintained for the next year, but that a much more rapid increase be made. Mr. Peet also urged the members to read their electrical trade journals more fully and explained that it is only by such means that the electrical contractor-dealer can keep up with the times. In closing, he requested the members to lend their support, and when called upon to perform any services by them they should do so willingly and to the best of their ability.

Franz Nielsen, attorney for the National Association, then spoke on co-operation in business. Mr. Nielsen was at a decided disadvantage on account of having had practically no notice that he was going to talk. His address, however, proved to be very interesting and brought out a number of points on the co-operation idea which should prove of value to the members. He described the growth of the co-operation idea in business and the remarkable position which it holds in the business world today. He also pointed out the fact that without the earnest support of its members no association can succeed and urged the members not to wait until called upon to assist in the conduct of the association's work but to come forward of their own volition and offer their services.

The first speaker at the afternoon session was Frank Stockdale, of Chicago, who spoke on "Keeping Up with the Rising Costs," with particular reference to merchandising. He explained that a large number of merchants do not give the proper consideration to profit and for this reason a large number of them fail. In his opinion the electrical contractor-dealer up to the present time had just been nibbling around the edges of the possible total amount of business. One of the reasons for this is the fact that the electrical dealer has entered the merchandising field from the mechanical side. While this fact unquestionably gives him a better knowledge of the goods that he handles, it does not materially assist him to become a successful merchant. He pointed out that the electrical contractor-dealer's problems cannot be solved by deciding what the other fellow should do but by what they do themselves. The successful merchant, he stated, should be a buyer, seller (which includes displaying, advertising and personal salesmanship), accountant, the manager of his store and its people. It is a difficult matter for one man to be successful in the first two qualifications especially, since their requirements conflict somewhat.

Merchandise, he stated, should be bought in cold blood and sold with enthusiasm. Too often the opposite conditions prevail and the merchant buys material without giving a thought as to how he is going to get rid of it. He pointed out the advantage which the electrical dealer has over other dealers in displaying his wares. Electrical merchandise from its nature contains the three fundamental attributes of good window displays—color, novelty and action. In spite of this, the average electrical contractor-dealer's show windows are not very attractive. The show window, he explained, is the face of the store and from it the public gets its impression of the store and the merchant. For this reason the merchant should try to keep his show windows as clean and attractive as possible.

He also spoke of the new accounting system which has been developed by the association and stated that in his opinion it was one of the best and simplest he had ever seen. He also briefly explained the cardinal principles of this system. In closing, he pointed out that a merchant gets paid exactly for the kind of work done and if he allows himself to be wrapped up in the details of his business he will never get very far. At the close of Mr. Stockdale's address a lively discussion ensued, during which several interesting facts relative to electrical merchandising were clearly brought out.

Albert Uhl, of Chicago, president of the Chicago Electrical Estimators' Association, then explained the new estimating forms which have been developed by this association. These forms provide a method of figuring an estimate and keeping record of it in an accurate and convenient form. Mr. Uhl's talk was suitably illustrated with lantern slides. E. L. Morley, treasurer of the same association, then described its overhead cost curve, which was described in a previous issue of the ELECTRICAL REVIEW, and a new set of electrical symbols which has been developed by the Chicago Electrical Estimators' Association for use on building plans. The value of the work which has been done by this association and the interest which the members who were present took in it was probably best evidenced by the discussion which followed Messrs. Uhl's and Morley's addresses.

A full report of the remaining proceedings of the association's convention will be given in our next issue.

OHIO ELECTRIC LIGHT ASSOCIATION HOLDS BIGGEST CONVENTION.

Twenty-fifth Annual Meeting, July 15 to 18, the Most Important Held by Organization—Many Vital Problems Discussed.

The twenty-fifth or silver anniversary convention of the Ohio Electric Iight Association, which was held at the Breakers Hotel, Cedar Point, Ohio, on Tuesday to Friday of this week, was declared by all to be the largest gathering in the history of the association. The initial registration was about 550. All of the meetings were largely attended and keen interest was taken in all of the papers, reports and addresses presented; this was shown by the active discussion which followed nearly every topic as it was presented.

The first session on Tuesday morning was opened by the presidential address of I. L. Oppenheimer, of Pomeroy, Ohio, who reviewed the activities of the association during the past year and spoke of the many lines in which substantial headway had been achieved by its various committees. He then took up a discussion of present conditions and problems. One of the needs of the association is increased membership among engineers and companies and he strongly advocated a membership campaign along these lines. The present membership of about 140 companies represents an investment of $20,000,000 in round figures. In conclusion, Mr. Oppenheimer spoke of the numerous benefits of membership in the association.

Following the presentation of the report of the Executive Committee, and of Secretary-treasurer Gaskill and appointment of several committees, there was a round table discussion on the association's work.

The second session opened on Tuesday afternoon with the report of the Station Operating Committee, which was followed by a paper entitled "Daily Unit Data and Cost Systems," by J. M. Strike, of the Acme Power Co., Toledo. A spirited discussion followed in which R. G. Sloat, C. W. DeForest, H. W. Bromley, Wm. Long, H. B. Dates, W. L. Wallau and R. N. Clarkson participated. It was pointed out by several speakers that station records are primarily for attaining economy; therefore, they must be accurate, complete and accessible. It is not so much the form of the records as what they typify that spells their value.

On Wednesday morning the third session opened with the presentation of the report of the New Business Co-operations Committee, submitted by W. H. Matthieu. This outlined the valuable work carried on by the committee at its various sessions in different parts of the state in the face of numerous difficulties. The report covered, among other things, electric welding, the new Ohio State industrial lighting code now in tentative form, refrigeration, industrial electric heating, etc.

Prof. F. C. Caldwell, Ohio State University, discussed the Ohio factory lighting code and urged its importance not only from the standpoint of safety, but of increased production. The requirements of the lighting code must be made known by the central stations acting as a publicity medium. Professor Caldwell explained the present status of the code as not being mandatory but suggestive. Based on the experience obtained in its application, it is expected to make such revision as may be necessary and then make the code compulsory in about two years. He referred to opposition to the code by certain parties, especially in the steel industry, who fear heavy expense in putting it into effect; this is due chiefly to misunderstanding the objects and requirements of the code. He spoke of the educational work undertaken by the Ohio Electric Light Association, the State University and the central stations in teaching the scope of the code and its purpose. Numerous public hearings were held before the code was formulated. Such hearings before formulation of laws have resulted in giving us better and fewer laws than if the laws are first passed and enforcement immediately attempted. In conclusion, he asked for criticisms of the code and for support and publicity of it by the association as a whole as well as by its individual members.

L. G. White, electrical engineer of the Ohio Public Service Commission, in a few words urged more carefully prepared rate schedules for central stations. A uniform rate schedule is needed; this should be drawn up on a rational basis. He cited examples of inconsistent and improper rates and said that the association is the right organization to take up the matter of standardized rate schedules and discussion of the fundamentals of rate-making. I. L. Oppenheimer also pointed out the vital importance of rates to all utilities, since both company and customer are alike affected.

William McClellan, vice-president of the Cleveland Electric Illuminating Co., made an address on the problems of the days. Local problems have largely been overshadowed by the universal problems of the war, yet an important local problem is the working out of the social upheaval created as the result of the new conditions during and following the war. He said we must all keep our feet on the ground. No real progress is made by revolution but by evolution. It is not what one spends but what one saves that is important. He emphasized the value as a citizen of the property owner, whether of land, home or Liberty bonds. The property owner is a better citizen and not so susceptible to radical social doctrines. He advocated extensive ownership by the public of utility stocks as probably the best means to stop the movement for municipal ownrship. The thrift movement is likely to result in a large part of the public investing in utility securities.

At the fourth session on Wednesday afternoon Col. Ralph D. Cole, Columbus, O., made an intensely interesting address, reciting some of his war experiences. The report of the Meter Committee was presented and discussed. The fifth session was held on Wednesday evening and consisted of a lecture and demonstration by William A. Durgin, Commonwealth Edison Co., Chicago. This dealt chiefly with the productive value of modern industrial illumination. He pointed out its numerous advantages and how readily these may be attained. This lecture was very largely attended by ladies as well as men, about 100 lighting salesmen from Toledo, Cleveland and other nearby cities coming especially to hear it. Mr. Durgin's lecture was followed by the exhibitors' carnival and by a display of moving pictures.

A feature of the convention was the extensive displays made by exhibitors, the exhibition being larger than any ever held at a state convention, it was declared. A report of the sessions on Thursday and Friday will be given in our next issue.

TRACITON LINES NEED A BILLION DOLLARS YEARLY TO MEET DEMANDS.

Interesting Facts Brought Out by Experts in Hearings Before Federal Electric Railways Commission at Washington, D. C.

The problems of the street railways of the United States, which assume a graver aspect from day to day, are being given careful consideration in hearings before the Federal Electrical Railways Commission, created by President Wilson to make a nation-wide study and report means for restoring street railway credit. Experts in this branch of public utility service are at Washington, D. C., appearing before the commission to present the case of the street railways. The testimony of these men bear out some interesting facts on the situation. It was the opinion of W. G. Bradlee, president of the Stone & Webster Management Corporation of Boston, that the traction lines of the country require about $1,000,000,000 each year to meet adequately the demands of the public. He declared that $600,000,000 to $7,000,000,000 new capital was added annually for extensions and improvements, and probably $350,000,000 for refunding of outstanding obligations, and that little has been done in the way of improvements in the last four years owing to unusual conditions. "There are only two ways to obtain this money," Mr. Bradlee said, "either through municipal ownership or through the establishment of some plan so that the private investor will feel that he can count on a reasonable return if he invests in street railway securities."

Guy E. Tripp, chairman of the board of directors, Westinghouse Electric & Manufacturing Co., and chairman of the committee of 100 representing the American Electric Railway Association, in his testimony predicted that many of the larger electric lines would be in bankruptcy before the commission completes its hearings. Mr. Tripp told the commission he believed the fairest method for calculating earnings would be to take the issues of securities, determine whether the money they produced was put in the properties, extract any "water," and use the result. Questioned by members of the commission, Mr. Tripp said great fortunes had been made by street railway corporations in the past, but not through revenues from fares. A return was never paid on a 5-cent fare, he said, but "hopes were capitalized and hopes were sold." He blamed stock watering, high costs of labor and materials, and the present methods of dealing between traction companies and cities for the difficulties of many companies. He said the nickel fare should be made 10 cents and predicted that while the inquiry goes on many companies will go into bankruptcy.

Bentley W. Warren, counsel for the corporation represented by Mr. Bradlee, read a letter from Edward N. Hurley, who was chairman of the United tates Shipping Board, who declared the war showed that adequate and efficient street railway facilities are as essential to cities as transcontinental lines are to the country at large. "They should," declared Mr. Hurley in his letter, "be fostered and safeguarded accordingly. It appears to me that there is only one remedy, and that is authority to increase the fares."

Mr. Bradlee said his company had experimented with gasoline busses and that none of them paid. Asked about Henry Ford's idea that he could solve the street railway problem with a gas car, Mr. Bradlee said Mr. Ford had "an idea and not a car."

DEVELOPMENT OF CENTRAL-STATION SERVICE FOR NEWSPAPERS.

Practically All the Big New York Dailies Are Customers of the New York Edison Company's Service.

The contemplated moving of the *New York Sun*, one of the country's best-known newspapers, to its new and larger quarters in the old Stewart Building, at Broadway and Chambers street, New York City, has brought to light some interesting electrical data. *The Sun* was one of the earliest converts to central-station service among the metropolitan journals, having closed down its own generating plant in 1898, in favor of electric supply from the New York Edison Co. By this act, *The Sun* became the largest customer on the Edison mains and detailed tests were made of its supply and service.

Thus, records show that the lamps used averaged 13.7 cp., with a consumption of 4.11 watts per cp. With the improved types of lamps now available, *The Sun* will have a consumption of only about 1 watt per cp., thus obtaining a 400% increase of lighting efficiency during the 21 years of central-station service. In 1898, when *The Sun* abandoned its own lighting plant, the Edison wholesale rate then in effect had a maximum price of 10 cents per kw-hr., with discounts depending on consumption and use, giving possible minimum of 5 cents per kw-hr. for light and 4 cents per hp-hr. for power. With the increased lighting efficiency now available, and the lowered Edison rates since 1898, *The Sun* now gets eight times as much light for every dollar expended as it did 21 years ago.

That *The Sun* became a genuine advocate of central-station service for newspaper use has been twice proved, for when the paper moved in 1915 to the American Tract Society Building, the plant then existing there was also abandoned, and Edison service contracted for. Anticipating the coming move to still larger quarters, Edison service has been adopted for the third time. Additional equipment has been ordered, including new electric melting pots for the linotype machines, while the hydraulic elevators in the Stewart Building will be electrified.

From the standpoint of the central station, it is interesting to note that all but two of New York's big newspapers are customers of the New York Edison Co., the list of journalistic users including the *New York Times, World* (morning and evening), *Sun* (morning and evening), *Globe, Mail, Evening Post, American* and *Journal*. The *Herald* and *Tribune* buildings still maintain isolated plants, but electric supply for the newspapers concerned is protected by large "breakdown" contracts with the New York Edison Co.

FEDERAL TRADE COMMISSION URGES FIXING OF RESALE PRICES.

Recommends Congress to Pass Enabling Act on Resale Prices, Subject to Review by Disinterested Body.

The Federal Trade Commission in a special report to Congress has renewed its recommendation made last December that manufacturers be permitted by law to fix and maintain resale prices, subject to review by a disinterested agency.

The Commission says that such a law would remove present complexity in the business world, promote the efficiency of manufacturing and commercial institutions and serve the interest of the consuming public.

Under this recommendation, manufacturers desiring to fix and maintain resale prices would file with an agency to be designated by Congress, descriptions of their articles, contracts of sale, and the price schedules to be maintained. The disinterested agency would be charged with the duty, "upon complaint of any dealer or consumer or other party at interest," to review the terms of contracts and prices.

The Commission's recommendations, it stated, were based on the following conclusions:

(1) That producers of identified goods should be protected in their intangible property right or good will, created through years of fair dealing and of sustained quality of merchandise.

(2) That the unlimited power both to fix and to enforce and maintain resale prices may not be made lawful with safety; and

(3) That unrestrained price-cutting is not in the public interest, and tends, in the long run, to impair, if not destroy, the production and distribution of articles desirable to the public.

"There must be a common ground," the Commission said, "wherein the rights of producer, purveyor and consumer may each be fully secured and equity done to all. The search for such a ground has been a task of the Commission."

NEW YORK SURFACE LINES TO CHARGE FOR TRANSFERS.

Two-Cent Charge Permitted at 99 Transfer Points for Period of a Year.

Public Service Commissioner Lewis Nixon, of New York City, has issued an order permitting Job E. Hedges, receiver of the New York Railways Co., which operates certain surface lines, to charge two cents for transfers at 99 of the 113 transfer points throughout the city. The order, which is in the nature of a compromise between that demanded by the receiver and the wishes of the municipality, is intended to provide only temporary relief to the surface lines since it will expire on July 7, 1920, one year from the date of issuance. Limitation of the effectiveness of the order to only 99 transfer points was made necessary by the fact that the franchises under the provisions of which the street railways operate specify free transfers at 14 street intersections. The receiver requested permission to charge three cents for transfers, but the municipal officials contended that the necessity for any charge has not been shown.

Commissioner Nixon stated that if at the end of six months the city is not satisfied with the apprasial of the receiver, it is authorized to apply to have this proceeding reopened. The order was made upon condition that the lines of the company are not disintegrated.

AIMS AND ACTIVITIES OF ASSOCIATED GENERAL CONTRACTORS.

First Issue of Members' Monthly News Letter Being Distributed—Association Active in Legislative Work.

The first monthly edition of the Members' News Letter published by the Associated General Contractors of America is now being distributed. The publication contains a brief outline of the organization, its purposes and activities. The association is composed of general contractors, either individuals, firms or corporations, who have been for at least two years in general contracting and who have established a reputation for skill, honesty and responsibility. They must also undertake work in its entirety, partly at least with their own constructing forces.

The objects of the association are to promote better relations between private owners and public bodies, their architects or engineers on the one hand, and contractors on the other; to maintain high professional standards in the conduct of work; to combat unfair practices; to encourage efficiency among contractors; to support contractors and contractors' associations in efforts to rectify conditions of an unsatisfactory character; to encourage those methods of contracting for work which relieve the contractor of improper risks, and to encourage sound business methods tending to raise the standing of contractors generally in the business world.

The association has been actively engaged in legislative work on bills that affect construction activities and has succeeded in having several very satisfactory measures brought up principally with regard to war work. Several committees have been appointed to investigate and report on subjects of interest to contractors and field secretaries have been established in Chicago, New York, Atlanta, Washington, St. Paul, etc., as the first step in establishing closer contacts with its widening membership. It has also undertaken to develop a stand and rental charge on equipment used in construction work and to establish contract forms. In regard to the latter topic, it proposes to make a careful study of existing forms of every kind and in co-operation with the engineers and architects to eliminate unfair practices and to establish clear, definite, and equitable clauses in contracts.

D. A. Garber, North-Eastern Construction Co. of New York City, is president of the association and its headquarters are at 111 West Washington street, Chicago.

ELECTRIC CLUB OF CHICAGO TO HAVE BIG OUTING.

Eleventh Annual Basket Outing at Ravinia Park—Athletic Events, Music and Other Attractions.

Following its annual custom, the Electric Club of Chicago will have an all-day outing at Ravinia Park, about 20 miles north of Chicago, on August 21. As usual, a very large number of prizes have been donated by electrical firms of Chicago and these will be awarded for a great variety of races and other athletic contests for the children as well as adults and also for certain guessing contests for those not in condition to engage in strenuous athletic effort.

The committee in charge of the outing announces that for those electrical men who are unable to attend the outing personally special arrangements will be made to take care of their families so that they may be represented. The tickets to the outing will also permit members and their families and friends to stay for the grand opera performance in the evening, if they so desire, this being a regular feature of the evening programs that has made Ravinia Park noted in the Chicago district.

REFUSE COLLECTION BY ELECTRIC TRUCKS FOUND ECONOMICAL.

Experience of City of Sheffield, England, Very Satisfactory—Plans to Use More Electrics.

J. A. Priestley, cleansing superintendent of Sheffield, England, has prepared an improved scheme for collecting and disposing of house refuse, which will require four additional motor vehicles or 12 horses and wagons. According to the *London Electrician,* he states that the experience of the past four years with electric vehicles has been eminently satisfactory, and has demonstrated that the work can be done by their agency more expeditiously and economically than by horse labor. For house-to-house collection work the electric vehicle cannot be approached by gasoline motors. Steam wagons approach more nearly to the electrics in suitability and economy, but the latter possesses advantages in noiselessness and ease of maneuvering that are not shared by steam wagons, and require also the services of one man only to drive them, and that not necessarily a skilled man. The total weight of refuse collected in the city during the past year was 110,855 tons, an average of 2131 tons per week; but, as the amount varies as between summer and winter, the maximum amount to be collected during the heaviest period of the year is about 2600 tons weekly.

To collect this quantity of refuse by electric vehicles will require about 60 electrics, or, allowing a 10% margin to cover breakdowns, 66 vehicles would be necessary. The city has at present 12 vehicles in use and three on order, and the full program would therefore require the provision of 51 additional machines. For charging the batteries of this number of vehicles three 100-kw. motor-generators would be required, in addition to present charging facilities, and, as a stand-by machine is imperative, four generators of this capacity should be provided. Charging panels, switchboards, measuring instruments, etc., would also be required in proportion to the vehicles, and the total cost of the equipment would be about $500,000.

GENERAL ELECTRIC'S CONTROL OF TRUMBULL COMPANY CONFIRMED.

Trumbull Electric Manufacturing Co. to Retain Name and Management Though Controlled by General Electric Co.

The statement in our issue of last week respecting the acquirement of controlling interest in the Trumbull Electric Manufacturing Co. has been confirmed by the following official announcement:

"The General Electric Co. has acquired an interest in the Trumbull Electric Manufacturing Co., of Plainville, Conn. The present management of the Trumbull Electric Manufacturing Co. still retains a financial interest in the company and will continue in active charge of its manufacturing and selling policy.

"The Trumbull Electric Manufacturing Co. has an enviable reputation, national in its scope, as large manufacturer of knife switches and safety-first iron-box enclosed switches, as well as a general line of miscellaneous supplies, and the General Electric Co.. believing in the great future of the safety-first movement, feels that an alliance between these two leading manufacturers of goods designed to promote the safety-first feature in service-entrance switches, motor-control devices, etc., will give considerable satisfaction not only to the present customers of the Trumbull company, whose name will remain unchanged, but to the trade in general."

AERIAL MAIL DELIVERY OF LAMPS STARTED BY EDISON LAMP WORKS.

New Mazda C-4 Lamp Shipped Safely About 500 Miles Within Twelve Hours.

Tuesday, July 8, marked the new day in the transportation of lamps from manufacturers to distributors. On that day, the Edison Lamp Works of General Electric Co., Harrison, N. J., delivered to the Republic Electric Co., Cleveland, Ohio, one of the new Mazda C-4 tipless lamps, via aerial mail service.

The regular mail plane left Belmont Park, New York, at 5 a. m., arriving in Cleveland about noon, and the lamp was delivered to Louis Griesser, president of the Republic Electric Co., in good condition, through the regular post office channels.

The transportation department of the Edison Lamp Works announces that it is now ready, in cases of emergency, to make delivery of lamps by airplane in all sections of the country covered by the Government aerial mail service.

It is expected that Heller Field at Newark, the largest Government landing field for aerial mail service in the East, will be ready for use shortly, and this will make for even quicker service.

Packages shipped by aerial mail are limited to 30 in. in length and girth.

NEW SUBWAY LINK OPENED IN NEW YORK CITY.

Train service on the new extension of the Brooklyn Rapid Transit subway between Times Square and Fifty-seventh street in New York City was initiated at midnight on July 3. The extension of the service to Fifty-seventh street is the addition of another link in the line from Coney Island through Brooklyn to lower Manhattan, and along Broadway and Seventh avenues to Central Park, then east to Long Island through the Sixtieth street tunnel under the East River. Local train service will be maintained north of Times Square. Express service will be maintained between Times Square, Manhattan, and Pacific street, Brooklyn.

The service is expected to be extended to Sixtieth street and Lexington avenue before September 1, and through the Sixtieth street tunnel to Queensborough Plaza soon after January 1. Track laying in the tunnel section of the line, which was started about July 1, is expected to be completed in about four months.

AMERICAN INSTITUTE OF MINING AND METALLURGICAL ENGINEERS.

From a technical point of view, the Chicago meeting of this Institute, Sept. 22 to 26, inclusive, promises to be one of the most interesting in its history. The wealth of material in the line of technical papers for discussion is greater than has been offered for any previous meeting; upwards of 150 papers have been submitted to the committee, which finds it no small task to arrange a program to present this number with a minimum of conflicts among papers on allied subjects.

One of the excursions to be made by the Institute as a body during this meeting is to the LaSalle district. A special train leaving Chicago early Thursday morning will take the members and guests to LaSalle, Ill, where automobiles will convey the different parties to the coal mines, cement works and zinc smelters; for the ladies and others of the party not particularly interested in these industrial operations, the LaSalle hosts plan an automobile trip to Starved Rock and nearby points of scenic and historic interest.

BROOKLYN TRANSIT RECEIVERSHIP COVERS SURFACE LINES ALSO.

The Brooklyn Rapid Transit receivership was extended on July 14 by Federal Judge Julius M. Meyer so as to place Lindley M. Garrison, the receiver, also in charge of the surface railways in Brooklyn. Previously only the Brooklyn Rapid Transit Co. and the elevated and subway lines of that system were included in the receivership. The extension was made to cover the Brooklyn Heights Railroad Co., the Nassau Electric Railroad Co., the Brooklyn, Queens County & Suburban Railroad Co., and the Coney Island & Brooklyn Railroad Co., which, through leases, virtually control all Brooklyn Rapid Transit lines to Brooklyn.

PUBLIC SERVICE RAILWAY EMPLOYES GRANTED INCREASE.

The employes of the Public Service Corporation of New Jersey that operates the street-railway systems in Jersey City, New Brunswick, Edgewater, Paterson, and other nearby municipalities have accepted the award of the War Labor Board granting increases in wages. The men demanded 65 cents an hour and an eight-hour day, but were granted ten hours' pay for nine hours' work. The award amounts to about 55 cents an hour, an advance of 5 cents. The decision made the pay retroactive to May 1 and directs the corporation to pay about $30 to each of its 4500 employes.

LORAIN INAUGURATES BUILDING CAMPAIGN.

With 200 houses under construction, a campaign has started in Lorain, O., which has as its slogan: "A Thousand Homes This Summer." Houses are being rented before the ground is broken.

J. B. Johnson, general manager of the Lorain County Electric Co., a Doherty property, reports that building activity is also going on in Elyria at a rapid rate. Over eighty homes are under construction there and permits recently have been issued at the rate of ten a day.

COPPER SUBSTITUTES FORBIDDEN FOR ELECTRICAL WORK IN NORWAY.

The shortage of copper, from which all Norway, but especially the electrical works of that country, has suffered through war conditions, no longer exists. America is now in position to deliver the whole of the metal purchased long ago on Norwegian account. In consequence of this, the electrical works at Christiania have forbidden the continued use of zinc and iron as electrical material. From July 1, 1919, only copper is to be used for electrical purposes. The imports from America will include large quantities of line wire.

SMELTER PRODUCTION OF COPPER DURING THE YEAR 1918.

The smelter production of primary copper in the United States during 1918 was 1,908,500,000 pounds, which, if compared with the production in 1917, 1,886,000,000 pounds, shows an increase of 1.17%. The total value of the output in 1918, at an average price of 24.7 cents a pound, is $471,408,000, against $514,911,000 for 1917.

ELABORATE PLANS MADE FOR BRITISH PEACE ILLUMINATION.

The British Electrical Development Association held a meeting in London on July 1 to consider the following points: (1) Provision of lamps for peace illuminations; (2) provision of strip devices and other material; (3) rates to be charged by electricity supply undertakings; (4) provision of additional or heavier service connections where required.

Commercial Practice

Rapid Increase in Power Load—Electrics Meet Favor in Delivery Work—Employes' School of Dayton Central Station

PUBLIC SERVICE COMPANY INCREASES LOAD BY 9809 HP. IN FIVE MONTHS.

Large Increase in Load Contracted for by Public Service Co. of Northern Illinois.

New electric power business contracted by the Public Service Co. of Northern Illinois in the period between Jan. 1 and May 31 this year amounted in the aggregate to 9809 hp. In the same period of 1918 the total was 4398 hp. and in 1917, 5900 hp. Thus the total of each of the previous years' first five months' business was greatly exceeded. Considerably more than half the power load which it was calculated should be secured in 1919 was entered up in contract form in these five months. In detail the figures which represent 382 contracts are as follows:

Jan. 1 to May 31, 1919.

Division.	Hp.	1919 Allotment, Hp.
A	3301.3	3000
C	354.2	2000
D	1066.5	3000
E	109.2	500
F	3176.2	3000
J	1109.9	3000
K	231.0	1000
L	114.0	250
O	95.1	100
R	135.1	150
S	117.3	1000
Total	9809.8	17000

Numbers of the contracts made were for large amounts of energy, some of them providing for big installations with exceedingly heavy connected loads. It is interesting to note that of the total figures shown in the list, 95 hp. represents the demand made by electric ranges installed. Not appearing in the table of new business there were also renewals of contracts for the same purpose reaching 309 hp.

In the month of June the company kept up its stride and landed new customers whose power requirements reached upwards of 1500 hp. Among these is the Construction Materials Co. at Waukegan for about 600 hp. in which installation a 500-hp. motor will be put in service. The Armour Fertilizing Works at Chicago Heights were connected up for 700 hp. to be employed in uses requiring a number of different sized motors. Other contracts included one for 75 hp. with R. F. Conway & Co. at La Grange, and one with the Oak Park Baking Co. at River Forest for 82 hp. additional.

ELECTRIC TRUCKS IN DEPARTMENT STORE WORK.

Gimbel Brothers, New York, Augment Their Electric Vehicle Fleet.

Gimbel Brothers opened their New York department store in 1910. At that time they purchased a fleet of 88 electric trucks. In 1918, after eight years' use of electric transportation, they purchased 11 additional electric commercial vehicles, and in the early part of 1919 further augmented their fleet by 9 additional electric trucks.

The nationally known department store business of Gimbel Brothers has been served adequately by electric transportation for a period of approximately ten years—long enough for a comprehensive trial. The best proof that the electric truck has made good is the repeat orders by this concern whose success in business is largely dependent on efficient, economic, dependable transportation—the sort rendered by electric trucks.

The electric commercial vehicle is the standard mode of transportation as employed extensively by many of the great department stores in this country and abroad. For example, Marshall Field & Co., Chicago, Ill., uses 264 electric trucks, while Harrods, Ltd., London, England, employs 72. Space does not permit a complete list of department stores using large electric vehicle fleets, but the above may be taken as indicative. The "electric" has proven, by long experience, that it is the ideal truck for such frequent-stop transportation service.

PITTSBURGH NEWSPAPER ADOPTS BIG ELECTRIC SIGN.

Sixty-four Thousand Candlepower Sign Lights Up Newspaper Office.

A large electric sign has been installed upon the roof of the Highland Building, Pittsburgh, Pa., by the Duquesne Light Co. The sign advertises two of Pittsburgh's daily newspapers, namely, the *Morning Gazette Times* and the *Evening Chronicle Telegraph.*

The sign, which is illuminated on three sides, is rated at 64,000 cp., and contains 3200 25-watt lamps which consume 80,000 watts per hour, or 150,000,000 watts per annum. Each letter is 10 ft. in height. The Highland Building is the tallest structure in the East End section of Pittsburgh. The illumination from this sign improves the lighting of the streets for several blocks and can be seen for a radius of 10 miles. Energy for lighting is furnished by the Duquesne Light Co.

ENERGY CONSUMPTION INCREASES TWICE AS FAST AS POPULATION.

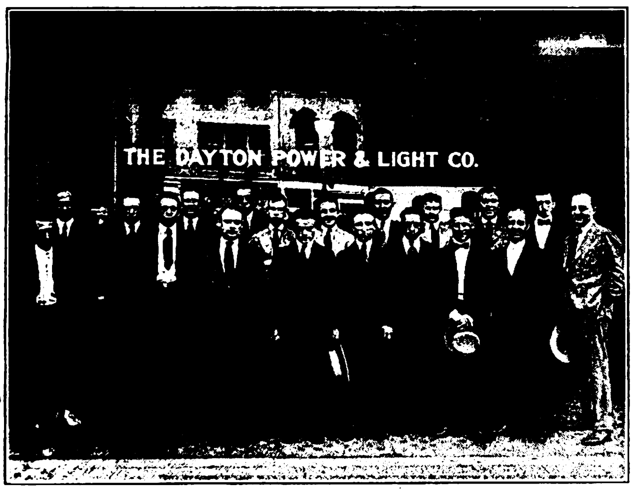
In his presidential address to the Pacific Coast Section of the National Electric Light Association at its recent convention in California, Samuel Kahn, vice-president of the Western States Gas & Electric Co., said:

"Not long ago a statistician compiled figures to indicate that the number of kilowatt-hours of electricity used increases more rapidly than the square of the population; in other words, if the population is doubled the energy consumption is more than quadrupled. Therefore, if the population of the Pacific Coast doubles within the next ten years, the use of electricity will be four or five times as much as at present. Figures recently published by the Bureau of the Census, Department of Commerce, indicate that the central stations of California during the year 1917 generated 2,746,000,000 kw-hr. of electrical energy as against 661,000,000 kw-hr. in 1907, an increase of 315%.

"These figures bear out the statement regarding the consumption of electrical energy and should be instilled in the minds of every thinking man and woman, for they must come to realize that the solution and responsibility of furnishing this energy rests with men trained to that particular industry, as they are in position to render that service, taking all factors into consideration, at less cost than a governmental agency."

ELECTRICAL SCHOOL OF DAYTON POWER & LIGHT COMPANY OPENED.

The co-operative school of the Dayton (O.) Power & Light Co. opened July 1 with 18 high-school graduates in the class. They will be given a thorough course in electricity and then later trained in the different branches of the company to which they seem most adapted. Some will enter the sales department, where a thorough course of salesmanship will be given them. The others will take a finished course in meter construction, testing, etc. This school is open to any high-school graduate and he is paid 30 cents an hour while attending the school and will later be placed in



Student Class of Dayton Power & Light Co.

some department of the company and his advancement is assured. This school was found to be absolutely necessary by O. B. Reemelin, general superintendent of the company, on account of the rapid growth of the company and because of the shortage during the past two years of young men owing to the war. Those finishing the course and passing an examination will be able to take a position in the department to which they show adaptability that would otherwise require a year or more time in the regular way of working. The Dayton Power & Light Co. is supplying service to some 46 communities such as Dayton, Piqua, Xenia, Wilmington, Jamestown and Germantown. It is operating three city car lines in Dayton and one suburban line, also 85% of available factory business in Dayton and other cities it serves.

During the war the Dayton Power & Light Co. supplied all the power used in the manufacture of war munition. It also is supplying power for all the Conservancy work, going so far as to operate the motors on the dredges at present engaged in straightening the Great Miami river.

UTILITY COMPANIES RESPONSIBLE FOR MOST OF OUR COMFORT.

Paul Tomlinson in *McClure's Magazine*, says:

"We have the public service corporations and the public utilities companies to thank for supplying us with most of the things which make our lives so comfortable. When we press the button which controls the electric lighting in our homes do we stop to think that at the heart and center of the maze of wires, over which runs the current responsible for our light, there is a great power house? That this same plant perhaps is sending out the power which carries us along so swiftly in subway trains or electric cars? That this power plant is the basis of a great industry, the result of modern science, industry and engineering skill? It may be that a great river has been harnessed and Nature made to work for us. Who knows the imagination, courage, and labor which have made it possible for us to live and travel about in comfort and convenience?"

SPARE-TIME SALES STIMULATE APPLIANCE BUSINESS.

The experiment tried out by the Public Service Co. of Northern Illinois some time ago, of giving commissions for appliance sales made by employes during spare time, has proved very successful. The offer applies only to employes outside of the sales department and the result has been not only increased sales of all kinds of appliances but greater interest on the part of all employes in the development of new business. Many leads are furnished the regular sales force by employes who heretofore paid little or no attention to company business outside of office hours.

As an indication of the direct results of the plan, four employes sold appliances valued at practically $6000 during the 6 months ended July 1, all sales being made during spare hours.

WHAT THE ELECTRIC STEEL FURNACE MEANS TO CENTRAL STATIONS.

The war brought forcibly to the fore the value of the electric furnace for steel making and refining because the demands of war create severe requirements that steel must meet. And steel made electrically meets the conditions imposed.

There are at the present time some 330 electric furnaces for steel production in this country. These furnaces consume about 750,000,000 kw-hr. when operating at capacity and are able to produce about 1,400,000 tons of castings and ingots.

A FAN FOR EVERY SLEEPING ROOM.

Henry L. Doherty has said that he would consider himself a great humanitarian if by his efforts there was an electric fan used in every sleeping room in the country, his idea not entirely being from the standpoint of promoting electricity, but for the promotion of that very inexpensive commodity known as "fresh air."

Operating Practice

Moisture Content of Coal — Cleaning Condensers — Boiler Tests with Powdered Coal — Problem of Neutral Current

VARIATION OF MOISTURE CONTENT OF COAL IN TRANSIT.

Tests Show Variation With Grades of Coal and With Seasons.

In transit between coal mine and power plant or point of consumption, coal is subjected to the influence of the elements. All coal, until treated, contains moisture. Coal in transit contains moisture, and whether the moisture content increases or decreases in transit depends upon several factors, the chief of which are the weather, the time the coal is in transit, the form in which the coal is shipped, and the distance of travel.

Some companies pay for their coal and the freight charges as weighed at the mine, others pay for the coal as weighed by the railroads at the point of delivery. In other instances, of which there are only a few, the coal and the freight charges are paid according to the weight as determined by the central station at its power houses. While this latter is most uncommon, it is the method in vogue with the Commonwealth Edison Co., one of the largest consumers of coal in the central-station industry.

This company has carried on extensive tests to determine the variation in moisture of coal in transit from the mines to its generating stations. A large number of samples were taken at the mine and when delivered, and the moisture content in both instances determined. The accompanying diagram shows the variation of moisture content of several different coals during the different seasons of the year.

The tests extended over a period of some 14 months and have shown that the average moisture content of coal as unloaded at the generating stations during the year varies but little from the moisture content as loaded at the mine. The moisture content does, however, vary with the seasons. For example, samples taken from Sept. 1 to Dec. 31 showed an average increase of moisture content of 0.34%; from Jan. 1 to March 31, an increase of 0.70%; from April 1 to June 30, a 0.12% increase, and from July 1 to Sept. 30 an increase of 0.28%.

A further instance of the changes with the seasons is afforded by comparison of the moisture content of coal unloaded during September and October of two consecutive years, shown in the following:

	Total precipitation.	Moisture in coal.
September of two consecutive years..	3.53	13.7
	2.24	13.0
October of two consecutive years....	0.40	13.4
	3.85	14.1

Coals from different localities behave differently as regards absorption of moisture. It was also found that the amount of moisture retained by saturated screenings depends both upon the relative quantity of fine particles and the nature of the coal.

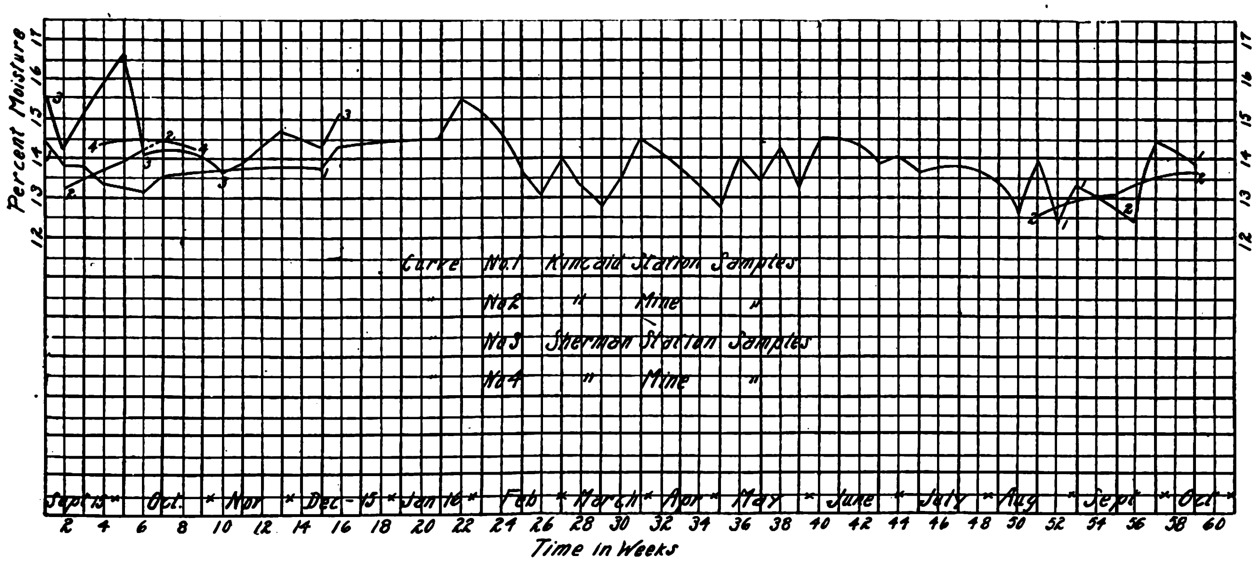
Greater differences were found between coals from northern and southern fields than between samples of the same coal having wide variation in average size.

SAND IN CIRCULATING WATER CLEANS CONDENSER.

Periodic Treatment With Sand Delays Growth of Deposit in Tubes.

The problem of cleaning surface condensers is often a difficult one, because of the large number of tubes requiring cleaning and because of the short time available between the time a machine can be taken out of service and when it must be ready again.

The use of compressed air and sand, compressed



Curve Showing Variation of Moisture Content in Coal With the Seasons.

air and a wad and the wire brush are some of the methods employed for cleaning the inside of tubes. The use of kerosene is also adopted sometimes. All these methods, except that of employing kerosene, necessitate taking the machine out of service and necessitate a somewhat protracted delay.

A method that has been employed with considerable success in some cases is to maintain a gradual cleaning process during operation. This can be done in the following manner. Sand is introduced into the condenser with the cooling or circulating water. About 1.5 cu. yd. of sand per day or thereabouts seems to suffice when this treatment is kept up for about three weeks. The tubes can be kept fairly clean in this way without the condenser being taken out of service. Such treatment might enable higher vacua to be maintained during the summer months and at other times where capacity does not permit of units being taken out of service for cleaning.

Experience will show the minimum amount of sand required for a given velocity of water through the condenser. More than this should not be used because of the scouring action of sand and its effect of reducing the life of the tubes.

BOILER TESTS WITH PULVERIZED COAL AS FUEL.

Operating Results Obtained on 468-Hp. Boiler Show High Efficiency.

The following report of a test of a 468-hp. water-tube boiler was presented by N. C. Harrison in his paper entitled "Pulverized Coal as a Fuel" read before the June meeting of the A. S. M. E. in Detroit. The installation is noteworthy not only by reason of the high efficiency obtained, but also because of the fact that it has made clear some of the conditions necessary for the successful operation of boilers utilizing powdered fuel.

When the boiler was first put into operation, a number of undesirable conditions resulted. An insufficient air supply caused high-furnace temperatures resulting in fusion of the ash particles and a consequent accumulation of slag between the tubes, on the furnace walls and in the ashpit. The removal of the molten slag presented considerable difficulty. It was also found that the combustion chamber was of insufficient size. High gas velocities resulting from insufficient air in the chamber tended toward destruction of the refractory surfaces of the furnace.

A new furnace was, therefore, designed. The combustion chamber was enlarged and a regulated air supply was provided for by means of a number of auxiliary air openings equipped with dampers. The accumulation of slag in the pit was prevented by raising the point of admission of the fuel into the furnace. As a result the flame path has been raised above the base of the pit, hence particles of ash dropping from the flame are not fused. The ash, therefore, can be drawn from the pit in the form of a powder and small slugs of slag. Analysis has shown that the ash contains practically no carbon.

Having established satisfactory furnace-operating conditions, a series of efficiency and capacity tests were conducted preliminary to proving the contract guarantees. The brickwork was then given a thorough trial by carrying the boiler at a continuous rating of 180% over a period of several days. On August 12 and 13 a final efficiency test, the results of which are given below, was run. The boiler is a three-pass water-tube 468-hp. boiler, equipped with a superheater.

LOG OF TEST OF A PULVERIZED-FUEL-BURNING STATIONARY BOILER.

Make of boiler	Edge Moor
Rated hp.	468
Heating surface, sq. ft.	4,685
Time fired or test started	11:15 a. m. 8/12/18
Time fire out or test finished	11:15 a. m. 8/13/18
Duration of test	24 hr.

	Maximum.	Minimum.	Average.
Temperature of boiler room (deg. F.)	99	85	93.3
Temperature of feedwater	168	135	157.2
Temperature of steam (deg. F.)	477	427	448.7
Barometer in. of mercury	29.35	29.20	29.25
Temperature of flue gases (deg. F.)	515	455	495.3
Average boiler pressure, lb.			167.0
Atmospheric pressure, lb.			14.4
Temperature of steam, deg. F.			373.8
Superheat, deg. F.			74.9
Safety valve set for, lb.			175
Fuel fired per hour, lb.			1,990.6
Total fuel, lb.			47,775
Total water, lb.			393,168
Water apparently evaporated per hour, lb.			16,393.0
Water apparently evaporated per lb. of coal, lb.			8.23
Factor of evaporation			1.1502
Water evaporated from and at 212 deg. F. per lb. of coal, lb.			9.47

	Maximum.	Minimum.	Average.
Corbon dioxide (CO_2), per cent	15.4	12.2	13.85
Oxygen (O), per cent	5.6	3.2	4.38
Carbon monoxide (CO)			None
Fuel used			Bituminous screenings

Fuel analysis	No. 1	No. 2	No. 3	Average
Amount of coal represented by each sample, lb.	19,775	20,000	8,000	.....
Per cent of total	41.3	41.1	16.9	.....
Moisture (per cent)	10.3	11.0	9.7	10.49
Volatile (per cent)	33.81	36.96	38.77	35.96
Fixed carbon (per cent)	50.43	49.13	48.29	49.53
Ash (per cent)	14.36	13.91	12.94	13.93
Sulphur (per cent)	1.90	2.06	2.12	2.04
B.t.u. as received	10,600	10,763	11,263	10,779
B.t.u. dry	11,817	12,093	12,473	12,045

Vacuum in burner, in.	0.000
Vacuum under primary arch, in.	0.000
Vacuum in combustion chamber, in.	0.000
Vacuum in first pass, in.	0.000
Vacuum in second pass, in.	0.0057
Vacuum in breeching, in.	0.09
Feeder speed, r.p.m.	(No. 1), 53.6 (No. 2), 50.7
Coal per rev. of screw, lb.	0.318
Accumulation of slag on tubes	None
Flues blown during test	5 times
Operation of furnace	Very satisfactory
Pulsation	None
Condition of smoke	Light
Heat effect on brick	None
Back lash of flame in burner	None
Pounds of steam per hour from and at 212 deg. F.	18,842.6
Horsepower	546.2
Per cent of rating	116.7
Boiler efficiency, per cent	85.22
Memoranda—Fuel-preparation deduction:[1]	
Coal used in drier, lb.	1.140
Motor operation	449.3 kw-hr.
Coal equivalent at 3 lb. per kw-hr., lb.	1,348
Total deduction, lb.	2,488
Resulting net efficiency, per cent	81.1

[1]No deduction made for stand-by losses in drier.

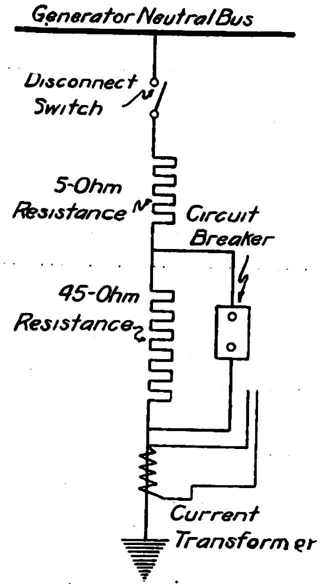
NEUTRAL RESISTANCE REDUCES INDUCTIVE INTERFERENCE.

Reducing Neutral Current by Resistance, Problem of Relay Performance.

By B. M. Smith.

The problem of dealing with inductive interference between heavy current lines and small-current lines, the one for transmitting power and light and the other for telegraph and telephonic messages has received much attention of recent years due to the ramifications of both forms of lines and the frequency with which these lines come into close proximity to one another. Both the A. I. E. E. and the N. E. L. A. as well as a number of public service commissions have taken up the subject of inductive interference. The subject is, therefore, a live one among operating engineers, both central station and telephone and telegraph.

In a recent instance that came to the attention of the writer complaints had been made that a high-voltage power transmission line was causing considerable noise in a telephone line during certain periods. The transmission line paralleled the telephone line, which was an important trunk line, for about 2 miles. This transmission line ties two generating stations together, these two generating stations being on different systems although operating in parallel. The noise in the telephone line was greatest when both stations were running together and the neutral at each station was closed to ground (the generators were star-connected machines, the units being turbogenerators). The noise was much less with the neutral of only one of the stations closed, and a minimum when both neutrals were open.



Layout of Resistors, Circuit Breaker and Disconnect Switch to Reduce Current in Neutral.

Finding the Cause of Inductive Interference.

The high-voltage transmission line consisted in part of aerial conductors and in part of underground cable. The aerial conductors were located in an equilateral triangle, an arrangement that tends to reduce induction and unbalanced static conditions between phases to a minimum.

The inductive interference commenced as soon as the transmission line between the two generating stations was placed in service, which was in the early spring. As it was at first thought the insulators might be the cause (before the effect of varying the neutral circuit at the generator stations was experimented with), these were tested and examined. Spring rains clean insulators and the sun dries them; cracks and broken petticoats on the other hand are weak places that cause leakage, which causes static interference with telephone wires in proximity. All insulators found defective were replaced with no effect upon the noise in the telephone lines.

Experiments with the neutrals of the generators showed that with both neutrals open the noise was a minimum, a maximum when both stations had their neutrals closed and somewhere between these limits when only one of the stations had its neutral closed to earth. It was also found that there was less noise with certain generators operating at each station with their neutrals closed to ground than when other generators were operated in the same way. The larger and more modern units created the least disturbance to the telephone lines. The distribution of load between stations and variation of total load seemed to make little if any difference in the noise induced in the telephone line.

The phenomena immediately suggested that the inductive interference was caused by the interchange of circulating current between the two generating stations, due to differences in wave-form, phase displacement, and, mostly, to the triple-harmonic current that would be short-circuited through the generators when the neutral at each station was closed. The wave-form at both stations was good and it was the consensus of opinion that it was the triple-harmonic that was the cause of the trouble.

Overcoming the Triple Harmonic.

By installing resistance in the neutral circuit it was found that the third-harmonic current could be reduced to such a value as to make the disturbance in the telephone lines almost disappear. Unfortunately the resistance that it was necessary to insert in the neutral circuit was of such a value that overload relays would not function when short circuits occurred in the underground cables between phases and sheath.

A recording ammeter was installed in the neutral to show the variation in circulating current through the earth. Measurements of effective resistance were taken to determine the resistance of the circuit between generating stations that the circulating current followed. It was found that the minimum resistance permissible if the relays were to be depended upon was about 5 ohms. On the other hand to reduce the noise in the telephone circuit to such a value that the telephone company were satisfied it was necessary to insert about 50 ohms in the neutral.

As telephone interference could not be tolerated nor could the idea of foregoing the protection of the overload relays it was decided to adopt a selective action by which the neutral current would be kept to the minimum where the telephone company were not interfered with during normal operation and yet where the neutral current would be able to increase during short circuits to sufficient value to enable the overload relays to function. In other words a resistance of 50 ohms was inserted in circuit during normal operation and so connected that it would be automatically taken out of circuit and leave only resistance of 5 ohms in circuit, when the relays functioned.

The above arrangement is obtained by employing two banks of resistance, namely 5 and 45 ohms respectively. The 45-ohm bank is shunted by a circuit breaker controlled by a current transformer located in the neutral circuit so that all neutral current passes through it. When a short circuit occurs between some phase and ground the current transformer operates to close the circuit breaker, which thereby cuts the high-resistance resistance bank out of circuit so far as affects the resistance of the neutral circuit, hence flow of neutral current. The relays then function because instead of 50 there is only 5 ohms in circuit.

In the diagram a disconnect switch is shown, the purpose of which is to enable the banks of resistance and current transformer to be isolated from the generator neutral bus should it be necessary to work on them. A spark gap may be inserted across the 50-ohm bank, but it plays no part in the reduction of inductive interference with the telephone line, but is used as a precaution to protect the underground high-voltage cable between generating stations, and of generators and station apparatus in case potential rises.

Contracting-Construction

Chicago License Fees to Be Raised—Lighting to Make Bank Building Conspicuous—Electrical Supplies for General Use

PROPOSED CHANGES IN CHICAGO CONTRACTORS' LICENSE LAW.

Ordinance Providing for Increased License Fees Expected to Bring Desirable Results—Inspectors' Salaries Raised.

An ordinance providing for several changes in the existing law governing the licensing of electrical contractors in Chicago was recently approved by a subcommittee of the City Council Judiciary Committee. The new ordinance which was drawn up by the local municipal inspection authorities in co-operation with the fixture manufacturers, contractors, and the local labor organization, is expected to do a great deal toward improving electrical contracting conditions in Chicago.

The principal change in the proposed ordinance is in the licensing fee, which has been considerably increased and divided so that different fees are charged for the various classes of work done. The present law provides for a charge of $25 for the original license with an annual renewal charge of $10. This license covers all classes of work. Considerable difficulty has been encountered due to the fact that this charge was so low that many electricians who were not strictly contractors could well afford to carry such a license, although actually employed as journeymen and do contracting work on the side. This not only made unfair competition for the legitimate contractor but caused trouble with customers, for no means were provided other than a revocation of the license which would force such men to install approved wiring. As a result many people were forced to have their wiring changed or repaired by another contractor after the work was supposedly completed. Furthermore, it is obviously unfair to charge the same license fee for all classes of work.

The new ordinance provided for the following license fees: General license, which enables the holder to do all classes of electrical work, $200, with an annual renewal charge of $50; electrical construction license, which allows the holder to do all kinds of construction work but does not include permission to manufacture or install fixtures, $100, renewal $25; fixture hangers' license, which permits the manufacture and installation of fixtures only, $100, renewal $25; sign license, which allows the erection and wiring of electric signs only, $25, renewal, $10; maintenance license, which allows the holder to make minor changes, repairs or alterations in existing wiring, $25, renewal, $10. The ordinance also provides for a surety bond which the applicant must secure and which insures the customer a proper installation but does not make the city responsible for the work. In addition, an examining board composed of representatives of the various branches of the industry will be established to determine the applicant's ability and responsibility. No license can be procured without the approval of this body.

The new ordinance further provides for changes in the payment of inspection fees. At present the fees are paid only by the electrical contractor, who is charged on a graduated scale per socket, for lights, or per horsepower. The fixture dealer is obliged to take out a permit for the fixture work but does not have to pay any fee.

Under the new ordinance the electrical contractor's fees will be based upon the circuit capacity to which will be added an additional fee for any drop cords, baseboard or wall receptacles that his men may install. The fixture dealer is also required to pay an inspection fee which will be based upon the number of sockets installed. The advantage of this new system is that the electrical contractor is enabled to determine more accurately the amount of his inspection fee when it is determined by the work which he installs. Under the old procedure this could not be ascertained until the fixtures were installed. As the inspector's approval could not be secured until this fee was paid it often delayed the use of the service.

At present the proposed ordinance is awaiting the approval of the Judiciary Committee and it is hoped that action will be taken immediately before the City Council adjourns for its summer vacation. Although some change will probably be made before it finally becomes a law it is expected that the ordinance will be approved and that as a result the electrical contracting conditions in Chicago will be considerably improved.

The Finance Committee of the City Council recently approved an increase in the salaries of the electrical inspectors. The bill provides for a yearly wage of $2400 dating back to Jan. 1, 1919, with a further increase to $2580 per year starting in August, 1919. The number of district inspectors was also increased to 44.

EXTERIOR LIGHTING OF BANK BUILDING PROVES SUCCESSFUL.

Contractors Often Neglect Opportunities in This Field—Features of Recent Installation.

Nearly every electrical contractor appreciates the value of outline or flood lighting on a building as an advertising feature, yet very few of them make any attempt to encourage the installation of such lighting unless the customer first requests their assistance. Perhaps the best field for such work is in the lighting of buildings occupied by firms that do a large amount of advertising but from the nature of their business do not have any use for display windows. Such firms for example, as banks and real estate offices, have nothing to display other than placards and very often have dark and forbidding exteriors. Such firms, however, are large advertisers and the electrical contractor will not have much difficulty in persuading them to install some form of exterior lighting, if he tries.

Although flood lighting is generally to be preferred for such work there are many cases where it is necessary or desirable to install a system of outline lighting on the building. Such a system was recently installed on the Peoples' State Bank building at 47th street and Ashland avenue, Chicago, by J. L. Burgard, an electrical contractor of that city, and has proven very satisfactory to the bank officials.

The building occupies one of the five corners formed by the intersection of three streets at this point. However, it was somewhat obscured because this particular corner set slightly back of the others, which were occupied by brilliantly lighted stores with attractive display windows. It was not considered advisable to install a flood-lighting system as it would be rather difficult to control it and some of the other building owners would not permit the flood lights to be installed on the roofs of their buildings.

The outline lighting as installed consists of 800 Cutler-Hammer Norbitt receptacles containing 25-watt Mazda B lamps arranged in a row along the top of the building. These receptacles are mounted on a channel-iron framework which extends about 12 in. out from the edge of the roof. In addition, 12 3-light showers equipped with 100-watt C lamps were installed at intervals about 2 ft. above. Over the main entrance to the building, which is triangular in shape, the system drops down to the level of the ceiling of the first floor and terminates at a flashing sign. All the sockets used were of the approved weatherproof type. The shower fixtures were also made by the Burgard company and are constructed entirely of conduit, the different pieces being held in place by outlet box covers through which they are run. Three No. 2 wires are installed in 1½-in. conduit from the main service located in the basement of the building to the roof where two cabinets are installed containing the necessary circuit blocks.

In order to demonstrate to the bank officials the effect of this system Mr. Burgard devised a clever method of illustrating it. An outline of the building was sketched on a piece of extra heavy paper. The lighting system was then drawn in and at the points where the lights were to be placed, holes were made approximately the size of the lights. On the back a piece of light yellow tissue paper was pasted. In this way by placing the drawing in front of a light stronger than the surrounding light, the proposed lighting effect on the building was clearly shown.

FIXING THE SELLING PRICE FOR SMALL MATERIAL PURCHASES.

Inability of Contractor to Give Definite Figure Causes Customers to Distrust Him.

There are a great many pieces of electrical construction material which can be used advantageously for other classes of works such as is usually done by the houseowner himself around the home. For example, conduit is often used for lawn fences where its rust-resisting qualities are very desirable. Locknuts, washers, screws, nuts, wire, etc., are other articles often desired and purchased from the neighborhood electrical contractor. While it is true that such sales are not sufficient to enable the contractor to realize any substantial profit from them, he can in this way render a service to the community which will improve his standing in it and at the same time often be the means of securing real business for him.

One of the most objectionable features in connection with such transactions, however, is the inability or timidity of the contractor to set a positive selling price for such material. Invariably he will state his price as "about so much," or "such a price to you," whether he is personally acquainted with the customer or not. This gives the customer the impression that the contractor does not know his business and leaves a doubt in his mind as to whether or not he has paid a fair price for the article. Nor does it gain the contractor the customer's friendship any more than if he had stated definitely the price of the article and suggested a further purchase.

As already stated the volume of this business is not great enough to warrant hiring a special salesman for such work or even to fix a price for every article in stock but it is much better to take a pencil and paper and figure out the price for every sale than to make a rough mental calculation and submit a vague figure. The contractor may also refer to the catalog or if he is a member of the National Association of Electrical Contractors and Dealers he may use his Universal Sales and Data book, which gives a resale price for material. The customer in the majority of cases realizes that such sales are out of the usual routine of the contractor's business and does not expect him to have the price already marked for the article, but he does expect that the contractor can get the price definitely and not guess at it.

Nor should he be afraid to give the price definitely including a sufficient margin to cover his overhead and profit. The cigar store dealer may be known to everyone by his first name, yet he sells everyone at a fixed price without endangering his business. Why then should the electrical contractor hesitate to state a definite price for such convenience purchases?

WIRING DATA FOR DIRECT AND ALTERNATING-CURRENT MOTORS.

The fourth edition of "Wiring Data for Direct and Alternating-Current Motors" has just been issued by the Oregon Insurance Rating Bureau, of Portland. Ore. This is a revised edition and has been compiled by F. D. Weber, chief electrical engineer of the Bureau. This 32-page booklet is a valuable collection of tables, formulas and other interesting information relative to the wiring of the more common types and sizes of motors. The following gives an idea of the principal contents of the book: Rules for load-factor or demand-factor allowance; feeder sizes for two or more motors; wiring tables for 115, 230 and 550-volt direct-current motors; specifications for motors operated on grounded railway circuits; intermittent-duty alternating-current motors; feeder sizes for alternating-current motors; wiring tables for single-phase, two-phase and three-phase of various voltages and types; stranded copper conductor data; copper busbar data; motor-wiring formulas for different types of current.

To persons or firms outside of the state of Oregon, this booklet will be sent for 30 cents on addressing the Oregon Insurance Rating Bureau, Box 745, Portland, Ore.

BOSTON ELECTRICAL CONTRACTORS FAVOR THE 44-HOUR WEEK.

At a meeting of the Electric Section of the Building Trades Employers' Association of Boston, held on July 1, it was decided as the sense of the meeting that a 44-hour week schedule be adopted. Representatives of 10 of the leading electrical contractors were present.

QUESTIONS AND ANSWERS

All readers are invited to submit questions and answers to this department. Anonymous communications will not be considered. Questions should relate to electrical matters of any kind. Answers contributed by readers should be submitted preferably within eight days of the date of publication of the question and should be limited, if possible, to 300 words. Payment will be made for all answers published.

Questions.

No. 464.—Transformer Design.—I am trying to build a transformer with 110-volt primary and 14 steps on the secondary varying by 7½ volts up to 105 volts, thus, 7½, 15, 22½, 30, etc. Each step must be capable of carrying 10 amperes. What size and amount of wire is necessary on the primary and secondary windings?—W. A. S., Augusta, Kans.

No. 467.—Operating Cost of Electric Household Refrigerators.—I would like to know from some reliable source what is the operating cost of the electrically operated refrigerators that are being recommended for household use. What is the experience as to their dependability?—R. H. T., New York, N. Y.

No. 468.—Wiring Lights From a Bell-Ringing Transformer.—Is there any provision in the National Electrical Code against reducing 110 volts to a lower voltage by means of a bell-ringing toy transformer and then wiring some small lights from this? Is it all right to run this wiring in the same way as ordinary bell wiring? If this is permitted, what is the highest voltage and wattage permissible on such bell wiring?—S. T. E., Bridgeport, Conn.

No. 469.—Length of Motor Branch Line.—What limit, if any, is there to the length of a tap line from a No. 0000 feeder to an autostarter for a 2300-volt motor? The tap line is to be No. 6 or No. 8 lead-covered cable run in conduit?—A. S. N., Plymouth, Mass.

No. 470.—Pulling in Lead-Covered Cable.—I would like information in regard to pulling lead-covered cable into iron conduit. What kinds and sizes of grips are suitable for use in pulling No. 0000 triple-conductor, lead cable of 2-in. outer diameter into 2½-in. conduit? Through how long a run and around how many elbows is it safe to pull this? I should like similar information regarding other cable sizes down to ¾-in. in diameter.—A. S. N., Plymouth, Mass.

Answers.

No. 462.—Electric Welding of Rails.—Is there a definite dividing line between spot and arc welding as to where one would be used and not the other, or does their utility overlap to a certain extent? I refer especially to the welding of street-car rails, for which both methods seem to have been used. Which method is preferred for this work?—T. N., Toledo, Ohio.

[One answer to this question was published in the issue of June 21, 1919.—Editor.]

Answer B.—There is no definite dividing line and the method used depends a great deal on the local conditions. Where the power is limited and only a few joints are to be made the arc welding outfit is generally used. The spot welder offers the advantage of heavy contact pressure, thereby making a lower resistance bond. The spot welder requires considerable power for shorter periods and consequently requires large machinery.

The spot welder is usually employed on large jobs and the arc welder on small jobs, the method used depending merely on the quantity of work and the distance and transportation facilities to the job with the equipment.

Wherever possible the spot-welded joint is used. Cost runs about $4500 for the first 1000 welds and about $800 for each additional 1000 welds. This cost is about twice that of the bolted type of joint. The Board of Supervising Engineers, Chicago Traction, made many tests on various bonding methods and these tests are found in its annual reports.—H. E. W., Chicago, Ill.

No. 465.—Underground Conduit.—The writer is about to install 4000 ft. of 1½-in. conduit underground to carry a No. 6 lead-covered single-conductor cable supplying a potential of about 1100 volts on a series "White Way" lighting system. As this conduit will only be about 8 to 12 in. under the sidewalk, I have been advised by an engineer of authority on metallurgy that a black iron pipe would last as long on this installation as galvanized conduit and he suggests that I use plain iron pipe and give it a good coating of asphaltum. The suggestion appeals to me from the standpoint of cost, which would only be about half as much as galvanized conduit and the material could be handled in 20-ft. lengths. I would like to take advantage of this suggestion, if practical, but don't want the cost to mislead me on a good job. I would like to hear from some of the readers experienced in this subject before going ahead with this installation.—W. W., Ludlow, Ky.

Before installing iron pipe for an underground duct line, standard 3½-in stone or tile duct should be given careful consideration. Stone or tile duct placed under a sidewalk would require little concrete work, and is probably the least expensive and most lasting duct line that can be installed. Careful consideration should be given to the future requirements of a given territory before installing a duct line. It generally pays to install at least a 4-duct line, unless there is no possible need for future circuits.—W. H. K., Evanston, Ill.

No. 466.—Grounding Transformers and Secondaries.—Up to the present time the undersigned has always grounded the neutral of secondaries on transformer poles, together with grounding the transformer cases at this point and installing the lightning arresters on the next pole away from the transformers. It is now strongly recommended by leading engineers that the lightning arresters be installed as near as possible to the transformers, which doubtless means on the same pole, and the neutral grounds will now have to be made at another point. I am in favor of this change and appreciate its protective advantages, but would like to hear from readers as to best location for the neutral grounds and their ideas on grounding the transformer cases. —H. M., Cincinnati, Ohio.

Answer A.—Electrical engineers are not of one opinion as to whether the grounding of transformer cases does result in additional protection against lightning. This subject is very much like that of a few years ago of grounding the secondaries where there were two different schools, one of which was strongly for and the other equally strongly against grounding.

Theory dictates that grounding transformer cases should reduce the likeliness of lightning damaging the transformer winding. Experience also proves that the theory is correct. The reason why transformer cases are not grounded to a wider extent than they are is because of the danger to linemen, the disadvantage in this respect offsetting the benefit of better protection against lightning.

It is not of extreme importance that the lightning potential between transformer winding and the earth or ground be kept down to a comparatively low value. On the other hand, it is extremely important that the difference of potential between primary and secondary, and likewise between primary, secondary and case be kept down to a safe value. Connecting the lightning arrester between primary winding and case, and further, connecting the transformer case to ground, accomplishes this.

It has been suggested to go a little further, namely, connect the transformer secondary and case to the lightning arrester through a small air gap. The effect of doing this is to enable a potential of several hundred thousand volts to exist between transformer and case, while at the same time the potential actually existing between transformer primary and secondary, and transformer windings and case, will be only a few thousand volts—perhaps eight or ten thousand—which a transformer subjected to the A. I. E. E. standard test could withstand.

Such an arrangement as explained above makes the protection of the transformer independent of the resistance of the ground resistance and eliminates the impedance of the ground wire between arrester and ground—a very great benefit where high-frequency discharges take place and the ground wire is long or of small cross-section. The actual benefit from grounding transformer cases will vary, and will, of course, be greatest in those localities where only high-resistance grounds can be obtained, and where long ground wires are employed.

The reason that the cases of distributing transformers are not grounded more generally than is the case, is chiefly for the reason that a grounded case creates a very real hazard for linemen working on the same pole with the grounded case. The hazard can be reduced by installing a link switch so as to disconnect the case from ground while men are working on the pole. This costs money, may be forgotten and adds a complication where conditions are already complicated enough.

As regards the location of lightning arresters, these should be installed upon the same pole as that on which are installed the transformers they are to protect. It has been shown conclusively by D. W. Roper in his papers before the A. I. E. E. and the N. E. L. A., that arresters are very much more effective in protecting when located beside the transformer than when even only one span away. The N. E. L. A. Handbook on Overhead Line Construction advocates installing the lightning arresters upon the same pole as the transformers they are to protect.

A transformer secondary should be grounded as near the transformer as possible. This means at the same pole. The lightning-arrester ground and the secondary ground wires should be kept separate and each should have its own "ground." Where a transformer case is grounded, the same conductor may be employed for the secondary. Secondary ground wires should be protected by wood covering up to about 7 ft. above ground at least.—B. M. S., Cicero, Ill.

Answer B.—For maximum protection lightning arresters should be installed on the transformer pole. The lightning-arrester ground and secondary ground should consist of two distinct grounds and should be on the transformer pole. In addition, the secondary should be grounded every 500 ft. The writer is not in favor of grounding transformer cases in the ordinary pole-type installation. A grounded case presents too large an area to be worked around safely. The linemen should be protected from arrester and secondary grounds by the use of wood molding.—W. H. K., Evanston, Ill.

BOOK REVIEWS.

"British Electrical Trades Directory and Handbook." Published by "The Electrician," 8 Bouverie Street, London, E. C. 4. Cloth; 1330 pages, 6½ by 9½ in. For sale by International Trade Press, Inc., Chicago. Price, $2.00.

The volume is prepared to supply information on all questions relative to the electrical industry that have a bearing on British affairs. The contents of the volume range from definitely technical to merely general matters so that it is valuable alike to the engineer, the contractor, and the dealer. The material in the volume, moreover, is gathered from all parts of the British realm and from such other countries as may be desirable to British engineers and contractors.

The volume is divided into two sections: namely, literary and directorial. The former section contains information about patents, designs, and trade-marks, domestic and foreign, about weights and measures, etc. The electric lighting acts and clauses regulating all phases of apparatus and practices occupy nearly 200 pages.

The directorial portion of the volume, which occupies nearly 900 pages, contains a classification of the electrical industry in Great Britain and its possessions. The classification of the industry in Britain is made alphabetically according to the name of individuals or companies and, again, according to the branch of industry. Classification of the industry in the colonies is made separately. The industry of the United States is not included in the volume. The volume, which is somewhat larger than the 1918 issue, will be of great value to the electrical industry not only in Great Britain and its colonies, but also to that in all other countries.

"Electricity and Magnetism for Engineers," by Harold Pender. Published by McGraw-Hill Book Co., Inc., New York City. Cloth; 200 pages (6 by 9 in.), 170 diagrams. For sale by International Trade Press, Inc., Chicago. Price, $2.00.

This is the second part of a treatise on Electricity and Magnetism for Engineers. Part I treats of Electric and magnetic Circuits, and the second part is devoted to Electrostatics and Alternating Currents. As the titles are not mutually exclusive, so we find that the treatment of alternating currents is not confined to Part II, but some phases of the subject are discussed in Part I.

While the treatment of electrostatics and alternating currents is theoretical, it is also from an engineering point of view, and the practical bearings of the principles are brought out by numerous problems and examples.

There are several interesting features of the text. The one that first impresses itself upon the attention of the reviewer is the scientific thoroughness of the discusions, and coupled with this is the care exercised in stating the limitaions of formulas. This last feature is especially valuable from a practical viewpoint. The statement of the limitations of formulas will save much confusion on the part of beginners, but it will do more than this. It will tend to develop in the student the power of discrimination and exactness.

Since the book is a continuation of Part I, the chapters are numbered consecutively throughout both volumes. The subdivisions of electricity and magneism treated in Vol. II are:

Electric Fields of Force, Electrostatic Capacity, Sine-wave Alternating Currents, Impedance and Admittance, Reactance and Susceptance, Effective Resistance and Effective Conductance, Polyphase Circuits, Symbolic Notation, and Non-sinusoidal Alternating Quantities.

The chapters on symbolic methods of solving alternating-current problems and on the analysis of alternating or non-sinusoidal waves will be found very useful in practice.

Any student who masters the principles explained in this text will have a most excellent foundation for the more technical studies of electrical engineering. The book should therefore be widely used by technical schools. C. M. JANSKY.

New Appliances

Mazda C-4 Lamp—Headlight Control Switch—New Cords —Berthold Washer—Willys Light—Marble-Card Machines

The White Mazda 50-Watt Lamp.

An important development in incandescent lamp manufacture is the "White Mazda" 50-watt lamp, or as it is also called the Mazda C-4 lamp. It was first briefly announced at the Atlantic City convention of the National Electric Light Association and further particulars have been made public in Bulletin No. 37 just issued by the Engineering Department of the National Lamp Works of General Electric Co., Nela Park, Cleveland, Ohio.

The new lamp is unique for several reasons. It has a milk-white smooth bulb which gives excellent diffusion of the light over its entire surface. It is of the gas-filled type, being the smallest lamp yet made of this type. It is a tipless lamp. The following facts are taken from the bulletin referred to:

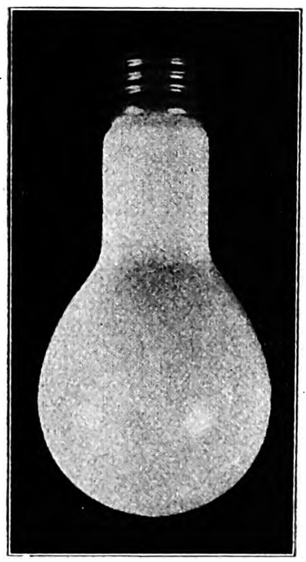
"The outstanding characteristic of this lamp is the pleasing softness of its light. The large volume of light which the small filament emits is diffused to the point where the bulb itself appears luminous. The brightness of the bulb is about 13 candles per sq. in. over the brightest square inch of area, which is, of course, far below that of the filament of a Mazda B lamp. The white Mazda lamp is made in the 50-watt size, and, notwithstanding the low brightness of the bulb, supplies more light than the 50-watt Mazda B lamp.

"It has been pointed out many times that glare (which, however defined, is ultimately light which hurts the eye) is to a considerable extent a matter of brightness contrast. The familiar illustration of automobile headlights, which glare at night but which are scarcely noticeable during the day, will be recalled. Because of the softness of its light, the white Mazda lamp can be used satisfactorily in locations where any other incandescent lamp unless frosted would be objectionably bright. Frosting the bulb has always proved an effective means of reducing the brightness of small incandescent lamps, but the practice has not been widely followed, largely because the frosted bulb collects dust and dirt more quickly than a clear bulb and is more difficult to clean. The bulb of the white Mazda lamp is smooth, and is as readily cleaned as a clear-glass bulb.

"There will, perhaps, be a tendency to use the white Mazda lamp without reflecting equipment because of the softness of its light. However, for most locations the bulb is still too bright to be used alone; moreover, it must be remembered that reducing glare is only one of the functions of a reflector. From the standpoint of effective distribution of the light generated, it is just as important that a good reflector be used with a white Mazda lamp as with any Mazda C lamp.

"Broadly, the field for the white Mazda lamp lies in the replacement of the smaller sizes of Mazda B lamps in existing reflector equipment. The effect produced by using white Mazda lamps in semi-indirect fixtures is particularly pleasing, for distinct shadows of the bowl edge and the bowl suspension, and all striations on the ceiling, are eliminated because of the large area from which the light comes. For the same reason, white Mazda lamps are also particularly desirable for portable lamps, where their use will eliminate the formation of grotesque, and frequently annoying shadows upon the walls or upon the pages of a book; fringe shadows, which are often very disagreeable, are eliminated.

In Table 1 are given the results of tests made to determine the effect of



White Mazda (or Mazda C-4) 50-Watt Lamp—Approximately One-Half Actual Size.

the diffusing bulb upon the output of lighting units. It will be noted that there is little difference in the absorption of any of the units tested when equipped respectively with Mazda B and with white Mazda lamps.

TABLE No. 1—DATA ON LIGHT OUTPUT.

Type of Unit.	Output in Per Cent of Bare-Lamp Output. Mazda B.	White Mazda.
Glass bowl, 6-in. diameter.	85.4	87.6
Glass bowl, 7-in. diameter.	84.8	86.1
Enclosing unit	77.5	76.4
Enameled-steel bowl	60.5	61.3

"With regard to the service which may be expected from white Mazda lamps, it may be said that laboratory tests indicate a satisfactory degree of ruggedness for home lighting, office lighting, and hotel and public building lighting, where these lamps will probably find their chief application. The low bulb brightness may result in white Mazda lamps, despite their higher wattage, being used to replace many smaller lamps used on extension cords for the inspection of machined interiors and similar places difficult to light with any general lighting system, and only trials under service conditions can establish what degree of rough handling in drop-cord service the white Mazda lamp will withstand.

"The white Mazda 50-watt lamp is made in the pear-shaped bulb, which is the shape used in Mazda C lamps. It will be noted from the illustration that the bulb is tipless. The lamp has about the same maximum dimensions as the 40 and 50-watt Mazda B lamps. No difficulty should be experienced in replacing Mazda B lamps in existing reflectors or shades."

Additional technical data are as follows: The lamps are made for voltages from 110 to 125; their lumen rating is 490, giving an efficiency of 9.8 lumens per watt. The bulb diameter is 2½ in. and the maximum over-all length is 5⅛ in. The base is medium screw size. The rated average life is 1000 hours; 50 is the standard package quantity.

The lamps are made by National Lamp Works of General Electric Co., Cleveland, Ohio; Edison Lamp Works of General Electric Co., Harrison, N. J.; and Westinghouse Lamp Co., New York City.

Ingenious New Locomotive-Headlight Switch Now Being Made.

High-speed railroad operation in the open country at night requires a very powerful locomotive headlight to insure safety. When nearing a train approaching on an adjoining track, a brilliant headlight confuses the other engineman, however. Also, when approaching signals the brilliant light of the headlight may cause confusion or inability to read the signal correctly.

Within cities a very bright headlight also causes blinding confusion and dangerous annoyance to pedestrians, teamsters and automobilists.

These conditions make it desirable to control the brightness of the headlight to a dim value when desired.

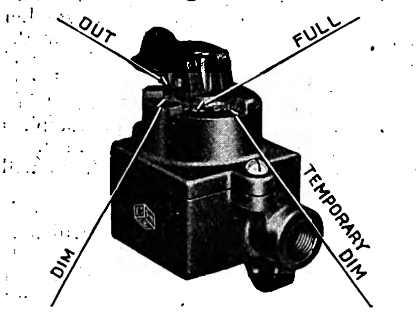
A new locomotive headlight switch has recently made its appearance. It has a number of features that will quickly appeal not only to the master mechanic but to the locomotive engineer.

This headlight switch is a complete, self-contained, dust-tight switch that will effectively take the place of a double-throw switch for dim and full light, and a momentary-contact switch for temporary dim light.

With an easy push the handle goes from "Off" to "Dim" and another slight push sends it to "Full." Going into "Dim" before going into "Full" gives the filament a chance to heat before coming to full glow, which means a longer life for lamps.

While passing another locomotive or for picking up signals, it is not necessary to bring the switch back to the "Permanent Dim" position. The engineer merely pushes the handle from "Full" to "Temporary Dim," holding it until he has passed the other train or the signals, when he releases the handle and the switch automatically snaps back to "Full."

If going through a yard or a city where the headlight must be dim, a slight lift of the handle brings the switch back to the "Permanent Dim" position.



Switch for Convenient Control of Locomotive Headlight Through Several Degrees of Intensity.

This handy little switch can be mounted at any place in the cab that is suitable. Its mechanism cannot get out of order. The internal spring and the stops on the cover insure proper location of the switch at the position desired and makes it impossible for the switch to stop between positions. This switch is a new product of the Crouse-Hinds Co., Syracuse, N. Y.

Belden New "Hard Usage" Portable Cord.

The Belden Manufacturing Co., Western avenue and Twenty-third street, Chicago, Ill., has developed a special type of portable cord, "Underwriters' PWp.," which has been exceedingly well received by the trade. This cord, while resembling the ordinary weatherproofed portable, has certain differences in construction that make it much more durable. Instead of the usual 1/64-in. wall of 10% rubber over the two conductors, there is a 1/32-in. wall of 20% (Beldenite) rubber. Then, in place of the ordinary soft cotton braid, there is a heavy twine used for the outside cover. The result is a cord which is exceptionally strong and which will stand exceedingly hard usage.

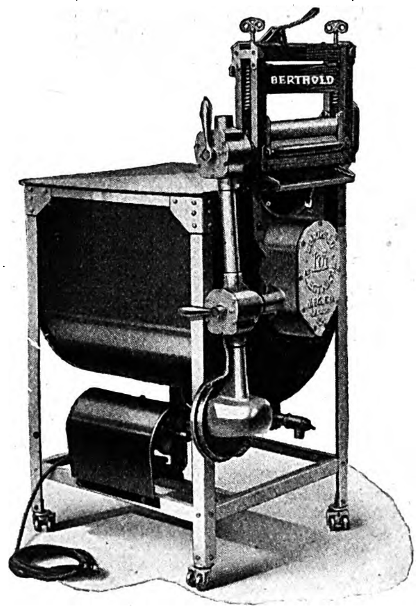
It has been found that when this cord is used for portable lamps, tools, etc., in garages, machine shops, locomotive repair shops and such places where the ordinary cord is subjected to extraordinary wear, it has a life which compares very favorably with armored cable and has the advantage of being much more flexible.

Berthold Electric Washing Machine.

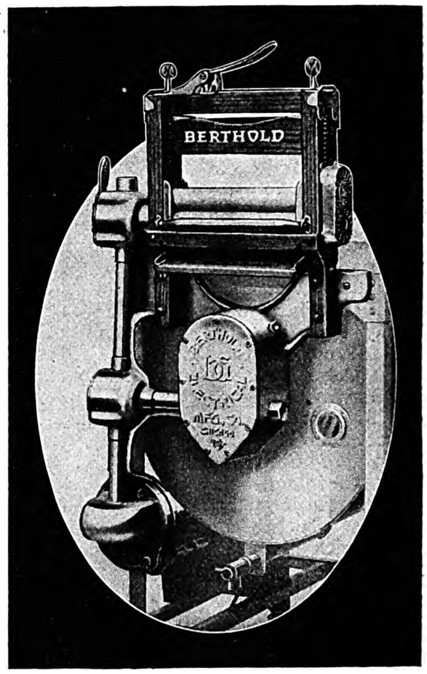
The increasing demand for electric washing machines of the last few years is stimulating the production of new devices of this kind, and among these one of special interest is the washer recently placed on the market by the Berthold Electrical Manufacturing Co., 127 South Green street, Chicago, Ill. This machine has been developed by E. E. and G. W. Berthold, who have been connected with the Electric Apparatus Co. for about 11 years, and their new design incorporates their experience with various types of appliances.

The new Berthold washer was designed with three principal ideas in mind. These were: Ruggedness and durability of construction, safety in operation, and efficiency in service. The accompanying illustration shows that the machine consists almost exclusively of metal, the only exception being a few parts of the wringer. The framework consists of angle irons well braced and secured together. The mechanism (including shafting, gears and other moving parts) is entirely inclosed in a one-piece casting. This is done for a number of reasons. First, it prevents these parts from getting out of order or alinement; it safeguards the operator or anyone else from having her or his clothing entangled in exposed gears or other moving machinery; finally it permits the gears, bearings and other running parts to be operated in oil just like the transmission of an automobile. This latter provision dispenses with the need for grease or oil cups and positively prevents any oil from oozing out of bearings or other places so as to stain the clothes being washed or the dress of the operator. It also provides the most perfect lubrication so as to insure very efficient operation and, therefore, low power consumption. The matter of safety, referred to above, has been given special consideration because exposed moving machinery around a washer has been found dangerous not only to the operator but to children who frequently are playing about the laundry while their mother is taking care of her washing. The complete inclosure of the machinery also insures very quiet running.

The machine operates on the reversing cylinder principle. The cylinder makes 5½ revolutions and then automatically reverses, repeating this cycle without attention. The capacity of the cylinder is eight large sheets or their equivalent. The cylinder is made in two types, either of solid copper or of galvanized steel. Simplicity of control is secured by providing only two operating levers, one of which starts and stops the washing cylinder, and the other starts and stops the wringer in either direction. The washer and wringer may be operated independently or together at the same time. The wringer is of the highest quality obtainable and is provided with a safety release to prevent damage to buttons or other delicate parts of the clothes in case a batch should become choked in the rolls. A high-grade motor is used; it is protected from splashing water as shown. The machine can be easily moved about since it is provided with the easy running casters. A sheet-metal top permits using the top as a table. Every detail in its construction and assembly is taken care of to insure perfect operation and freedom from trouble.



The Berthold Electric Washer with All Gears, Shafts and Other Moving Parts Enclosed in a One-Piece Casting.



Enlarged View of Berthold Washer Showing the Large One-Piece Enclosing Casting.

John N. Willys to Market New Electric Light and Power Plant.

A modern electric lighting and power plant for farms, rural schools, churches, suburban homes, yachts, etc., is to be manufactured by one of the John N. Willys companies, the Electric Auto-Lite Corporation, of Toledo, Ohio. The new outfit will be known as "Willys Light." It will be marketed by the Willys Light Division of the Electric Auto-Light Corp. through distributors and dealers. The formation of the sales organization is now under way; it will extend throughout the United States and eventually throughout the world.

The new plant is claimed to be the most complete that has yet been placed on the market. It is operated by a

Willys-Knight sleeve-valve engine which is known for its simplicity of operation and its quietness. The engine has been developed to such an extent that it requires practically no attention and is so simple that a child can operate it, according to those who have observed it.

The complete plant consists of a Willys-Knight engine, a direct-connected generator, a simple control box and a storage battery. The engine burns kerosene at approximately one-half the cost of gasoline. It is air-cooled, self-cranking, self-running, and self-stopping. The control is semi-automatic.

Noisy poppet valves are eliminated in the Willys-Knight engine. In their place are two cylindrical sleeves, one within the other, which glide silently up and down between the piston and the cylinder wall. The long ports in these sleeves register with each other and with the ports in the cylinder wall at the proper intervals, forming large and direct passages for the intake and exhaust gases. This engine is said to improve with use; carbon, instead of decreasing its efficiency, increases it.

The Willys Light generator is shunt-wound and designed for 32 volts. Its capacity is 750 watts. The armature of the generator, the engine flywheel and crankshaft are constructed in practically one piece, thus eliminating separate generator bearings and reducing friction.

The battery consists of 16 lead type cells with 9 plates to the cell. These are enclosed in sealed glass jars. They have a capacity of 160 ampere-hours.

The quality and dependability of the new equipment is assured by the fact that John N. Willys would not have permitted it to take his name until the outfit had been proved out thoroughly. With the Electric Auto-Lite Corp., a company long engaged in the manufacture of electric lighting and starting systems for automobiles, producing it, there is assurance as to the high standards of manufacture that will enter into its construction and of service in its distribution.

The new lighting outfit is adapted to a large number of uses. In addition to its general utility on the farm, it is available for isolated cotton gins, lumber and construction camps, oil and gas-pumping stations, mines, outlying stores, garages, dairies, telephone exchanges in smaller towns, and railroad stations. It also may be utilized for remotely located hospitals, fishing and hunting clubs, country homes, for street, store and home lighting in very small towns, for small theaters, military camps, and in summer resorts and cottages.

New Line of Commutating-Pole Motors and Generators.

Direct-current generators and motors have been manufactured over 35 years, but improvements in construction are still being made as is shown in a new line of these machines developed and manufactured by the Marble-Card Electric Co., Gladstone, Mich. These motors and generators are designed to incorporate some 26 years of fruitful experience in designing direct-current machines by John F. Card, during which time over 40,000 machines have been built after his designs. Every detail of the new line of these motors and generators has been carefully studied and the final features selected to combine in the complete design the highest standards of construction and operation. The machines are liberally proportioned and conservatively rated, and are therefore especially adapted for exacting service.

All machines are of the commutating-pole type with as many commutating as main poles; these insure perfect commutation at all times and eliminate the need for shifting the brush position. The field frames are made of high-grade cast steel in one piece, including the feet. All poles are securely attached with two lag screws; the main poles are laminated and assembled under hydraulic pressure. All bearings in standard machines are of the best ball-bearing type of generous size to withstand all possible strains; these ball bearings assure low losses and therefore high efficiency and also permit a shorter shaft length. The bearing brackets are designed so that the machines may be mounted on floor or ceiling without any change whatever. If mounted on a side wall or column it is necessary to rotate the outer bearing closures only to bring the drain plugs into the vertical plane. The sliding base is of heavy construction and has a three-point bearing and improved belt-tightening device within the base.

The brush holders are of very simple and effective design, having only two moving parts and no spring adjustment, the tension of the spring being set at the factory to the correct value. The commutators are of rolled copper with the mica undercut; they are of large size. All armature coils are form-wound, dipped and baked. Field coils are wound on collapsible forms, covered with many layers of oiled muslin, taped, dipped and baked, and finally varnished. Commutating-pole coils are wound directly on the poles after these are first well insulated.

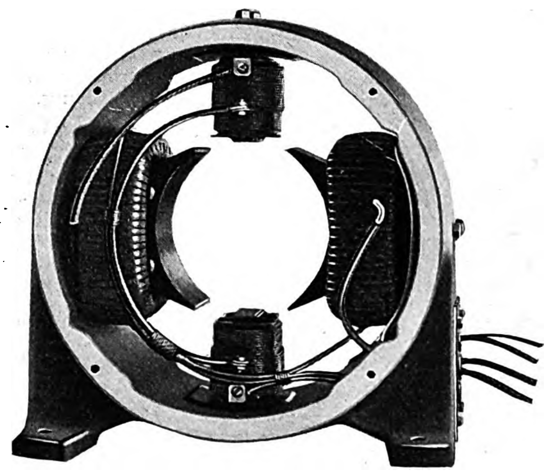
These machines are made in the two-pole type in the smaller sizes (7.5 hp. and smaller) and of the four-pole type for 7.5 hp. and larger sizes. The standard speeds are 575, 850, 1150 and 1700 r. p. m. Standard motors are made with either shunt or compound field windings. All terminals are brought out to the terminal board so that it is very easy to change motor direction. All the machines are especially well ventilated and are quiet in operation. They are well suited for a variety of purposes and the motors have been found especially adapted for electric freight and passenger elevators. The generators have been found exceptionally well suited for low-voltage farm lighting plants and motion-picture service.

Portable Suspension Cord for Gas-Filled Lamps.

The Belden Manufacturing Co., Chicago, Ill., has developed and placed on the market a cord especially adapted for pendent lighting units using gas-filled lamps. This cord, which has been approved by the National Board of Fire Underwriters, is made in both the types "P" and "PS" portable, and consists of the ordinary conductor, rubber-covered, and then covered with a heavy braiding or serving of asbestos. The remainder of the construction, that is, the rubber outer wall and braid over-all, is the same as in the ordinary portable.

This type of construction has been developed as a result of the insistent demand of the trade that the portable cord for pendent purposes be so manufactured as to withstand the very high temperature of the commercial gas-filled lamps, and for this purpose it has proved itself to be excellently adapted.

Type M. C. Direct-Current Machine, Showing Commutator End.



View of Field Frame, Showing Arrangement of Main and Commutating Poles.

Trade Activities

Eureka Vacuum Cleaner Erects Large Modern Factory—C. T. Coe Company Takes Over Hafer Interests—Literature

Edison Electric Appliance Co., Hotpoint Division, Chicago, sustained a heavy loss when fire practically destroyed the storage house at 2214-30 Ogden avenue on Sunday, July 6. W. H. Casper, superintendent, places the loss at $75,000.

The Edison Storage Battery Co. announces the removal of its district office in Pittsburgh, Pa., to Room 431 Union Arcade building. The removal has been made necessary by the tremendous increase in the volume of business handled through this office. The new location provides better facilities and more commodious quarters.

P. W. Miller Co., 735 Andrus building, Minneapolis, Minn., has entered the field as an electrical jobber in 32-volt accessories. The company has just obtained a contract from the Electric Auto-Lite Corp., Toledo, Ohio, for the Willys farm lighting plants for the state of Minnesota, part of North Dakota, Wisconsin and Montana, and anticipates a large volume of business in this territory.

Jeannin Electric Co., Columbus, Ohio, has entered the electrical field, having recently been incorporated with an authorized capital of $150,000 to engage in the manufacture of electric motors. C. H. Clement, formerly with the Bock Bearing Co., is president and treasurer of the concern; H. W. Jeannin, vice-president, and Morton C. Seeley, secretary. The factory will be located at 110 11th street and will have an estimated output of 100 small motors monthly.

The Wallace Barnes Co., Bristol, Conn., has issued Booklet No. 7 descriptive of "Barnes-made" springs, screw machine products, cold rolled steel and wire, washers, stampings, etc. The booklet is well illustrated and contains a number of diagrams and tables showing decimal equivalents of wire, gauges, weight of cold drawn steel, weight of cold rolled strip steel and weight of wire; also specifications to be used in ordering compression and extension wire springs, and table of capacities of compression and extension wire springs.

Contra-Pole Electric Co., 1227 Prospect place, Brooklyn, N. Y., recently incorporated with a capital stock of $100,000, is manufacturing electro-therapeutic apparatus. Mortimer E. Freid, formerly affiliated with the purchasing department of the Signal Corps of the Army, is president of the company; Julien de Beaumont, consulting electrical engineer, first vice-president; Julius Heinecke, general manager of Liebig Extract Co., second vice-president; Samuel T. Siegel, attorney, 165 Broadway, New York, secretary.

The Aberthaw Construction Co., Boston, Mass., has opened a permanent office in Atlanta, Ga., which will be under the direction of N. McL. Sage.

The Electric Furnace Construction Co., Finance building, Philadedphia, reports the receipt of an order for a one-ton Greaves-Etchells electric furnace from the Sullivan Machinery Co., Claremont, N. H.; also an order for a furnace for the manufacture of coinage bronze from the Imperial Japanese mint, Osaka.

F. I. Hutchinson, mechanical engineer, founder of the Heating & Power Equipment Co., Milwaukee, Wis., has severed his connection with the company to engage in business for himself. He has opened offices at 1226 First National Bank building, Milwaukee, as a consulting and designing engineer of heating and power plants, specializing in central-station installations.

J. H. Honig, Antofagasta, Chile, S. A.; announces the opening of an office at Latorre 446-448, which will give representation to American manufacturers who desire a connection in northern Chile. Mr. Honig has been engaged in this line of business for many years and until recently was manager of the Chile Trading Co., of Antofagasta. He will be pleased to hear from any manufacturers desiring representation in the territory mentioned.

Elvin Mechanical Stoker Co., 30 Church street, New York, has issued an illustrated folder describing the Elvin mechanical stoker for use on locomotives. Several advantages of the stoker are that its operations are wholly mechanical, that it regulates automatically the amount and distribution of the coal, and that it prevents the entrance of cold air into the fire box. An installation of the stoker on an Eric locomotive shows that the economy of the mechanical stoker is as great as if not greater than that of hand firing.

C. T. Coe Co., Chambersburg, Pa., engineer and combustion expert, owing to the greatly increased demand for the Coe grate and Coe turbine blower, has again found it necessary to extend its manufacturing facilities. The company has, therefore, purchased the plant, patents and equipment of the Hafer Foundry & Machine Co., Chambersburg, Pa., which since 1906 has been engaged in the manufacture of the Hafer double-shift rocking grate and Little Giant soot blower for boiler tubes. The plant has a foundry with a 12-ton daily capacity, brass foundry, machine shop, pattern shop, blacksmith shop, all of which has been added to the equipment of the Coe company, resulting in a more complete organization, better able than ever to supply the needs of the trade. The combined patterns of the two plants include all standard grates, arch plates, etc., so that the company is now prepared to manufacture a most complete line of boiler room equipment. The Coe organization specializes in everything that pertains to combustion and its competent staff of engineers is ready to solve problems relating to this important subject.

Central Electric Co., 316-326 South Wells street, Chicago, is sending out a new combined price list and catalog of new material designated as No. 39-A. Some 80 pages are devoted to a listing of net prices and discounts applicable to general catalog No. 39. The remaining pages carry a list of devices either new or redesigned, consisting of marine lighting and signaling appartus, industrial signals, receptacles and plugs, transformer and junction cutouts, switches, sockets, switch plates, lighting units, lamps, transformers, etc.

Acme Lighting Fixture Co. has taken over the plant of the Acme Gas & Electric Co., Inc., and will continue operations at 132-136 West 14th street, New York. The former company manufactures a complete line of electric and combination lighting fixtures, lamps and accessories, and has added to its staff competent designers of lighting fixtures in order to furnish special as well as staple designs of lighting fixtures and accessories. The company has greatly increased its facilities and is now in a position to meet the requirements of the trade. The present plant provides facilities for the production of designs of elaborate decoration, durable construction and lasting finish, embodying the newest ideas in interior and commercial decorative schemes.

American Electric Fusion Co., Warren, Ohio, is the name of a recently organized concern with an authorized capital of $25,000 to manufacture electrical apparatus for heating, melting and fusing. The company has acquired a two-story building which will be used as its plant. For the present the company will devote its attention to the production of a new type of an alternating current arc welder, which will be built in sectional form, the lower section to contain equipment for transforming standard voltages, 440, 220 or other commercial circuits, down to 60 volts. The upper section will contain the stabilizing and regulating apparatus. Fred P. McBerty, president of the Federal Machine & Welder Co., is president of the new organization; E. J. Henke, vice-president, and Z. A. McBerty, secretary and treasurer.

Roller-Smith Co., 223 Broadway, New York, has issued an illustrated bulletin (No. 140), describing a new device known as the "Handy" auto type volt-ammeter. This device has six ranges and provides a means of quickly and accurately making all the different tests which are involved in electric lighting and starting systems of automobiles. The entire outfit is simple, sturdy, compact, light and built for the hardest kind of service. "Handy" instruments are also furnished in a complete line of ammeters, milli-ammeters, voltmeters, milli-voltmeters and volt-ammeters.

The Central Station Steam Co., Detroit, Mich., announces the opening of a branch office at 902 First National Bank building, Chicago, with W. K. Abernethy, formerly manager of the Minneapolis office, in charge. All business in Illinois, Iowa, Nebraska, Missouri, Indiana and Ohio will be handled from the Chicago branch.

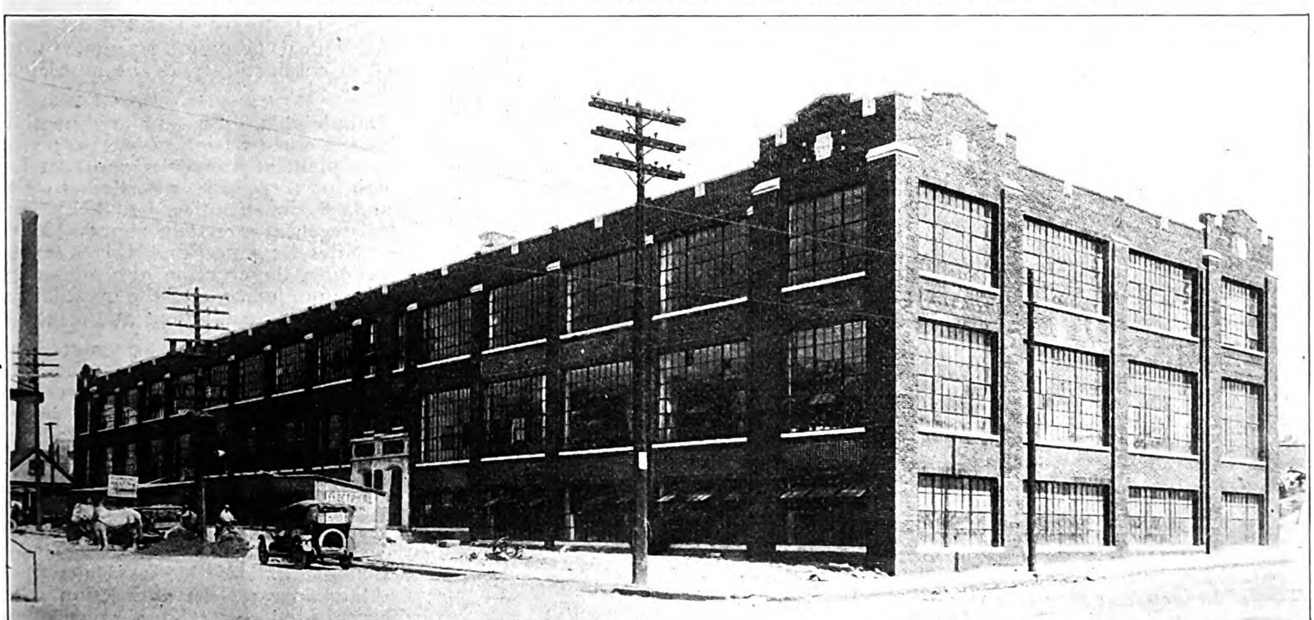
The Wellman-Seaver-Morgan Co., Cleveland, Ohio, has prepared Bulletin 22, which contains valuable engineering charts on shafts. The bulletin is devoted to three large charts giving the relations in any shaft between power, shaft diameter, torsional stress and speed, and contains several examples showing the method of using the charts. By means of these charts it is possible to instantly solve any one of four problems: (1) Given the power, speed and allowable torsional stress, to find the shaft diameter; (2) given the shaft diameter, power and speed, to find the torsional stress; (3) given the power, torsional stress and diameter, to find the speed; (4) given the speed, torsional stress and diameter, to find the power. These charts have been prepared by one of the company's engineers. Copies of the publication will be sent to all engineers and draftsmen free of charge upon request.

The Thistle Manufacturing Co. of Chicago, manufacturer of the "Up 2 Date" home electric washer, recently moved into its new factory, located on Armitage avenue, between Major and Mango avenues. The constantly increasing popularity and unusual demand for this washer made it necessary for the company to seek larger quarters, but as it is now able to produce twice the number of machines turned out heretofore, it will probably be able to keep up with the demand. The new factory consists of two floors of a large building, giving the company more than twice its former floor space. The building faces the main line of the Chicago, Milwaukee & St. Paul railroad at the Galewood yards, at which point are located the switch yards of the railway company. From this point all loaded and unloaded cars running over the Milwaukee line are handled. This location gives the Thistle company excellent shipping facilities. In addition it has equipped the new factory with the most modern machinery, giving it every facility for quick and efficient work.

Eureka Vacuum Cleaner Co., Detroit, Mich., has erected a new plant which it claims is the largest exclusive vacuum cleaner factory in the world. The building is a three-story structure and covers an area of over 19,000 sq. ft. Over 60,000 ft. of floor space is provided and the plant is equipped with a tremendous amount of up-to-date machinery which will make possible the production of 1000 electric cleaners per day. Since the war the influx of orders for the Eureka cleaner has been so great as to render the company's facilities entirely inadequate to meet the demand, and at the present writing orders for 12,000 machines remain unfilled. The building of this large factory is indicative of the optimistic view the Eureka company has of the future, and also signifies the success and stability of the vacuum cleaner industry as well as the remarkable success which has attended the Eureka cleaner. The company is also erecting in the heart of Detroit a five-story office building which will be used as the general offices of the Eureka Vacuum Cleaner Co. exclusively. It is modern in every respect and affords ample space to handle a business which is rapidly expanding. The company is about to launch the largest national publicity campaign in its history to be of distinct aid to its many distributors throughout the country.

Fort Wayne Engineering & Manufacturing Co. has prepared for the dealers' bulletin file a catalog of the Paul water systems, bringing together under one cover a number of bulletins which have been issued from time to time. It contains descriptions, diagrams and list prices of the popular combinations of pumps and systems to meet most requirements within their limits. The company has also issued Bulletin 5005, superseding Bulletin 4096, describing Paul electric pumps and water systems using 32-volt direct current. Installation examples of these systems for the farm and country home are given as well as detailed descriptions of the various pumps and systems manufactured by this company.

Mercury Manufacturing Co., 4119 South Halsted street, Chicago, has issued a new publication entitled "The Trackless Train" treating of the Mercury method of internal transportation, which will attract widespread attention and prove very interesting to users and prospective users of industrial tractors. It discusses the development, use, construction and function, economy and flexibility of this system of industrial haulage and sets forth 15 pertinent reasons why the "trackless train" should be adopted. The bulletin is replete with illustrations of typical installations and the economy affected by the Mercury tractor is manifested by its representation in practically every industry. This method of internal transportation is based upon the sound principle that transportation efficiency requires the handling of material with the smallest possible number of men and the smallest possible number of power units. It is adaptable to every type of industry, and practically to every haulage problem within each. The advantages of this method of industrial haulage may be briefly summarized as follows: Installation economy, operating economy, flexibility, maximum operating efficiency, ease of operation and safety.



New Factory of the Eureka Vacuum Cleaner Co., Detroit, Mich.

Current News

Weekly Record of Construction Activities—Conventions

EASTERN STATES.

Portland, Me.—Fire recently damaged the building of the Cumberland County Light & Power Co. It is understood that the company is planning for immediate repairs.

Rutland, Vt. — Rutland Railway, Light & Power Co. has recently been awarded a contract by the Wallingford Manufacturing Co., Wallingford, for furnishing additional power to the amount of about 100 hp. for the operation of a new saw and planing mill at its works.

Springfield, Vt.—Colonial Power & Light Co. is making rapid progress on the construction of the new electric substation, and it is expected that the work will be completed at an early date.

Quincy, Mass.—Fire recently destroyed the coaling station at the plant of the Quincy Electric Light & Power Co., with loss estimated at $15,000.

Hartford, Conn.—Case & Marshall, Inc., has awarded a contract to the J. H. Grozier Co., 721 Main street, for the construction of a new boiler plant at its works in the Burnside section. The structure is estimated to cost $10,000.

Binghamton, N. Y.—In connection with the installation of large quantities of electrical equipment at the new plant of the Achilles Rubber & Tire Co., work is now under way on the installation of a 150-kw. motor generator set. Power for operation will be furnished by the Binghamton Light, Heat & Power Co.

Binghamton, N. Y.—Plans are under consideration by the Board of Contract and Supply for the construction of a new municipal lighting plant to be located on Conklin avenue. W. E. Weller is city engineer.

Brooklyn, N. Y.—R. H. Comey Co., Inc., 73 19th street, is planning for alterations and improvements in the boiler plant at its works, to facilitate operations.

Brooklyn, N, Y.—Kayenn Manufacturing Co., manufacturer of electrical specialities, has completed negotiations for the leasing of the entire third floor of the building at 291-3 Adams street, for a new establishment.

Manhasset, L. I., N. Y.—Town Board, North Hempstead, is understood to be considering plans for the extension of its street lighting system on Station Road, at Great Neck Station to connect at Kensington.

New York, N. Y.—Long Acre Hardware & Electric Co., 806 Eighth avenue, has filed notice with the Secretary of State of an increase in its capital from $10 000 to $20,000, to provide for general business expansion.

New York, N. Y.—New York Edison Co., Irving Place and 15th street, has recently been awarded a contract for furnishing electric energy for the operation of the plant of the Auto-Strop Safety Razor Co., 656 First avenue. The works require 500 lamps for illumination, and 300 hp. in motors for manufacturing, as well as power for an electrically heated furnace for tempering steel blades. The company has also received a contract for furnishing power to the Union Trust building, 80 Broadway, and the Electrical Exchange, 136 Liberty street, having lighting installations of 2000 and 1000 lights, respectively.

New York, N. Y.—Belzo Electric Motor Co. has filed notice with the Secretary of State of a change in name to the Zobell Electric Motor Co.

New York, N. Y.—Alpha Electric Co., Inc., 116 West 29th street, has leased property at 151-55 West 30th street, aggregating about 22,500 sq. ft. for a new plant.

New York, N. Y.—Manhattan Railway Co. has had plans prepared for alterations and improvements in its one-story repair shop at Lexington avenue and 98th street. The work is estimated to cost about $50,000.

Syracuse, N. Y.—W. S. Hoffman, 329 Tuckel street, is having plans prepared for the construction of a new one-story foundry and power plant, about 50x200 ft., the entire work being estimated to cost $50,000. Contract for construction has been awarded to Dawson Brothers, Union building.

Califon, N. J. — Califon Electric Light & Power Co. has entered into a contract with the Hackettstown Electric Light Co. whereby the latter concern will supply electric service. The company will also issue capital stock to the amount of $10,000 for expansion. Permission for the stock issue has been granted by the Board of Public Utility Commissioners.

Dover, N. J.—New Jersey Power & Light Co. is making rapid progress on the installation of a new pumping station in the local plant. It is understood the station will be utilized for condensing purposes during dry seasons.

East Orange, N. J.—General Electric Co., Harrison, has filed plans for the construction of a two-story brick addition to its works on North 18th street, to cost about $40,000.

Jersey City, N. J.—Eastern States Refrigerating Co., 147 16th street, has filed plans for the construction of a seven-story concrete addition to its works on 15th street, to cost about $125,000.

Newark, N. J.—M. & L. Electric Co. has filed notice of organization to operate in a general electrical contracting capacity at 470 Warren street. Raymond Miller, 263 Bloomfield avenue, Verona, and Carl M. Lindheimer, 712 Ocean avenue, Jersey City, head the company.

Newark, N. J.—Weston Electrical Instrumental Co., 4 Weston avenue, has had plans prepared for the erection of a new addition to its plant. The structure is estimated to cost $7500.

Newark, N. J.—Terminal Electric Co. has filed notice of organization to operate a general electrical contracting establishment at 94 New street. Robert and M. M. Goldberg, 301 Belmont avenue, head the company.

Trenton, N. J.—Considerable electrical equipment of various kinds will be required in connection with the construction of the proposed hospital buildings to be erected by the state, contracts for which were awarded to the Standard Construction Co., Sansom street, Philadelphia, Pa., at a cost of about $300,000.

Trenton, N. J.—Trenton & Mercer County Traction Corp. has commenced work on the extension of its traction system from Bridge street to the municipal dock. E. J. Peartree is general manager.

Trenton, N. J.—A building permit has been taken out by the Hutchinson Storage Battery Co., Warren street, for the construction of new additions to its plant, to provide for increased capacity. The structures will be one and two stories, brick and steel, and are estimated to cost $16,500.

Westmont, N. J.—Township Committee has been granted permission by the State Board of Health to erect a new local pumping station, to be used in connection with the municipal sewage plant.

Philadelphia, Pa.—In connection with the construction of the proposed power plant at its works, contract for which was recently awarded to the Standard Construction Co., 1713 Sansom street, at a cost of about $10,000, the Niles-Bement-Pond Co. has arranged for the erection of a one-story brick pump house, and the installation of new boiler equipment at the plant.

Philadelphia, Pa. — Contract has been awarded by the Surpass Leather Co., Ninth and Westmoreland streets, for the construction of a new boiler plant at its works, estimated to cost $6000.

Philadelphia, Pa.—Plans have been prepared by the Griffon Co., Adams avenue and Wingohocking street, for the erection of a new three-story plant, about 4445 ft., at Unity and Oakland streets. In connection with the proposed structure, a boiler plant will be erected, the entire project being estimated to cost $104,000.

Pittsburgh, Pa.—Atlantic Refining Co. has filed plans for the erection of a one-story brick and concrete boiler plant to be located on Butler street, near 57th street, estimated to cost $25,000.

Elkton, Md.—Atlas Powder Co., Wilmington, Del., has disposed of its power plant at Perry Point to new interests. The company will be incorporated with extensive operating capital, and will operate the plant for local service. Electric energy will be furnished to Perryville, Port Deposit and Havre de Grace, with a system of distributing lines through this district. The new company is also planning for the erection of an ice manufacturing plant and mechanical laundry works, both to be electrically operated.

Seat Pleasant, Md.—The council is preparing to establish municipal lights. Address Severing Grobstad.

Clifton Forge, Va.—Notice has been filed with the Secretary of State by the Western Virginia Power Co. of an increase in its capital from $1,000,000 to $1,250,000, to provide for general expansion. W. G. Matthews is president; and A. C. Ford is secretary.

Bowman, Ga.—Bonds have been voted for issuance of municipal bonds for establishing an electric light plant.

Springfield, Ga.—The city contemplates the installation of an electric light plant. Address the mayor.

Unadilla, Ga.—The city will install an electric light plant.

Miami, Fla.—Miami Beach Electric Co., Carl G. Fisher and associates, was voted a franchise for operating an electric railway and light and power plants in Miami Beach.

NORTH CENTRAL STATES.

Canton, Ohio.—George Eastman, 401 Daily News building, has prepared plans and will let contracts for a $75,000 hotel to be erected here. The specifications include electric machinery.

Cincinnati, Ohio.—An ordinance has passed the council authorizing a bond issue of $22,000 to repair the city hall and to make the necessary changes in the wiring system to permit the lighting of the building by the Union Gas & Electric Co. Petitions were filed with the council to extend the boulevard lighting system on Race street from 12th to McMicken avenue and on Colerain avenue from Central to Millcreek bridge.

Mansfield, Ohio.—Mansfield Sheet & Tin Plate Co. will erect a $1,000,000 addition to its steel plant. When the new plant is completed the company will have a complete unit in the steel industry, permitting it to take ore through its several processes and turn out the finished plate.

Columbus, Ind.—City will vote Aug. 7 on the question of a $60,000 bond issue for the erection of a gymnasium.

Indianapolis, Ind.—Architect W. L. Jungclaus, 822 Massachusetts avenue, has prepared plans for a $10,000 power house to be erected by the G. & J. Tire Co. The building will be of brick construction, steam heated, plumbing, electric lighting.

DATES AHEAD.

National Council of Lighting Fixture Manufacturers. Midsummer convention, Cleveland, Ohio, Aug. 5 and 6. Secretary-treasurer, Charles H. Hofrichter, 8410 Lake avenue, Cleveland, Ohio.

Michigan Section, N. E. L. A. Annual convention, Ottawa Beach, Mich., Aug. 19-21. Headquarters, Hotel Ottawa. Secretary-treasurer, Herbert Silvester, Monroe, Mich.

Washington State Association of Electrical Contractors and Dealers. Annual convention, Seattle, Sept. 11. Secretary, Forrest E. Smith, 205 Boston block, Seattle.

Southeastern Section, N. E. L. A. Annual convention, Asheville, N. C., Sept. 17-19. Secretary-treasurer, T. W. Peters, Columbus, Ga.

New England Section, N. E. L. A. Annual Convention, New London, Conn., Sept. 22-24. Headquarters, Hotel Griswold. Secretary, Miss O. A. Bursiel, Boston, Mass.

International Association of Municipal Electricians. Annual convention, Chicago, Sept. 23-26. Secretary, Clarence R. George, Houston, Tex.

Association of Iron and Steel Electrical Engineers. Annual convention, St. Louis, Mo., Sept. 22-26, 1919. Secretary, John F. Kelly, Empire building, Pittsburgh, Pa.

National Association of Electrical Inspectors. Annual meeting, Springfield, Mass., Oct. 13 and 14. Secretary, W. L. Smith, Concord, Mass.

Illuminating Engineering Society. Annual convention, Chicago, Ill., Oct. 20-23. General secretary, Clarence L. Law, 29 West 39th street, New York City.

Logansport, Ind.—A new turbo-generator with a capacity of 200,000 voltage and weighing 75,000 lb., for use in the local electric light plant, has been installed at a cost of $25,000.

Chicago, Ill.—Grip Nut Co. has acquired a tract of about 250,000 sq. ft., on which it proposes to erect a large new plant. It will be one of the most modern in the country, will have traveling cranes extending the full length of the building and over the switch tracks. It is stated the building and ground will represent an investment of about $500,000.

DeKalb, Ill.—DeKalb-Sycamore Electric Co. is erecting cooling tower 75 ft. in height.

Urbana, Ill.—Board of local improvements has ordered the installation of 60 ornamental lamp standards on West Green street, at a cost of $6300. The board is also considering the installation of similar standards over the entire southwestern part of the city, adjacent to the University of Illinois. Address J. E. Smith, mayor and president of the board.

Villa Grove, Ill.—The failure of the Central Illinois Public Service Co. to furnish power several days the past weeks has started a movement to establish municipal lights. Address village clerk.

Lansing, Mich.—Architect O. E. Eckhart, City Hall, has prepared plans for extension to be made to the electric light plant. $300,000 will be expended, specifications including extension to electric light plant, steam heating, plumbing, power plant, electrical equipment. Contracts will be let by city clerk.

Black River Falls, Wis.—Architects Mead & Seastone have prepared plans for power plant to be erected by the city. Estimated cost $25,000. The power plant will be erected and engine dynamos, electric machinery purchased.

Milwaukee, Wis.—Permit was granted to the Electric Co., to erect a substation at 27th avenue and Burham street.

Neenah, Wis.—The council has decided to enter into a new lighting contract with the Wisconsin Traction Light, Heat & Power Co. The contract will provide for a larger number of lamps in the business district and less powerful ones in the outlying districts.

Superior, Wis.—The lighting system commission will petition for new white way in East End, Superior.

Wells, Minn.—City council is considering the construction of an electric power plant and distribution system and concrete reservoir. Engineer C. L. Pillsbury, Metropolitan building, Minneapolis.

Bloomfield, Iowa.—Citizens authorized officials to rebuild and repair municipal electric light and power plant. Address E. Z. Morrow, city clerk.

Ferguson, Iowa.—The question of establishing municipal lights will be submitted to vote. J. R. Finders, city clerk.

Humboldt, Iowa.—Northern Gas & Electric Co. contemplates extending its electric transmission lines from Ruthven to Lost Island Park.

Spencer, Iowa.—Spencer's municipal electric light and power plant will furnish electricity for power and lighting to farmers and several towns.

Butler, Mo.—Improvements for the electric light and water plant are contemplated.

Carrollton, Mo.—Harry A. Spradling and George A. Allen have purchased a substantial interest in the water, light and transit company. Mr. Spradling has been appointed manager and superintendent of the plant. The work of improving the plant is being rushed to completion. A 500-kw. engine and generator will also be installed to more than double the present capacity of the plant.

Edina, Mo.—Special reports have been prepared by experts on the proposition of placing a value on the light and ice plant. Improvements are also contemplated.

St. Joseph, Mo.—A new 10,000-kw. turbine with surface condenser is being installed in the plant of the St. Joseph Railway, Light, Heat & Power Co. The new equipment also includes two 1000-hp. boilers. G. W. Saathoff is the engineer in charge of the work.

Arlington, Kans.—Election will be held Aug. 1 to vote $20,000 in bonds for the purpose of purchasing, constructing and extending works for supplying the city with electric current. W. P. Barley, city clerk.

Elkhart, Kans.—Election to vote $60,000 additional bonds for the extension of the city water and electric light plant carried. It is planned to raze the old power house and erect a much larger building in which will be installed an elaborate two-unit plant giving 24-hour service.

Hutchinson, Kans.—Elections are to be held at Arlington, Langdon and Turon to vote the necessary bonds for the building of transmission lines from Hutchinson.

Kansas City, Kans.—The Kansas City commissioners awarded the contract for generators for the municipal electric light plant to the Westinghouse Electric & Manufacturing Co. The cost of the generators will be about $232,000 and the contract calls for delivery in 90 days. Contracts for other machinery, boilers, poles, and necessary equipment have been awarded. The addition will double the capacity of the present plant.

Liberal, Kans.—A resolution has passed ordering the installation of a white way. The new street lighting system will extend about three-quarters of a mile.

Ness City, Kans.—Another engine and generator are needed for the light plant. These will probably be purchased in the near future.

Partridge, Kans.—Election will be held Aug. 1 to vote $20,000 in bonds for the erection of an electric transmission line and power plant by which that town can get current from Hutchinson.

Wichita, Kans. — Kansas Gas & Electric Co. will build a transmission line ten miles west of the city.

Woodston, Kans.—Election to vote $13,000 in bonds for the purpose of buying and improving the light and power plant carried.

Antler, Neb.—At a special meeting city council decided to enlarge the lighting capacity of the city electric light system. Address town clerk.

Hickman, Neb.—Plans being made by Grant, Fulton & Letton, Bankers' Life building, for an electric transmission line from Lincoln to Hickman and an electric distributing system to be voted.

Oshkosh, Neb.—Bond issue of $9750 for construction and equipment of lighting system to be voted. G. M. Robinson, clerk.

SOUTH CENTRAL STATES.

Springfield, Ky.—Plans are being arranged by the Springfield Water & Electric Co. for the installation of a quantity of new equipment at its plant, including alternators, engines, panel switchboards, etc. It is understood that the company is planning to convert the plant to the alternating current system.

Jackson, Miss.—The light and power plants, gas plant and other properties of Jackson Light & Traction Co., were purchased by M. H. Grossman, Milwaukee, Wis., representing the bond holders. The plants will be improved.

Meridian, Miss.—Board of Managers of the local Masonic Home is considering plans for the installation of a new electric lighting plant. E. J. Martin is superintendent.

Merigold, Miss.—Sage Brothers & Jones Construction Co., Memphis, Tenn., is erecting a school building. The electrical work on this contract will amount to $1300. M. M. Alsop, Randolph building, Memphis, Tenn., is the architect.

Lamar, Ark.—The City Council has given the Commonwealth Public Service Co. of Fort Smith a franchise and has entered into a contract whereby the latter company will furnish electric power for lighting and other purposes. The company will extend its main line from Jamestown to Lamar.

Marvell, Ark.—Marvell Light & Ice Co. has increased its capital stock from $20,000 to $40,000. A. V. Newman is president.

New Orleans, La.—Plans are being arranged by the Board of Managers of the Charity Hospital, for the installation of a new underground system to be used for the furnishing of electric lighting to about twenty buildings at the institution. Construction has been completed on the power house, and work will soon be commenced on the installation of the necessary equipment, including 300-kw., direct-connected, 3-wire generators, steam engines, motors, etc. The entire work is estimated to cost $90,000. A. Wyndham Lewin, 335 Carondelet street, is consulting engineer.

Comanche, Okla.—Election to vote $35,000 for improving the electric light plant, carried recently.

Gotebo, Okla.—City is having plans arranged for the construction of a new municipal electric light plant. Bonds to the amount of $20,000 were recently voted to cover the cost of the work.

Hobart, Okla.—The electric light bonds have been accepted and sold and work will commence at once on the new system.

Hydro, Okla.—A bond issue for the purchase by the city of the electric light plant and ice plant carried.

Tahlequah, Okla.—A bond issue of $200,000 has been authorized by the city officials, to provide for the construction of a new municipal electric power plant.

Beeville, Tex.—Improvements in the electric light plant are contemplated.

Breckenridge, Tex.—Texas Power & Light Co. will install new equipment.

Dallas, Tex.—It is stated by Fred A. Jones, engineer who is in charge of the surveys now being made for the proposed interurban electric railway that is to be constructed between Dallas and Wichita Falls that eight tentative routes have been gone over and that the preliminary survey of the ninth route is now being made. It will be left to the executive committee of the Dallas-Wichita Falls Interurban Co., as to which route will be selected. The distance by the shortest route is 130 miles. Glen Stiff, right of way agent of the construction company, is working in conjunction with the field engineers.

Fort Worth, Tex. — Investigations are being made to get information on different systems of street lighting previous to the improvement of the city system here.

Fort Worth, Tex.—Construction of the proposed interurban line to Mineral Wells will begin Oct. 1. H. E. Robinson, promoter of the company, that proposes to construct the line with the Palo Pinto county watering place and afford the isolated section of Parker and Palo Pinto an outlet to market their produce and crops. The line will extend 60 miles west of Fort Worth with prospects of it being constructed to the oil fields of Stephens county via Breckenridge and on to Ranger and Cisco. When incorporated it will be known as the Fort Worth & Western Electric Railway Co., and will be capitalized at $3,000,000. The company is headed by H. E. Robinson.

Luling, Tex.—A petition is being circulated asking that the Board of Commissioners order an election on city bonds in the sum of $75,000 for installing a municipal lighting plant and water plant.

Ranger, Tex. — Construction of a system of interurban electric railways through the Central West Texas oil fields is planned by the Ranger Light & Power Co., which has just been granted a franchise for a street railway system here by the city commission. The first of the interurban lines to be built will run between Ranger and Eastland, 12 miles. The company will construct a large central electric power station here.

WESTERN STATES.

Boise, Ida.—Mackay Light & Power Co. was given permission by public utilities commission to extend its lines down the Lost river to Arco. In this event it is probable that the town of Arco will not proceed with plans for a municipally owned power transmission line 46 miles long for which a bond issue of $60,000 had been planned.

Marshfield, Ore. — An estimate of what it will cost to put the power plant at the Smith Mill in good running order in relation to both the part which supplies the power for the Mountain States Power Co., and that which furnishes power for the Smith Mill, has been completed by the consulting engineer of the power company. The cost is estimated at $60,000.

Roseburg, Ore.—William Polman, owner of the local light and water plant who resides at Baker, Ore., was here recently inspecting the property with a view to making improvements. Pumping and power plant on the North Umpqua will be improved and entire system put in shape.

St. Johns, Ore.—Construction of electric railway connections between the municipal terminal at St. Johns and the city street car system may be undertaken by the public dock commission, as the result of an offer from the Portland Railway Light & Power Co. The cost of the connection is estimated at $25,000.

Bellingham, Wash.—E. F. Williams, engineer of Seattle, will investigate the feasibility of a plan to divert the South Fork of the Nooksack river into the Skagit river with the idea of installing a power plant of about 14,000-kw. capacity. He is the owner of the water rights on the South Fork.

Kelso, Wash.—Contract for the substation at this place was awarded by the North Coast Power Co. to N. A. Strand, construction to start at once. The company also has a crew of men rebuilding the line from Kelso to Kalama to carry a load of 66,000 volts and a total outlay of $40,000 is being made by the company in this vicinity this summer.

Seattle, Wash.—Installation of an additional unit of 10,000-kw. capacity at the Lake Union Station plant will cost more than $75,000 according to estimates filed with the city council by J. D. Ross, superintendent of the city lighting plant who is urging immediate steps to meet what he says is a serious shortage of electrical power.

Seattle, Wash.—In connection with the proposed construction of the 18,000,000-ton capacity dry-dock at the plant of the Ames Shipbuilding & Drydock Co., large quantities of electrical equipment will be required, including complete electrically operated pumping apparatus, motors, etc.

Wenatchee, Wash.—Plans are being perfected by the Okanogan Valley Power Co. for the construction of a new dam and power plant on the Similkameen river, in the vicinity of its present works. It is understood that the proposed plant will have a capacity of 5000 hp.

Petersburg, Alaska — Citizens are organizing a company to install a hydroelectric power plant on Five Mile creek, to deliver power to the city. The City Council is to constitute the majority of the board of directors and the company is to issue bonds for $40,000, the estimated cost of the first unit of the plant, the bonds to be taken up by the city, which will become the owner of the enterprise. H. P. Crowther of Juneau is doing the engineering work.

Fresno, Cal.—Announcement has recently been made by the Pacific Telephone & Telegraph Co. that plans are now in process of formation for extensions in its cable system in the north and east sections of Fresno to be inaugurated during the coming fall. The work is estimated to cost about $55,000. Maynard Bailey is superintendent of the Fresno district.

Greenville, Cal. — Trask Copper Mining Co. has recently completed the construction of a new power line from Englemine to its local mining properties. Power for operation will be supplied by the Great Western Power Co.

Holtville, Cal.—Holton Power Co. is arranging final plans for the installation of new electric generating equipment in its dismantled power plant at Holtville. It is understood that the work is estimated to cost about $75,000. E. A. Judy is district manager.

Los Angeles, Cal.—Plans are being arranged by the Southern California Edison Co. for the installation of new generating equipment in its Big Creek plant No. 2, located about 240 miles from Los Angeles in Fresno County. In this connection the company will be obliged to construct an additional pipe line. It is understood that plans are under consideration for the installation of a similar unit in power plant No. 1 at a later date.

Los Angeles, Cal.—Large quantities of electrical equipment will be required in connection with the construction of municipal power plant No. 2, located in the San Francisquito Canyon, the entire installation being estimated to cost about $500,000. The machinery will include electric generating equipment, transformers, hydraulic equipment, and auxiliary electrical apparatus.

Los Angeles, Cal.—In connection with the proposed plant of the Keystone Iron Works, Merchants National Bank building, estimated to cost in excess of $100,000, large quantities of electrical equipment will be required, including three electrically operated cranes, motors, etc. The new works will be located on Santa Fe avenue.

Los Angeles, Cal.—Public Service Commission has approved plans for the installation of the proposed new ornamental lighting system on Broadway, to extend from California street to 10th street. The entire work is estimated to cost approximately $100,000.

San Diego, Cal.—The City Council is understood to have authorized the preparation of estimates of cost for the construction of a new municipal electric light and power plant, now under consideration. W. H. Judy is city manager of operation.

FOREIGN TRADE

[Addresses of firms referred to in these trade opportunities may be obtained by writing to the Bureau of Foreign and Domestic Commerce, Washington, D. C., or its branch and local co-operative offices. Request for each opportunity should be on a separate sheet and the file number given.]

Electrical Goods (29,921).—An electrical dealer in France desires to represent manufacturers of electrical goods in Brittany, except conduit, but particularly electric fans. Correspondence should be in French.

Electrical Equipment (29,931).—A merchant from France who is in this country desires to purchase from manufacturers only, for Roumania, iron and steel, and products, electrical goods, automobiles, rubber goods, agricultural machinery, machinery, hardware, electric railway cars and equipment for electric railways, glass and general merchandise. References.

Electrical Supplies (29,934).—A firm in this country is about to send a representative to Cuba to establish branch offices and desires to secure exclusive agencies from manufacturers of all kinds of hardware, tools, nails, roofing materials, railroad accessories of all kinds for tracks used on sugar plantations, dry goods, paper, special wrapping paper, electrical supplies, drugs and chemicals, and any merchandise that will find a ready sale in that country. References.

Vacuum Cleaners (29,933).—A firm in Belgium desires to purchase or to secure the agency for the sale of sanitary ware, heaters for bath, radiators, valves and accessories, and vacuum cleaners. Quotations should be given c. i. f. Antwerp. Payment, cash against bill of lading at Antwerp. Correspondence should be in French. References.

Electrical Goods (29,911).—A company in the United States composed of Americans and native Finlanders, who are going to send representatives to Finland, desire to purchase and secure the agency for the sale of all kinds of foodstuffs, wearing apparel, machinery, agricultural implements, electrical goods, etc. Reference.

Electrical Materials—Furnaces (29,945). — A mechanical engineer, graduate of an American university, will be in America to secure commission or consignment contracts for sale in Belgium of electrical material and supplies, metallurgical appliances, rolling mills, electric furnaces, ores, coal, etc.

Electrical Supplies (29,876).—The purchase by a company in Norway of electrical industry supplies, gas and electric fixtures, iron, steel boilers, various metals, shipbuilding materials, engines, electrical cable-making machinery, flour-mill machinery, motion-picture machinery, raw rubber, porcelain insulators and porcelain articles used in electrical industries, is desired. Terms, cash against documents. Reference.

PROPOSALS

Street Lighting System.—Bids will be received by J. W. Allard, city clerk, Osawatomie, Kans., until 8 p. m., July 28, for furnishing all material and installing a special street lighting system to consist of 102 metal lamp standard, steel topped and lead covered cable, street light switchboard panel, crossarms, pole-line hardware, No. 8 triple-braid waterproof wire and all appurtenances called for in plans and specifications, which may be secured at the office of the city clerk or the engineers, Black & Veatch, Interstate building, Kansas City, Mo. Contractors desiring plans will be required to deposit $10, $8 of which will be refunded when the plans are returned. Certified check $500.

INCORPORATIONS

Los Angeles, Cal.—Guaranteed Battery Equipment Co. has been incorporated with a capital of $25,000 to manufacture batteries, equipment, etc. T. S. Juden, H. M. Motzkus, T. O. Osborn, C. E. Corson, and Edward Corson, all of Los Angeles, are the incorporators.

Philadelphia, Pa. — Electro-Lyte Storage Battery Co. Incorporated under Delaware laws with a capital of $200,000 to manufacture storage batteries, etc. Incorporators: R. F. Hansell, Philadelphia; E. M. MacFarland, and J. Vernon Pimm, Camden, N. J.

Personal

E. C. Bennett Joins International Paint Corp.—Ervin Dryer Opens Sales Engineering Office—I. B. Zimman Promoted

HERMAN G. HARDY has assumed the position of chief mechanical and electrical engineer of the Arizona Copper Co., Ltd., Clifton, Ariz. He was formerly associated with the Old Hickory Powder Plant, Jacksonville, Tenn.

ROY PAGE, for the past two years associated with the Nebraska Power Co., has been appointed to the position of general superintendent, having direct supervision of the power station, purchasing department, garage, storeroom and the claims and welfare department. Prior to joining the Nebraska company Mr. Page was for some time connected with the Southern Pacific Railroad.

C. D. MCCLARY, who has been with the Western Electric Co. since February, 1910, has been made sales manager of the Pittsburgh office, effective July 1, 1919. Mr. McClary was first connected with the Philadelphia office and transferred to Pittsburgh in the latter part of 1910. In April, 1916, he joined the sales force, and in April, 1918, was promoted to the position of assistant sales manager, continuing in that capacity until his recent promotion.

I. B. ZIMMAN, manager of the sales and service department of the Nebraska Power Co., Omaha, Neb., has been promoted to the position of assistant general manager in charge of public relations. He will have supervision of the company's general relations with the public, franchises, municipal contracts, taxes and property assessments, reporting to the vice-president and general manager. Mr. Zimman has been connected with the Nebraska Power Co. and its predecessor, the Omaha Electric Light & Power Co., in various capacities for 17 years, principally in new-business work.

ERVIN DRYER has opened an office as sales engineer at 1535 Old Colony building, Chicago, and will handle steam, electric and hydraulic lines with an organization for doing the necessary engineering work in connection with the installation of such equipment. Mr. Dryer is one of the best known engineers in the Middle West, having had much to do with the design and construction of many of the most prominent power stations in this territory. He was graduated from the University of Illinois in the mechanical engineering class of 1887. He first became connected with the United States Electric Lighting Co., and when this company was taken over by the Westinghouse Electric & Manufacturing Co. he was made sales engineer in the Chicago territory. In 1904 he left the Westinghouse company to become a sales engineer in the Chicago district for the Allis-Chalmers Manufacturing Co., which position he had held continuously until the present time. Mr. Dryer is affiliated with a number of technical and engineering societies and has taken a very prominent part in the development of steam-electrical engineering.

ELL C. BENNETT, of St. Louis, has resigned from the office of seventeenth Mercury of the Jovian Order, to which position he was elected last October to serve until January, 1920, to join the International Paint Corp. in the capacity of secretary and general manager. This company, under the name of the Railway Supply Co., has been engaged in the production of paint

Ell C. Bennett.

oils, graphite and asphaltum paints for a number of years. Its capital stock has been increased to $150,000. The plant is located in East St. Louis, Illinois, with headquarters in St. Louis, and it will specialize in paints used in the electrical industry. Mr. Bennett served the Jovian Order for a longer period than any other elective officer in the history of that body, being elected for eight consecutive years. During his term of office the Order grew from less than 5000 members to nearly 20,000, the peak being reached just prior to the outbreak of the world war. Since that time the stress of war and changing conditions in the electrical industry have operated to materially reduce Jovian numbers.

L. W. W. MORROW, who has been at Yale University on leave of absence from the University of Oklahoma during the past year, is retained at Yale as assistant professor of electrical engineering. Professor Morrow was in charge of one of the divisions of the Signal Corps Training School for officer candidates while it was active. When at the University of Oklahoma Professor Morrow was director of the School of Engineering and took an active interest in public utilities of the state, particularly in connection with engineering and valuation matters.

Obituary.

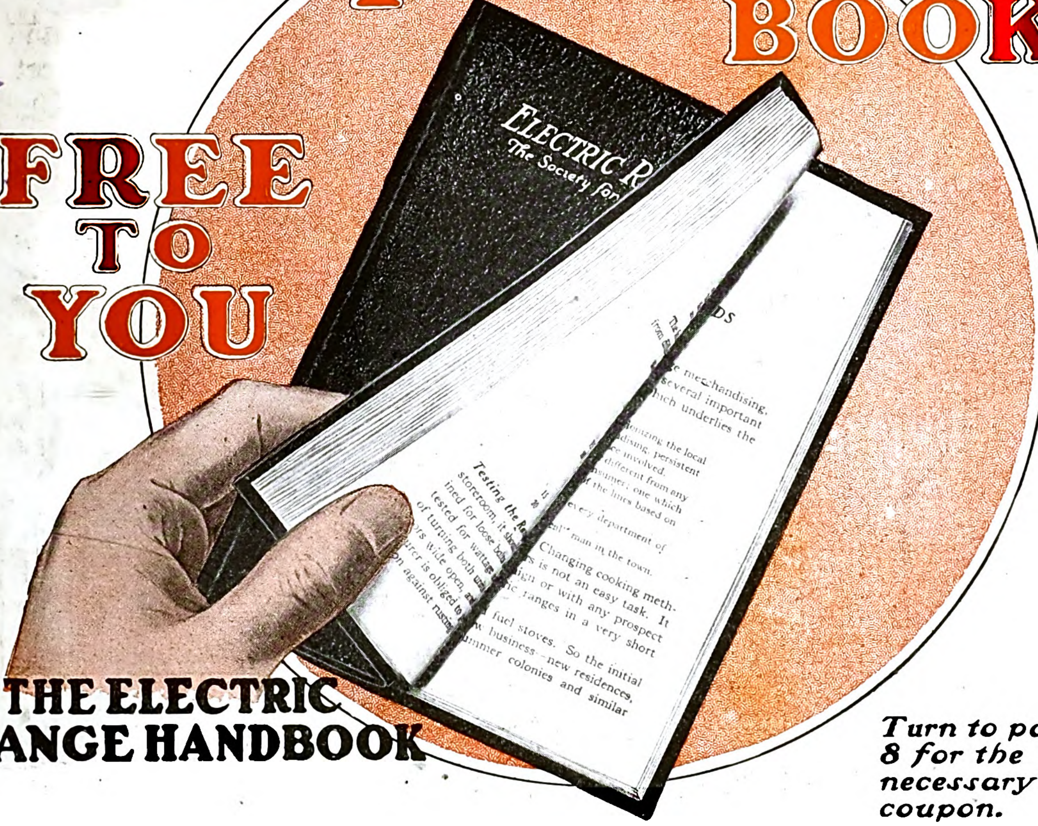
GEORGE B. WEBB, capitalist and organizer of street railways and telephone companies, died July 7 at Baltimore at the age of 60. Mr. Webb began his business career with the Baltimore & Ohio railroad and subsequently in connection with Harry Parr he constructed the Baltimore & Northern railroad. Then with Alexander Brown & Sons, bankers, he consolidated the street railways of Baltimore, and for a short time was the president of the amalgamated companies. Mr. Webb's activities rapidly broadened. He organized the Maryland Telephone Co., the Pittsburgh & Alleghany Telephone Co., Wilmington Light & Power Co. and the Duquesne Light Co. of Pittsburgh. At a later period, with Baltimore associates, he consolidated the United Railways of San Francisco, and with Pierre S. du Pont and Harry P. Scott he consolidated the street railways and light and telephone system of Wilmington, under the name of the Wilmington & Philadelphia Traction Co.

BARON RAYLEIGH (John William Strutt), known as "Peter Shopkeeper" and as one of England's greatest physicists, died on June 30. He was born in 1842, a descendant of Sir Godfried Strutz de Winkered, who resided in Essex as early as 1240, and was graduated as senior wrangler at Trinity College, Cambridge, in 1865. From 1879 to 1884 he was Cavendish Professor of Experimental Physics in Cambridge University, and in 1887 he accepted the post of Professor of Natural Philosophy at the Royal Institution of Great Britain. He was awarded the Noble Prize for physics in 1904. Baron Rayleigh became well known throughout Europe many years ago by his papers on mathematics and physics, written under the name of "J. W. Strutt." The scope of the subjects treated in his essays was large and included such specialized subjects as chemical physics, theory of gases, flow of liquids, photography, optics, color vision, wave theory, and problems in the theory of electricity and magnetism. A characteristic of his experimental apparatus, which was designed and built by himself, was that it was unusually crude and unpretentious in appearance, but that it was essentially perfect and demonstrated his theory accurately. At the time of his election as Chancellor of Cambridge University in 1908, his reputation was such that it was said of him that "since the death of Lord Kelvin he is the most eminent chemist in Christendom."

Electrical Review

Vol. 75. No. 4. CHICAGO, JULY 26, 1919 Three Dollars a Year

THIS $1.50 RANGE BOOK FREE TO YOU



THE ELECTRIC RANGE HANDBOOK

Turn to page 8 for the necessary coupon.

HERE is a book that tells you what you want to know about Electric Ranges. It is prepared and published by the Society for Electrical Development, Inc., and consists of 208 pages of good solid facts based on the experiences of Central Stations all over the country who have been putting Ranges onto their lines. There is nothing theoretical about the book. You learn by the experience of others.

Turn to page 8 of this Review. Fill out the coupon you will find there and mail it to us at once. Although the book is usually sold by the Society for $1.50 the Hughes Division has secured a limited number of copies for Central Station men contemplating Range campaigns. The coupon mailed us at once will bring you your copy before it is too late.

HUGHES DIVISION
Edison Electric Appliance Co., Inc.
CHICAGO

New York **Ontario, Calif.** **Atlanta**

Electrical Review

WITH WHICH IS CONSOLIDATED WESTERN ELECTRICIAN AND ELECTROCRAFT.

VOL. 75—No. 4. CHICAGO, SATURDAY, JULY 26, 1919. PAGE 135.

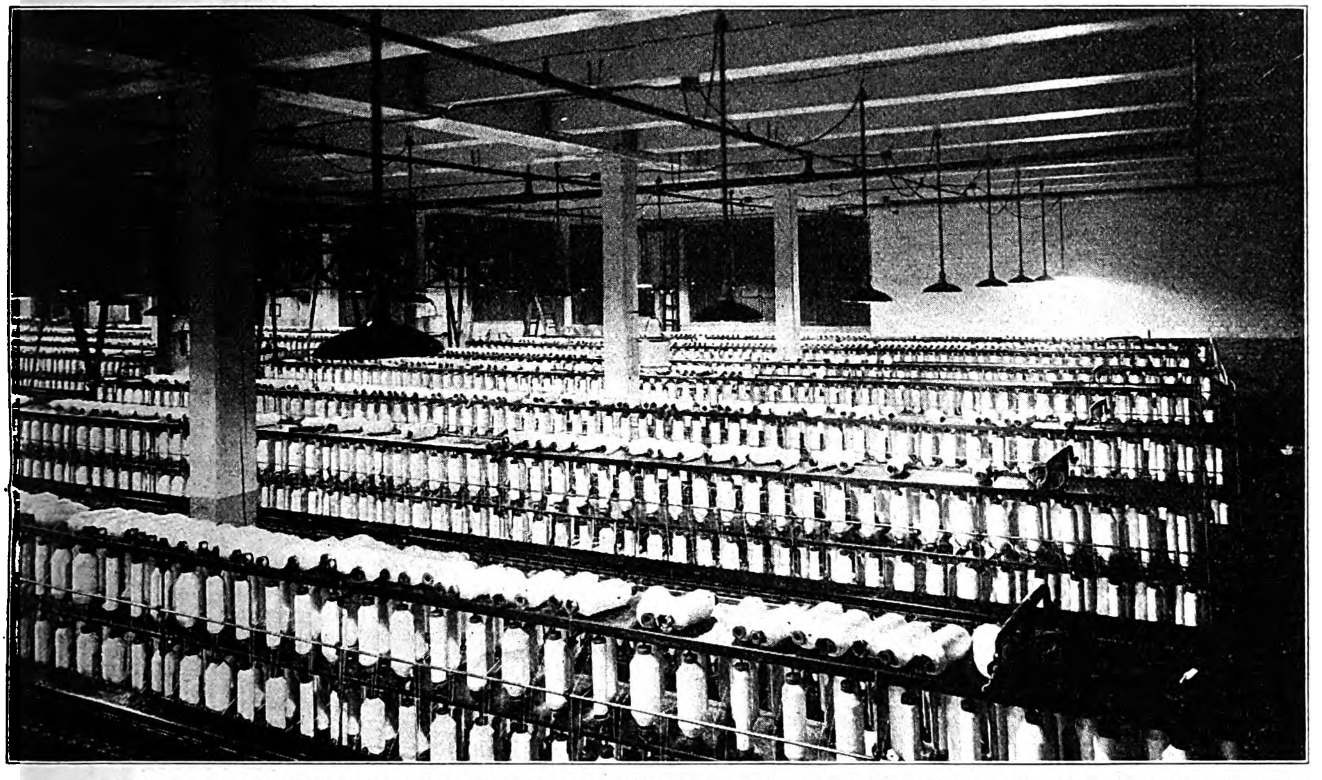


Fig. 1.—Night View in a Spinning Room, Showing General Illumination Meeting All Requirements—Fixtures Can Be Easily Taken Down for Cleaning or Repairs, an Important Feature in a Cotton Mill.

Canadian Textile Mill Operated by Central-Station Service

Canadian Cotton Co.'s Plant Electrically Equipped Throughout — Remote Control and Other Features of Motor Service — Exceptionally Good General Illumination in Every Department

By V. K. STALFORD

Hamilton District Inspector, Electrical Inspection Department, Hydro-Electric Power Commission of Ontario.

A VERY fine example is shown in the accompanying illustrations of a textile mill operated entirely from central-station service. It is the new plant of the Canadian Cotton Co., and is located in Hamilton, Ontario, Canada.

This mill manufactures all grades of cloth used for making overalls, mattresses, bed ticking, and light ducking. The building occupies an entire city block, about 300 ft. square and faces three streets. It is of mill type construction, three stories high. The total load is approximately 1000 kw., including lighting and power. This is an ideal load for central-station service. A number of the manufacturers in this territory had very great difficulty during the war in obtaining coal supplies and they are now contemplating central-station service to prevent recurrence of these difficulties.

The latest practice in the textile industry is to have all motors controlled entirely from a centrally located power house or substation, maintaining an operator at this substation at all times. The motors are only equipped with the emergency switches to permit disconnecting the same in case of accidents or other emergency. In this mill Detroit "Square D" enclosed switches are used near the motors for this purpose.

In Fig. 2 a view in this substation is given, showing two rows of panels with starting switches for each motor and the necessary meters. A 150-hp. 220-volt, two-phase, 66⅔-cycle motor is shown in the center of the photograph for operating one of the weave rooms. The control for this motor is shown at the right of the picture. All the equipment in this substation was supplied by the Canadian Westinghouse Co., and installed by it. Each motor is started and stopped from this substation by the operator. Ammeters and voltmeters are used to give indications of the starting condition of each motor.

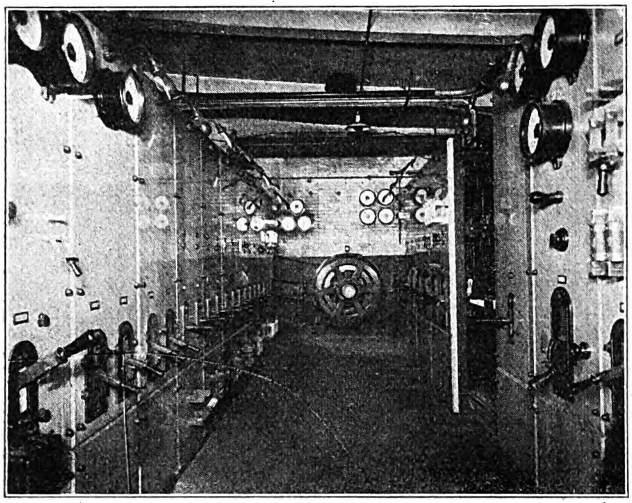


Fig. 2.—View in Central Substation, Showing Motor Control Panels and Distributing Boards—A 150-Hp. Motor Is Also Shown.

Fig. 3 is a rear view of the panels, showing the starting and running fuses. On the right-hand side of the illustration are shown the autotransformer coils with interlocking knife switches for rearranging the percentage taps of the autotransformers. This is a very compact installation. Sufficient space is provided at the rear of panels for making all necessary repairs.

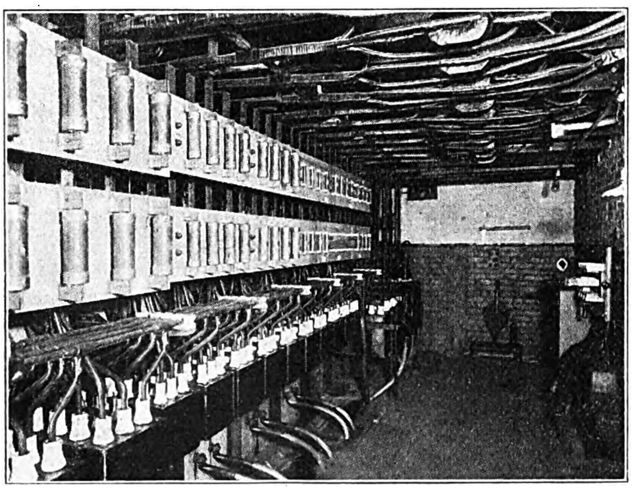


Fig. 3.—Rear View of Motor Control Panels in the Central Substation, from Which Nearly All the Motors Are Controlled.

Samples of the electric lighting throughout this mill are given in four of the accompanying illustrations. These are considered excellent examples of modern textile-mill lighting. The management of this mill recognized that it is most important to have proper lighting facilities in order to reduce accidents during the hours of darkness and semidarkness. The factory lighting shown in these views will increase production, decrease cost, improve quality, reduce spoilage, and prevent accidents. In other words, it will not only improve production, but also conserve the human material in the textile industry which is its most valuable asset. The average time of artificial lighting in factories of this type is three hours per day. It is most important that the working conditions under artificial lighting should equal closely those of the best daylight at all working hours. This is more particularly true where night shifts are working.

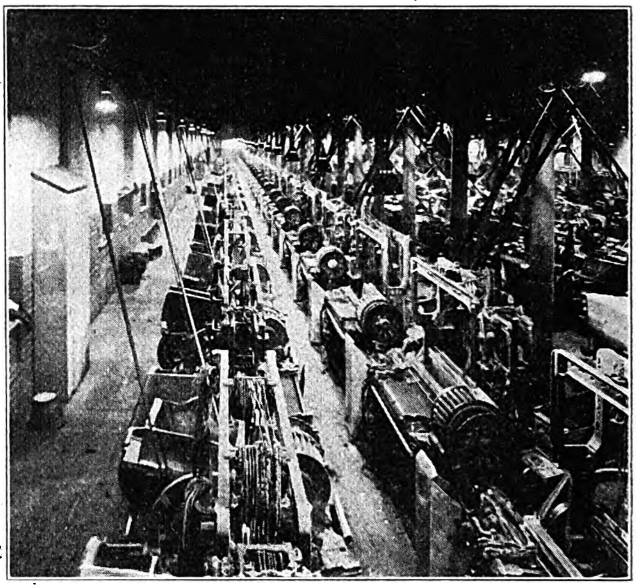


Fig. 4.—Night View in One of the Weave Rooms—Illumination That Has Been Found to Give Most Satisfactory Results.

Efficient lighting throughout the factory is equal to good tools. No foreman or superintendent would expect the workman to properly perform his task with poor tools. The workman and machinery are a combination and as such must work harmoniously. The machine may be the best type that can be obtained, but with poor lighting the workman is handicapped, consequently the combination cannot produce satisfactory work to the highest efficiency. As the practice

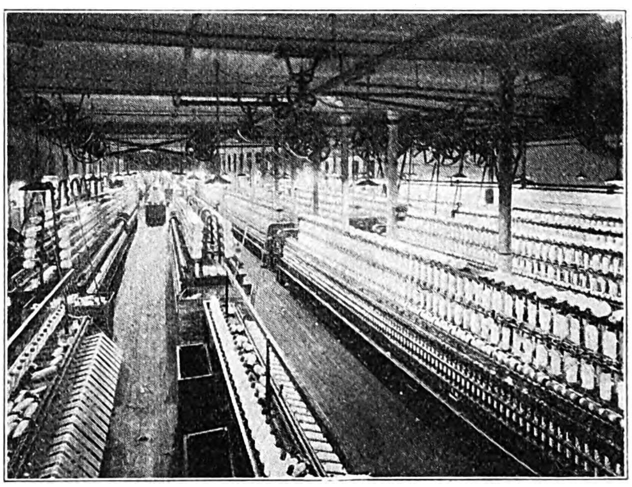


Fig. 5.—View in One of the Spinning Rooms—General Illumination That Floods the Whole Room in Light.

now is to reduce working hours it will be necessary to increase production accordingly. It is the prime purpose of every plant to earn as much profit as possible; in fact, this is the reason for its existence. Therefore, if the manufacturer neglects to install proper illumination, he is taking cash from his pocket to pay for his own carelessness.

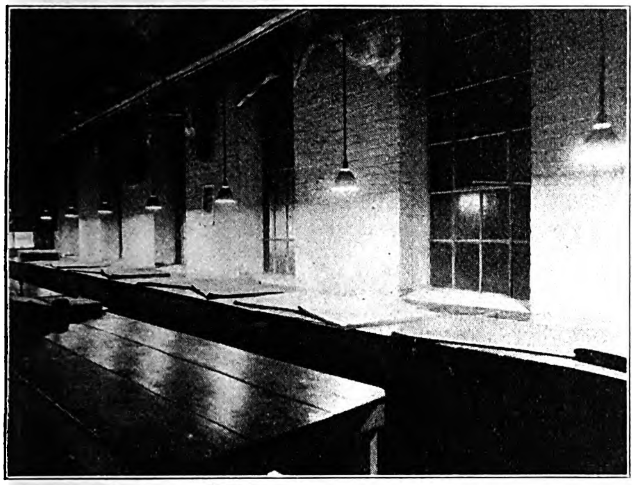


Fig. 6.—Inspectors' Tables Effectively Lighted to High Intensity so That Any Defect in the Cloth Can Be Detected Before Finishing and Shipping.

These ideas were given careful consideration before deciding on the lighting of this mill. In designing the installation thought was also given to the fundamental principles for lighting, which are: Correct intensity, good diffusion, lighting from the proper direction, absence of drop cords, and absence of glare, both direct and reflected.

Fig. 4 is a night view in one of the weaving rooms. The units in this room are 60-watt Mazda lamps in Benjamin deep bowl reflectors mounted approximately 7 ft. from the floor, located directly over the center of the machine. This has been found to give the most satisfactory results. The units at the rear of the machines are spaced approximately 15 ft. and 9 ft. from the floor. As these are only for general lighting purposes it is not necessary to have so great an amount of illumination at the rear of the machine.

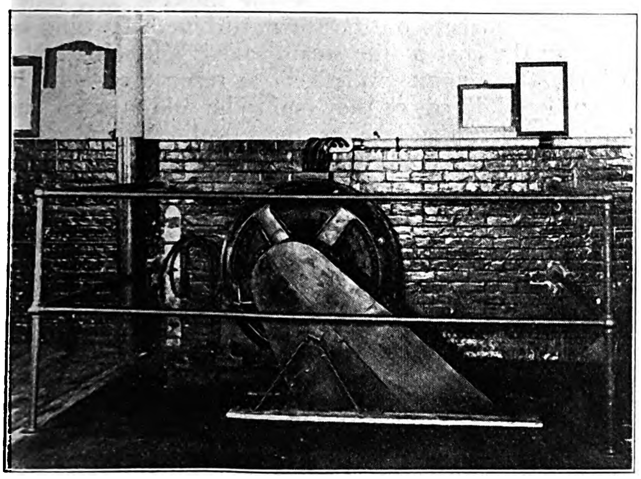


Fig. 7.—One of the Motors Connected to Drive a Group of Machines Through Silent-Chain Belt Drive.

In Fig. 5 is shown a view in one of the spinning rooms, using Benjamin shallow bowl reflectors of 60-watt size with 25-watt Mazda lamps and mounted 7 ft. from the floor.

In Fig. 1 another view is shown in the spinning rooms. The detail shown is very clear and there is a marked absence of confusing shadows. The fixture used throughout this mill is the Benjamin hanger with shock absorber suspended from the screw hook in the wooden ceiling. Reinforced cord is suspended between the outlet box and the fixture. Bryant type KA No. 13 receptacles are used in the outlet box for connecting the fixture plug; this provides a ready means for disconnecting the fixture so that it can be taken down for cleaning and repairs. This type of receptacle is very flexible for factory work.

Fig. 6 gives a view of the class of lighting used at the cloth inspection table where the final inspection is made of all of the cloth for defects before it is shipped to the customers. It is most important that this lighting should be as nearly perfect as possible in order that the inspector can find the defects. Benjamin 100-watt bowl reflectors with 60-watt Mazda C lamps are mounted approximately 3 ft. above the bench and on 6 ft. centers.

This lighting system has been in use for over one year, and the management is entirely satisfied with the excellent results obtained therefrom.

Fig. 7 is a typical installation of one of the motors with Link-Belt silent-chain drive enclosed and operating in oil. Group drive has been extensively used throughout the mill, using motors of 50 hp. and larger.

NEW POWER PLANT FOR PITTSBURGH DISTRICT.

Duquesne Light Co. to Erect Big Power House at Cheswick, Pa., to Serve Entire Pittsburgh District.

The Duquesne Light Co., Pittsburgh's central-station organization, has made arrangements for floating a $25,000,000 30-year bond issue, the bulk of the proceeds of which will be used for building a big new power plant at Cheswick, Pa., of such capacity that it can supply all of the electric power needs of the Pittsburgh district for an indefinitely long time in the future.

This plant will be along the Allegheny River within two miles of a 3000-acre thick-vein Freeport coal tract of the Equitable Coke Co., a subsidiary of the Philadelphia Co., which controls the Duquesne Light Co., thus assuring abundant supplies of water and fuel.

During the war a comprehensive survey was made by engineers of the War Department of Pittsburgh's probable power needs and it was estimated that the probable maximum demand was equal to 556,000 kw. The power plants of the Duquesne Light Co. have now a capacity of more than 156,000 kw.

Transmission lines will be erected to reach every vital part of the Pittsburgh district and to connect the various power plants and substations in such a way that uninterrupted electric service will be assured at all times. The Duquesne Light Co. now has 85,000 customers, 7 generating stations, 163 substations, 7375 miles of electric conductor and almost 1000 duct miles of underground conduit.

FAN SALES BREAKING RECORDS.

Reports from many parts of the country indicate that the present will probably be the best electric fan season in numerous cities. The continued hot weather has exhausted stocks at several points. In fact, the early onset of the hot spell in June caused unusually heavy sales for that month which are continuing. The records of 1916 are likely to be broken.

Central-Station Rates in Theory and Practice

Third Article—Capital Charges of Central Stations and How they Affect the Demand Cost—Interest and Depreciation—Influence of Peak Load on Expense

By H. E. EISENMENGER

This is the third article of a series to appear weekly throughout the current volume. A general outline of the entire series was published in the issue of July 5 and the first of the articles appeared July 12. In the first two articles the author discussed costs in general and then took up the cost of electric service in particular, showing that the three principal elements of this cost are energy cost, demand cost and consumer cost. The present article continues the discussion of demand cost, which will necessarily be extended through several installments. The reader must realize that a knowledge of the various elements on which the cost of the service depends is necessary before the subject of rates (or price of the service) can be properly discussed.

PART I—THE COST OF ELECTRIC SERVICE—Continued.

II-A. THE THREE ELEMENTS OF COST.

A. THE TOTAL DEMAND COST OF THE PLANT.

2. *The Constituents of the Demand Cost.*

a. Capital Charges.

1. Net Return (Interest, Dividend).

SECTION **18.** The capital invested in a commercial enterprise has been paid in by its owners because they have the belief that they will get a satisfactory return, whether that be a certain prearranged fixed percentage, as on bonds, or a variable one in accordance with the degree of success of the business. (See Insert III-A.)

This return on the capital is the *raison d'être* of any business enterprise and therefore it has been mentioned first. As a matter of fact it is the last one of the capital charges inasmuch as all the other charges to be mentioned hereinafter (depreciation, repayment, taxes, insurance, etc.) must be, or should be, considered first. We can thus distinguish a gross return and a net return, both of them being based on the *net* income. The gross return includes all capital charges, or at least depreciation and possibly repayment[1]; after deducting all those charges from the gross return we get the net return which is paid to the owners of the capital as bond interest and stock dividend.

We have therefore to distinguish the following four items:

1. Gross income.
2. Net income = gross income — cost.
3. Gross return $= \dfrac{\text{net income}}{\text{capital}}$, usually given in per cent.
4. Net return = percentage gross return — percentage depreciation, etc.

2. Depreciation.

19. For practically all construction work, whether it be machinery, or buildings, or electric lines, etc., we can figure that after a certain number of years it has to be replaced because it is worn out and useless. How great this number of years is depends largely on the nature of the construction. A building may last 50 years or longer, a pole of an overhead line may be too decayed for further use after 10 years or less, etc. The value will decrease year after year and this is called the depreciation of the construction.

Moreover, some parts of construction, especially machinery, must not infrequently be discarded long before they are physically unfit for further use because new inventions have been made and it has become either more economical or otherwise advisable to install machinery which embodies the new improvements rather than to continue employing the old obsolete machinery. This has, for instance, been frequently done in the last few years with reciprocating steam engines, which, although still in their prime of life and perfectly serviceable, had to be exchanged for the newly invented steam turbine because the latter consumes so much less steam (and requires so much less space) that the whole interest and other investment charges on the steam-turbine set would be less than the cost of the steam saved[2] annually. The reciprocating engines were kept as reserve capacity in case of breakdowns or they had to be sold at what one could get for them—that is, the so-called scrap value, which generally is only a small percentage of the price paid originally.

We see therefore that the value of the capital invested in an electric plant is not, without further measures, safe and secure for all times, but that on the contrary this value is incessantly and automatically being reduced and we must take steps to counterbalance this reduction of value by creating a fund into which the equivalent of the depreciation is deposited out of the annual earnings before we apply the latter for profit.

Suppose, for instance, we have bought a generator set for $100,000 and after 12 years it is worn out and has to be scrapped, the scrap value to be $10,000. The balance of $90,000 has disappeared out of the generator set and if we do not want to lose that amount we must have earned so much over and above the

[1] Taxes and insurance are frequently counted as cost, although from the present point of view they should rather be classified as capital charges.

[2] And capital charges on the floor space saved, which can be utilized for extensions of the capacity.

interest that the aggregate of these yearly excess earnings with compound interest has accrued after 12 years to make up the $90,000 which has disappeared. We have to establish a "depreciation fund" into which regular payments are made every year and invested at compound interest. That means, for instance, if we invest the money accumulating in the fund at 5% compound interest, we have to pay in every year about $5650 for depreciation, or 5.6% of the original capital of $100,000; then at the end of 12 years we will have $90,000 accumulated in the fund which, together with the expected proceeds of $10,000 from the sale of the scrapped generator set, will just about suffice to buy a new generator set in place of the old one.

Of course, all these calculations have to be rather crude ones as the figures we are dealing with are all known only very approximately. We do not know what the actual useful life of the generator will be. We can be guided from past experience, which is laid down in tables for various classes of machinery and other constructions, but these tables give, of course, only average values and, moreover, when it comes to obsolescence, due to future new inventions, we are entirely at sea. Even apart from obsolescence, we do not know how great the scrap value will be and what the price of the new generator set will be in about 12 years from now, etc. But something near that figure (5 or 6%) will have to be put aside every year for depreciation in the assumed simple case.

20. It is obvious that in this hypothetical simple example the money in the depreciation fund rises from zero at the beginning of the first year to 100% of the net replacement value at the end of the twelfth year and then drops suddenly to zero again as the new generator is bought. This 12-year cycle is periodically repeated an indefinite number of times. As the value disappears from the physical property by depreciation it turns up in the depreciation fund and then by purchase of a new equipment flows back into the physical property, thus fluctuating in a 12-year cycle to and fro between the two. In practice, however, the fluctuations of the fund are not as large but much smaller, for several reasons, which are briefly explained in Insert III-B.

3. Repayment (Sinking Fund).

21. Where, as usually, a portion of the company's capital has been raised by bonds, these bonds mature within a certain time, for instance, after 20 or 30 years; this means that the principal (face value of the bonds) has to be paid back at that time according to the terms of the loan. It is then most commonly raised by a new issue of bonds. An alternative is the creation of a fund for the payment of the bond indebtedness ("sinking fund"). A certain amount must be paid into this fund every year of such size that at the time when the bond issue matures the accumulations in the fund with compound interest aggregate to just the face value of the maturing bond issue.

In some cases the franchise granted to the company stipulates that the franchise will expire after several decades, perhaps after 30 or 50 years, and that the equipment of the company has to pass at that time into the hands of the city, or some such body, without any compensation whatever to the company. If we want to be very exact and careful, we will have to create another sinking fund in such cases of such size that this fund, together with the liquid amount contained in the depreciation fund at the end of those 30 or 50 years (or whatever the term is), amounts to just the capital invested. The depreciation fund and the sinking fund together will then, at the time of the termination of the franchise, serve to pay back the face value of all stocks and bonds. Now, it is obvious that under these conditions any company will endeavor to avoid replacements of machinery, etc., during the last years of its franchise, as it knows that in the near future it will have to give up, without any compensation, its physical property. Consequently, at the end of the period the depreciation fund will be as nearly 100% filled as it can be. The plant will be run down and an unusually large portion of its value will have passed over into the depreciation fund. For this reason and because, in view of the great length of time, the annual payments into a repayment fund of that kind would be a very small percentage, these payments are sometimes neglected.

4. Other Capital Charges.

22. Interest, depreciation and possibly repayment are not the only annual capital or investment charges. *Taxes* are mostly in accordance with the value of the property—that is, in first approximation, with the capital invested. The cost of *insurance* also is the higher, the costlier the plant. These two items may therefore in first approximation be regarded as proportional to the capital invested.

23. We come to the conclusion that we can, as an approximation, assume every one of the capital charges, whether interest, depreciation, repayment or other charges, as proportional to the capital invested and therefore we can also assume the sum of these items, that is, the total capital charges, to be approximately proportional to the capital invested. The capital charges are therefore proportional to the plant capacity and in further approximation to the plant's peak load.

b. Demand Cost Other Than Capital Charges.

24. In addition to the above expenses we have certain other expenses which are not capital charges but which also depend on the size of the plant only, and may be assumed to be proportional to the latter and consequently to the peak load.

Thus, a certain portion of the fuel and lubricating cost and of the cost of maintenance and repairs, etc., may depend on the size of the plant. To explain this, let us assume, for instance, that we have to generate 24,000 kw-hr. in 24 hours by a 1000-kw. generator set, running at full load. Let us assume further that we have in another instance to generate the same number of 24,000 kw-hr. in the same total time of 24 hours, but no longer at uniform load, but with a 4-hour uniform peak period of 5000 kw. This would, of course, require an equipment of larger capacity, for instance, a 5000-kw. set instead of the 1000-kw. set. During these four peak hours the generator would furnish $4 \times 5000 = 20{,}000$ kw-hr., leaving 4000 to be generated during the remainder of the day—that is, during 20 hours. The average load during these 20 hours will therefore be only 200 kw.—that is, 4% of the capacity of the 5000-kw. generator.

Now, large generating units are more efficient than small ones; that means they are consuming fuel more economically per kilowatt-hour output than small ones running at the same percentage of their normal (full) load. The same refers to consumption of lubricants. On the other hand, there is a certain economic load for every generator set at which the latter is most efficient; this load is near the rated or normal load of the set. As the load decreases below that amount the specific fuel and oil consumption *per kilowatt-hour* is getting larger and larger, and for small percentages of full load it will become quite high.

In the assumed example the 5000-kw. generator will therefore work more efficiently than the small one during the four hours of its full load, generating in that time 20,000 kw-hr. During the remaining 20-hour period the large generator will work less efficiently than during the peak load period and, in fact, it will work quite wastefully, as it is running at only 4% of its normal load. The average efficiency at which the large generator supplies the energy is therefore in general different from the efficiency of the 1000-kw. set. It may be higher or lower, depending on the way in which the efficiency varies with the size of the generator and with the percentage of the load. In practice, these figures are such that an increase of the demand will under the given conditions probably always result in a decrease of the average 24-hour efficiency and therefore in an increase of the fuel and oil consumption.[3] We see from this how the peak load of the central station influences the cost of fuel and lubricants in such a manner that under the given assumptions a part of these costs may be assumed to be proportional to the peak load.

Similar considerations prevail for the maintenance and the repairs of the equipment. As regards the total cost of attendance, it will of course always be larger for a larger machine than for a smaller one, etc.

25. We see in this manner that there are certain costs which are not investment charges, but still are dependent on the peak load and can be assumed to be proportional to the peak load. Together with the capital charges which are, as shown, also approximately proportional to the peak load they make up the *"demand cost,"* sometimes called *"fixed cost."* The demand cost of a central-station plant can therefore be assumed as being proportional to the central station's peak load. This involves, as we have seen, certain approximating assumptions which are recapitulated and discussed more in detail in Insert V.

Insert III—Appendix to Sections 18 and 20.

Interest and Depreciation.

A. Interest on the Capital Invested.

(To Section 18.)

The capital invested in fairly sized electric central stations is practically never the property of an individual, but belongs almost always to a corporation and we have to distinguish various ways in which this capital or its parts have been raised, as this influences the distribution of the interest.

A (physical or juristic) person desiring to invest money in an enterprise of that kind may do so either by becoming part owner of the company's property or by lending money to the owners at a certain prearranged rate of interest without acquiring any rights or duties of ownership in the latter case. The company's property serves as security for the loan. In the first case the person investing money receives *shares of stock*, which are certificates that he shares in the ownership, and in the second case he receives *bonds* (or notes), which are receipts for money and a promise to pay together with interest at a rate agreed upon. When a person buys stock he becomes in a sense a partner of the enterprise and if he buys bonds or notes he becomes a creditor and as a creditor has no proprietary interest.

The capital may be raised entirely by bonds (municipal enterprises), or entirely by stocks, or (usually) partly by stock and partly by bonds. The revenue of the enterprise is used to defray the running expenses (wages, salaries, raw material, etc.), after this the fixed amount of interest on bonds and the other capital charges, like depreciation funds, sinking funds, etc., (see Sections 19-22) are taken care of. The stockholders are entitled to the entire balance, which may be large or small or zero, according to the prosperity of the enterprise.

The stock may be all *common stock* or a part of the capital may have been raised by the issuance of *preferred stock*. The difference between common stock and preferred stock is the same as that between stocks and bonds, as far as the payment of interest is concerned. The holders of the preferred stock receive a certain prearranged rate of interest from the balance of the earnings after the bond interest has been deducted and, unless the preferred stockholders can receive their full rate of interest, the holders of the common stock will not be paid any return on their investment. Sometimes the preferred stock is subdivided into first and second preferred, so that the interest on the second preferred is paid out of the balance remaining after the deduction of the interest on the first preferred.

The preferred stock may be "participating" or "non-participating." In the first case, after the preferred stock has received the dividend provided for, and after the common stock has received a certain prescribed dividend, the balance of the profit is divided between the preferred and the common stock. In the second case, which is the usual one, the whole balance goes to the common stock.

The dividend on the preferred may be "cumulative" or "non-cumulative." This means if the enterprise has not had earnings enough to pay the full percentage on the preferred stock in one year the holders of cumulative preferred stock will be indemnified at the expense of the common-stock dividend as soon as the earnings become better in subsequent years, whereas with non-cumulative preferred the holders have no claim for indemnification out of the earnings of later years.

B. A Few General Remarks About Depreciation Funds.

(To Section 20.)

The reasons why the depreciation fund does not, as may seem from the simple example of Sections 19 and 20 of the main text, fluctuate between 0% and 100% of the net replacement cost but within much narrower limits are briefly the following:

In the first place, the plant contains different parts with different lengths of life so that the fluctuations of the respective parts of the depreciation fund overlap each other.

In the second place, the growth of the plant in the course of the years must be considered; in other words, the fact must not be lost sight of that the entire existing plant has not been built at the same time, but at different periods. This causes another overlapping and consequent smoothing out of the fluctuations of the various parts of the depreciation fund.[1]

In the third place, where we have a greater number of parts of the plant, even if all have the same average life and all have been installed at the same time, they will not all have to be replaced in the same year, because the actual life of the individual part is generally not equal to the average life. If, for instance, we have installed in a certain year a new transmission line with wooden poles having an average life of 10 years, though we will have to replace a large number at the end of the 10th year and in the years near it (for instance, between the ends of the 6th and 14th years), yet when the transmission line is old enough so that every pole has been exchanged several times, the varying periods of life of the individual poles evidently will overlap finally to such a degree that we have to exchange the same number of poles every year, namely, 10% of the total number.

That the depreciation fund is far from reaching 100%, even at the time when the first replacement is due, is shown by Table 1, which is based on the arbitrary but verisimilar assumption that the number of poles which require their first replacement in each year is as given by Column II of the table. (The interest accruements to the fund and the consequent reduction of the annual payments are disregarded in this table as non-essential for the present purpose.)

---

[3] We would, of course, for the very reason of improving the economy of generation not install (as assumed) one unit of 5000-kw. in the above example, if we could choose the size and the number of the generating units in such a manner that a better 24-hour efficiency can be obtained. It is then conceivable that the change of the load curve (that is, the increase of the peak load) may bring about a reduction of the fuel and oil cost, that is, that the percentage of the fuel and lubricant expenses (which is proportional to the peak load) is negative. The explanation of this apparent contradiction with what has been found above is given in Insert IV—"The Influence of the Central Station's Capacity (Peak Load) on the Operating Expenses."

[1] Very interesting investigations on the subject of depreciation in connection with the growth of the plant are published under the title "Growth and Depreciation," by Julian Loebenstein in the 1916 Transactions of the A. I. E. E., pages 1389 to 1407.

TABLE 1.

I. End of Year.	II. Percentage Poles Requiring First Replacement in Respective Year.	III. Aggregate Percentage of Poles Requiring First Replacement up to Respective Year.	IV. Percentage Payment Into Fund in Respective Year.	V. Aggregate Percentage Paid Into Fund.	VI. Balance Remaining in Fund. (Column V — Column III.)
1	..	..	10	10	10
2	..	..	10	20	20
3	..	..	10	30	30
4	..	..	10	40	40
5	..	..	10	50	50
6	3	3	10	60	57
7	5	8	10	70	62
8	12	20	10	80	60
9	15	35	10	90	55
10	30	65	10	100	35
11	15	80	10	110	30
12	12	92	10	120	28
13	5	97	10	130	33
14	3	100	10	140	40
15	..	100	10	150	50

Note.—Commencing at the end of the 12th year the second replacements begin for which corresponding amounts are taken out of the fund. As the second replacements are not considered in this table, the values of Column VI beginning with the 12th year are slightly too high.

The maximum amount ever contained in the replacement fund is then 62% of the net replacement value and this maximum occurs in the 7th year. As shown above, the replacement fund is generally reduced in the course of the following renewal periods to the limit of 10%, so that 52% are set free.

It is very interesting to observe that the transition from the 62% to the 10% is not a steady reduction but is made up of oscillating increases and decreases. Column VI of the above table shows this tendency very clearly. The oscillating character of the decrease is still better brought out by the following considerations: Assuming, for instance, the first renewal ("renewal of the first order") to be spread out over four years from the ends of the 8th to the 12th years, inclusive, the first poles will have to be replaced at the end of the 8th year while others will last as long as 12 years. Now, some of the most short-lived poles (8-year poles) will be replaced by equally short-lived ones. This may be an accidental coincidence or the local conditions may be so unfavorable that in that location the renewed poles will generally require replacement after every 8 years; at any rate, the period of the second replacement of poles will begin at the end of the 16th year. On the other hand, some of the most long-lived poles (12-year poles) will last another 12 years after replacement before a third pole has to be installed in that locality. Thus the second replacement period is spread out between the ends of the 16th and the 24th years—that is, over 8 years as against 4 years of the first replacement period. Following the same line of thought further, we get the data of Table 2.

TABLE 2.

Replacement.	After	Years Duration.
1st	8th to 12th year	4
2nd	16th to 24th year	8
3rd	24th to 36tn year	12
4th	32nd to 48th year	16
5th	40th to 60th year	20

Since in every renewal period the same total number of poles has to be replaced, namely 100%, and as the renewal period spreads out over greater and greater lengths of time, it is obvious that, as the renewals progress, less and less poles are to be renewed in every year as far as one certain order of renewals (first, second, third, etc.) is concerned. On the other hand, the renewals of different orders overlap more and more. For instance, in the 34th year we have a number of poles to be renewed for the third time and others for the fourth time (see third and fourth lines of Table 2). These conditions are shown in Fig. A. The lower part shows how around each renewal period (10th, 20th, 30th, etc., year) renewals have to be made and how the lengths of the renewal periods spread out from one period to the next, whereas the number of renewals of the same order to be made during one certain year decreases as time goes on. The upper part of Fig. A then shows the sum of the renewals of all orders in every year and demonstrates clearly the fluctuations with decreasing amplitude (damped oscillations), converging to the 10% limit[2].

The interesting subject of depreciation is sufficient for a treatise in itself, but the above remarks are all that is considered necessary for the scope of this series of articles.

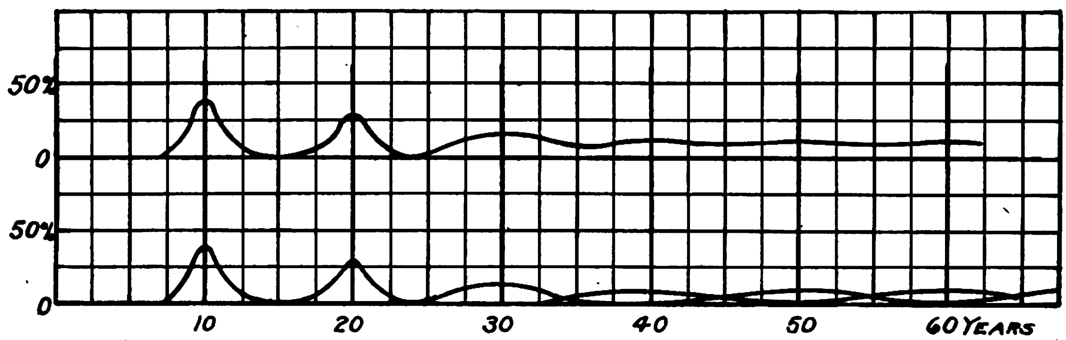


Fig. A.—Renewals of Wooden Poles Having an Average Life of 10 Years, Showing the Overlapping of the Successive Renewals (Lower Curve) and Their Sum (Upper Curve).

Insert IV—Appendix to Footnote of Section 24.

The Influence of the Central-Station's Capacity (Peak Load) on the Operating Expenses.

The example of Section 24 deals with a four-hour load of 5000 kw. and a 20-hour load of 200 kw. every day, and it is assumed that to carry this load a 5000-kw. generator would be installed.

We will, of course, try to improve on this and choose the size and the number of the generators in such a manner that a better 24-hour efficiency results. Other factors beside the efficiency curves also take a part in this problem; for instance, the reserve capacity, changes of load to be expected in future, the prices of generators of different sizes, the value attached to efficiency of generation as compared to savings in the capital invested, etc. The price of the fuel, oil, etc., will in its turn influence the relative value attached to the efficiency of generation and we might continue this analysis of influencing factors until we arrive at the mood in which the designer of the plant found himself when he made this decision about the size of the sets and whether at that time he happened to take a more or less optimistic view of the future growth of the plant, etc.

Assuming that we could be fairly positive about the constancy of the load curve in the future, special investigations might show that it is advisable to install two units of 5000 kw. (one of them as reserve) and one of 200 kw., or possibly three 2500-kw. sets, or some such combination. Now comparing, for instance, the first one of these two combinations ($2 \times 5000 + 200$ kw.) with the 1000-kw. set for uniform 24-hour service (see Section 24) it is evident that the efficiency will probably be greater than at uniform 24-hour service, because the bulk of the energy (20,000 kw-hr. or more than 83%) is generated by an economical 5000-kw. generator at full load—that is, by a generator five times greater than in case of the uniform 24-hour service, whereas less than 17% is generated by a (fully loaded) generator only one-fifth as large (200 kw.) as in case of the uniform 24-hour service. This means that the demand will have a *negative* influence on the fuel and oil consumption; in other words, the larger demand will result in a *reduction* of the fuel and oil cost. (The same will probably be true for the 3×2500-kw. combination.)

This seems peculiar. In the first instance [using 5000-kw.

[2] M. D. Cooper, of the National Lamp Works, has made interesting investigations on a closely allied field, the replacement of burnt-out incandescent lamps (Electrical World, Jan. 12, 1918, pages 93 to 95) in which he shows that the number of renewals of lamps installed at the same time and always burning simultaneously is subject to periodic fluctuations until, after a number of lamps have burned out in each socket, the stable condition is reached.

units throughout (Section 24)] we saw that an increase of the peak load from 1000 to 5000 kw. resulted in an *increase* of the fuel, etc., cost and now the same change of the peak load results in a *decrease* of these costs. The explanation is that a certain portion of the fuel, etc., cost is neither proportional to the demand nor to the energy consumption, but depends on some other elements which are not among the three fundamental items considered in our system of cost computation (compare Section 10). A portion of the fuel consumption depends, for instance, on the shape of the load curve, another portion on the size of the machines, etc. We try to apportion this part of the fuel cost somehow into the three items, just as we squeeze in the salaries of the executive officers, the advertising expenses, etc., somewhat sacrificing accuracy for simplicity and practicability, as explained in the general discussion of costs. The result of these little inaccuracies, which are entirely permissible, are little inconsistencies as the one just quoted above—the relation of the demand and the cost of fuel. To be exact we would have to say: Under the given conditions with regard to changes of the load curve, size of machinery, etc., a certain given portion of the fuel, etc., costs is proportional to the maximum demand and the factor of proportionality has a certain given—positive or negative—value. More particulars about this question will be given in Insert VIII about the determination of the numerical values of the three items of cost.

Insert V—Appendix to Section 25.

Approximations Made to Compute the Demand Cost of the Plant.

The approximating assumptions which permit us to set the demand cost of an electric plant as proportional to the peak load of the plant (see Section 25 and footnote 2 of Section 17) are shown in comprehensive form in the diagram of Fig. B. These approximations bring about much less inaccuracy than would seem at first sight, because we have to deal always with the changes produced in one *individual* central station only by the changes of its peak load and these latter changes remain within certain limits during a given period.

Thus, for instance, if the peak load of the central station increases from 5000 to 6000 kw. in one year, the other conditions, such as the geographic distribution of the load over the territory of supply (approximation 3), or the percentage of reserve capacity, etc. (approximation 1) will not have to be changed very materially. If, however, these conditions do vary to a large degree in the course of years, this will simply mean that the factor of proportionality—that is, the annual capital charges per kilowatt of peak load—will have to be changed.

Supposing, for instance, that in a certain territory the use of electric service is not very widely spread; then the copper section of the lines is not fully loaded (because the lines must have a certain minimum of copper section for mechanical reasons). If now the use of electric service becomes more general in that town the wires will first become fully loaded and then we will have to string additional wires, but the existing poles can be used for the new wires, so that the cost of the lines does not increase proportionally with the peak load. Larger generator sets will be installed, which cost less per kilowatt of capacity than those originally installed. For these and many other reasons the capital, and consequently the total annual capital charges, will under these conditions grow more slowly than the peak load does. Yet we assume that they grow at the same rate, for a number of years at least—that is, that they remain proportional to the capital. If the discrepancy in the course of the years becomes too great we simply change the factor of proportion-

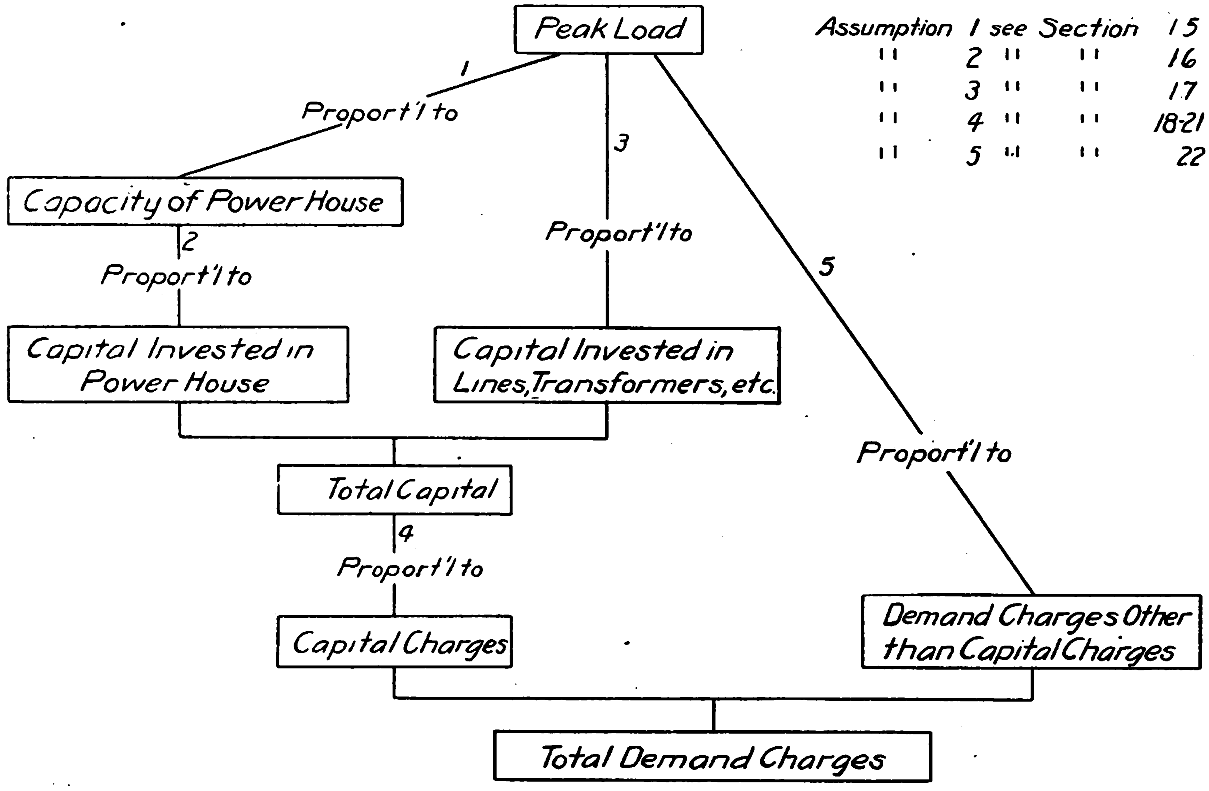


Fig. B.—Diagram Showing Assumptions as to Proportionality of Demand Charges to Peak Load.

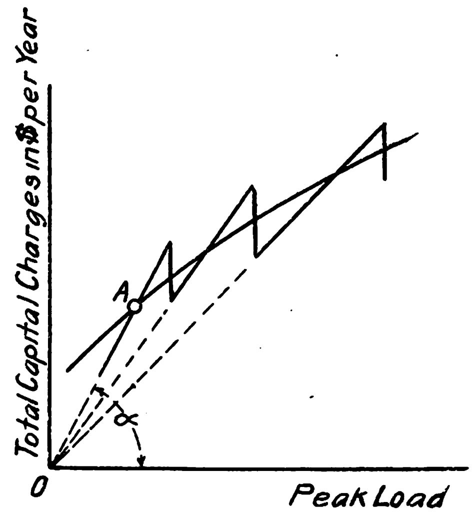


Fig. C.—Relation of Capital Charges to Peak Load.

ality—that is, we change the number of dollars per kilowatt per year to another one for the following period.

Readers who are familiar with the elements of graphic representation may get further illumination on this point from Fig. C. (An example of the principles of graphic representation employed therein will be contained in Insert XII on Step Meter Rates.) The central station's peak load is stepped off on the axis of abscissae (horizontal) and the ordinates give the corresponding total yearly capital charges per year, in dollars per year. If we connect a certain point *A* of that curve with the origin *O* of co-ordinates, the angle α between this connecting line and the axis of abscissae will be the greater the greater the capital charges per kilowatt of central-station peak load ("unit capital charges") are. (Readers who are familiar with elementary mathematics will understand that the unit capital charges are given by tan α.) Assuming the unit capital charges as being constant means that we replace the curve of the actual unit capital charges by a straight line starting from the origin with an inclination depending on the size of the assumed constant unit capital charge. If this angle of inclination is chosen properly—that is, if the value for the constant unit capital charge is chosen properly—the straight line will more or less closely follow the curve, at least for a certain distance, because the curve must necessarily rise from left to right. Where the deviation of the straight line from the curve becomes too great we substitute another straight line. This means that when the peak load in the course of the growth of the central station becomes so great that the constant unit capital charge used so far becomes too inaccurate, we revise the calculation of the unit capital charge and substitute a corrected value.

In normal times this revision will always be a revision downwards, owing to the smaller unit capital which is necessary for a large plant. But in times of war, or when money is very scarce, etc., it is conceivable that in spite of the growth of the plant, the unit capital charges may rise.

(To be continued.)

TELEGRAPH SYSTEMS IN THE UNITED STATES.

Census Bureau's Report for 1917 and the Five-Year Period 1912-1917—Commercial Wire and Wireless Telegraph Systems—Telephone Train Dispatching.

According to a report just issued by Director Sam L. Rogers, of the Bureau of the Census, Department of Commerce, the 21 commercial land telegraph systems in the United States in 1917 operated 241,012 miles of pole line, comprising 1,888,793 miles of wire; sent 151,725,238 messages; and employed 47,227 persons, to whom were paid salaries and wages amounting to $36,392,140. This report, which is issued under the title "Telegraph and Municipal Electric Fire-Alarm and Police-Patrol Signaling Systems," was prepared under the supervision of Eugene F. Hartley, chief statistician for manufactures, and is the fourth of a series of quinquennial reports on the telegraph systems of the country.

The pole-line mileage in 1917 was less by 2.6% than in 1912, but was greater by 0.6% than in 1907. The wire mileage, however, showed an increase of 4.1% as compared with 1912 and of 19.7% over 1907. The increase in the number of messages was much greater—45.7% during the last five-year period and 53.1% during the ten years from 1907 to 1917. The number of employes increased by 39.2% between 1912 and 1917 and by 84.9% during the period 1907-17, and the corresponding percentages of increase in their salaries and wages were 59.2 and 124.2.

The number of telegraph offices in 1917 was 28,-865, a decrease of 6.2% as compared with 1912 and of 0.7% as compared with 1907. The total income from telegraph traffic was $91,312,567, an increase of 74.5% over 1912 and of 140.8% as compared with 1907; the income from all other sources was $1,641,803; the total expenses, including charges for depreciation and sinking funds, were $80,828,970, an increase of 52.9% over 1912 and of 111.4% over 1907; and the net income was $12,125,400, an increase of 253.4% as compared with 1912 and of 113.7% over 1907. The par value of the outstanding capital stock of the companies was $106,360,237, a decrease of 1.7% as compared with 1912, but an increase of 4% over 1907.

The foregoing figures relate only to commercial telegraph companies, and thus exclude the wire and pole line wholly owned and operated by railroads, and also exclude the equipment and telegraph business of the various press associations which lease and operate wires for dispensing news.

The Postal Telegraph-Cable Company transacts some little telephone business in addition to its telegraph business. Its development of long-distance telephone service has been particularly rapid in the South and Southwest.

During the five-year period 1912-1917, the printing telegraph came into extended use by telegraph companies, press associations, and railroads. The printing telegraph consists essentially of a sending instrument, equipped with a keyboard similar to that of a typewriter, electrically connected with a receiving instrument in such a manner that the latter automatically reproduces what is typewritten on the sending instrument. Without the printing telegraph it would have been difficult or impossible to handle the increased telegraph business during the World War.

A special feature of the report, relating to train dispatching, is of some interest. The first installation of telephone and selector equipment for train dispatching was completed on the lines of the New York Central Railroad in October, 1907. The use of the telephone for this purpose has increased rapidly. The report shows, for 1917, 105 lines employing this method of train dispatching, as against 42 in 1912. The mileage of telephone pole line for train-dispatching purposes was 95,268, an increase of 67.6% as compared with 1912; and the mileage of wire was 201,662, an increase of 55.7% over 1912. The total line mileage of railroads reporting the use of telephones for transmitting train orders in 1917 amounted to 110,404. It is asserted that not a single accident has resulted from the use of telephones in train dispatching.

All the wireless telegraph systems in the United States were taken over by the Federal Government under authority of an executive order issued April 6, 1917, for which reason the figures for 1917 give little indication of the increase in commercial wireless telegraph operations during recent years. The systems reported for 1917 numbered 3, as compared with 4 in 1912 and 5 in 1907; and the number of tower stations was 63, as compared with 74 in 1912 and 117 in 1907. The number of messages handled prior to April 6 was 122,244. No exact record of the number transmitted during the period of Government operation is available, but it is roughly estimated that 330,-000 messages were handled between April 6 and Dec. 31, 1917. This number, added to that already given, would make a total of more than 450,000.

The total income and the net income increased greatly. The former aggregated $1,385,060 in 1917, representing a gain of 107% over 1912 and of 1197% over 1907; and the latter amounted to $609,526, as compared with a net income of $4738 in 1912 and a net deficit of $53,538 in 1907. The employes numbered 586, a decrease of 38.8% from the corresponding number in 1912, but an increase of 233% over the number for 1907; and their salaries and wages aggregated $461,402, an increase of 17.2% over 1912 and of 464.2% over 1907.

Contractor-Dealers Hold Enthusiastic Annual Convention

Proceedings of 19th Annual Convention of National Association of Electrical Contractors and Dealers Held in Milwaukee—Merchandising Principal Topic — Repair and Labor Problems also Discussed

BETTER MERCHANDISING with a view of increasing the use of electric apparatus and improving conditions in the electrical contractor-dealer field was the principal topic of discussion at the recent annual convention of the National Association of Electrical Contractors and Dealers held in Milwaukee, July 16, 17 and 18, although many other topics of interest were also presented and fully discussed. The remarkable growth of the retail electrical store idea during the past two years, largely through the efforts of W. L. Goodwin and his associates, is largely responsible for the enthusiasm and keen interest displayed in this subject and it is evident that the advancement in this direction will continue, that more and better retail electrical stores will be established and all will be conducted in accordance with the best and latest merchandising practices. This was also the subject of many interesting addresses by prominent speakers, who described and explained not only the fundamentals of merchandising but the proper conduct of a retail store and offered many valuable suggestions to merchants and prospective merchants.

The proper relationship between employer and employe that will make it possible for both to live and work together in harmony and progressive efficiency, was another principal topic and one that in its discussion, better than any other, demonstrated the progress that has been made by the association and its members. This subject, which finally resulted in the adoption of the "Declaration of Principles" published further on in this report, was discussed freely and with considerable spirit at the meetings of the Executive Committee and on the floor of the convention on Friday afternoon. In addition, a very interesting and instructive address on this subject was delivered by H. C. Metcalf, Ph. D., Bureau of Industrial Research, New York City. In the discussion the membership showed that it has advanced far beyond its former standing and is ready and able not only to take its place in the world of business but to be the leaders in that sphere.

The meeting of the Repair and Sale of Used Apparatus Section also proved of great interest to those members engaged in that line. This meeting was the first of its kind ever held by the association, but, from the results obtained and the interest displayed by those who attended this meeting, there is no doubt but that they will be a regular part of future convention programs.

Throughout the entire convention the more than 400 members who registered exhibited the keenest interest in the proceedings and in the discussions and by constructive criticism and suggestions did much to make this the best convention the association ever held. And, they evidently succeeded for the consensus of opinion among the older members seemed to be that this was really the best convention ever held and that it would rank high among all electrical conventions.

Meetings on Opening Day

A complete report of the sessions on the opening day, Wednesday, was published in our July 19 issue. At the morning session on this day the delegates were welcomed to Milwaukee by Cornelius Corcoran, acting mayor of the city, to which W. Creighton Peet, chairman of the association responded. In his address Chairman Peet briefly reviewed the activities of the association during the past year and described the work now under way. Through co-operation with the other branches of the industry the Bureau of Education and Research is now fully developed and is expected to begin its labors in the field shortly. Other committees have also been very active, particularly since the armistice was signed, which has resulted in a large amount of work for the good of the association and its members being accomplished.

Franz Nielsen, counsel for the association, then spoke on "Co-operation in Business." He described the growth of the co-operation idea and the many advantages which it offers to the contractor-dealer in his relation with other merchants and the other branches of the electrical industry. He spoke of the work that the association has done to further this idea and the remarkable results that have been obtained, as evidenced by the conference held on Monday evening to complete the arrangements for the educational campaign. In closing he urged the members to take a more active part in the work of the association and to assist its officers, willingly, in every possible way.

In the afternoon Frank Stockdale, of Chicago, delivered a very interesting address on "Keeping Up With Rising Costs." In this address, Mr. Stockdale carefully analyzed merchandising, particularly as applying to the electrical retailer. Many valuable suggestions for the retail merchant in the conduct of his store were brought out and many of his problems were explained. He particularly emphasized the need for keeping a proper cost accounting system in order that the dealer may keep a check on his business. The cost accounting system that has been developed by the association, he stated, was one of the best and simplest he had ever seen and recommended its adoption by all of the members.

Albert Uhl and E. L. Morley, representatives of the Chicago Electrical Estimators' Association, then explained the work that has been done and is being done by that association. Mr. Uhl described the estimating forms that have been developed and which offer many advantages in making and tabulating estimates for electric wiring. Several minor changes have recently been made in these forms which render them much more convenient than they formerly were. The forms were illustrated by lantern slides which added greatly to the effectiveness of the address and brought out their many advantages very clearly. Mr. Morley described the work that the association has done in solving the problems of overhead on construction work which has already received a great deal of attention among electrical contractors. These lectures brought out considerable discussion which clearly indicated the interest which the members take in such work and the value of the results obtained by the Estimators' association.

In the evening a reception and dance was held at the Hotel Pfister which was very well attended and proved to be a very enjoyable occasion.

"Goodwin" Day at Waukesha Beach.

The session on Thursday, which was styled a "Goodwin" day as a mark of appreciation to W. L. Goodwin of the General Electric Co., and his untiring efforts in behalf of the association, was held at Waukesha Beach, a beautiful resort located about 25 miles from Milwaukee, and an especially fitting place for such an affair.

The opening address on this occasion was delivered by J. H. Moss, former president of the Milwaukee Association of Commerce, on "Americanization." In this address, Mr. Moss emphasized the importance of naturalizing the foreign element in this country and the dangers of neglecting to do so. Materially, it is estimated that a saving of two billion dollars annually will result from such naturalization as the education thus acquired will greatly increase the earning power of these inhabitants. As their education could be accomplished for only a small part of this sum it is surely worth the effort. Politically and morally the results would also be highly desirable, particularly at this time when the country faces a crisis in many ways and as the number of illiterate foreign born is steadily increasing. In Mr. Moss' opinion there are two phases to this problem, immigration and education, which must be studied and suitable remedies applied if the proper solution is to be arrived at.

In introducing W. L. Goodwin, who was the next speaker, Chairman Peet took occasion to thank both Mr. Goodwin and Samuel A. Chase of the Westinghouse Electric & Manufacturing Co., for their unselfish efforts in the work of the association.

At the opening of his address on the fundamentals of merchandising, Mr. Goodwin heartily endorsed the new educational campaign that has been developed by the association and which will be put into effect shortly. The conference held on Monday evening to complete the arrangements for this campaign and which was attended by representatives of every branch of the industry, proved conclusively he stated, that this campaign has been the means of planting the germ of co-operation in the electrical industry. He also described the vast improvement that has been made by the contractor-dealer in his business affairs during the past two years and which he especially noticed in his recent trip around the country, particularly in regard to the improved credit and moral standing of these firms. In this way the contractor-dealers have already proven their ability.

There is still a lack of knowledge of merchandising, however, in spite of the fact that 350 retail electrical stores have been opened during the past two years with but one failure. In this way the electrical men have set a pace in merchandising and are fast regaining the business and although they do not wish to drive others out of this field they do desire to establish certain practices which if possible, will preserve the electrical business to the electrical people.

Merchandising is simple if properly understood and the need of natural ability to become a successful merchant is only true to a certain extent. The greatest need at the present time is for good stores and the next is to improve the packing of merchandise so that commodities may be standardized and a well ordered stock maintained. To accomplish this several manufacturers have changed their methods of packing their products, and very desirable results have already been obtained.

Delegates at 19th Annual Convention of National Association of Electrical Contractors and Dealers Assembled on Auditorium Steps in Milwaukee, Wis.

The location and the selection of goods salable in that community are very important items in the establishment of a retail store. There is always one class of merchandise that satisfies the local demand in any community and the dealer should handle that class rather than any other, even if the discount on it is not as great as in the others. For there is no profit until the goods are sold and larger discounts do not always mean larger profits. Nor should the dealer attempt to handle every concievable line but should concentrate on one line that he is sure will meet the requirements of his trade. Store employes with a knowledge of electricity and electrical apparatus are also necessary if the best results are to be obtained and the dealer should keep posted on his business by reading carefully the electrical trade papers. In this respect Mr. Goodwin advised every dealer to read a trade paper at least 15 minutes every morning if he is to keep abreast with the times.

There is also a tendency on the part of many electrical dealers to argue with their customers, which should always be avoided. No sale can really be considered completed until the customer is satisfied which shows particularly the value of only handling goods of known merit as the customer will usually accept goods on the dealer's recommendation. Another feature that must be appreciated is the value of attractive window displays. The most desirable store is of no value without a window and likewise the best window is worthless unless it is well decorated and attractive. Proper window displays he considers are of much more value to the dealer than larger discounts from the manufacturers.

The most important item retarding the growth of such stores is the lack of standardization of receptacles and wall outlets for the use of appliances. Due to the petty jealousies of the various manufacturers of such apparatus, practically every line requires a different type of outlet and receptacle which means that the customer must have several cords for the appliances in use. This of course retards the use of such appliances. The contractor-dealers, however, can force the manufacturers to standardize such connections, just as the lamp bases have been standardized and should take steps as soon as possible to bring this about.

Mr. Goodwin also urged the contractor-dealers to establish card records of prospective customers such as are used in many other industries, particularly by the piano and other musical instrument houses and mail order firms. These records could also be exchanged among the various dealers in the town and the central-station companies to advantage.

In order to assist the contractor-dealers in every way in the operation of retail stores and to encourage the opening of such establishments a lecture has been made up by the General Electric Co., in co-operation with the Westinghouse Electric & Manufacturing Co., which was given by J. A. Corcoran of the former company. In introducing Mr. Corcoran, Mr. Goodwin invited the criticism of those present, for it is only by such criticism that the dealers can secure the fullest results.

Mr. Corcoran's lecture was very interesting, bringing out many valuable suggestions for the proper conducting of a retail store which were illustrated with many charts and other properties that added a great deal to its effectiveness. Throughout the whole lecture there runs a strain of humor which serves to bring the suggestions out even more forcibly.

Sales, he explained, are the most important part of retailing and it is therefore very desirable for the dealer to know the extent of the possible field for electrical merchandise. There are at present 15,189,000 homes in this country not wired for electric service, while 5,500,000 are wired and the amount already spent in wiring houses is $275,000,000 against $759,459,000 which must be spent to wire the remainder. To accomplish this wiring of existing homes he estimates would take 10,000 contractors of average size, 20 years. The average percentage of income that the families of this country spent for electric current is 1/10 of 1%.

In order to secure the proper proportion of the business of the country the electrical dealer must first consider his points of contact with the public. There are five principal contact points,—store exterior, store interior, window display, publications and advertising. Next, he should appreciate the motives which prompt a purchase or buying motives of which there are also five—gain, necessity, pride, foresight and luxury. Every purchase is prompted by one of these motives alone or a combination of them. Memory is another feature that should be cultivated by the dealer both for himself and his customers, and this depends on association, repetition or intensity. He should also know the fundamentals of advertising,—interest, desire, action and in this he should remember that the nerves leading from the human eye to the brain are four times as great as those from the ear.

In choosing the location for a store the dealer should study the situation carefully and endeavor to locate along the principal trade stream. Such trade streams will usually be found near the local post-office, a large department store or the local central-station company's office and follow along the street in certain directions. However, it often happens that one side of a street affords a much better location than the other or the trade stream may stop at a certain point and turn back leaving the store but a few feet further on out of its influence.

The exterior of the store should be made as attractive as possible. This applies not only to the windows, sidewalks and doorway, but the upper floors as well, for the prospective customer sees the outside of the store first which also includes these upper floors. and their windows. The sidewalk in front should be free from any obstructions, such as trap-doors, etc., and the entrance should always be at the street level.

The most important factor of the store interior is the employes. The salespeople should know something about electricity and electrical apparatus and the stock in the store and the dealer's policies must be thoroughly understood. In the arrangement of the interior two plans may be followed, the jewelry and the hardware store styles. The former, which consists of a row of cases or shelves along the walls and a glass U-shaped counter in the center is preferable in some places but the latter with the sales counters along the side walls backed up by shelves is more generally used. In the selection of colors for interior displays and decorations considerable care should be taken. Nearly every color has some advantage which renders it especially fitting for certain displays, for example: red for intensity, blue suggests coolness, and grey is good for quality goods. Lavender, however, is only good for funerals and should always be avoided. Every sale should be accompanied by a demonstration in order to enable the purchaser to properly understand the appliance and its operation. The telephone is another contact point in the interior of the store which can be used to advantage by the enterprising dealer. In addition the personality of the proprietor, the outside employes, the firm's trucks, lantern slides, etc., are important factors of contact with the public.

Under the heading of publications as a point of contact come the mailing lists, distribution of posters and signs, stationery, calendars, advertising pencils, car cards, which are very effective but also rather expensive and display cards and price tags, especially. A great many dealers do not appreciate the value of showing the price of all articles on display. If the price is not marked the public assumes it to be high, whereas, if the price is plainly marked they assume it to be a bargain and are more interested.

In newspaper advertising the text should be timely, forceful, direct and truthful. It should be neat and attractive in appearance and if possible, should always have a distinct white border around it which causes it to stand out better. Special attention should also be given to the position of the advertisement.

Window displays are of course of vital importance. Such displays should be changed frequently and made as attractive as possible, with special attention to the window lighting. As in interior displays lavender should always be avoided. In illustrating this point miniature display windows were used and the different types of displays shown.

Following Mr. Corcoran, Mr. Goodwin again spoke and requested the frank criticism of those present on any of the ideas presented. The job of merchandising, he explained, was big enough for all to attempt and the field was far from saturated.

In the afternoon a number of athletic events were held in which all present were invited to participate, and a number of valuable prizes were presented.

Repair and Sale of Used Apparatus Section.

On Friday morning two parallel section meetings were held, one by the Repair and Sale of Used Apparatus section and the other by the Merchandising and Fixture Dealing section. A. L. Swanson of Evansville, Ind., presided at the former and Jos. A. Fowler, of Memphis, Tenn., at the latter.

The first address delivered before the Repair and Sale of Used Apparatus section was delivered by A. Penn Denton, of the Denton Engineering & Construction Co., Kansas City, Mo. Mr. Denton's address is reproduced substantially in full in another section of this issue.

This was followed by a paper by A. O. Kuehmsted of the Gregory Electric Co., Chicago, on the "Methods of Determining the Value of Burned Out Apparatus." This concern is one of the oldest and largest handling used electrical apparatus and Mr. Kuehmsted's talk was largely the result of its experiences in this line. The methods of determining the value of any burned out motor or generator, he said, are comparatively simple if sufficient data are provided. The Gregory company has collected these data from three sources and from these data has compiled indexes which have proven of great value in this work. The first of these indexes contains information gathered from catalogs published by the various manufacturers of this equipment which lists the weight and size of the apparatus together with its characteristics.

The second is a card cost system in which is listed the cost of rewinding armatures or fields or refilling and connecting commutators. Each card shows the cost of the raw material, the credit for scrap material, and the labor cost. From these costs on past operations the company can easily ascertain the approximate cost of similar repairs to these machines. It may be of interest to note that the cost of rewinding armatures or fields is practically the same for all makes of the same size and type but the cost of refilling commutators varies in the products of the different manufacturers.

The third index consists of an up-to-date schedule of standard machine prices, the cost to the dealer, the jobber's cost, etc., and from this is based the price which shall be paid for a machine in good condition. However, this price will vary according to the actual age of the machine and whether there is any demand for it or not.

By using these systems the company is able to estimate what any machine is worth. If it is in good condition the offer can be made from the price schedule. If it is in very poor condition, its scrap value can be ascertained by referring to the catalog index which lists the weight of the iron and steel in that particular piece of apparatus. If the commutator needs refilling or the armature or field needs rewinding, the cost of making such repairs can be determined and is deducted from the amount offered for the apparatus.

The company has found that it can afford to purchase used machines for resale that have only one part needing replacement, that is, if the commutator needs refilling, or the armature rewinding or the field rewinding. However, it cannot afford to buy a machine for resale that will require the replacement or repair of any two of these parts except under very unusual conditions, for the repair cost would be too great and therefore only the scrap value can be allowed.

In the discussion of this subject many valuable points were brought out. For example, it was shown that the average price of a second-hand machine in good condition will average 60 to 75% of the cost of a new machine under ordinary circumstances. It was also pointed out that the overhead expense of conducting such enterprises will be from 33⅓ to 50% of the cost.

Mr. Kuehmsted also gave some pertinent advice on guarantee polices which caused considerable favorable comment among those present. The dealer's reputation, in his opinion, is the best guarantee to be given and to guarantee the performance of any apparatus for a certain length of time is inadvisable. The Gregory company ships apparatus which it guarantees to be in good condition when installed and will refund the purchase price and take back the apparatus if it proves unsatisfactory. It will not, however, make any rebate for minor claims arising after the apparatus has been in service.

Following Mr. Kuehmsted, C. M. Jamison, of the Milwaukee Railway & Light Co., explained the policies of that company with regard to appliance repairs. The merchandising department of that company, Mr. Jamison stated, is conducted for profit and he believes its influence is of assistance to the local dealers as it also increases their sales. The minor appliance repairs are made on the customer's premises for which a charge is made. The large repair work is done in the company's shop or distributed to the local repair firms.

Following the presentation of this paper the idea of establishing central repair shops was brought up and discussed. Such shops could more easily carry a stock of parts for all types of appliances than the individual repair shop, for the volume of business would be much greater.

Merchandising and Fixture Dealing Section.

The first speaker at this session was John G. Learned, chairman of the Commercial Section of the National Electric Light Association, who spoke on "Complete Electrical Equipment for the Home." Mr. Learned explained in detail the plans for a nation-wide educational campaign for the purpose of creating a greater demand for complete installations of wiring and appliances in the home which have been developed by the Commercial Section. Mr. Learned's address will be reproduced in full in a later issue.

Phil Polacheck of Milwaukee then described the "Arrangement and Conduct of a Retail Store." Mr. Polacheck recommended that in the electrical retail store the different departments be separated from each other but should be arranged so that any purchaser entering the store can see at a glance all the kinds of merchandise offered for sale. Such departments, for example, as those that sell ordinary supplies such as fuses, sockets, lamps, etc., appliances and fixtures should be distinctly separated but not isolated. Many interesting and valuable suggestions were brought out in this paper and in the very lively discussion that followed. In this way the value of the various methods of arranging store were clearly shown.

Following this, a paper on the "Relations of the Dealer to the Public in Merchandising" was read by J. R. Tomlinson of Portland, Ore. This paper will also be reproduced in an early issue.

A. L. Oppenheimer of Cleveland, Ohio, delivered an address on the features of fixture business as a part of retailing in which he clearly explained the value of selling lighting fixtures as an adjunct to the sale of appliances and other electrical goods, and described the difficulties frequently met in such endeavors.

Afternoon Session.

At the afternoon session, H. C. Metcalf, Ph. D., of the Bureau of Industrial Research, New York City, delivered a stirring address on "Human Relations in Industry." The subject was especially fitting coming as it did immediately before a discussion on this subject by the association.

Doctor Metcalf described the growth of the human relations idea industry which has resulted in the establishment of personnel or similar divisions in many large concerns throughout the country. In this respect, he stated, the interests of the employe, the employer and the public are practically concurrent if not identical. The loyalty of its employes is a great asset for any concern which, of course, can best be secured by realizing what the employe wants and can reasonably expect to get from his employer. In his opinion, what the employe wants is, first, a knowledge of the firm and his work so that he may be able to select a firm to work for just as the modern employer selects the proper man to work for him; second, security of employment; third, a living wage; fourth, a share in the management; fifth, his own status in the company. The employe also wants the right to organize, but such organizations should be for the purpose of working together. On the other hand, the employers should be willing to experiment in democracy, which means participation. The problem, as Doctor Metcalf sees it, is largely an educational one and ability at the top to recognize and deal with it is the only limit to the expansion of business. However, to establish justice in work relations is the greatest problem to which business can address itself.

During the course of his address Doctor Metcalf referred to "Declaration of Principles" that had been drawn up and which was about to be considered for adoption. In his opinion, this was a big step in the right direction and he complimented the members and the association for their efforts to solve this problem.

The adoption of the "Declaration of Principles," however, met with considerable opposition from some of the members who were skeptical of its purpose and feared lest it should offend those members who do not employ union labor. After considerable lively and interesting discussion in which everyone was given an opportunity to express his opinion and during which an enthusiastic appeal for its adoption was made by Mr. Goodwin, the association voted to adopt this code. The resolution from the Executive Committee and the "Declaration of Principles" as adopted are as follows:

Resolution from Executive Committee to the Nineteenth Annual Convention.

Whereas, The fundamental problem which confronts the business world today is the necessity of establishing relations between men that will make it possible for them to live and work together in harmony and progressive efficiency, and

Whereas, The solution of that problem can be found only through mutual application of infinite patience by employers and employes in co-operative research and education, and

Whereas, No agency for such co-operative work by employer and employe now exists in the electrical contracting industry, and

Whereas, In view of the conditions recited, it is the opinion of the National Executive Committee that the time has come when the National Association of Electrical Contractors and Dealers must change its position of regarding matters of relationship between employer and employe as beyond its legitimate field of activity, and face the fact that the issues now arising and which will continue to arise, involving the very life of industry, and therefore the life of the community, can be settled peacefully only through the faithful co-operation of employers and employes, whose interests in the productive effort are common and inseparable; now, therefore,

Be It Resolved, That the National Executive Committee approve the "Declaration of Principles" presented herewith, and

Be It Further Resolved, That the Executive Committee refer the said Declaration of Principles to the National Association of Electrical Contractors and Dealers, in convention assembled, approve it, and authorize the Executive Committee to act as it may deem best in applying the principles enunciated with a recommendation that a special committee be appointed to act in the matter.

Declaration of Principles—Preamble.

The vital interests of the public and of employe and employer in industry are inseparably bound together. All will benefit by a continuous peaceful operation of the industrial process and the devotion of the means of production to the common good.

Principles.

1. The facilities of the electrical industry for service to the public will be developed and enhanced by recognizing that the overlapping of the functions of the various groups in the industry is wasteful and should be eliminated.
2. Close contact and a mutually sympathetic interest between employe and employer will develop a better working system, which will tend constantly to stimulate production while improving the relationship between employe, employer and the community.
3. Strikes and lockouts are detrimental to the interests alike of employe, employer and the public and should be avoided.
4. Agreements or understandings which are designed to obstruct directly or indirectly the free development of trade or to secure to special groups special privileges and advantages, are subversive of the public interest and cancel the doctrine of equality of rights and opportunity, and should be condemned.
5. The public interest is conserved, hazard to life and property is reduced, and standards of work are improved by fixing an adequate minimum of qualifications in knowledge and experience as a requirement precedent to the right of an individual to engage in the electrical construction industry, and by the rigid inspection of electrical work, old and new.
6. Public welfare, as well as the interests of the trade demands that electrical work be done by the electrical industry.
7. Co-operation between employe and employer acquires constructive power, as both employes and employers become more completely organized.
8. The right of employes and employers in local groups to establish local wage scales and local working rules is recognized and nothing herein is to be construed as infringing that right.

The convention closed on Friday evening following the annual dinner of the association. This proved to be a fitting finale of a most successful convention. James R. Strong, a New York City contractor-dealer, was the song leader on this occasion and although he has filled this position on many former occasions, his efforts at this time were particularly praiseworthy.

Next Convention to Be Held in Baltimore.

Requests for the next convention were received from many cities, which were backed up by the efforts of enthusiastic delegates. After considerable deliberation on this subject the Convention Committee decided to hold the next annual convention in Baltimore, Md., with Oct. 6, 1920, the opening day.

Electricity for Heat Treatment in the Steel Industry

Use for Soaking Pits, Reheating and Annealing Furnaces—Automatic Heat Treatment—Iron and Steel Institute Paper

By THADDEUS F. BAILY

President, The Electric Furnace Co.

THE introduction of electrically heated furnaces to the heating operations subsequent to melting and refining in the steel industry has experienced the slow development incident to the introduction of all radical innovations in any industry. Many of the types that will find wide application in the future, while entirely feasible, have, when offered, been met with the statement that if such an equipment was a good thing, why were they not in general use. Other types that have been in regular service for a considerable number of years whose construction and operation are much more elaborate and whose commercial advantages are no greater, are now generally accepted as the most rugged and reliable equipment for the purpose. This latter refers to electric furnaces for the annealing and heat treatment of steel.

One of these types installed some three years ago has been used exclusively since its installation for the particular material for which it was designed—namely, cast steel draw-bar knuckles—and subsequent to the installation of the first unit, a second unit of the same capacity was installed. This equipment has, since its installation, handled over 50,000 tons of material—approximately half of all the material of this character used on American railroads having passed through these furnaces.

The higher "fuel" cost for electric furnaces over fuel-fired furnaces that might have been used for the same purpose has been amply justified in commercial practice by the labor saving effected, the precision of the treatment produced, and the elimination of the rejections of parts due to defective heat treatment; the precision of the laboratory is obtained in regular plant practice.

There has been a reluctance of manufacturers generally to consider that there is a difference in cost per ton of material put through a furnace and the cost per ton of material heat treated and coming within the specifications. There has been no greater factor in changing this attitude than the conditions brought about during the war, where in a great many plants there was a wide difference between the quantity of material inspected and the quantity of material accepted. Manufacturers now are generally conceding the justness of the higher requirements for steel, and this is one of the greatest arguments in favor of electric furnaces.

Three conspicuous examples of the electric furnace for heat treating are those for Liberty motor crank shafts, over half of which were so heat treated; cast steel anchor chain, all of which was heat treated in furnaces of this character; and draw-bar knuckles, substantly half of those which are used in America being thus heat treated.

These examples are typical of the furnaces to be described in this paper adapted to other operations in the steel industry and embrace soaking pits for the soaking of hot stripped ingots, re-heating furnaces for hot blooms and billets, combination fuel and electric furnaces for the heating of bold blooms and billets, recuperative car type annealing furnaces for bars and sheets, and automatic heat treating equipments for drop forgings and castings and for the heat treatment of steel rails and similar material.

The Electric Soaking Pit.

The electric soaking pit for hot ingots is perhaps the most promising development of the electric furnace to the steel maker, as the shortcomings of the present pits—whether of the fired or non-fired type—are well known, and many troubles of the rolling mill can be traced to the present type of it.

The principal recommendation of the present type of pits, either of the fired or non-fired type, is the low fuel consumption per ton of metal soaked. This cost in a well handled pit is almost a negligible item, amounting frequently to only a few cents a ton.

However, in the larger mills, when running at full capacity, features such as lack of uniformity in temperature of the heated ingot, excessive oxidation of the ingot, etc., are often such as to quite outweigh the item of mere fuel cost, and while it is to be admitted that electric pits cannot compete with fuel-fired pits under ordinary circumstances, when heating cold ingots, the time is not far distant when substantially all modern mills rolling hot ingots will use electric pits for this part of steel mill operation.

It has been difficult to overcome the prejudices against this innovation in ingot soaking, but the advantages to be gained are so apparent and the success of electric furnaces in other similar fields has been so marked, that it will not be long until electric soaking pits will be in commercial operation.

From electric furnaces operating at the same temperature, or at even higher temperatures than that required in soaking pits, and which have been operating over long periods of time, it is apparent that the standby, or wall losses, of a typical pit adapted to hold sixteen 3-ton ingots will not exceed, as a maximum, 1000 kw. and will be expected to operate on considerably less current.

However, taking 1000 kw. as a basis, which is amply safe, and when operating on hot ingots, whose superheated interiors are sufficient to bring to temperature their colder outer shells, and operating on a soaking time of 1½ hours, the capacity per pit will be 32 tons per hour with a figure of 1000 kw. current on the furnace, the current consumption per ton of metal soaked would thus be 35 kw-hr. per ton; taking as a basis of cost of electricity in the steel mill one-half cent per kilowatt, the cost per ton of metal soaked would be 17½ cents, to which might be added a cost of 5 cents per ton for renewals and repairs, making a total cost of 22½ cents per ton for these two items.

It is to be expected that this cost for heat may be in excess of similar costs for gas-fired pits or unheated pits, but when taking into consideration that the electric pit will eliminate the roll breakages due to cold ingots, delays in the mill due to ingots unevenly heated, oxidation (thus producing a cleaner bloom and an actual saving in metal due to this elimination of oxidation, amounting to perhaps one-half of 1%),

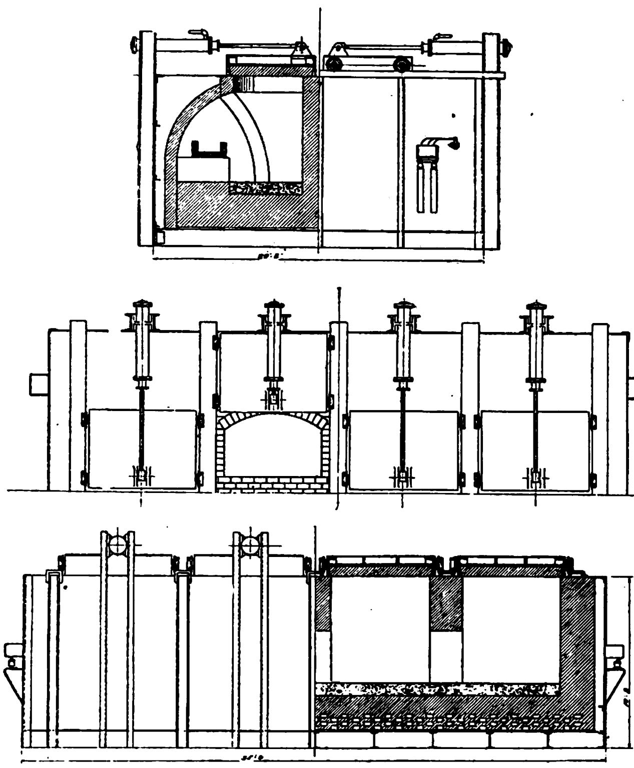


Fig. 1.—Pit Type Furnace for Soaking Ingots for Heavy Forgings and Shafts.

as well as the ability of the electric pit to save labor, it is certain that the higher cost will be more than offset by the advantages, and that per ton of metal rolled in a given period the actual cost by the use of an electric pit will be less than by other means.

Fig. 1 shows the general arrangement and character of such a pit. This pit will be provided with eight holes, instead of the usual four, and in consequence only half as many ingots will be located in each cell.

The resistance elements themselves, composed, as in all furnaces of this class, of broken carbon thrown loosely into a carborundum fire-sand trough supported on brick pillars, are located along the outer wall of each side of the pit and protected against the liability of serious accident from the ingot by being recessed some distance back from the ingot cell itself. The heat from this resistance element, it will be noted, is radiated to the circular wall of the pit and thence to the cover, the partition wall of the pit, and to the ingots themselves. The cross section of this resister element is such that there is very little difference between its temperature and the ruling temperature of the pit, and in actual practice most of the heating is done by the walls of the pit itself, rather than by direct radiation from the resistor element—this being of the highest importance in obtaining uniformity of heating.

In cases where the ingots cannot be delivered to the pit with enough heat for them to reach a high enough temperature without the addition of more heat from the pit itself, a longer time will be required by the ingots to bring them to temperature, and at the same time the capacity of the pit in tons per hour will be reduced.

But taking as a basis ingots whose average temperature would be 1800° F., requiring 300° additional for bringing them to temperature, the capacity of the pit would be reduced to 24 tons per hour, the electrical capacity of the pit increased to 1500 kw. and the current consumption increased to 60 kw-hr. per ton.

With the ingots charged at an average temperature of 1500° F., the capacity of the pit would be reduced to 16 tons per hour, and the current consumption increased to 90 kw-hr. without increasing the electrical capacity beyond 1500 kw.

Thus we have for a total of heating costs, including the renewals and repairs, and with power taken at ½ cent per kw-hr.

Material,	Cents per ton.
Hot ingots	22½
Ingots at 1800° F..............	35
Ingots at 1500° F..............	50

the final temperature in each case being taken as 2100° F.

These figures can be safely taken as guarantees and it can be expected that they will be much bettered in actual practice and operation over long periods of time.

Continuous Type Reheating Furnaces.

It is believed that this type of furnace (Fig. 2) will find wide application in the heating of cold steel for forging and rolling in relatively small capacities and in reheating steel of high quality, but where very large tonnages of cold blooms or billets are to be heated, a combination fuel and electric furnace—to be later described—will be better adaptable for such work.

The illustration on the next page illustrates an all-electric billet heating furnace.

This furnace was built for heating 3¾-in. round billets for shell forgings and while the current cost for supplying this particular furnace was high and the operating conditions not particularly favorable, nevertheless the reduction of rejections of forgings due to eccentricity, the saving of the dies due to the elimination of scale and other advantages, such as better working conditions and simplicity of control, enabled the results to compare favorably with coal-fired practice.

This furnace was of 600-kw. capacity and in actual practice handled 1½ tons of steel per hour, with a current consumption of a little over 450 kw-hr. per ton or a thermal efficiency of a little more than 50%. Under more favorable conditions, an efficiency of 66%, or a current consumption of approximately 300 kw-hr. per ton has been obtained. So that with low cost of current, which it is believed may be taken as ½ cent per kw-hr. in steel mill power costs, the "fuel" cost for cold heating in units of this size would be $1.50 per ton.

This cost will compare favorably with direct coal-fired furnaces of similar capacity and will actually show some commercial advantage when taking into consideration the saving in metal due to scaling, which may readily run several per cent and at least in average operating conditions may be taken as 2% and under the worst conditions 5%, actually observed in one or two instances.

Furnaces of larger capacity than the one described show a less favorable comparison to the electric and furnaces of smaller capacity show a more advantageous comparison with the electric furnace, and it is believed that in any case, the cost of material heated in furnaces of this size, all things considered, may be safely taken as running very close together, with the electric furnace having the advantage in greater uniformity of temperature and other incidental advantages, including a higher yield of good finished pieces.

An application that it is believed will find favor in certain steel mill operations is the use of an electric furnace for re-heating billets for finishing mills,

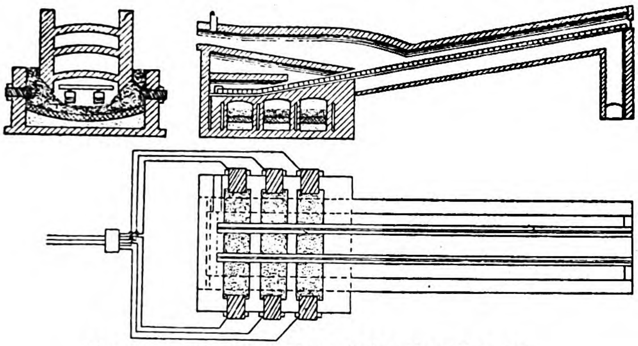


Fig. 2.—Continuous Type Reheating Furnace.

wherein the blooms or billets coming from one mill are too cold to put into the finishing mill and will require approximately 200° additional heat.

The calculations on such an equipment are as follows for a capacity of 15 tons of 4-in. square billets per hour, charged into furnaces at 1800° F. and brought to 2000° F. Such a furnace would require 800 kw. current for its operation and somewhat under 60 kw-hr. per ton of metal re-heated, and with ½ cent for power, making a cost of 30 cents per ton of metal re-heated. As an electric furnace of this character would undoubtedly save one-fourth of 1% of metal over fuel-fired furnaces, which would amount on steel worth $40 per ton to a saving of 10 cents per ton, and then taking into consideration the low efficiency to be expected of a fuel-fired furnace of this character operating on hot billets only, there would be a decided advantage in the use of the electric furnace for such an operation.

Combination Fuel and Electric Reheating Furnaces.

Where large tonnages of cold blooms and billets are to be heated, however, unless electricity can be obtained at an exceptionally low rate and fuel can only be had at a high cost, a combination gas and electric furnace (Fig. 2), wherein the earlier stages of the heating up to, say, 1800° F. are handled by fuel, and the final temperature handled electrically is perhaps the only type that can compete with the continuous fuel-fired billet heating furnace.

Such a combination would enable the preliminary heating to be done with fuel, without the danger of excessive oxidation that is present in the fuel-fired billet heating furnace, and will insure a uniformity in the heating of the billets that is not generally obtainable in fuel-fired furnaces of this type, and while there would be a small saving of perhaps 50 lb. of coal per ton of metal heated due to the lower temperature to which the billets are heated by the fuel-fired end, against this must be charged, say, 60 kw-hr. per ton of metal or 30 cents per ton of metal heated for the final stage by electricity; nevertheless, the advantage of uniformity in temperature, elimination of scale, etc., and more accurate control will justify in many cases the use of such a combination furnace.

Annealing Furnaces.

Of the annealing furnaces in the steel industry, the recuperative car type will have perhaps the widest application. Two furnaces of this type are now under construction. The largest of these will have a capacity of 150 tons per day when annealing at 1200° F. and is adapted for the annealing of cold-rolled strip and sheets. The second furnace, though having approximately the same dimensions, will be for annealing alloy steel bars, which require a long soaking time at maximum temperature.

The first of these furnaces is shown in Fig. 3. One notable feature of these furnaces is that the annealing will be done without the usual covers required in fuel-fired furnaces ordinarily used for this work, which will constitute one of the greatest savings in annealing, as compared with present methods. This recuperative type furnace lends itself to the highest

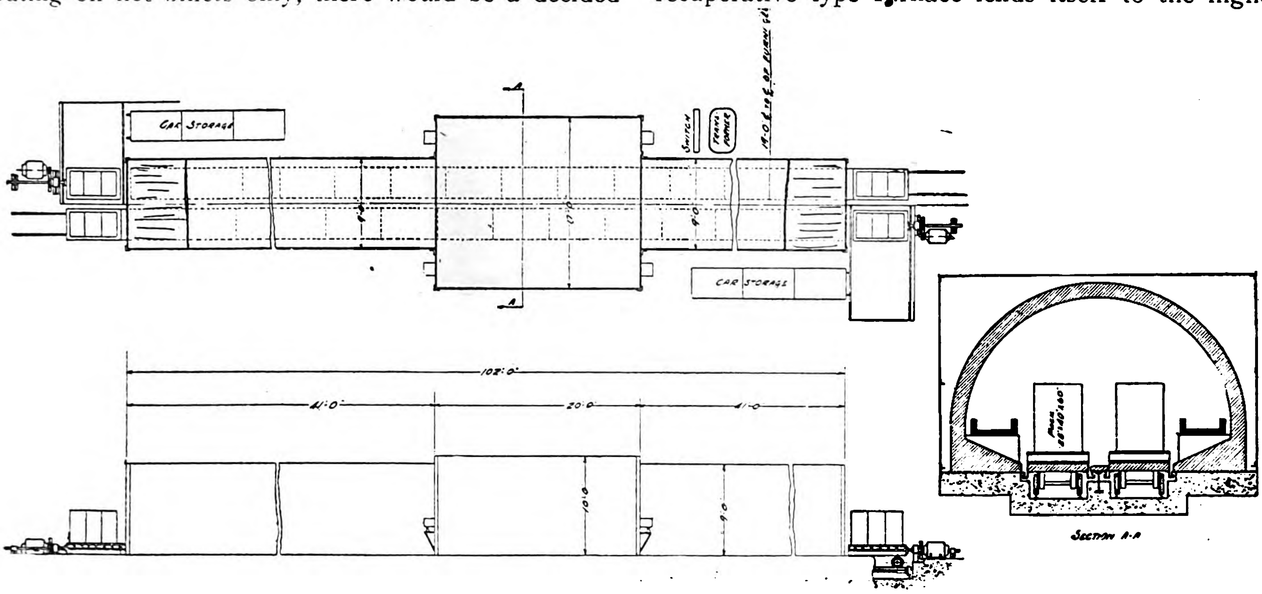


Fig. 3.—Continuous Recuperative Cary Type Furnace for Annealing Tin Plate, Cold-rolled Steel, Etc.

economy, as after the steel has reached the full temperature and is passing toward the discharge end of the furnace, a large part of this heat is given up to the cold incoming material.

In the preliminary trials of the first of these furnaces, excellent annealing results were obtained as well as high economy, but difficulty was experienced with the equipment from the standpoint of complete elimination of oxidation, due to a lack of proper precaution at the ends of the furnace. This matter, however, is one readily overcome and this equipment will soon be in regular operation.

The equipment illustrated in Fig. 3 is of 600 kw. electrical capacity and is approximately 225 ft. long by 22 ft. wide. The material is handled on sand-sealed cars, each car being substantially 13 ft. long by 4 ft. wide and adapted to hold 20 tons of material, there being in all 17 cars located on each of the two lines of track passing through the furnace, each line of cars passing in opposite directions. In the middle of the furnace is located the heating chamber proper, which is 26 ft. long, holding two cars in the heating zone on each track at a time or substantially 80 tons of material at a time in the heating chamber.

A movement of the cars takes place on each track approximately every 6 hours, discharging at that time two 20-ton cars of material, one at each end of the furnace, and similarly charging at each end of the furnace a car of cold material. The cars are moved forward by means of a hydraulic machine, operated by a 600-lb. water pressure system.

One of the requirements of this equipment is that when annealing low-carbon cold-rolled strip, the hardness should not exceed 20 sceleroscope measurement. All of the tests taken were between 18 and 19.

While no tests for maximum capacity could be taken at the time owing to sufficient steel not being available, the operation at half capacity was well within 200 kw-hr. per ton, which clearly indicated that when operating at full capacity the current consumption would be somewhat under 120 kw-hr. per ton.

Taking again large steel mill practice of current at ½ cent per kilowatt, the cost of annealing in this type of furnace would not exceed 60 cents per ton, which will compare favorably with coal-fired annealing furnaces from a fuel standpoint, and in addition will completely eliminate the expense of covers, as well as a considerable amount of labor, and will introduce a precision in annealing which it is not possible to obtain with present equipment.

The other equipment of this character, although of approximately the same dimensions, excepting being somewhat shorter in length, requires a larger heating chamber proper, even though the rated capacity is only 75 tons per day. This is due to the fact that the metallurgical requirements are such on the alloy steel to be treated that the material must be soaked for 40 hours at a maximum temperature of 1400° F.

The furnace itself is supplied with 800 kw. transformer capacity and will operate with a current consumption something under 250 kw-hr. per ton of metal annealed. In this furnace ten 15-ft. cars, each holding 30 tons of material, are located on each of the two tracks, and a maximum of 600 tons of material is in the furnace at a time, 120 tons of which are in the heating zone proper. The full movement of each line of cars will take place substantially every 20 hours, delivering substantially 72 tons per day.

One of the special requirements of this furnace is that the cooling from maximum temperature over the first 200° of the cooling range must not take place at a greater rapidity than 10° per hour. This necessitates the introduction of a very powerful and slow pulling mechanism wherein the speed of travel does not exceed 9 in. per hour.

This special equipment consists of a motor-operated chain haul similar to the equipment used in the larger types of draw benches for tube drawing, and is supplied with a 10-hp. motor through seven gear reductions. As the cars must pass through a sealed entrance hood or chamber before going into the furnace proper, this precaution being found necessary in order to prevent reducing the atmosphere of the furnace during charging, the pushing mechanism and the door operating mechanism are interlocked so that when the push button starter is operated the interlocking mechanism first raises the door of the entrance hood, then the cold car of material is pushed into the chamber, the entrance door closed, the door to the main furnace next opened, the pusher continuing the push of the car just far enough into the entrance hood until it comes in contact with the main line of cars in the furnace. From this point on the travel is at the rate previously mentioned, namely 9 in. per hour, during which time the door at the discharge end of the same line of cars at the opposite end of the

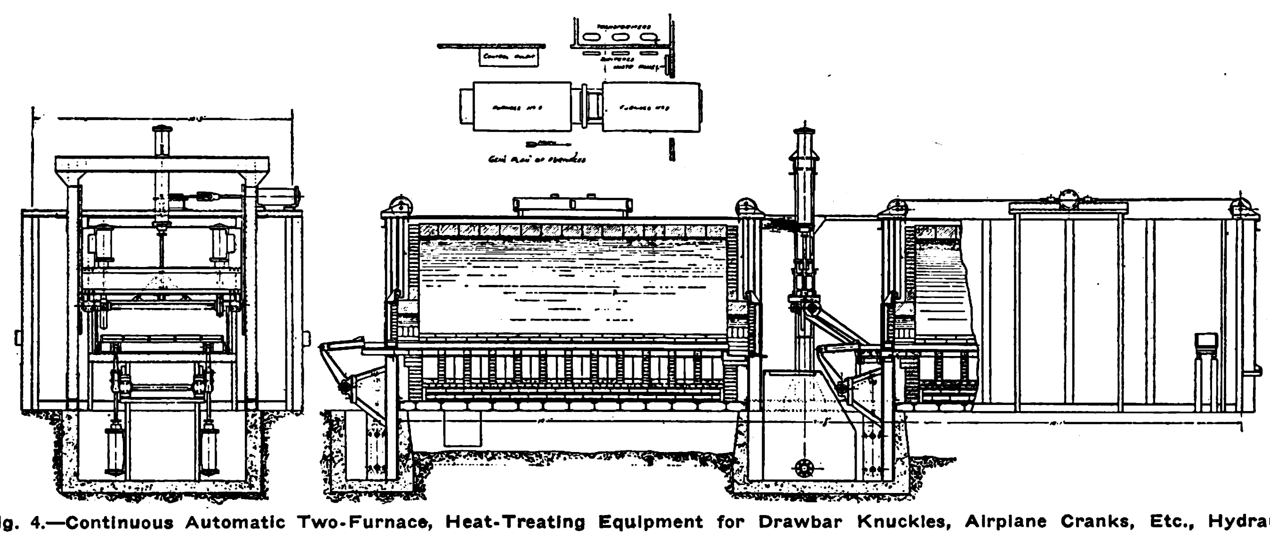


Fig. 4.—Continuous Automatic Two-Furnace, Heat-Treating Equipment for Drawbar Knuckles, Airplane Cranks, Etc., Hydraulically Operated.

furnace is opened and the car at the discharge end moved into the cooling hood at that end, the discharge door on the vestibule itself still being closed. When the cold car being pulled in has come fully within the door line of the furnace proper, the door is dropped behind it and the heating chamber thus sealed.

At this point, the pushing dog behind the car is reversed and it is returned to its starting position to bring another car into the entrance hood. While doing so, however, a pull-out chain, operated by the same shaft as the main pulling drum, latches, through means of a special dog, into the car of cooled material on the opposite track, moving it a few inches forward from the line of cars that has pushed it to the discharge position, then the interlocking mechanism drops the door in front of the line of cars, after which the outer door of the vestibule is opened and the drawback mechanism pulls the car entirely clear of the furnace, at which time the door of the vestibule is closed. Immediately following this operation a similar operation to the one just described begins at the opposite end of the furnace, the chamber and the furnace proper being first opened.

Heat Treating Equipments.

It is, however, in heat treating equipments—which consist of two furnaces, one for the hardening temperature and one for the drawing temperature, in connection with a quenching mechanism located between—that electric furnaces have been first recognized as standard equipment for exacting work in the steel industry, and the earlier of these furnaces, especially of the automatic type, have been in use now for several years.

One of the most notable of these is an installation made at Sharon, Pa., over four years ago which the following year was augmented by a duplicate installation.

A similar equipment of the same capacity was installed last year for the heat treatment of crank shafts for the 12-cylinder Liberty airplane motor. This equipment is shown in Fig. 4. On account of the irregular shape of the material under treatment and also to enable other sizes and types of airplane shafts to be handled interchangeably, a special type of cast steel chair was developed so that the direct force of the pushers brought against a line of these chairs, the material to be heated thus lying independent and free from strain while going through the furnace.

The steel used in these crank shafts was perhaps one of the most difficult to heat treat, and the requirements were most exacting. Opportunity for obtaining the exactness of this treatment was in this case readily available, as test pieces were taken from each end of every piece, and it is interesting to note in connection with this rigid inspection that for days at a time, when producing even several hundred cranks a day, there would not be a single rejection for any cause. This fact not only speaks well for the heat treating equipment but for all the previous operations in connection with the steel, including the forging, heating for forging and the making of the steel itself.

Anchor Chain Heat Treating Furnaces.

A heat treating equipment of similar capacity but with a modification as to handling mechanism is installed at the plant of the National Malleable Castings Co., Cleveland, Ohio, for the heat treatment of cast steel anchor chain. This consists of a 600-kw. hardening furnace, approximately 28 ft. long by 16 ft. wide, and a hearth the full length of the furnace and 6 ft. 6 in. wide. At the discharge end of this furnace is located a concrete quenching tank, 40 ft. long by 8 ft. wide, for quenching the chain. At the other end of this pit is a furnace of similar size but of 300-kw. capacity for drawing the temperature of the chain after quenching. Each of these equipments has a rated capacity of 50 tons of chain per day and the current consumption when operating at capacity is substantially 450 kw-hr. per ton, this current consumption being 150 kw-hr. per ton higher than in the other heat treating furnace just described and than the two similar sets at the same company's Sharon plant, due to the fact that the material is such that a larger furnace chamber was required for a given capacity. (Fig. 5.)

The charge of material consists of two 90-ft. lengths of 2-in. cast steel anchor chain, folded into loops 22 ft. long. These loops are dropped over heavy cast steel hooks, the ends of which, when the charge is in the furnace, protrude through recesses cut in the furnace door. The ends of these hooks are connected to a heavy steel cross bar, which is provided with lugs for fastening on the pulling chains, operated by a heavy winch, similar to a crane drum and equipped with a 20-hp. motor. One of these winches is located 30 ft. beyond the discharge end of the drawing furnace, the other directly over the quenching pit.

The operation of heat treating these chains begins

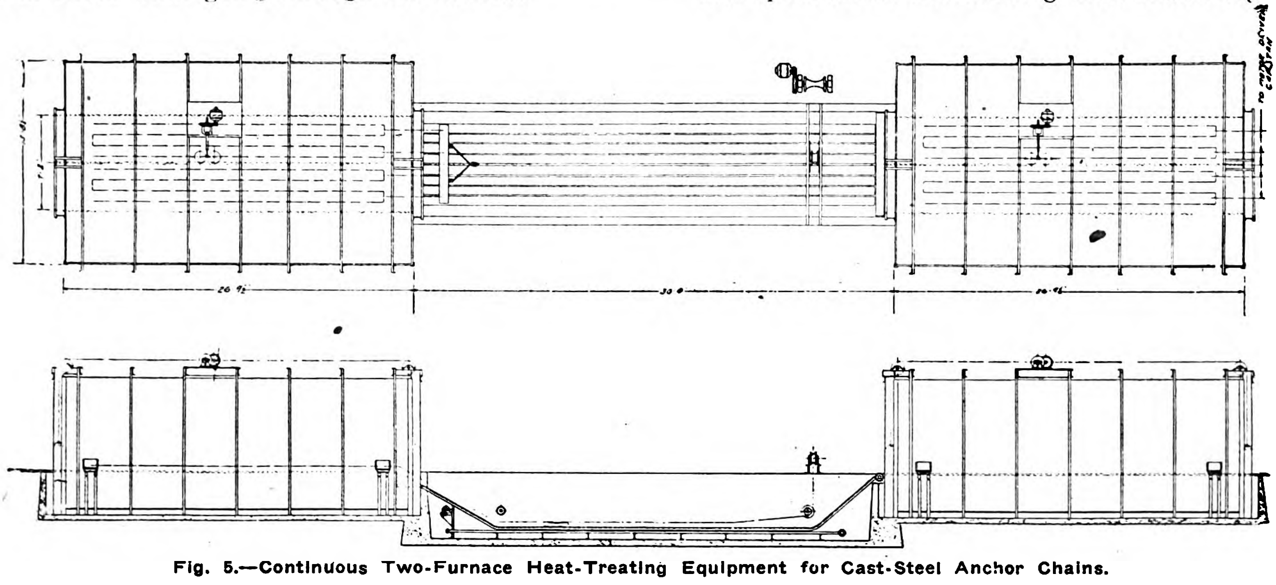


Fig. 5.—Continuous Two-Furnace Heat-Treating Equipment for Cast-Steel Anchor Chains.

by dropping the loops of the folded chain over the hooks in front of the charging end of the hardening furnace, the hearth of the furnace being level with the foundry floor. The pulling chains are dragged through the hardening furnace from the front end by means of a light iron bar, the winding drum backing off the chain as it is pulled through. These chains are now hooked onto the steel cross bar of the cast steel hooks just mentioned, the winch reversed and the chain pulled into the hardening furnace, where it remains for substantially 2 hours, during which time it is fully and entirely heated to the furnace temperature, which is about 1650° F. The doors of the hardening furnace are then opened and the winch pulls the chain out of the furnace into the quenching pit, where it lies on a steel framework composed of 7-in. channels. As the chain is immersed into the quench it is met by a strong flow of fresh water from submerged nozzles so as to give it an initial chilling, directly as it is immersed. As the tail ends of these chains pass out of the furnace door, the door closes and the chain is allowed to lie in the quench for several minutes. Before it is completely cooled, however, the chains from the winch of the second furnace are dragged through that furnace and hooked into the cross member and hooks holding the chain in the quench. The pulling chains from the first furnace are disconnected, the doors of the second furnace are opened and the winch of the second furnace pulls the chain into the drawing furnace, where it remains for another two hours and is subsequently and in a similar manner withdrawn from that furnace.

Large heat treating furnaces of the automatic type such as are described in this paper, whose certainty of operation and precision of treatment have been clearly observed over several years, justify the consideration of the heat treatment of large tonnages of heavy material. such as steel rails. The building of equipments for such purposes presents no serious difficulty.

It is readily apparent to anyone interested in this subject that the heat treatment of rails is highly desirable, as the increased physical properties readily obtainable by a proper heat treatment are such as to very remarkably increase their efficiency, not only adding to the life fom the standpoint of wear, but adding materially to the ultimate strength and the elastic limit, without appreciably sacrificing the ductility or toughness, and the only real question that can be raised is whether successful heat treating equipments can be found wherein every rail treated will have exactly the heat treatment specified, and whether such equipment can be rugged enough to operate with precision over long periods of time, and the cost of operation come within a reasonable commercial range.

The furnaces described in this paper, especially those of the automatic type, which have records of years of successful service, fully answer the question as to precision and reliability.

As to the special requirements of an equipment for the handling of rails, this will require, of course, a rugged quenching mechanism that will prevent a 33-ft. rail section from twisting during the quenching and perhaps a similar mechanism after the drawing operation.

Such an equipment will have the advantage of complete elimination of the gag press operation now admitted to be one of the principal undesirable operations in the making of steel rails.

As to the commercial cost of the heat treating operation, as compared with the increased physical properties, it may be stated that the actual cost for electric heat under the conditions named in this paper would not exceed $1.50 per ton, and the labor cost would probably be no more, and perhaps less, than is now required in the straightening press operation above referred to. The ultimate strength of the rail would in all probability be increased more than 25% and the elastic limit perhaps doubled, while the life of the rail from a wearing standpoint would undoubtedly be materially increased. It is a conservative statement to say that a 25 to 50% more effective rail from a wear and safety standpoint could thus be obtained at an additional cost per ton of not to exceed 5%.

The equipments described in the latter part of this paper are the forerunners of electric furnaces of the type that will soon come into regular use for operations on a far larger scale than will generally be conceded by the average steelmaker today and will embrace the wide and almost exclusive use of certain types, such as the soaking pit and certain forms of the re-heating furnace first mentioned in this paper. While in some cases there will be an actual reduction in cost of operation over present methods due to the electric furnace, even for steel of average quality, the more rigid requirements in finished product will in some cases compel the use of electric furnaces.

Where requirements of the steel specified must be met, a lower cost may readily be found in operating electric furnaces, when taking into consideration the difference between the cost per ton of material put through the furnace, as compared with the cost per ton of material meeting the specifications.

Many of the arguments used against the introduction of electric furnaces were used against the introduction of large motors in the steel mills and against electric haulage, and the statements frequently made through all the years about any innovation that "it has not been done and it cannot be done" must gradually yield, as one by one the various types of electric furnaces from heat treating equipments to soaking pits go into regular, commercial service.

ELECTRICALLY HEATED STEAM BOILERS.

Under certain special circumstances the electrical heating of boilers is justifiable; for instance, in very northerly countries, for the wood pulp and paper factories with water-power driven machinery, which requires large quantities of steam for the process.

The Allegemeine Elektricitäts Gesellschaft of Berlin, Germany, has developed special boilers in which the heating is effected by the passage of electric currents through the water. For this purpose narrow tubes of insulating material are provided. These contain water and are vertically arranged so as to communicate with the interior of the boiler at the upper and lower ends of the tubes. Current is sent through the water columns contained in the tubes and, as the resistance is great, considerable voltages are required. Alternating current must be used, in the case of three-phase currents the tubes are connected in groups of three. The current is regulated by moving the electrodes in the tubes. The efficiency of the boilers is 95% and over, and one kw-hr. of electricity produces about 2.75 lb. of steam at 90 to 120 lb. pressure. Up to the present electric steam boilers have been built in units up to a capacity of 1500 kw. with voltages of supply up to 10,000 volts.

Service Tests of Small-Capacity Meters

Schedules of Tests—Experiences as to Errors—Paper Before Ohio Electric Light Association

By ARTHUR HORACE BRYANT
Meter Engineer, Cleveland Electric Illuminating Co.

FIVE years ago our business, like that of many other industries, was getting along very satisfactorily on the whole. To be sure, there was always a changing condition to be foreseen, and there was the ever present problem of labor and its various moods, its restlessness and consequent "turn over" with the continual question of how best to select and keep efficient workers—for hereupon rests the success of any enterprise. However, the aims and purposes of our lives and business were being worked out without any very serious obstacles or challenges, when suddenly and before we could realize what it all meant, we were confronted with the world at war. First, we assured ourselves that we were safe and could go about business with little or no interference. But soon we too had cast aside as non-essential everything that was not contributing in some measure toward the winning of the war and we entered into the spirit of the day. Men all about us—employes of experience and those who could ill be spared—left to others their responsibilities and set out to help in the larger work of the country. Help became scarce, wages and material commenced to climb in price; you know full well how the central stations were ofttimes taxed to their limits to meet the increased demand for more power; their business boomed. However, the added work had to be accomplished by fewer men at a greater cost and this was capped with an increased scarcity and poorer quality of coal, not to mention other needful supplies. The rates having been fixed and contracts for most services having been given on a peace-time basis, and with no upward revision possible except at the approval of the Public Commission—representing a public already exasperated with uncontrollable advances of almost everything needful to life—and with a money market tight, the central stations found themselves in anything but an enviable position. Nevertheless, the war had to be won no matter to what extent the sacrifice, and the central stations were an important element in the industrial performance of this task. All non-essentials had to be cut out or deferred; even many things that previously had been looked upon as essential had to be set aside for the time. Periodic testing of meters was one thing that could thus be deferred and the labor and expense thereby relieved could be used to fill in the dangerously yawning gap in departments with more imperative needs.

All periodic testing, however, could not be deferred without more or less irreparable losses in revenue. In the case of the residence class meter, however we have not only the largest percentage of the total number of meters, involving a large share of the cost of maintenance, but therefrom is derived the smaller percentage of the total revenue. Consequently, in practically every large central station the periodic testing of residence or smaller capacity induction meters has been partially or entirely discontinued for the period of the war, with exception of such necessary tests as are required by complaint investigations or on account of verification of questionable registrations at the request of the billing or accounting departments.

Now that the armistice has been signed and war activities are rapidly declining, we are fast approaching or have already arrived at the time when we must again pick up the work which was temporarily deferred. However, we have in the meantime come to look upon many things in a new light and from a broader experience, so that we are asking ourselves and one another: What changes should be inaugurated and what improvements are possible? We do not wish to return to the pre-war methods and conditions except insofar as such shall be found to be the best and most satisfactory.

Since we are finding meters with extended periods between periodic tests still registering their loads within their required limits, such questions as these naturally confront us: How much longer could these service periods between periodic tests be extended without the occurrence of serious errors? What should we try to establish as the most suitable period between tests?

If such a period can be safely extended one or two years, say, from three years to four, or even five years, it would decrease the costs of such tests from 35 to 40%. Assuming for the moment that this saving thus made should be but half this amount, it represents an economy well worth the consideration of every central-station company.

One large central station to our knowledge has at the present time over double the number of meters in service to that of five years ago. In contrast with this, the total number of meters tested this past year was less than 40% of the number tested five years ago. Even if, with the return of peace conditions, this company were to receive back all the testers it has lost—which cannot be expected—it would fall far short of what would be required to maintain its pre war schedule of tests. It takes time to secure and properly train men to the point where they are capable of handling satisfactorily the tests on customer's premises. What should we recommend to this company and others similarly situated when they come to us for advice?

Should we recommend extending the intervals between tests of the smaller capacity induction meters to—shall we say five years or what?

Should we include in this recommendation all modern makes and types of induction meters or ought we to qualify this in certain cases?

Should we recommend that an inspection with an approximate load test be made after, say, 60 to 75% of this period has elapsed?

Should we recommend a careful consideration of all meters in this classification which show a questionable deviation from the normal monthly registration to be followed up with a test if a satisfactory explanation is not readily obtained therefor?

Should we advise the changing of meters within this class for laboratory or shop tests where the operating company shall find itself incapable of making service tests after an elapse of, shall we say ...... years? Is this latter method going to prove acceptable to the company or customer as representing the service accuracy of such a meter?

Should we strive to maintain the small capacity induction meters within the same limit of accuracy as those involving larger revenues? If not, what should be the limit? Note: The cost per test differs but little between the meter with a monthly average revenue of but $2 to $3 from that which runs into hundreds of dollars a month. A 5% error in the first case represents a loss in revenue very much less than 1% in the latter.

Do some makes and types of meters have causes of error different from those of other makes and types? If so, would it not be advisable to establish the interval of service between period tests, taking also into account the type and capacity of the meters involved, rather than to base the same on the meter capacity only, irrespective of type Should the average cost of test and the approximate average yearly revenue have any influence in the establishment of the service period between periodic tests? If so, how should the same be applied?

With such questions as these in mind, the writer desiring to ascertain what might be the status of some of the larger central stations in respect to some of these matters, prepared a simple questionnaire which he sent to 12 meter superintendents in various parts of the country. Nine replies were received which, together with the writer's, makes ten. Following is an attempt to summarize their questions and answers:

(1) Regarding the normal pre-war intervals between periodic tests in the case of the smaller capacity induction meters: Two reported that they had been following a 24-month schedule. One reported that they had been following a 30-month schedule. Six reported they followed a 36-month schedule.

(2) The question was asked as to why these particular schedules were adopted rather than some other. The answers were quite varied in nature. Two attempted no answers at all; one, who reported a 24-month schedule for small a. c. meters, replied that when the schedule was adopted there were several new types of meters being placed in service, and they were somewhat apprehensive of their performance over a long period of time, so they felt that a test at least every two years was warranted from the point of being assured that they were properly maintaining the meter accuracy. Another states that their schedule (a 36-month) was adopted because a great many other companies had adopted this same time interval for small capacity residence type a. c. meters. Two laid the burden upon the State Commission, claiming that the schedule for residential meters was adopted by their Public Utility Commission, "probably after comparison with other commission rules and investigation regarding the performance of meters." Still others reported that in the case of a. c. meters the schedule was not originally established on any definite basis so far as the accuracy of the meter is concerned but it was started on the theory that all meters should be tested once a year, but this was soon found to be unnecessarily often, due to the large number of O. K. tests; so that this schedule was accordingly lengthened as far as it was thought to be safe considering the accuracy obtained and revenue derived from these meters.

(3) Answers to the question whether it had been possible to maintain these schedules uninterruptedly up to the first of this year shows that in the case of each of the ten reported, none had been able to maintain such schedules, while at least four stated that they had practically abandoned for the time being all periodic testing of residence meters, one adding that "the Billing Department kept a pretty strict watch over the monthly bills for the small customers, and when the bills showed any abnormal fluctuation from either the previous month or the corresponding month of the previous year, they made a special investigation, and in case they were unable to discover anything which satisfactorily accounted for some fluctuation, they tested the meter."

(4) As to the intention to return to the pre-war schedules of testing residence meters, four replied to the effect that such was their intention. One replied that they contemplated trying to have their schedule for small capacity induction meters changed from 30 and 36 months, giving as their reason that they thought these meters would give good results on the longer schedule. Three replied that they did not contemplate returning to their pre-war schedule. It is the opinion of the writer that these latter were not so required by their State Commissions while the others were.

(5) With a view of ascertaining if there might be any approximate relation between the error occurring in a meter and the million of turns of the moving element, the question was asked: "Have you any data showing the relation between shaft turn of the moving element and the relative accuracy of the meter registration?" Seven answered that they had no data on this subject. One sent curves made up which showed that when but a few meters were considered, the relation seemed to be rather erratic.

I would like to quote from the reply of one who has evidently given this matter considerable thought and study, in which he writes: "It is rather difficult to obtain any definite relation between shaft turns of the moving element and the relative accuracy of registration. With sapphire jewels, the jewel has a very considerable influence on the accuracy of the meter but the curve of deterioration is not a straight line. We found that our accuracy was very much improved by arbitrarily removing sapphire jewels at each periodic test and having them repolished, and our schedule was made, as before mentioned, largely upon the expected life of the jewel." (The reference thus referred to is: "The d. c. schedule was based originally on the basis of revolution of the disc, as at that time we were using sapphire jewels which had a considerable influence on the sustained accuracy of the meter. We are now using diamond jewels but are still retaining the 12 months' limit of these meters and unless the use is very light, I do not believe it wise to lengthen it.")

Continuing, he adds: "It made considerable difference in the wear of the jewel, whether the meter was running at high speed or at a comparatively low rate With diamond jewels the deterioration is practically all in the shaft end, and compared with the other sources of trouble, is practically negligible. From the data I have compiled on the C. S. type of meter, the deterioration in accuracy seems to be a function of the time the meter is in service, or rather the time between periodic tests rather than a function of revolution; but the rate of change is not sufficiently uniform in the meters so far tabulated to allow us to base our test accurately even on this factor. With the a. c. meter, from the little data we have compiled to date, there does not appear to be any relation whatever in actual practice between the sustained accuracy and the length of time between periodic tests. In other words, the average accuracy of a block of meters allowed to run 48 months appears to be practically the same as that of a similar block of meters allowed to run 12 to 24 months. We are compiling data of this, but as yet have not enough available to make showing conclusive."

The writer has been compiling data covering several hundred meters grouped according to make and type. His data bears out the conclusion expressed in the above to the effect that it thus far affords little upon which to help establish an efficient interval between periodic tests. Probably the most striking conclusion to be reached from this compilation is that no period was reached which showed a decided tendency for deterioration of accuracy. Possibly when the tests cover longer intervals between tests, this characteristic may appear.

(6) The last question in the questionnaire, previously referred to, aimed to bring out, if possible, some relation between the average cost of testing and the average revenue derived from any class of meters, it read: "Do you consider it practical to try to establish the test period by taking into consideration the average cost of test and the approximate value of revenue saved through corrected accuracy" In answer to this, the party previously quoted writes: "In spite of what I have said in the foregoing, I think that for d. c. meters approximate curves of increasing errors could be had that would give some indication of the errors to be expected under certain conditions and that it would be possible to apply these curves, taking into consideration the average cost of test and the approximate value of revenue involved through correction of accuracy, to make it worth while. It would be considerably more complicated than our present method of arriving at test periods. For meters that are outside of what would be commonly known as small use meters we have used for years a method which roughly approximates this idea, but in addition meters which show a decided tendency to fall off in accuracy, due to either its location or to the use to which it is put, the period is shortened. One complication with a. c. meters is, of course, the weakening of the magnet which can hardly be allowed for." Another answer reads: "From our data I do not believe it is practical for us to test meters on the basis of shaft revolutions. There is one weakness I see in this method. Most full load errors are due to change in magnet strength due to aging or short circuits. This has no bearing on shaft revolution." This has been brought forcibly to my attention on the test we are now making of meters which we had extended to the four-year plan." Still another writes: "We feel as though satisfactory results can be obtained by arranging a test schedule primarily based on the capacity of meter." Contrasted from this, showing considerable diversity of opinion expressed, another writes: "The average cost per test and the approximate revenue saved to correct its accuracy should be considered in making up a test schedule, but consideration should also be given to maintaining meter accuracy. By this I mean that I consider it good policy to set a time interval whereby we test the meter before the revenue commences to decrease because of slow meter, then to set a time interval whereby we are almost certain to find meter running slow."

The general conclusion gathered from these very interesting replies are as follows:

(1) The pre-war schedule for periodic tests of the smaller capacity induction meters was in most cases 36 months. No longer periods have been indicated.

(2) A few, if any, of the larger central stations were able to maintain this schedule for this class of meters during the war. A number of companies practically abandoned periodic tests on meters of this class during the war time conditions.

(3-4) Those companies operating under State Commissions, which have adopted definite ruling pertaining to the testing of meters of this class, are endeavoring to return as rapidly as possible to their former schedule of tests.

Those companies operating under more liberal ruling are not contemplating, for the present at least, the return of their pre-war schedule for this class of meter. The reason for this change seems to be based on the opinion that tests made after extended periods show no increased tendency to error over those taken after the previously shorter periods.

(5-6) Little or no effort appears to have been made to arrive at a period between periodic tests for meters of smaller capacity from an analytical, systematic or economical basis.

After considering the problem of extended intervals between periodic tests, I would like to present the following suggestions for your consideration:

Since the general accepted period between periodic tests on the residence class a. c. meters is given as 36 months and since it is the expressed opinion of not a few that this period can be safely extended by one or two years, I accordingly would recommend:

(1) That a thorough inspection be made in place of usual 36-month test and that where the inspection raises no question as to the accuracy of any given meter, its test be set at 60 months (24 months after the inspection).

(2) The adoption of the following, where it is not already the established policy, to the effect that all cases of unusual changes in monthly registration be investigated and where there shall be no satisfactory explanation therefor, that a thorough inspection or test be made at once.

(3) That the inspections above referred to (Sec. 2) should cover:

(a) General external conditions, such as condition of wiring, seals, etc.

(b) Approximate stop-watch or whatever standard check of the meter on a standardized 60-watt load.

(c) Where this check shall show the meter accuracy to be within 4%, the meter may be opened, the jewel cleaned and oiled or replaced when rough. The top bearings of such meters as show characteristic friction at this point may be cleaned and oiled, the magnets and disc cleared from any foreign matter.

(d) The meter to be again sealed, daily reading recorded.

(e) Where the 60-watt test shows the meter to be found in error over 4 or 5%, the meter should be again checked on this load after general inspection and cleaning. If it still is shown to be over 4% in error, the meter should be scheduled for test.

(f) Normally the last feature of this inspection should be a 10-watt or starting load taken to insure that the meter has no serious light load error.

CHAIN TRANSMISSION IN NEVADA MILL.

Eight Tube Mills and Several Auxiliary Machines Electrically Driven Through Chains in Ore Mill.

Mining and metallurgical companies in the Pacific coast and inter-mountain states were among the first of industrial concerns to adopt electric drive with silent-chain transmission for the operation of power and milling equipment.

While the problems of transmitting power are practically the same in all the industries, the data and illustration given herein show the special adaptability of that type of transmission to the driving of tube mills, conveyors and centrifugal pumps in ore-reduction plants. They relate especially to the equipment in the plant of Tonopah-Belmont Development Co., Tonopah, Nev., in which gold and silver ores are pulverized to a very fine state preparatory to treatment by the cyanide and flotation processes. This mill contains eight Allis-Chalmers tube mills, each 5 ft. by 18 ft., and driven at a speed of 30 r.p.m.

The tube mills are operated in four different units, each unit of two mills being driven by a 100-hp. motor running at 570 r.p.m., with Morse silent chains for transmitting the power. Two chain drives are required for each tube-mill unit. One of these connects the motor to a countershaft, while the other connects the two countershafts together. Each mill is controlled through a friction clutch coupling, making it possible for the two mills to be operated singly, or both at the same time. The arrangement of a tube-mill unit, with motor and silent-chain connections, is well shown in the illustration at the bottom of the page.

A summarization of the Morse silent-chain installations in this mill is as follows:

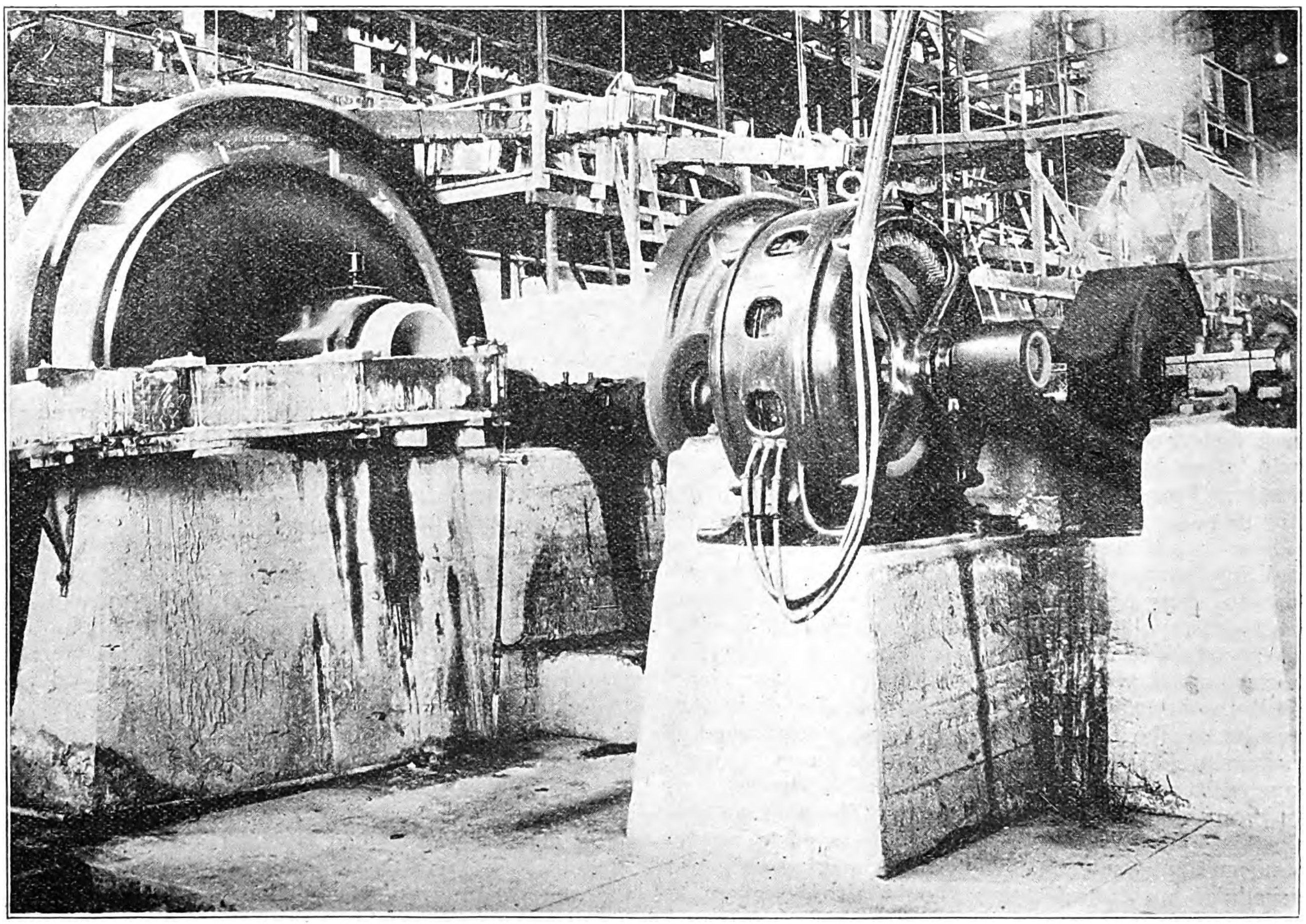
Four 100-hp. drives, 570-162 r.p.m., 48-in. centers, each made up of one 19-tooth driving sprocket, 9.06-in. diameter; one 67-tooth driven sprocket, 32.26-in. diameter, and one chain 13.75 ft. long, 10 in. wide, and 1½-in. pitch. Also four 100-hp. drives, operating at speed of 162-162 r.p.m., 40-in. centers, each having one 53-tooth driving sprocket, 34.13-in. diameter, and a driven sprocket of 53 teeth and same diameter; the chain in each drive being 15.67 ft. long, 6 in. wide, and 2-in. pitch.

There are other motor drives in this mill for which silent-chain transmission is employed. One of these consists of a 15-hp. drive, 860-113 r.p.m., 56-in. centers, with a 4.87-in., 17-tooth driving sprocket; and a 37.14-in., 129-tooth driven sprocket; one chain 15.3 ft. long, 3 in. wide, and 9/10-in. pitch. This is for operating a conveyor.

Another 15-hp. motor drive, with silent-chain belt connecting with a Krogh centrifugal pump, has a speed of 1150-1000 r.p.m., requiring a 6.29-in., 31-tooth driving sprocket, and a 7.09 in., 35-tooth driven sprocket, on which operates a chain 4.8 ft. long, 4 in. wide, and ⅝-in. pitch.

While this type of chain drive is positive, there is sufficient flexibility to relieve the motor and the driven machines from vibration; and the sustained efficiency is understood to reach 98.6% or higher.

The installations described were made in 1912, and this is one of the most complete milling plants in Nevada.



View of Tube-Mill Unit in Mill of Tonopah-Belmont Development Co., Showing 100-Hp. Motor Drive, With Morse Chain Transmission.

Editorial Comment

Parallel Sessions at Contractor-Dealer Conventions

ONE of the most interesting and instructive sessions at the recent annual convention of the National Association of Electrical Contractors and Dealers was that of the Repair and Sale of Used Apparatus Section. Although this was the first time that any attempt had been made to provide for the discussion of this important subject, the interest displayed by those who attended the meeting assures that in the future this subject will be given a prominent place in the convention programs.

The subject is one that is closely allied with electrical contracting and merchandising, inasmuch as it is usually carried on in conjunction with these, yet it differs from them in many respects. For this reason it is surely advisable to hold separate sessions for its discussion. However, there is a question as to the advisability of holding parallel sessions for this purpose for many of the members desire to attend all the sessions as their business comprises all three lines.

While it is true that parallel sessions are held at the conventions of the National Electric Light Association and other organizations and that a considerable saving in time is effected in this way, the conditions are different from those that exist at the contractor-dealers' conventions. At the N. E. L. A. conventions the majority of companies send several representatives each one to cover a certain section. The smaller members of the contractor-dealers' association especially are not in a position to send more than one representative, at present anyway, and this representative is usually the owner. For this reason it is very desirable that the sessions be arranged so that they will not conflict, especially those dealing with merchandising, contracting or repair work. But, in any event the sessions of the latter should continue for they will undoubtedly prove of great value, not only to the members engaged in such work but to the association as a whole.

Test Schedules for Residence Meters

WITH most central-station companies, the residence customer represents the largest number of customers and the ones that bring in individually the smallest revenue. Under these circumstances it is imperative that those costs that are independent of the amount of energy consumed should be kept to a minimum. These charges include the investment in meter and service connections, the cost of maintaining and reading meters, cost of billing, etc.

Routine testing of meters registering the residential consumption is important because, except for the fixed charge often levied to take care of fixed charges upon apparatus, it is the meter reading that determines the revenue from this type of load. The residence load is a comparatively small one, individually, and exists on the average for but relatively short periods each day. Accurate registration is therefore very important. Testing the residence meter, while not costly, perhaps often approaches and sometimes exceeds the revenue derived from a single month, and for this reason it is most advisable to have a maximum lapse of time between routine tests compatible with accuracy of meter operation.

Just what period may be safely allowed between routine tests is a mooted question. Some companies allow 24, some 30 and some 36 months to elapse between tests. The labor situation created by the war necessitated revising meter testing schedules, not from choice but from necessity. Companies are now finding that it may be quite permissible to decrease the frequency of testing from 36 months to some longer period. Sixty months has been proposed. If this can be done quite generally without loss of revenue to the central station or unfairness to the customer, there is a very real gain to the former in that a financial saving accrues as well as other complications.

Elsewhere in these columns will be found an account of what some of the Ohio utilities are doing in the way of making periodic tests of residence meters. Modifications in the test schedules are proposed by which this item of cost can be very materially reduced. This article is worthy of consideration by every central-station company since every such company is dependent upon its metering devices. It is hoped this matter will be taken up alike nationally and that it will be found that much less frequent testing of residence meters is usually permissible.

Electrical Heat Treatment in the Steel Industry

ELECTRICITY in the steel industry. But, then, the steel industry without electricity would be very much like the steel industry without iron. Mention the steel industry and one instinctively thinks of electricity—electricity for driving the rolls and tables, electricity for running the cranes and hoists and supplying the light.

The steel industry is the largest single industrial consumer of electrical energy. Yet as a consumer it may perhaps be said to be only beginning. Most of the electrical energy consumed by the steel industry is used by motor applications of divers sorts. The electric furnace is making headway and each year sees more and more electric furnaces finding their way into the steel industry, mill and foundry.

But there is another use for electricity that has as yet attracted but little attention except perhaps from those most closely interested. Just as intense heat made electrically is now being used on an ever-increasing scale for melting steel and refining purposes, so too there are those that expect heat made electrically to be employed upon a large scale in the not far-distant future for heating at the lower temperatures, for the soaking pits, for the reheating and annealing furnaces. Electricity so used would represent a very high load-factor and a very considerable consumption of energy.

Mr. Thaddeus F. Baily tells in other columns of this issue what electricity has done in heat treatment in the steel industry during the last year or two. He tells enough to show the vast possibilities of this form of load. He foretells, based upon his experience, the types of furnaces that may be expected to find the widest usage and what they will represent in the way of energy consumption and cost of operation.

It is undoubtedly only a matter of time before soaking pits, reheating and annealing furnaces or ovens come into wide usage because of the better product they make possible and the greater convenience and assurance of uniform product. Meanwhile there is a development stage to be passed through. The possibilities of electricity for these purposes must be made known and those having the greatest faith and the greatest interest at stake must be expected to spread the word. Every engineer connected in any way with the production of steel and electricity should give the above-mentioned article the study it deserves. Electricity for heating at the lower temperatures will not come into the steel industry in a day. Perhaps the day is not yet when it is best that it should come. Meanwhile the more known about this phase of electricity supply the better.

Solving a Threatened Street-Car Strike

WHAT had every indication of becoming a very serious interruption of local transportation in Chicago has been brought into a very satisfactory process of settlement by a simple act of Gov. Frank O. Lowden of Illinois. The organized car and train crews of the surface and elevated electric railways of Chicago presented demands for wage increases averaging some 77%, for reduction of working hours to 8 and for other bettered working conditions. The companies replied that even now they were hard pressed to make ends meet because of high operating costs and it would be utterly impossible to grant the new demands without going into bankruptcy, unless fares were materially raised. At first the city authorities opposed any higher fares. The only body authorized to order increased fares is the Illinois Public Utilities Commission and it showed no desire to take up this matter unless the usual procedure were followed wherein the companies would first have to show that their actual expenses were clearly beyond their income. There was, therefore, every prospect of a continued deadlock coming to a climax by the probable strike of the 14,000 employes involved and very grave interference with all business and social activities through paralysis of the most vital means of urban transportation.

Happily, at this point Governor Lowden stepped in and ordered the Public Utilities Commission to make a comprehensive investigation of the entire situation and act in accordance with its findings. This investigation is now well under way and gives every promise of being impartial, thorough and conclusive. There is a general consensus of opinion that a reasonable increase in wages is due to the men, even if it involves a moderate raise in fares, which is conceded to be an inevitable concomitant. Consequently we look forward to an early and definite settlement of the question that is fair alike to all three parties—the employes, the companies and the public.

On numerous occasions for some five years we have pointed out in these columns that the public service commissions are the bodies most fittingly adapted to consider wage or other labor disputes of the utilities that involve higher operating charges against them. Such questions should and must be considered by the commission that regulates the rates or income. A separate labor board without power to see that its findings can be carried out through abundant income is far from satisfactory, as has been shown by the extremely embarrassing financial position into which so many electric railway companies have been forced due to the wage increases ordered by the War Labor Board last summer. The utility regulating commissions represent not only the utilities and the public but the employes of the utilities as well. Each of these three elements must be fairly considered in utility wage disputes. An outside arbitration board is likely to give inadequate consideration to the public, which in the end must foot the bill.

Even if the public's interests are properly considered, there is likely to be a troublesome time lag before the recommendations of the outside board are acted on by those in authority as to rates, especially in a case like the present.

We hope, therefore, that the present Chicago case will not only be promptly, amicably and equitably settled, but that it will serve as a precedent to utility commissions in other states. This is undoubtedly the most satisfactory method of handling such cases. If legislation is necessary to enable the utility commissions to take up these matters without special request from the state executive, it should be enacted as soon as possible. Meanwhile, Governor Lowden deserves the gratitude of the entire community for having clearly seen a way that is fair to all out of a very threatening difficulty.

Current Events

Important Topics Discussed by Ohio Lighting Men—Plans for Big I. E. S. Convention — Facts on Reconstruction

PUBLIC RELATIONS, SOCIALISM AND TRANSMISSION TOPICS AT CEDAR POINT.

Closing Sessions of Ohio Electric Light Association Deal with Problems of the Hour.

The first two days of the Ohio Electric Light Association's convention at Cedar Point, O., were reported in the July 19 issue of the ELECTRICAL REVIEW. The two last days of the convention, July 17 and 18 were devoted to sessions, addresses and pleasure. On the last day the election of officers for the ensuing year took place. C. H. Howell was elected president, F. H. Golding was elected vice-president, D. L. Gaskill, Greenville, was re-elected secretary-treasurer.

On Thursday two sessions were held. In the morning Freeman T. Eagleson, Columbus, O., presented an address on "The Relation of Utility Companies to Public Service Corporations," in which was discussed the vital problems of today faced by the great public utilities. At this session was presented the report of the Illuminating Committee. This report, presented by F. C. Caldwell, reviewed the work of this committee during the past year. It also made recommendations that the giving of correspondence courses to Association members be continued; that the number of men taking this course be increased and a second series started on the completion of the first; that effort be made to extend the use of the "Technical Letters" course among contractor-dealers, architects and others.

In the afternoon F. G. R. Gordon presented an address on "The Trend of Socialism" before a very large attendance. This was a scathing indictment of the trend of socialism. Mr. Gordon told what socialism has done in Australia, New Zealand and Great Britain. He showed what it was doing in Canada and what it was going to do here unless stopped. He pointed out that municipal control was the thin edge of the wedge, that the attacks upon public utilities and taking them over, was the path of least resistance. It was this path that socialism was following. He brought home to all those present the trend of socialism, its dangers.

At the conclusion of Mr. Gordon's address a water carnival was held on the beach, a number of water sports being indulged in and prizes awarded. A banquet was held in the evening, there being present about 350 persons, after which adjournment was made to the ball room.

The eighth session, held on Friday morning, completed the convention. At this session the reports of the Transmission and Distribution and Finance Committees were presented and officers for the ensuing year elected.

The report of the Transmission and Distribution Committee consisted of a review of the past year's activities, including the papers upon "An Electric Underground Record System" by M. K. Thomen, Massillon Electric Co., "Duct and Manhole Ventilation and Cable Protection" by C. M. Rakestraw, Cleveland Electric Illuminating Co., and "Voltage Regulation of Distributing Feeders as a Means of Improving Central Station Efficiency" by Frank Hershey, General Electric Co., and "Industrial Power Substations" by G. B. Schneeberger, and a statement from the Detroit Edison Co., as to their underground high-voltage distributing system.

A general discussion followed the committee's report on high-tension transmission system design and operation. H. R. Summerhayes, of the General Electric Co., discussed the tendencies in transmission line engineering. He pointed out that much can be done toward development and improvement by closer co-operation between manufacturer and user of apparatus, since the latter is able to find out how equipment behaves in actual practice. Standardization of voltages and high-voltage apparatus was dwelt upon, the benefits being better deliveries, lower cost and interchangeability of bushings and similar details of design. A recent improvement in transformer design by which transformer taps can be changed without having access to the interior of the transformer case was explained, as were also methods of preventing moisture entering the transformer by "breathing." Mr. Summerhayes pointed out the value of the static condenser for power-factor improvement, going on to say that for capacities up to 1000-kv-a. the higher efficiency and absence of attendance, makes the static condenser preferable to the synchronous condenser, on the score of initial cost and efficiency. The influence of power-factor upon voltage regulation, and investment losses was mentioned.

The outdoor substation and outdoor apparatus came in for considerable comment as did also the automatic and semi-automatic substation and power house. According to Mr. Summerhayes, there are about 25 automatic stations in service and some 70 in various stages of completion. For those semi-automatic substations the re-closing circuit breaker was advocated, several methods of obtaining the re-closing feature being described.

W. L. Wallau briefly discussed the possibilities and problems connected with going to the higher potential of 220 kv. He referred to the paper on this subject by Silver before the A. I. E. E. convention, and also to the various reports presented before the recent N. E. L. A. convention. Prof. Caldwell spoke of certain features of re-closing circuit breakers and the control of attendantless substations. R. R. Krammes spoke of oil-break and air-break circuit breakers, drawing remarks from Mr. Summerhayes to the effect that both types of circuit breakers are answering the purpose and that to date it cannot be definitely stated just where the one switch should be replaced by the other. I. L. Kentish-Rankin spoke of the different types of commercial substations, some of which could be made entirely automatic and some where the higher investment would not be justified. For this latter type of substation the re-closing circuit breaker was particularly well adapted, reducing the time of service interruptions. A method was described by which such substations may often be made to have re-closing features without changing the type of relay, but instead merely making some cheap and simple mechanical changes.

COUNCIL OF NATIONAL DEFENSE ISSUES BOOK ON RECONSTRUCTION.

Reconstruction Research Division Prepares 188-Page Volume Giving Data on Readjustments in 46 Foreign Countries.

The following statement has been issued by Grosvenor B. Clarkson, director of the United States Council of National Defense.

Realizing that American business must, with the signing of peace, be furnished with information concerning foreign reconstruction and readjustment activities, the United States Council of National Defense has prepared for distribution the latest data available.

Through its Reconstruction Research Division, the Council is now transmitting this material in the form of a printed volume of 188 pages to all member organizations of the United States Chamber of Commerce and to all public libraries.

The volume is completely indexed and covers as fully as possible in tabloid form information gathered by the Council. An instance of the scope of the work is in the case of Japanese notes covering not only the reconstruction problem in the Mikado's empire, but also data covering an outline of Japan's development of Chinese shipping, her colonization in Brazil, Japanese monopolization of trade in China, the relations of the empire to the Siberian Railway system, and the China-Japanese secret treaties.

The volume contains information concerning readjustment and reconstruction activities in 46 foreign countries and groups of countries, relating mainly to the governmental activities in the organization and administration of readjustment and reconstruction work.

Compiled from such important official periodical publications of the various governments as were available and from private sources where official information could not be obtained, it covers several hundred different subjects of readjustment and reconstruction activity.

Among these may be mentioned the steps taken in the various countries for the restoration of forests and the revival and increase in agricultural and forestry production; the various treatments that have been accorded discharged soldiers and sailors in the way of bonuses, employment and re-education; the facilities given for their settlement in homes and on farms; investigations made in the various countries where destruction had been wrought, concerning economic conditions; the disposition and utilization of war materials; and steps taken for the changing of factories producing war material to a status of peace production. The systems of finance, banking and credit adopted in the various countries are outlined and the steps taken for the relief of food scarcity and the rehabilitation of the invaded areas are pointed out. The need for and methods used in controlling the distribution of raw materials are outlined, and the plans for the restoration of foreign trade relations and of transportation systems are discussed.

The director of the Council, in announcing the completion of this study, stated that because of the practical impossibility of supplying all business interests throughout the country with separate copies of this digest, it has been considered best to furnish the public libraries of the country with two copies each, and in addition to deliver a copy to each of the member organizations of the United States Chamber of Commerce, as well as to all trade journals—this because of restrictions in the edition due to the necessity of conserving the limited funds available to the Council under its present appropriation.

ILLUMINATING ENGINEERING SOCIETY PLANS BIG CONVENTION AT CHICAGO.

General Convention Committee Developing Numerous Features of Special Interest—Program to Emphasize Applications of Good Lighting.

Plans for the next annual convention of the Illuminating Engineering Society were further developed at the second meeting of the General Convention Committee at the office of Homer E. Niesz, chairman, Edison Building, Chicago, on July 21. The meeting was attended by several officers of the Society, including President-elect S. E. Doane, Past-president George H. Stickney and General-secretary Clarence L. Law. A general consensus of opinion prevailed that the convention, which will be held at the Hotel Sherman, Chicago, on the four days, October 20 to 23, should include numerous features out of the ordinary so as to attract not only a large local attendance but members and visitors from all parts of the country.

At the technical sessions, which will be held Monday afternoon, Tuesday morning, Wednesday morning and afternoon, and Thursday morning, there will probably be less papers of academic interest than formerly and considerably more than usual dealing with commercial application of good lighting. Among these is expected a symposium on the experiences met in different states in applying the state factory lighting codes, which will probably lead to a general discussion bringing out many valuable suggestions for the enactment of such codes in other states. Several papers dealing with factory lighting and equipment therefore are expected. Other papers will present important features of lighting practice in other lines. Military searchlights and use of lighting during the war will be described, if the data on this subject are released by the Government before the time the convention is held.

There is likelihood of one or more joint sessions of the Society with the Illinois State Electric Association and the Illinois Electrical Contractors and Dealers' Association, both of which will hold conventions at the same time. Wm. L. Goodwin will probably address one of these joint meetings, which will be for mutual educational benefit in learning each other's attitude on and method of attacking lighting problems.

Careful consideration is being given to entertainment as well as the business features. Aside from the customary president's reception and subscription banquet, there is planned a special theatre party featuring a dramatization of light and illumination. A special visit to the Chicago Electrical Show is also included, since this will have a large number of very interesting lighting exhibits including a special decorative scheme of illumination for the Coliseum, where the show will be held.

SUMMER COURSE IN FACTORY ORGANIZATION AND SCIENTIFIC MANAGEMENT

Fourth Annual Summer Session at Pennsylvania State College for Two Weeks, August 11 to August 23.

A special course in the above branches will be offered at The Pennsylvania State College on Aug. 11 to 23. No examinations are required for entering the course, but practical industrial experience is desirable. This course is offered particularly for men engaged in industrial activities, as foremen, time keepers, cost accountants, store clerks, members of production or planning departments, superintendents and employment managers. The summer course has been arranged to cover a two weeks' period in order to afford an opportunity to men whose vacation period is restricted to two weeks, to combine a summer outing and recreation with acquisition of practical knowledge in their own field of employment. The instructors are practical men who have had mechanical training, as well as experience in management.

Each morning will be devoted to lectures and discussions on organization, cost accounting and employment management, while the afternoons will be devoted to practical work in the college shops which have been arranged and equipped with a special view to demonstrating and teaching scientific management. The afternoon work will include the making of time and motion studies, the preparation of instruction cards, tool lists, bills of material, route sheets, and scheduling order of work.

The lectures and discussions will be conducted by Maj. Hugo Diemer, professor of industrial engineering at The Pennsylvania State College, whose practical experience includes that of superintendent of the National Motor Vehicle Co., Indianapolis; organization manager for the Goodman Manufacturing Co., Chicago, Ill.; and consulting industrial engineer for many manufacturing corporations, including the Cincinnati Milling Machine Co., Fairbanks-Morse Manufacturing Co., International Harvester Co., and as major of ordnance in charge of important munitions works at the United States Cartridge Co., Lowell, Mass., and the Bethlehem Steel Co.

The afternoon practicum work will be in charge of Lieut. J. O. Keller, who has done time study work at the Aluminum Castings Co., and shop layout work with the Austin Co.

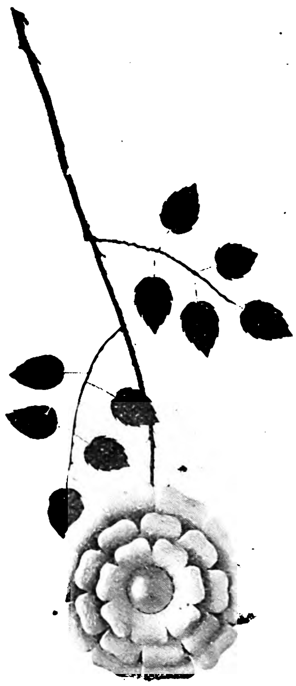
Summer work in the mountain environment of The Pennsylvania State College becomes a pleasure instead of drudgery, providing a summer outing pleasurable, profitable, and economical.

ELECTRICAL DECORATIONS AT PORTLAND ROSE FESTIVAL.

Attractive Illumination of Downtown Streets from Huge Roses with 1000-Watt Lamp Centers.

Electrical decorations were profuse and many of them artistic on the streets and in show windows of Portland, Oregon, during the annual Rose Festival on June 11 to 13. An unique feature of the decorative lighting was the installation on the streets in the business center of 250 Mazda C lamps of 1000 watts each, designed as imitation roses in three colors—deep red, pink and yellow. An illustration of the design, given herewith, shows the frosted lamp bulb as the center of the rose, surrounded by corolla of metal petals, making an imitation rose 30 in. in diameter. The diffusion of the light and the petal coloring were such as to produce to a very good degree the natural tints of the rose. Three such lights were grouped at street intersections and six others were placed between such intersections. Each lamp was hung 30 ft. above the street from the feed wire in such a position as to reflect the blended rays of colored light downward, and to proclaim the glory of the Portland rose to the admiring multitude. The result was a flood of light at night that gave the requisite color effect, and attractive decorations by day.

The 8-foot stem of the imitation rose was the limb of a tree, and the imitation leaves were of tin, so painted as to give the national coloring. The design was that of F. H. Murphy, illuminating engineer of the Portland Railway, Light & Power Co., which furnished the lighting current, and the lamps were installed by the Jagger-Sroufe Co., which carried out the plan of electrical decoration for the Rose Festival Association. The scheme of this kind of decorative lighting was initiated by J. H. Sroufe of that company.



One of the Electrically Illuminated Roses Forming a Feature of Portland's Rose Festival.

LEGISLATURE'S POWER OVER UTILITY RATES REVERTS TO COMMISSION.

The Court of Appeals of New York State has handed down a unanimous decision to the effect that, in cases in which the Legislature had authority to regulate rates, it delegated that authority to the Public Service Commission when it passed the law creating the Commission. The decision was rendered in the case of the International Railway Co., of Buffalo, N. Y., which sought to compel the Public Service Commission to give it a hearing in an endeavor to show that the present five-cent fare is inadequate. The Commission refused the hearing on the ground of lack of jurisdiction. The decision establishes the right of the International Railway Co. to a hearing before the Commission and it is expected such a hearing will be held in the near future.

Commercial Practice

Commission Ruling—Obtaining the Rural Load—N.E.L.A. Christmas Folder—Minneapolis Business—Electric Oven

COMMISSION CITES AUTHORITY TO COMMAND MUNICIPAL UTILITIES.

New Jersey Commission Orders Borough Authorities to Improve Their Electric Plant.

The Board of Public Utility Commissioners of New Jersey has handed down an order directing the borough officials of Madison to make improvements and betterments in the municipal electric plant and system in order to provide safe and adequate service. An inspection was made of the plant to see if operation complied with the standards for service as adopted by the Board, and this led to a contention on the part of the municipal authorities denying the jurisdiction of the Commission over the property. On this point, in its decision, the Board says:

"The observance of the recommendations is resisted by the municipality on the ground that this Board has no power over its electric plant because it confines its service to the municipal limits and does not serve consumers outside thereof. They fear the encroachment of powers reposed exclusively in them.

"The section of the law conferring the authority, however, makes it the duty of the Board to see that its standards of service are maintained alike by public utilities and municipalities engaged in operating public utilities, so that the public served may be insured of safe, adequate and proper service.

"With its experience in matters of standards of equipment and service to be maintained to thus insure safe service, and because of the expertness of its engineers in such matters, both privately and publicly owned utilities rather welcome than resent the inspection of plants, so as to receive the suggestions and recommendations of the Board and its engineers to improve their service.

"We assume the municipal authorities are disposed to furnish the inhabitants of the borough the best service reasonably possible. To do this it is necessary that the things required to be done and recommended in the inspector's report should be complied with."

HOW WE GET THE RURAL LOAD.

Interesting Instance of Power Purchased and Re-sold.

By H. C. Stair,

President, Cambridge (Wis.) Light & Power Co

The last two years have been very prosperous ones for the farmers, especially through the Middle West. Money is plentiful and the growing familiarity with power apparatus, through the general use of tractors and gasoline engines, has created a demand for more power. The gasoline engine has, so to speak, whetted the farmers' appetite for more; it has shown him what the possibilities are and at the same time its limitations and the bother it gives him have made him a live prospect for the convenient and reliable power of the electric line.

Our experience in the central-station business has presented many problems whose solution, I believe, will be of interest to others who have a farming country in their territory. We got into the game in August, 1912, through requests of neighbors that we supply them current from the 110-volt direct-current generator which we had set up in our garage and which was driven by a general-utility gasoline engine. Little by little the business grew and we installed a larger generator and engine in connection with the town's water pumping plant. However, the economical area was restricted to a few blocks and the gasoline engines were costly for fuel and maintenance. Eventually, one of our salesman friends, Harry Caird of Julius Andrae & Sons Co., showed us the possibilities in retailing alternating current purchased from a generating company.

The proposition as we finally worked it out was to build a transmission line 14 miles long from the Edgerton substation of the Janesville (Wis.) Light & Power Co. We purchased the line material, including poles, and secured an experienced construction foreman and crew through Mr. Caird. The work was done during the summer of 1918 and power was turned on Oct. 27, 1918. Along the line we serve a large number of farmers, each of whom pays for his own transformer and protective apparatus. These are all of Westinghouse make and range from 1 to 5 kv-a. The farm load, in addition to lights in house, buildings and yard generally, includes a water pump automatically controlled delivering into a pressure tank for house use, a feed grinder and a washing machine. In some cases a single 3-hp. motor drives a line shaft to which are belted a pump washing machine, churn and separator. Farmers are good customers for appliances and practically every home has an electric iron, tableware and vacuum cleaner.

Our transmission line is 6600 volts, three-phase, and wherever a large block is to be tapped off, we have installed two transformers in open-delta. In the little village of Albion we have two 20-kv-a., 6600 to 220/110 volts, which supply a 15-hp. motor in a creamery and a 30-hp. motor in a grist mill. This mill contains a corn sheller, corn crusher and attrition feed mill, formerly driven by a gasoline engine. We placed an additional pulley on the main shaft and set the motor alongside the engine, thus making the change without rearranging the drive. (In another mill, the owner installed a Sprout-Waldron mill which is driven by two 15-hp. motors mounted on a common bed-plate.) In Albion we serve about 25 domestic consumers, running a wire from the mid-point of one transformer secondary to give 110 volts.

In Cambridge, a town of about 1000 population, we have two 25-kv-a. transformers serving about 130 lighting consumers, as well as a grist mill, a creamery, a garage and the pumping plant. In the creamery we have a $7\frac{1}{2}$-hp. motor driving a separator, churn, deep-well pump and cream pump. It displaces a steam engine and the owner says that even though he must keep his boiler in service for sterilizing and water-heating, he finds the motor a paying investment in convenience. In the garage is a 5-hp. motor driving various machines, and in the pumping plant is a 10-hp. motor supplying water to the town.

So far we have shut down two low-voltage gasoline-electric sets and in the near future expect to shut down five more. We consider these plants as "trail breakers" for central-station service; they are not powerful enough for the heavier farm service and when central-station power is available, the private plant is out of the running.

Our policy has been to consider the entire project as a money-making proposition. However, as we have secured most of our funds from our consumers, they share in our profits. Farmers are required to pay all costs of connecting to our main line, and we have three short branch lines for which the men served dug the pole holes and paid for all the material.

We do not maintain a "trouble man" but when necessary secure linemen from Janesville. My supervision, bookkeeping, etc., takes about one-fifth of my time. The electric company does not sell appliances or do wiring, but I devote part of my time to the Cambridge Electric Co., which renders these services.

We buy about 8500 kw-hr. per month at the regular wholesale rates and sell it on a four-step graduated scale for domestic use.

POSSIBILITIES FOR ADDITIONAL OUTLET BUSINESS SHOWN.

That certain, definite concerted steps must be taken to provide the necessary outlets for the full utilization of electrical energy is the view of F. H. Scheel, of the Public Service Co. of Northern Illinois, who points out that in analyzing ways and means of promoting this purpose, we find the field naturally divides itself into three separate and distinct units:

"(1) The new home proposed or under process of construction.

"(2) The house already wired, but not equipped with appliance outlets.

"(3) The old residence not yet wired.

"Taking them as they are listed, the first calls for some missionary educational work by the central station among those who have to do with new buildings, such as the architect, general contractor and electrical contractor; also more attention to the wiring specifications of new buildings on the part of the central station commercial department.

"The instalaltion of added outlets in premises of existing customers can be materially increased.

"(a) By combining the offer of outlet and the appliance, particularly in the case of vacuum cleaners, washers, ironing machines and portable lamps.

"(b) By carrying this class of wiring on deferred payments the same as on wiring jobs.

"(c) The use of duplex receptacle, thus permitting two attachments at the cost of one outlet.

"(d) By promoting the sale of electrically wired tea tables.

"(e) By paying salesmen commission on this business as well as on new contracts.

"In the old residence not yet wired, the matter is entirely in the hands of the central station and the electrical contractors. The numerous advantages and comforts of electrical appliances have been a big talking point in getting the prospect to wire. There is, therefore, no logical reason for insufficient appliance outlets. Central stations should—

"(1) Line up the contractor on equipping a home for electric service as well as electric lights. It means more wiring for him.

"(2) Govern the amount of salesman's commission partly by the number of appliance outlets.

"(3) Where price prohibits extra outlets, as in bedrooms, use wall brackets with socket in canopy, thus using same outlet.

"(4) If one or two outlets are given as a premium on special housewiring campaign, make it the appliance outlet.

"(5) Keep a comparative record of outlets secured by each salesman.

"In a few words—think it—talk it—practice it—tie up the idea with our general advertising by some catch word slogan. For want of a better one, I suggest 'More Sockets for More Service.'"

CHRISTMAS SALES FOLDER NOW READY FOR PUBLICATION.

Sample copies of "Electrical Gifts," a Christmas advertising folder prepared by the Commercial Section of the National Electric Light Association are now being distributed. This folder, which features electrical goods as Christmas gifts and briefly describes the many advantages which they offer for this purpose, is attractively printed in four colors and should be of great assistance in creating a big demand for electrical gifts. Many of the more common electrical appliances are illustrated and described with alluring captions. Space is provided on the back of the folder for imprinting the name and address of the company that distributes them.

A very large edition of this business-getting folder will be printed shortly, so that shipments can be made well in advance of the Christmas season. In this connection companies desiring copies are especially urged to order them now, for the imprinting, if done when the folder is on the press, enables the association to quote lower prices. These prices range from \$4 per 100 in small lots to \$16.50 per 1,000 in quantities of 50,000 and over.

Orders received after edition is printed, necessitating additional labor and expense, will be filled, if possible, but at increased prices. The advisability of estimating the requirements and ordering now is therefore evident.

Requests should be made to the Publications Committee, Commercial Section, 29 West 39th street, New York City.

ELECTRIC OVENS COUNTERACT SERVANT SHORTAGE.

At the manufacturers' exhibit of the Ohio Electric Light Convention, Cedar Point, O., July 15 to 18 inclusive, Miss Sigourney J. Frush, demonstrator for the Westinghouse Electric & Mfg. Co., baked pies and cakes and candy with a Westinghouse oven.

Miss Frush backed her statements with deeds, keeping an interested gathering around her as she explained the automatic features of the electric range, how it became a "fireless cooker" and how simple it was. Miss Frush said the servant problem would be less serious and less often discussed, if people only realized the cleanliness and convenience of the electric range.

Operating Practice

Testing and Setting of Relays—Complex System Trouble Due to Generator Breakdown—Protecting Rubber Gloves

PRECAUTIONS TO BE FOLLOWED IN TESTING AND SETTING RELAYS.

Application of Test Current and Method of Timing Important Factors in Testing.

Costly and ideal systems of relay protection are of little value unless the relays installed are properly tested and checked with sufficient frequency and accuracy to assure that they are in proper working conditions. In this connection pertinent advice was given in the paper on "Transmission-Line Relay Protection," presented before the A. I. E. E. convention recently. A large part of this paper was abstracted in the issue of July 5.

In order to secure the best results from the relays, it is desirable to make a complete check on the current and time settings of each relay on the first installation and at least once every six months thereafter. Although the time for making these tests is determined to a large extent by the operating conditions, best results will be obtained if a general plan is worked out for performing these tests at regular intervals.

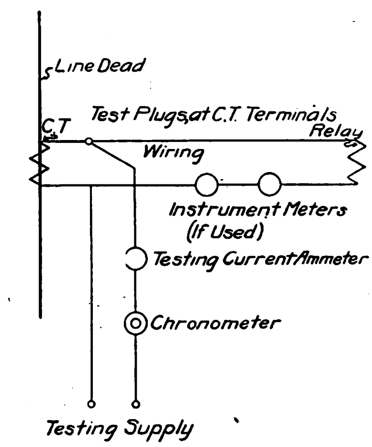


Fig. 1.—Diagram of Connections for Supplying Testing Current to Secondary Terminals of Current Transformer.

If selective operation is to be obtained from the relays the greatest care and precautions must be taken in making these tests. The tests should be performed under conditions as nearly equal to the operating conditions as possible which makes it desirable to include the wiring and complete relay equipment in this test.

In this test, the test current should be applied, wherever practicable, to the primary of the current transformer. Where it is impracticable to do this the testing current may be supplied to the secondary terminals of the current transformer with the current transformer left in circuit as a shunt, as shown in accompanying wiring diagram. The results obtained under these conditions very closely approximate those under short circuit and serve to check the relay wiring and current transformer, as well as the relay. This will detect any short circuit in the current transformer or wiring and any open circuit in the wiring but open circuits in the transformer coils should be determined by a separate continuity test.

The degree of accuracy obtained when the relay is tested alone is dependent upon the type of transformer used and the secondary load. The error in this method is due to the high magnetizing current of transformers (especially with the low-ratio single-turn type on heavy secondary loading) on the heavy short-circuit conditions. As an example, a 40-volt-ampere secondary load on a current transformer at full load imposes a 16-kv-a. load under short-circuit conditions of 20 times full load. This, in many cases, is above the saturating point of the transformer and the ratio breaks down badly.

The time-current curve of a relay is affected by the nature of the secondary load or by the characteristics of the current transformer. It is, therefore, desirable that each individual relay be tested with current such as would be occasioned by short circuit. At least three points along the curve should be taken, one of which should be approximately 150% of the minimum value, one at as near maximum short-circuit current as the testing equipment will permit, and one intermediate point. The time should be taken by a chronometer or cycle counter which will eliminate the personal equation of the operator. The method of timing by a stop watch is entirely inadequate for close relay settings.

An additional inspection should be made about every month for continuity of trip circuits (where this is not indicated by lamps) and for dirt or mechanical defects. Moreover, where conditions will permit, the relay should be operated to trip the circuit-breaker. In case of bellows relays the bellows should be oiled with neatsfoot oil to prevent hardening.

ACCIDENT TO TURBOGENERATOR CAUSES MANY TROUBLES.

Hunting of Systems and Exciter Troubles Follow Breakdown of Field and Armature.

On a big central-station system there were six 10,000-kw. turbogenerators on one sectionalized bus operating in parallel with three 10,000-kw. and one 25,000-kw. turbogenerator on another section of bus, these two bus sections carrying about 45 and 55% of their rating, respectively. At another station, tied into the above station over tie-lines, were four more turbogenerators carrying about 60% of their rated load. At a third station three large units, of 20,000 kw. and above, were operating at about 70% rating. This station was tied in with the other two stations over tie-lines.

One of the field end-plates of one of the 10,000-kw. vertical type generators became detached and fell in between the field and armature. This resulted in the coils of both field and armature being cut, causing a short-circuit on the 9000-volt windings and the exciter side of the machine. The defective machine was cleared from the system almost immediately.

Directly following the burn-out of the unit and the disturbance created, several of the turbogenerators in the same station tripped out due to overspeed; a number of synchronous converters in various substations on the system shut down. One rotary burnt up. The system began to hunt and persisted for about 18 minutes after the turbogenerator broke down, the frequency varying considerably above and slightly below normal, and the voltage going from 7000 to 8800 volts in heavy swings. The wattmeters on the tie-lines between the three generating stations swung continuously from one end of their scales to the other, indicating heavy interchange of current between stations.

After this had continued for about 18 minutes conditions suddenly quieted down, although for no apparent reason, and the system pressure rose to 9400 volts, about normal.

It was then found that the reactances in the tie-lines between stations have been so hot as to oxidize at the surface of the cables (they were of the bare cable, concrete core type), and the insulating compound on the frame work was blistered. Tie-line ammeters and wattmeters on one end of a tie-line were badly damaged.

It was later discovered that one tie-line solenoid-operated circuit-breaker and one high-voltage feeder circuit-breaker were in the half-open position, the solenoid of this latter being burned open and grounded. It then became known that the negative return from the oil circuit-breaker of one of the 10,000-kw. turbogenerators has grounded and burnt open, and that a dead earth has occurred on the exciter system.

One explanation of the cause of the 18-minute surge or hunting between the three generating stations is that the breakdown of the defective turbogenerator had resulted in a phase displacement between the three systems. As these systems were tied-in together through tie-lines, the reactance prevented sufficient synchronizing current to flow between systems to bring the systems into phase again. And the disturbance continued until the abnormal conditions subsided and the system attained its equilibrium again. Whether it was excess resistance or too much or too little reactance might be a mooted question without investigation, of course.

The trouble to the exciter system was doubtless due to the exciter system being subjected to high potential to ground, it causing breakdown at several places, and possible weakened insulation at others. Contact between armature and field when the field end-plate cut into the coils caused direct contact between the 9000-volt system and the exciter system, of course, and a consequent breakdown in the immediate vicinity.

While only a few of the salient features of the trouble have come to hand, and these are not complete, sufficient is known to bring out the facts that hunting between systems is not yet a matter that can be fully explained nor guarded against under unexpected conditions. Moreover, the above incident shows that exciter systems may be subjected to direct contact as well as to induced high potentials, hence it might be well to give exciter systems the respect given to circuits of higher potential, and perhaps at the same time furnish a means at individual generators to prevent high potentials dissipating themselves promiscuously throughout the exciter system.

PROMOTING USEFULNESS AND SAFETY OF LINEMEN'S RUBBER GLOVES.

Container Hung from Belt Is Advocated.

Rubber gloves are now furnished by most central station and electric power companies to their linemen. Safety first rules dictate that they be used whenever work is being done on voltages above 600 volts. Although wooden poles have an insulating value, the wood is not to be depended upon and rubber gloves are considered as absolutely necessary for the lineman.

As a matter of fact, while most companies and municipalities furnish rubber gloves to their men free, these gloves are not always used. Frequently in cases of electrocution it is brought out that the man killed did not use his gloves or did something else that he ought to have known he should not do.

One reason that rubber gloves, although available, are not used, is because they are not always conveniently at hand. Some linemen tuck their rubber gloves in their trouser pocket while climbing the pole and fixing their belt. Others tuck them between their belt and body. One of the chief reasons linemen tend to not use their rubber gloves is because they usually have no convenient place to keep them unless on their hands, and they should be worn only when actually needed because otherwise they may be punctured by splinters on poles, nails and similar sharp projections. Moreover, rubber gloves enclose the hands and keep out air which results in sweating, which in turn rots the rubber and causes personal discomfort.

A policy that has much to recommend it is that of furnishing weatherproof canvas bags of such a size that the rubber gloves may be slipped into them without folding or crumpling up, either of which tends to cause cracks in the rubber. These bags should have a loop or two loops so located that the bag may be hung from the lineman's belt. The top should have a flap that comes down well over the opening of the bag so that rains will not enter the bag and the lineman can easily close the bag by merely pressing the flap against the side.

If companies would furnish their linemen with these bags when they allot the gloves there would be less tendency on the part of the men to work without their gloves on their hands, since the gloves would always be available at a convenient place, like all the other tools in the lineman's belt. The gloves would be less likely to be damaged due to mechanical injury, one glove of a pair would be less likely to be lost. The gloves would have a longer useful life and the element of danger would be less.

AIR-COOLED BRICKWORK REDUCES CLINKER TROUBLES.

By designing the furnace setting for circulation of air from beneath the fuel bed through the brickwork into the furnace, there is less need to chisel frozen clinker from the walls; coke is burned off the clinker, thereby reducing loss of carbon; heat units lost by radiation through the side walls are largely recovered again; and considerably less labor, time and expense are required to keep furnaces in good condition. Furnaces are able to maintain rates of combusion and remain in service longer without shutdown and the life of the brickwork of furnace walls is greatly increased.

Contracting-Construction

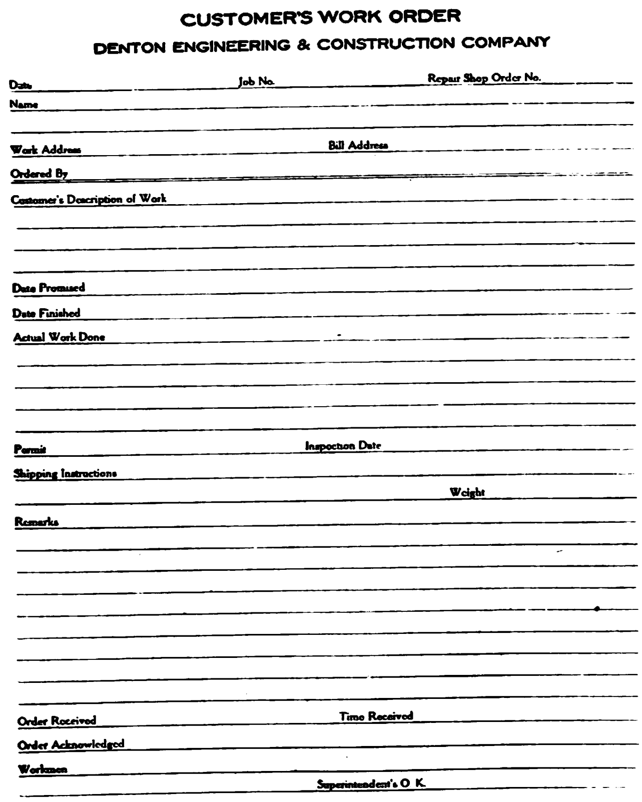
Some of the Methods Employed in the Conduct of a Successful Electrical Machinery Repair Business Explained

WHAT CONSTITUTES EFFICIENCY IN REPAIR BUSINESS.

Paper Presented at Recent Convention of National Association of Electrical Contractors and Dealers.

By A. Penn Denton,
Denton Engineering & Construction Co., Kansas City, Mo.

In the development of the contractor-dealer's business during the period of reorganization and readjustment since October, 1917, when Wm. L. Goodwin pointed the way to larger fields of endeavor and greater possibilities for them, there has come to many contractors a realization of the opportunities to be had in the sale of used and rebuilt electrical machinery and in the repairs of such equipment. It is not the intention to discuss the business of selling used machinery which has been found profitable, but to give briefly the result of the experience of the author's company in repairing and rebuilding electrical equipment and to point out how important efficiency is in this line of work.

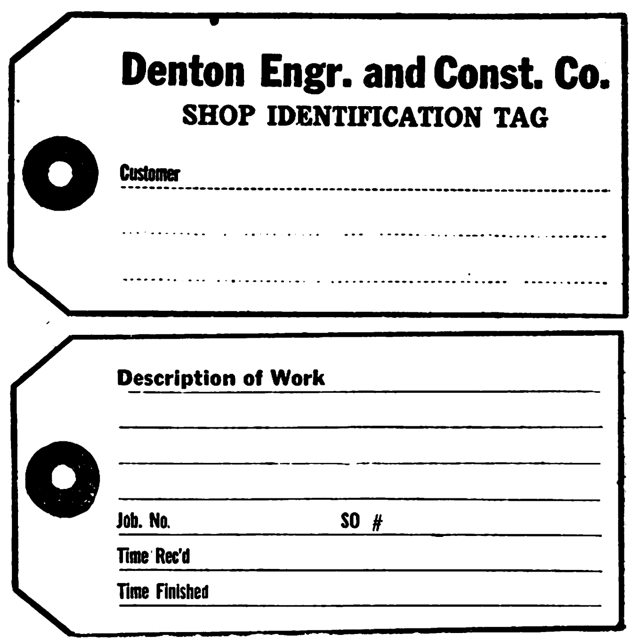

CUSTOMER'S WORK ORDER
DENTON ENGINEERING & CONSTRUCTION COMPANY

Date — Job No. — Repair Shop Order No.
Name
Work Address — Bill Address
Ordered By
Customer's Description of Work
Date Promised
Date Finished
Actual Work Done
Permit — Inspection Date
Shipping Instructions
Weight
Remarks
Order Received — Time Received
Order Acknowledged
Workmen
Superintendent's O K.

Customer's Work Order Form Used by Denton Engineering & Construction Co.

The repair shop of the contractor a very short time ago was not much more than a corner of the stockroom. In some cases he had a small room set aside for this work but the one or two men employed at that time did not appear to him of sufficient importance to provide these men with either the proper place or equipment so that they could make a showing that was at all comparable with the wiring and construction department. This company passed through this stage of development and then began to realize that by giving its machinery repair department just a small part of the attention the construction department was receiving, in a short time it began to show real results and looked like a paying proposition. It then turned its attention to the department with the idea that it should become as important a factor on the total business as the construction department. The plan followed started with a careful study of the best way to get the machinery repair business and the proper way to handle it after it was secured.

It was found that three important factors were essential in going after repair business. It was necessary to: First, advertise in the local newspaper and the trade papers. The repair business is entirely different from contracting or merchandising in that the average consumer who needs such service has no idea of where he can go to get a good job of repair work done, and in the case of the large industrial plant usually has done its own repair work or sent it to the repair shop of the manufacturer of its particular electrical equipment. It found also that an excellent advertising medium was a series of letters sent to the customers, enclosing advertising blotters. The third and most important fact in the now to get the business plan was found to be a good live salesman who was sent out to sell what was termed as electrical repair service and it was found by carefully following up the advertising that the company was able to get business



Front and Back of Tag Attached to Machines, Which Facilitates Identification.

from companies who formerly had said they were not in the least interested. A salesman of this service need not call oftener than once a month on the larger plants and once in 60 days on the small plants. By persistently following this plan any dealer can get a share of the repair business in his community.

When the business is secured, the next part of the scheme is to be able to handle it properly and efficiently. It is even necessary in some cases to give better service, certainly a prompter service than the manufacturers' repair shop, if the business of the plant or customer who has felt he was fairly well taken care of before you sold him, is to be held. It is therefore of primary importance to have a good organization. A manager of the repair department is required, someone who can be held entirely responsible for the proper handling of the work, and this party may be at the same time a salesman. The Denton company has found the duties of the manager and salesman combined nicely and worked out much the same as in its construction department where the department manager is responsible for getting all business and supervising the work after it is secured. It is also necessary to have a service man who can assist with the purchasing of the repair department materials. Then, most important in the repair shop organization is the foreman of the shop, who must be a man of practical and technical experience, a good executive in handling men and a person who is willing to co-operate with other employes.

It is also necessary to have a good stockman and a careful accounting and billing department. Promptness and accuracy in sending invoices makes the repair business a pleasure because a large part of the work is labor and all repair business should be handled on a strictly cash basis. In this connection it was found that a most important adjunct to the organization was proper forms for making records of each job handled. Some of the forms developed are illustrated herewith.

The importance of such an organization is in a measure secondary to the proper equipment of the shop. It has been found that the right kind of equipment such as coil winding and taping machines, a baking oven, coil dipping tanks, etc., are an absolute necessity in a shop that expects to be any factor at all in the repair business because without such equipment the work cannot be efficiently handled and if not efficiently handled it is not profitable. It is therefore necessary to invest a considerable sum of money in the proper kind of equipment and for this reason no contractor should undertake to go into the repair business who has not sufficient capital.

No.________

REPAIR SHOP ORDER

DENTON ENGINEERING & CONSTRUCTION CO.

Date Job No.

Name

Address

Work Done At

Description of Work

MACHINE DATA

Manufacturer

Name Plate No.

Type Form

Speed Cycles Phase

H. P. Volts

Current Amps.

Connection Print No.

No. Coils

Turns per Coil

Throw of Coil

Weight per Coil

Size Wire

Adjacent Coil Series

Alternate Coil Series

One Circuit Winding

Two Circuit Winding

Connections ▲ or Y

Quantity	MATERIAL ITEMS

Job Ticket for Keeping Record of Repair Jobs.—Front.

DESCRIPTION OF WORK						
Dismantling and Cleaning	Date	S. M.	Hrs.	Date	S. H.	Hrs.
Making Coils						
Installing Coils						
Bearings						
Commutator						
Miscellaneous						
Finish						
	Total					
	Cost		Bill			

Reverse Side of Job Ticket.

New Appliances

Intermediate Size Dungar Battery Charge Set—Small D. C. Instruments—Auto Lighting System—Entrance Switch

The New "Four-Battery" Tungar Rectifier.

The General Electric Co., Schenectady, N. Y., has just placed on the market a new "Four-Battery" Tungar battery charger, designed to meet the needs of the automobile dealer or garage owner, who desires to do a small amount of battery charging.

As its name indicates, this new size is an intermediate between the big 10-battery Tungar outfit for service stations and the small Tungar for home use.

The "Four-Battery" Tungar will charge from one to four three-cell batteries at a maximum of 5 amperes. The rate can be varied from 3 to 5 amperes. It operates from a standard 115-volt, 60-cycle alternating-current circuit.

The essential parts are a bulb for rectifying the current and a transformer for reducing the voltage, both of which are contained in an attractive sheet-

Tungar "Four-Battery" Charging Rectifier and Controller.

metal case. An ammeter, for reading the charging current, and a dial switch are mounted on the front of the case.

The device is very easily installed. Simply mount it on the wall with four screws and connect the leads to the alternating-current supply. The operation is very simple. Connect the direct-current leads to the batteries. Turn the dial switch to the right until the ammeter reads the desired charging current. To stop charging, turn the switch back.

There are no moving parts in the Tungar set, and it requires no oil or grease. It has been approved by the fire underwriters, and can be safely operated over night without attention. If the alternating-current supply fails, the batteries cannot discharge back through the rectifier. When the current comes on again, the Tungar will commence charging automatically at the same rate as before.

Automobile Lighting With a Single Lamp.

Ira T. Swartz, president of the Swartz Electric Co., Indianapolis, Ind., has developed a new method of automobile lighting, to be known as the "wireless-lite." Although the conventional number of head lamps, side, dash and tail lamps are provided, only one electric incandescent lamp is used in the entire system. This feature gives the new system its name, as all exposed wiring is eliminated. A lamp of high candle-power is employed as the source of illumination. The light from this single lamp is, by a clever arrangement of mirrors and lenses, distributed to the various points. Various adjustments of the light can be made by the driver from a control lever on the dashboard. The system is said to be very efficient and economical.

Pocket-Size, Portable Direct-Current Instruments.

The Roller-Smith Co., 233 Broadway, New York City, announces a new design of its small, pocket type, direct-current "Handy" ammeters, voltmeters and volt-ammeters. This instrument was in the course of development for many months, during which time there was constant experimental work to determine the best design and materials suitable for an instrument of this class. The result is one of which the company is justly proud. The new "Handy" instrument is small, compact and light. It was designed with the idea constantly in mind that accuracy and reliability must be maintained even under the most severe conditions.

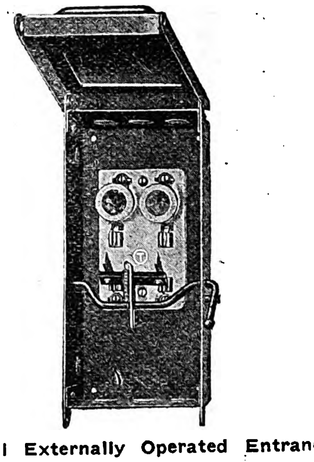
This line is very complete, comprising milliammeters and ammeters up to 50 amperes; millivoltmeters and voltmeters up to 150 volts and volt-ammeters up to 50 amperes and 150 volts, all self-contained. The ranges are increased beyond that by the use of appropriate shunts and multipliers. These instruments are of the permanent-magnet, moving-coil type giving uniformly spaced scale divisions and dead-beat or instantaneous indications. There are two magnets that are well aged and made of high-grade tungsten steel. A very rigid but light-weight moving coil is used. It swings on hardened steel pivots in sapphire jewel bearings. The staff of the moving system is stiff and not likely to bend and cause friction. A rigid aluminum pointer of the knife-blade type is used. The scale is 2¾-in. long and usually divided into 50, 60 or 75 divisions. All instruments are individually calibrated and guaranteed accurate within 1% of full scale value.

A brass case encloses the instrument's mechanism and scale; it receives a black rubberoid finish. The instrument dimensions are 4 in. wide by 5 in. high, by 2 in. deep. On the average instrument the weight is about 20 ounces. Instruments are available in this line with double or even triple ranges of scale markings at slight additional price. In the case of volt-ammeters it is possible to obtain instruments having even three volt and three ampere ranges.

These instruments are well adapted for general commercial testing of various kinds as well as for school and college laboratories where a small and quite accurate, but moderate-priced instrument is desired.

Enclosed Service-Entrance Switch.

Service switches must be installed at a point as close as possible to where the service entrance is made to the building. They must be of reliable type so as to permit quickly cutting off of all



Trumbull Externally Operated Entrance Switch.

current from the building in time of emergency or when extensive repairs are necessary to the interior wiring. They should also be properly safeguarded to protect the occupants of the building from coming into contact with exposed conducting parts. This necessitates a suitably enclosed switch that can be externally operated without opening the enclosure.

These various requirements are incorporated in the externally operated service switches illustrated herewith. They are made by the Trumbull Electric Manufacturing Co., Plainville, Conn., and consist of its regular switch No. 701 in a No. 16 gauge steel box. It is known as No. 5741 and is rated 30 amperes, 125 volts and is made for plug fuses. The switch is of the quick-break type and a marked improvement over the ordinary service switch from the safety standpoint.

Trade Activities

Okonite Holds Annual Outing—Wheeler Condenser & Engineering Elect Officers — Electric Furnace Installation

Electric Furnace Installation in Navy Yard.—An interesting development recently took place at the League Island Navy Yard, Philadelphia, when the first heat of steel was made in the Greaves-Etchells furnace recently installed by the Electric Furnace Construction Co.. Finance building, Philadelphia, in the new foundry. The foundry itself is said to be one of the most modern and up-to-date in the country, and the manufacture of steel in this yard opens up very interesting possibilities for large future development.

Philip H. Ward, Jr., formerly general manager and secretary in charge of sales and exports of the Chelten Electric Co., announces that he has severed his connections with that company and has organized the Ward Electric Co., Inc., Philadelphia, with headquarters in the Philadelphia Stock Exchange building. The new corporation will manufacture for domestic and foreign distribution, an extensive line of electrical supplies and specialties, including knife, push button and surface snap switches, flush receptacles, new code and plug fuses, porcelains, ground clamps. It will be the aim of the new organization to furnish to the trade products of superior merit, promptly, at attractive prices.

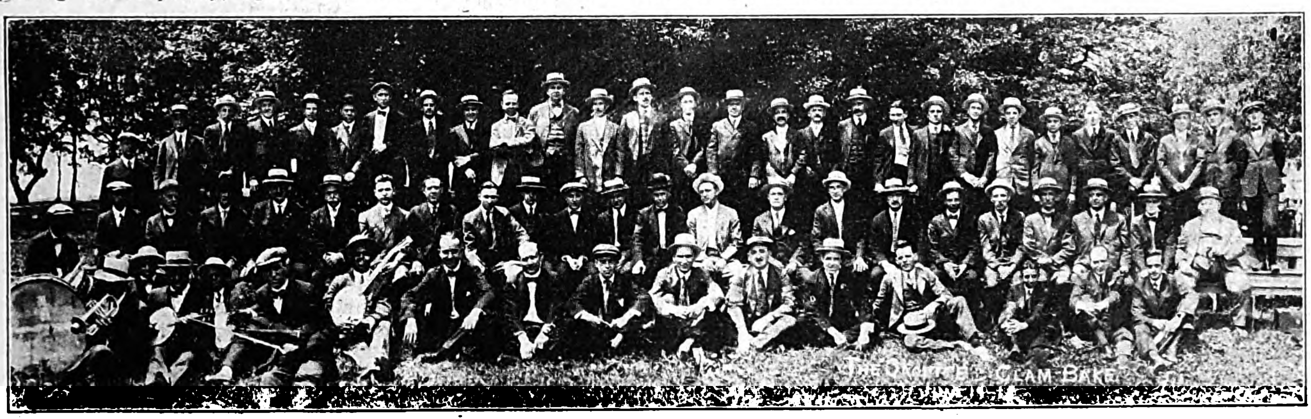
Dayton-Dowd Co., Quincy, Ill., manufacturer of centrifugal pumps, is distributing Bulletin No. 240, illustrative and descriptive of its redesigned line of type CS single-stage, double-suction type centrifugal pumps. These pumps embody the most advanced principles of design and represent among the most modern, high-grade, standardized, highly efficient machines on the market. They are simple in design and rugged in construction, insuring reliability in service and durability. The bulletin contains several curves made from data resulting from shop tests showing the characteristics of several sizes of Dayton-Dowd pumps; also a table giving the capacity, speed and efficiency of the type CS single-stage double-suction pumps.

The Belden Manufacturing Co., 2300 South Western avenue, Chicago, Ill., has recently let contracts for the erection of a new four-story factory building at its new plant location at Kilpatrick avenue and West Congress street, Chicago. This will make the third building erected by the company on this tract of land. The erection of five more buildings is contemplated in the next few years. The new building will be used for expansion of the different magnet wire departments.

The B. & K. Manufacturing Co., New Britain, Conn., manufacturer of pole line hardware and pressed steel construction specialties, announces the appointment of David C. Rosetahl, formerly affiliated with the National X-Ray Reflector Co., as general sales manager of its portable lamp department. The company has adopted a new plan for merchandising its product throughout the country with the idea of expanding its organization in every large city in the United States and Canada and with this end in view has engaged Mr. Rosetahl as its general sales manager. For the past six months the designing department of this organization has been very active in making up illustrations of novelty portable lamps and it is today one of the representative manufacturers of this line of electrical equipment.

The Okonite Co., Passaic, N. J., well known manufacturer of insulated wires and cables, has inaugurated the custom of giving an annual outing to its office and factory staff. This year the gathering took the form of an old-fashioned Rhode Island clam-bake and was held at College Point, Long Island, with an attendance of 65. The group picture presented herewith shows President H. Durant Cheever near the center of the first row of chairs and ex-President Willard L. Candee, one of the founders of the company, seated at the right of the same row. General Sales Manager J. D. Underhill and Treasurer W. H. Hodgins are to be seen standing at the left of the last row.

Wheeler Condenser & Engineering Elects Officers.—At a meeting of the board of directors of the Wheeler Condenser & Engineering Co., Carteret, N. J., on July 8, J. J. Brown, formerly vice-president and general manager, was elected president, succeeding Charles W. Wheeler, recently deceased. H. S. Brown, of 50 Congress street, Boston, was elected vice-president. H. S. Brown has been associated with the Power Specialty Co., 111 Broadway, New York City, for the past 15 years, the greater part of the time as New England manager for that company. During the war he was active with its government work with headquarters at Washington and Philadelphia. He is also president of the Brown-Ferries Co. of Philadelphia. The business of the Wheeler Condenser & Engineering Co. has more than quadrupled during the past ten years under the management of J. J. Brown, and the manufacturing capacity of the plant has been correspondingly increased. One important addition has been the construction of a large tube mill for the manufacture of seamless drawn tubing of brass, copper and special mixture. In this mill the record output of nearly one million pounds of condenser tubing in one month was recently made. This tubing is used not only in Wheeler condensers, evaporators, reboilers etc., but it is also made in large quantities to customer's specifications for American trade and for exporting. At this writing, in the condenser department, 16 condensers of approximately 50,000 sq. ft. cooling surface are being made. Among other products of this well known company are: natural and forced draft cooling towers; centrifugal pumps; vacuum pumps — patented steam jet, turbo dry rotative and Wheeler-Edwards; jet condensers; heaters; exhaust relief valves; vacuum pans, and single and multiple effect evaporators.



Office and Factory Staff of the Okonite Co. at Annual Outing.

Current News

Weekly Record of Construction Activities—Conventions

EASTERN STATES.

Bar Mills, Me.—Bar Mills Power Co. is having plans prepared for extensions and improvements in its hydroelectric power plant, including considerable remodeling work.

Boston, Mass.—Nelson Corp. will build a one-story, 400x500 ft. manufacturing plant, a two-story, 80x400 ft. receiving building, a four-story, 60x120 ft. office building and a two-story, 84x87 ft. power house.

Boston, Mass.—Nova Scotia Tramways & Power Co., Halifax, Nova Scotia, has arranged for a note issue of $1,000,000, the proceeds to be used, in part, for extensions and betterments in its plant and system. The work will include addition to boiler plant for increased capacity, extensions to gas plant and system; new rolling stock, and other equipment. The company, managed by the Stone & Webster Corp., Boston, operates the electric light and power, and other public utility properties at Halifax, Dartmouth, etc.

Brockton, Mass.—George E. Keith Co., has commenced the construction of the proposed one-story power plant at its local shoe manufacturing works, to be used for factory operation. The structure will be 60x70 ft., and will be connected with the factory by means of an underground tunnel. The structure with equipment will cost about $100,000.

Quincy, Mass.—Fire recently damaged the plant of the Quincy Electric Light & Power Co. The loss is estimated at $15,000.

Whitman, Mass.—Edison Electric Illuminating Co. of Brockton has disposed of its former power plant building at East Whitman to the National Foundry Co. The structure was erected about 30 years ago by the Whitman Electric Light & Power Co., and was employed for furnishing service in this district. About fifteen years ago the plant was purchased by the Edison company; following arrangements for taking power from Brockton and later, from East Bridgewater, the plant was closed down and has not been operating for some time past.

Hartford, Conn. — Arrow Electric Co. will erect a two-story addition to its factory to cost $45,000.

Hartford, Conn.—Twin State Gas & Electric Co. has arranged for an increase in its capital to provide for additional operating funds, as well as proposed extensions and betterments.

New Haven, Conn. — Yale Tire & Rubber Co., Highwood, has broken ground for the construction of a one-story power plant at its works, to be provided with a brick or reinforced concrete stack.

Belport, N. Y.—Northern New York Utilities, Inc., contemplate the erection of a high-tension steel tower transmission line from the company's power house to Towville, a distance of 20 miles. The estimated cost of this extension is $200,000. H. G. Davis, Light and Power building, Watertown, is chief engineer.

Binghamton, N. Y.—L. P. Amslie, 41 Laurel street, Johnson City, N. Y., has received the electrical contract for work in a new two-story school building at Hooper, near Binghamton.

Central Islip, N. Y.—Bids have been taken by the State Hospital Commission, E. W. Elwood, secretary, Capitol building, Albany, for the installation of the proposed new boilers, stoker equipment, etc., at the Central Islip State Hospital. Lewis F. Pilcher, Capitol building, Albany, is State Architect.

New York, N. Y.—Henry L. Doherty & Co., 60 Wall street, have announced the establishment of a new branch office in the Morris building, Philadelphia, Pa., to be placed in charge of Ralph Runyan. The company is now operating 14 branches in various cities.

New York, N. Y.—Western Union Telegraph Co. has completed negotiations for the leasing of the entire fifth floor of the building at 395-99 Broadway, located at Walker street, to be used for new executive offices. The lease aggregates $100,000 in rentals.

New York, N. Y. — International Telephone Sales & Engineering Corp., a Delaware incorporation, has filed notice of authorization to operate in New York with a capital of $3,800,000. R. S. Gould, 37 Wall street, is corporate representative.

New York, N. Y.—The Wills Egelhof Co., Inc., 101 Park avenue, has been awarded the general contract for the erection of the Citizens National Bank building located at Covington, Va. Alfred C. Bossom, New York City, is architect.

New York, N .Y.—Wappler Electric Co., Inc., 173 East 87th street, manufacturer of batteries and other electrical equipment, has awarded a contract to the Turner Construction Co., 244 Madison avenue, for the construction of its proposed three-story reinforced concrete manufacturing plant on property recently acquired on Harris avenue, near the Queensboro Bridge, Long Island City. The structure will provide a total manufacturing area of about 50,000 sq. ft. The company recently increased its capital from $750,000 to $850,000.

Ossining, N. Y.—Contract has been awarded to the Van Wagoner Linn Construction Co., 143 East 27th street, New York, by the New York Commission on New Prisons, Hall of Records, New York, for electrical work in connection with the construction of proposed additions to Sing Sing Prison, Ossining. The electrical work is estimated at $16,365.

Potsdam, N. Y. — Final contracts have been awarded by the State authorities for the construction of the proposed boiler plant at the Potsdam Normal School, the H. M. Week Co., New York, being the building contractor. Contract for electrical work has been let to the Hudson Electric Engineering Co., New York.

Troy, N. Y.—In connection with the construction of a large new local armory building now under consideration by the State Armory Commission, a quantity of electrical equipment will be required, the proposed structure being estimated to cost $475,000. Col. Franklin W. Ward, Telephone building, Albany, is secretary of the commission. Lewis F. Pilcher, Capitol building, Albany, is state architect.

Bernardsville, N. J.—Following a severe electrical storm, the lines of the New Jersey Power & Light Co., at Brookside, near Mendham, were thrown out of commission. This is the high-tension system furnishing service at Bernardsville, and the city was in darkness for about 24 hours.

Bloomfield, N. J.—Bloomfield Electric Shop has filed notice of organization to operate at 596 Bloomfield avenue. Leon G. Frank, 1395 Brestow street, New York, heads the company.

Jersey City, N. J.—Modern Gas & Electric Appliance Co., 568 Newark avenue, has filed notice of organization to manufacture electric and gas fixtures. Frank Tury heads the company.

Newark, N. J. — Rainbow Electric Co., 258 Chadwick avenue, has filed notice of organization to manufacture electrical specialties. Samuel Rubinstein is head.

Newark, N. J.—Springfield Light Co. has filed notice of organization to manufacture electric lighting fixtures, with works at 452 Springfield avenue. Harry Shapiro, 115 16th avenue, heads the company.

Newark, N. J.—George J. Crosman, operating a plant at 139 Jackson street for the manufacture of composition specialties, will install a new boiler and engine plant in connection with his works, to be located on Astor street.

Paterson, N. J.—Business interests located on Main street are negotiating with the Public Service Electric Co., for the installation of a new white way street lighting system along the thoroughfare.

Perth Amboy, N. J.—Jersey Central Traction Co. has been ordered by the Board of Public Utility Commissioners to make improvements and extensions in its plant and system for general betterment in service. The work includes improvements on the Keyport-Perth Amboy Division, the Matawan-Keyport Division, and at Atlantic Highlands.

Plainfield, N. J.—A new company is being organized to be known as the New Jersey Trackless Trolley Co., to construct and operate a trackless trolley line between Plainfield, South Plainfield and Metuchen. The estimated cost of the new system, including overhead lines, poles, etc., is $125,000. Among the first subscribers to the new company are the Spicer Manufacturing Co., Charles H. Frost and Tepper Brothers. The Public Service Railway Co. has refused to extend its lines along this new route, holding that it would cost about $140,000 and the company was not in a financial position to make the investment.

Trenton, N. J.—Trenton Electric & Conduit Co. has filed plans for the erection of two new one-story additions to its works at 1-3 Tyler street, to cost about $10,000.

Trenton, N. J.—A 10-ton electric traveling crane and other electrically operated equipment will be installed in the new one-story machine addition to be erected at the works of the John E. Thropp's Sons Co., Lewis street, manufacturer of tire-making molds and machinery.

Trenton, N. J.—The Board of Public Utility Commissioners has ordered the Trenton & Mercer County Traction Co. to make a number of improvements and additions in its system in different parts of the city.

Trenton, N. J.—The Board of Public Utility Commissioners has granted permission to the Trenton & Mercer County Traction Co. to dispose of property, aggregating about 37½ acres of land in Hamilton Township, to the Pennsylvania & Newark Railroad for a consideration of about $15,000.

Washington, D. C.—The Bureau of Yards and Docks, Navy Department, will build an addition to its electric power plant at Paris Island, S. C., to cost about $10,400.

Bristol, Pa.—The Borough Council and local citizens are negotiating with the Eastern Pennsylvania Gas & Electric Co., for the operation of its auxiliary plant, installed in co-operation with the borough, during non-service periods from other sources of supply. The auxiliary plant was designed to be used in connection with the local street-lighting system, as well as for other service.

Catasauqua, Pa.—An ordinance is being considered by the Common Council providing for a bond issue of $50,000 for the construction and operation of a municipal electric light and power plant.

Easton, Pa.—Pennsylvania Utilities Co. will soon commence the installation of three new boilers at its Dock street plant for increased capacity. The units will have a total capacity of about 2300 hp.

Pittsburgh, Pa.—The Public Service Commission has approved the merger of a number of electric companies operating in Beaver county with the Harmony Electric Co., to be operated as a unit system in the future.

Pittsburgh, Pa.—Pittsburgh Model Engine Co. has commenced the erection of a plant on Lexington avenue, near McPherson street, to cost about $200,000. The works will comprise a one and two-story building, 40x180 ft., and 60x320 ft., respectively.

Pittsburgh, Pa.—Considerable electrical equipment and machinery will be required in connection with the proposed additions and improvements to the local water supply and sewerage systems. Bonds have been voted by the citizens for $1,401,000 and $1,341,000 for the work, covering water and sewerage systems, respectively. The Board of Public Works will be in charge of the project.

Pittsburgh, Pa.—In connection with its new electric generating plant at Springdale, estimated to cost about $5,000,000, the West Penn Power Co., Pittsburgh, has developed plans for mining coal under the Allegheny river at this point. As the coal is mined and removed, the shaft will be ribbed and converted into a two-track railroad tube, and extending from one side of the river to the other. In this manner, the coal will be transported from the Westmoreland County side of the stream to the Springdale plant, where it will be utilized and stored.

Hagerstown, Md. — Union Bridge Electric & Manufacturing Co. is planning for the extension of its lines to New Windsor, Taneytown, Legore, Key Mar, Middleburg, New Midway and other places in this district. At Legore, the company will connect with the system of the Hagerstown & Frederick Railway Co. Electric service is now being furnished to Union Bridge and Linwood. Clarence Easterday is president.

DATES AHEAD.

National Council of Lighting Fixture Manufacturers. Midsummer convention, Cleveland, Ohio, Aug. 5 and 6. Secretary-treasurer, Charles H. Hofrichter, 8410 Lake avenue, Cleveland, Ohio.

Michigan Section, N. E. L. A. Annual convention, Ottawa Beach, Mich., Aug. 19-21. Headquarters, Hotel Ottawa. Secretary-treasurer, Herbert Silvester, Monroe, Mich.

Washington State Association of Electrical Contractors and Dealers. Annual convention, Seattle, Sept. 11. Secretary, Forrest E. Smith, 205 Boston Block, Seattle.

Southeastern Section, N. E. L. A. Annual convention, Asheville, N. C., Sept. 17-19. Secretary-treasurer, T. W. Peters, Columbus, Ga.

New England Section, N. E. L. A. Annual Convention, New London, Conn., Sept. 22-24. Headquarters, Hotel Griswold. Secretary, Miss O. A. Bursiel, Boston, Mass.

International Association of Municipal Electricians. Annual convention, Chicago, Sept. 23-26. Secretary, Clarence R. George, Houston, Tex.

Association of Iron and Steel Electrical Engineers. Annual convention, St. Louis, Mo., Sept. 22-26, 1919. Secretary, John F. Kelly, Empire building, Pittsburgh, Pa.

National Association of Electrical Inspectors. Annual meeting, Springfield, Mass., Oct. 13 and 14. Secretary, W. L. Smith, Concord, Mass.

Illuminating Engineering Society. Annual convention, Chicago, Ill., Oct. 20-23. General secretary, Clarence L. Law, 29 West 39th street, New York City.

Indian Head, Md.—The Bureau of Yards and Docks, Washington, has awarded a contract to Levering & Gerrigues, 553 West 23rd street, New York, for the building to house its proposed power plant at the Government works at this place.

Charleston, W. Va. — The State Board of Control has completed plans for the construction of a new one-story and basement power plant at the State Institution, Institute, W. Va. H. Russ Warne, Masonic Temple, Charleston, is architect.

Wierton, W. Va. — Wierton Steel Co. has awarded contracts to the Westinghouse Electric & Manufacturing Co., Pittsburgh, Pa., and the General Electric Co., Schenectady, N. Y., for electrical machinery and equipment for its proposed steel plant. The orders are said to aggregate $1,000,000.

Walnut Cove, N. C. — Piedmont Power Co., recently organized, is planning for the construction of a new electric transmission line to Winston-Salem. The company will furnish electric light and power service to Walnut Cove and Walkerstown.

Johnston, S. C. — Boyd utilities plant, F. M. Boyd owner, will install a 75-kv-a., 2300-volt alternator driven by internal combustion engine.

Lockhart, S. C.—Lockhart Power Co. will build a new one-story power plant, about 35x160 ft. The Hardaway Contracting Co., Columbus Ga., has received the contract for the building.

Orangeburg, S. C.—City will vote on issuance of $75,000 of bonds for enlarging the electric light plant and installing new machinery. E. Hawes, city engineer.

Cedartown, Ga.—Cedartown Cotton & Export Co. is building a $40,000 addition to its cotton products plant and will expend $125,000 for new machinery. An additional electric power plant is also to be erected.

Hayesville, Ga. — The Public Service Co. is in the market for electrical equipment for a hydroelectric plant and six transmission systems.

Springfield, Ga.—A municipal electric plant may be established.

Pensacola, Fla.—The contract for the construction and equipment of a 5000-ton drydock of the Crandall type has been let to the Aberthaw Construction Co. of Boston. The new drydock was designed by the Crandall Engineering Co. of East Boston, Mass., and consists of five floating pontoons, each 100x40 ft. and 10 ft. deep and costs approximately $450,000. Each of the five pontoons will be equipped with four submerged electric centrifugal pumps designed to empty the dock in one hour. The dock, which is being built for the Emergency Fleet Corp., will be used largely for government work when completed.

NORTH CENTRAL STATES.

Ashland, Oho.—Henry L. Doherty & Co. plan to install a 10,000-kw. turbine at the company's power station near Mansfield, Ohio.

Chillicothe, Ohio. — McVicker & Evans will erect a $150,000 paper mill Specifications include electric lighting.

Cleveland, Ohio. — Drew Electric & Manufacturing Co. has purchased a two-acre tract, on which it proposes to erect a plant at an estimated cost of $50,000 to include a machine shop and brass foundry. James H. Drew, president.

Lima, Ohio. — Ohio Electric Co. plans the erection of a new lighting and power plant. J. E. Dugan is general manager.

Lima, Ohio.—The question of issuing $100,000 bonds for municipal light plant will be submitted to voters. The plans as outlined in the report is for the city to install 600 lights of 400 cp., erecting its own poles and wires. With the equipment placed the city would then ask for bids on current from both the Ohio electric and water works plant.

Lima, Ohio—Lima Locomotive Works will spend $125,000 to build its own electrical plant as an aid to supply additional power if the Ohio Electric Co. does not proceed with its plans to double capacity of the local power plant. Address city clerk.

Oxford, Ohio.—Oxford will give up its municipal lighting plant after 30 years' operation. The town has received a bid from the Ohio Gas & Electric Co., Middletown. This company will erect a transmission line and will supply current under a franchise from the town. The proceeds of the sale of the light and power plant will be used for the purpose of rehabilitating and electrifying the municipal waterworks.

Indianapolis, Ind. — Springer McComas Grain Co. will erect concrete transfer elevator, capacity 25 cars, 177 ft. high, to cost $60,000, exclusive of ground. The company will install two grain dryers and one cleaner.

LaPorte, Ind. — Advance-Rumely Co. will erect new storage shed, 1000 x125 ft.; three two-story additions to the machine shop, one 20x187 ft., one 20x300 ft., and one 20x160 ft. The case-hardening and heat-testing departments will be enlarged by the erection of an addition, 30x40 ft. Improvements will also be made in the powerhouse.

Peru, Ind.—Modern Refrigerator Co. will erect two large buildings at its plant and will increase its capital stock from $25,000 to $100,000.

Shelbyville, Ind.—Universal Electric Co. has received a contract to wire Johnson county infirmary on its bid of $689.38, in order that an electric lighting plant can later be installed.

Arcola, Ill.—A company is being organized to establish a local light plant. Address Collins Brothers.

Charleston, Ill.—Coles County Telephone & Telegraph Co. will place all its wires underground at an estimated cost of $57,000.

Columbia, Ill.—An election to vote $16,000 bonds to extend and improve the municipal light plant carried.

Decatur, Ill.—The Illinois Traction System plans to erect a $2,000,000 power plant on the Sangamon river near Faries Park and the Wabash bridge on the way to Decatur. The plant will furnish power for Illinois Traction System interurbans and arrangements will be made for the transmission of power to Decatur. The present power plant at Cerro Gordo and Edwards street, Decatur, will be abandoned.

Dwight, Ill.—The mayor of this city and the members of the light and water committee of the Council have made a trip to Joliet, Ill., to study the lighting system of that city. The Public Service Co. of Northern Illinois has made a proposal to furnish lighting for Dwight and also for the use of electricity for pumping the city water supply.

Plato Center, Ill.—Board of education plans erection of township high school, 110 ft. x 100 ft. brick to cost $50,000.

Raritan, Ill.—A fund of $2500 has been raised by public subscription as bonus for the promotion of the enterprise for electric lights for Raritan. John K. Barry, president.

Springfield, Ill. — The mayor and city commissioners planned for a $400,000 bond issue to improve and complete the city electric light and power plant. That the light department will be amply able to take care of the payments is assured by commissioner Willis J. Spaulding.

Urbana, Ill.—The Urbana board of local improvements passed a resolution providing for the southwest ornamental lighting system, which provides for the new system of boulevard and West Race streets.

Urbana, Ill.—J. W. Swartz Electric Co. has secured the contract for the electrical work on the new building of the Transport Truck Co., Mount Pleasant, Mich.

Woodstock, Ill.—The City Council has contracted for a new unit for the municipal electric plant. It will be necessary to build an addition to the plant, estimated to cost $25,000.

Bay City, Mich.—Handy Brothers plan the extension within the next year or so of the Detroit, Bay City & Western Railway from Marine City into Detroit.

Verona, Mich.—Union Steam Pump Co. is erecting a machine shop, 150x 200 ft. The first unit of the proposed plant will cost about $500,000.

Chetek, Wis. — Agitation for a municipally owned light and power system has resulted in a proposition from the Chetek Light & Power Co. for sale of distribution system to the city for $9000. The question of purchasing the system and bonding the city will be submitted to voters next month.

Hortonville, Wis.—The village of Hortonville, which has been without street lighting since its gas plant was abandoned will be lighted with electricity furnished by the Wisconsin Traction Light, Heat & Power Co. The traction company will extend its lines to Dale, Medina and Sherwood. Nearly all farmers living along the lines have agreed to purchase current for lighting and power purposes.

Dubuque, Iowa—Dubuque Casket Co. will erect a new $30,000 factory building.

Waverly Iowa. — High school board of education plans the erection of a $200,000 high school.

St. Louis, Mo. — Bell Telephone Co., Broadway & Oliver streets, will build a $30,000 addition to plant.

Omaha, Neb.—Herring Motor Co., Des Moines, Iowa, will erect a plant for handling Fordson tractors and parts.

Wahoo, Neb.—Wahoo Produce Co., will erect a modern produce and cold storage plant, 66x120 ft., to cost $40,-000.

SOUTH CENTRAL STATES.

Louisville, Ky. — The Commercial Department of the Louisville Gas & Electric Co. during the week ended July 5, secured 45 new electric light and power customers with 17 kw. of lighting load and 382 hp. in motors. The net gain in business connected for the week was 54 customers with 55 kw. of lighting and 19 hp. in motors. Electric energy output for the week was 9.7% greater than for the corresponding week of 1918.

Texarkana, Ark.—Texarkana Telephone Co. will make extensive improvements. About $60,000 will be expended. Address the mayor.

Albany, Ala.—Alabama Power Co. has been granted a 30-year franchise by the City Council to take effect upon the completion of the new hydroelectric line from the Coosa river. It is estimated the line will be completed early in January. It will provide ample power for all industrial needs in the vicinity.

Montgomery, Ala.—Alabama-Georgia Syrup Co. will erect a $50,000 addition to plant. Conveyor systems will be used throughout all products being handled into and out of cars by the conveyors. Electric elevators and other modern devices for the expeditious handling of the immense business of this plant will be installed.

Union, Ala.—The City Council has arranged for the issuance of bonds for $10,000 to provide for improvements and extensions in the municipal electric plant.

New Orleans, La.—The erection of a central power house on the Mississippi river is planned by the U. S. Naval Station. The estimated cost is $120,000. Engineering Department of the U. S. Navy, Algiers Station, engineers.

Duncan, Miss.—The city will vote Aug. 5 on the issuance of $12,000 of bonds for extending electric light and waterworks systems. Address C. W. Erwin, mayor.

Natchez, Miss.—Improvements and additions are being made to the plant of the National Box Co., representing an investment of over $2,000,000. An electric plant is being installed and it is planned to operate all machinery electrically.

Ruleville, Miss.—The city will issue

$40,000 of electric light plant and street improvement bonds. R. S. Parker, city clerk.

Chelsea, Okla.—At a recent election bonds to the amount of $30,000 were authorized for a water and light plant.

Comanche, Okla. — Bonds to the amount of $35,000 have been voted for the water and electric plant. Address the mayor.

Enid, Okla.—City Ice Co. will improve its plant. J. C. Calhoun has been engaged to prepare plans for a complete new high-speed motor-driven machine with ice tanks of a capacity of 30 tons daily which will make the total capacity of this plant 40 tons per day. Necessary additions to be building will be commenced as soon as plans are completed.

Okemah, Okla. — An election will be held to vote on the question of issuing $50,000 extension and improvements of electric light plant. Address mayor.

Oklahoma City, Okla.—State Board of Affairs will erect a power house and laundry. N. T. Hardin, architect, Equity building, Muskogee, Okla.

Sapulpa, Okla. — Sapulpa Refining Co. has announced improvements to its local plant to cost in the neighborhood of $1,000,000. The Sapulpa Electric Co. has been asked to furnish current for operating 225 hp. in motors, more than one-half of which will operate continuously.

Burkburnett, Tex. — William L. Sonntag, of Wichita Falls, and associates are promoting the construction of an interurban electric railway between Burkburnett and that city. The preliminary arrangements in the matter of financing the project have been made. The line will be about 18 miles long, and will, it is expected, relieve the congestion of passenger traffic between two towns caused by the unprecedented oil development operations.

Corpus Christi, Tex.—Upon application of the Merchants Union Trust Co. of Philadelphia, Pa., the Federal court here has placed the Corpus Christi Railway & Light Co. in the hands of a receiver. C. U. Culberson of Houston was appointed receiver. The company owns the street railway system and electric light and power plant here. Improvements will be made to the property as soon as the sanction of the court for same is obtained.

Houston, Tex.—Houston Lighting & Power Co. will install additional generators and other equipment in its electric power station here and extend its power transmission system. The proposed improvements will cost about $500,000. S R. Bertron, Jr., is general manager.

Mexia, Tex.—The City Council is considering the erection of a municipal electric light and power plant to cost about $150,000.

San Antonio, Tex.—San Antonio Public Service Co. has adopted plans for installing a new steam turbine of a capacity of about 13,000 hp. at its power house on Conception avenue. The improvement will cost about $275,000.

Sherman, Tex.—The city proposes to build and equip an electric light and power plant to cost about $500,000.

Temple, Tex.—O. A. Ryfle of Houston, and associates who are promoting the construction of an interurban electric railway between Temple and Waco expect to have the surveys finished and right of way obtained so that construction may be started about Sept. 15. Committees of citizens have been appointed here and in towns on the route of the proposed line to assist in the preliminary plans for the project. The road will be about 35 miles long.

WESTERN STATES.

Missoula, Mont.—Improvements to cost $80,000 have been started by the Missoula Light & Water Co. at Bonner Dam.

Boise, Idaho. — Idaho Power Co. plans the erection of a transmission line from American Falls to Pocatello, a distance of 25 miles. The company is now installing a 3600-kv-a. generating unit at its lower Salmon hydroelectric plant.

Boise, Idaho. — Mackay Light & Power Co. will extend its lines down the Lost River to Arco.

Seattle, Wash.—Providing for the improvements and additions to the city's Lake Union steam power plant urged by J. D. Ross, superintendent of lighting, an ordinance appropriating $1,250,000 for the work was introduced into the City Council and referred to the utilities committee. The ordinance will be passed and work on the steam plant rushed.

Seattle, Wash. — Electric lighting fixtures estimated to cost $10,000 are to be installed in some of the present school buildings.

Marshfield, Ore.—An estimate of what it will cost to put the power plant at the Smith mill in good running order, in relation to both the part which supplies power for the Mountain States Power Co. and the part which furnishes power for the Smith mill, has been completed by the consulting engineer of the power company, to cost $60,000.

Portland, Ore. — Franks Laundry Co. will erect a $50,000 laundry at East 7th & Pine streets to be operated by electricity.

Porterville, Cal.—The City Council has under advisement plans for the establishment of a municipal electric light plant.

PROPOSALS

Lighting System.—Bids will be received until 8 p. m., July 28 by Black & Veatch, engineers, 507 Interstate building, Kansas City, Mo., for a lighting system at Osawatomie, Kans.

Centrifugal Pumps.—Bids will be received at the office of the director of public service, Delaware building, Akron, Ohio, until Aug. 1, for furnishing two horizontal centrifugal pumps, normal capacity 1000 gal. per minute against a total head of 80 ft. direct connected to electric motors. Specifications may be obtained from the Bureau of Waterworks Improvement, 102 East Mill street, Akron. G. G. Dixon, engineer; H. H. Frost, superintendent of waterworks.

Motor-Driven Triplex Pump.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until Aug. 8, for a new motor-driven triplex pump, etc., in the United States post office and custom house at Cairo, Ill.

FOREIGN TRADE

[Addresses of firms referred to in these trade opportunities may be obtained by writing to the Bureau of Foreign and Domestic Commerce, Washington, D. C., or its branch and local co-operative offices. Request for each opportunity should be on a separate sheet and the file number given.]

Electrical Machinery (30,004).—The agency for the sale of building materials, hardware, domestic and general, motor accessories, and electrical machinery and fittings is desired by a man in England. References.

Electrical Apparatus (29,964).—A firm in Australia wishes to get in communication with American exporters of electrical wires, cables, conduits, machinery, lamps, fittings, and glassware, metals and metal products, machinery for all industrial purposes, hardware, plate glass, sheet glass, lumber, oils, chemicals, paper, textiles, canned goods, automobiles and accessories.

Electrical Aerial Trolley System (29,966).—An electrical aerial trolley system to carry passengers between mountain top is desired by a company in Portugal. Quotations should be given c. i. f. Portuguese port. Payment, credit in New York. Correspondence may be in English. References.

Electric Motors (29,967).—A company in India desires to purchase complete paint manufacturing machinery with output of 10 tons per day, a portion of which will be enamels, oxides and ochres. Electric motors should be supplied with large machines. Quotations should be given c. i. f. Indian port. Payment in the United States against documents. References.

INCORPORATIONS

New York, N. Y.—Metricappliance Corp. Capital, $20,000. To manufacture electric meters. Incorporators: A. W. Franklin, M. B. and D. B. Kassel, 47 West 112th street.

New York, N. Y.—Universal Condenser. Capital, $100,000. To manufacture condensors and kindred equipment. Incorporators: P. G. Chichester, Brooklyn; E. Nolan, and D. T. Howell, 945 East 180th street, New York.

Personal

C. H. Howell Elected President Ohio Electric Light Association—V. R. Lansingh President of Lunken Window Co.

W. S. Robertson, who has been connected with the Nebraska Power Co. for about two years, has been appointed assistant general manager in charge of operation. He will have charge of all the operating departments of the company.

William Petschel, electrical engineer and storage battery expert, formerly president and manager of the Atlas Electric Storage Battery Co., Greenville, Mich., is now general manager and vice-president of the Vulcan Storage Battery Co., Brazil, Ind.

John Gillespie, formerly affiliated with the steel casting department of the Midvale Steel & Ordnance Corp., has accepted the appointment of general superintendent of the Philadelphia Electric Steel Corp., Conshohocken, Pa., succeeding Arthur S. Breithaupt.

Raymond G. Sherman, superintendent of the Deerfield River Power Co., has been appointed superintendent of the Connecticut River Power Co. of New Hampshire, Brattleboro, Vt., both of which concerns are under the management of the New England Power Co., with headquarters at Worcester, Mass.

Terence Farley, New York, has been appointed general counsel to the Public Service Commission, New York, by Commissioner Lewis Nixon, to succeed Godfrey Goldmark, recently resigned. Mr. Farley has been an assistant corporation counsel for 27 years, and for the last 12 years has been at the head of the Appeal Bureau of that office.

George W. Hubley, who recently terminated his office as administrative engineer and chief of conservation of the United States Fuel Administration of Kentucky, has opened an office in Louisville as a consulting and advisory engineer and also to furnish service as a power plant specialist. Mr. Hubley was previously general manager of the Badenhausen Co. of Philadelphia and New York City, prior to which time he was general manager and chief engineer of the Merchants' Heat & Light Co. of Indianapolis, Ind.

H. M. Turner has been made assistant professor of electrical engineering in the Sheffield Scientific School of Yale University. Professor Turner was graduated from the University of Illinois and for several years has been in the Electrical Engineering Department of the University of Minnesota. He went to Yale last fall as assistant professor of radio and advanced electrophysics and directed the field radio work of the Signal Corps Training School for officer candidates. Since its disbanding his work has been in the Electrical Engineering Department, in which department he is now continued.

Van Rensselaer Lansingh, formerly general manager and chief engineer of the Holophane Works of the General Electric Co., Cleveland, and later manager of the Holophane Sales Department of the National Lamp Works of General Electric Co., Nela Park, Cleveland, has been elected president of The Lunken Window Co., Cincinnati, Ohio. This company manufactures a unit window consisting of window frame, disappearing sash and fly-screens. The upper and lower sash telescope into a window box above the usual window opening, making it possible to secure maximum ventilation from the entire window opening at the same time screening from top to bottom.

Van Rensselaer Lansingh.

Mr. Lansingh entered the University of Chicago in 1892, graduated January, 1896. From February, 1896, to June, 1898, he attended the Massachusetts Institute of Technology, receiving the degree of Bachelor of Science in electrical engineering. In February, 1899, he entered the testing department of the Western Electric Co. with whom he remained until July, 1900, when he formed the V. R. Lansingh Co. in Chicago, sales agent for Holophane reflectors. In September, 1904, he was appointed general manager and chief engineer of the Holophane Works of General Electric Co. and in March, 1914, became manager of the Holophane Sales Department of the National Lamp Works.

In August, 1914, Mr. Lansingh resigned that position to start in Chicago The Hardware Buyers Association, which later became the By-Lo Stores Co., operating a chain of hardware stores at Muncie, Frankfort and Anderson, Ind. The advent of our entering into the world war prevented the expansion of this chain and consequently, in March, 1917, he entered as a volunteer in the Council of National Defense at Washington, D. C., serving under Dr. Hollis Godfrey, one of the advisories of this Council. He continued work along different engineering lines until June, 1917, when he sailed for France to represent the Massachusetts Institute of Technology, which was later consolidated with the American Universities Union in Europe with headquarters in Paris and with branches in England and Rome. For a year he served as a director of the Technology Bureau in the Union and also as business manager and assistant director of the organization, whose purpose it was to serve college men and friends in service abroad and to promote closer relationship between American and foreign universities. In July, 1918, he returned to the States and in October was placed by the Government in the Metz Plant at Waltham, Mass., as works manager in the plant manufacturing airplanes for the Government. He continued in this capacity until April, 1919, and in June became president of The Lunken Window Co., Cincinnati, Ohio. Mr. Lansingh has been prominent in the activities of the Illuminating Engineering Society, having been its general secretary in 1906 and president for the term ending in December, 1912. He has also served the society in other offices and on committees, and has been closely identified with the advancement of scientific principles concerning the use of reflectors of light sources. In collaboration with J. R. Cravath he wrote a book, "Practical Illumination," which has had a very wide circulation and is not only in the library of every man interested in lighting, but has been used extensively as a text book in many educational institutions.

Franklin T. Griffith, president of the Portland Railway, Light & Power Co., Portland, Ore., and C. M. Clark, chairman of the board of directors of that company, of Philadelphia, recently made a 5-days' trip on horseback over the headwater-region of the Clackamas river, on the western slope of the Cascade mountains. Their trip was to look over sites for possible hydroelectric development. This is undoubtedly in anticipation of greatly increasing power demands within the next few years.

E. H. Waddington, president of the St. Louis Electrical Board of Trade and western district manager of the Pole and Line Material Department, Western Electric Co., met with a serious accident recently while on a tour of inspection in the West. While engaged in the work of inspection at the company's pole yards at Spirit Lake, Idaho, he was caught in a slide of poles and had his left leg broken below the knee. An X-ray revealed the injury to be two fractures near the joint. He will be confined to his home for several weeks. Mr. Waddington has been actively connected with the St. Louis Jovian League for a number of years and was a member of the committee that formulated the plan for its reorganization into the St. Louis Electrical Board of Trade. He has a host of friends who sympathize deeply with him in his misfortune.

ARTHUR E. ANDERSON, formerly chief engineer of the Intermountain Railway, Light & Power Co., Denver, Colo., has assumed the position of general superintendent of the Grand Junction Electric, Gas & Manufacturing Co., and the Grand River Valley Railway Co., Grand Junction, Colo.

LANDERGREN ARMSTRONG, for the last three years publicity manager for the Crouse-Hinds Co., Syracuse, N. Y., has associated himself in a similar capacity with the Brown-Lipe Gear Co.. of the same city, the pioneer manufacturer of transmissions, clutches and control sets for pleasure cars and auto trucks. Mr. Armstrong was a member of the Crouse-Hinds organization for ten years, during the first seven years of which he served as assistant publicity manager. Prior to that connection, he occupied an editorial position with the New York News Bureau of New York City.

B. F. TUCKER, manager of operations for the Central Illinois Public Service Co., with headquarters at Mattoon, Ill., has resigned that position to become manager of a 1225-acre farm near Peoria, owned by himself and two associates. Mr. Tucker was one of the owners of the electric lighting plant at Virden, Ill., until it was taken over by the Central Illinois Public Service Co. He then entered the service of this company at Taylorville, Ill., taking the position of district superintendent. He was later transferred to Mattoon, where he became assistant general superintendent and in February, 1915, was appointed general superintendent and in January, 1919, became manager of operations. Mr. Tucker has also been deeply interested in agricultural operations for a number of years and will take up farming on a large scale. He will apply mechanical power as far as possible to farm operations.

DR. V. BUSH, engineer of the American Radio & Research Co., has been appointed associate professor of Electrical Engineering at the Massachusetts Institute of Technology. Dr. Bush is a graduate of the Electrical Engineering course of Tufts College and received an M. S. degree from that college in 1914. He received the degree of Doctor of Engineering from the Massachusetts Institute of Technology in 1916. After graduating from Tufts he had been an instructor on its staff with a notable record as a teacher and was later made an assistant professor. During the course of scientific researches in the war, Dr. Bush was associated with the New London researches of the United States Navy for the detection of submarines and did distinguished service in that work. The doctor's thesis which he presented at the Massachusetts Institute of Technology will be remembered by electrical engineers from a paper read before the midwinter convention of the A. I. E. E. in February, 1917, entitled "Oscillating Current Circuits by the Method of Generalized Angular Velocities," in which a discussion is given of the "threshhold impedances." In his new position, Dr. Bush will take up a portion of the instruction to undergraduate students heretofore given by Professor Wickenden, who recently resigned to go permanently into the service of the Western Electric Co. In addition Dr. Bush will give a course of advanced lectures to postgraduate students and devote the remainder of his time to research.

C. H. HOWELL, newly elected president of the Ohio Electric Light Association, is vice-president of The Ohio Service Co., Coshocton, Ohio. He was graduated from Richmond College, Richmond, Va., in June, 1905, with the degree of Bachelor of Science, and immediately thereafter accepted a position as car barn foreman with the Newport News & Old Town Street Railway Co. at Hampton, Va. In January, 1906, he entered the student course of the General Electric Co. at Lynn, Mass., and coincident with this work in 1906-1907 took post graduate work in thermodynamics and electrical engineering at the Massachusetts Institute of Technology. In 1908 Mr. Howell entered the student course of the General Electric Co. at Schenectady, N. Y., and in 1909 entered sales work as commercial engineer in the power and mining and small motor department of the General Electric Co., Pittsburgh. He pursued this work until August, 1912, when he accepted the position of manager of the Coshocton Light & Heating Co., Coshocton, Ohio. In January, 1913, jointly with this position, he took the managership of the New Midland Power & Traction Co., Cambridge, Ohio, and in May of the same year took a similar position with the County Electric Co. at New Philadelphia and Dennison, Ohio, and the Twin City Traction Co. at Dennison, Ohio, and the Tuscarawas County Light, Heat & Power Co., New Philadelphia. Also during the year 1913 he was appointed manager of the Lafayette Light & Power Co., Strasburg, Ohio. All of these companies, including the Strasburg Electric Co., Strasburg, the Newcomerstown Light, Heat & Power Co., Newcomerstown, were later merged into a single corporation, which is now known as The Ohio Service Co.

C. H. Howell.

Under Mr. Howell's directorship the company since 1914 has constructed over 111 miles of 33,000-volt transmission lines, connecting all the above towns, some 21 miles of 13,000-volt power feeders, and two new power houses. The company is now operating in 26 different communities scattered over four counties; two railway systems; two central district heating systems and two hydroelectric plants. Since 1914 the revenue of The Ohio Service Co. has grown more than 100% and the number of customers connected to its lines since the beginning of 1916 has increased 77%. Mr. Howell was one of the first among those who appreciated the possibilities of selling utility stock to customers and residents in the territory served by the utility. Today he is reaping the benefit of this for his policy has been prosecuted most successfully. He is a member of the American Institute of Electrical Engineers, American Electrochemical Society, the Boards of Trade of Coshocton, Cambridge, Dennison, Uhrichsville, New Philadelphia and Dover, and is a director in the Coshocton Board of Trade, a Rotarian at Coshocton, and for a number of years has been a member of the executive committee of the Ohio Electric Light Association.

G. F. WITTIG has been appointed assistant professor of Electrical Engineering in the Sheffield Scientific School of Yale University. He has been at Yale during the past year, first in connection with the Signal Corps Training School for officer candidates and after its disbanding has been a member of the Physics Department. Professor Wittig received his degree at Columbia. He was associated for a time with the Westinghouse, Church, Kerr Co. and assisted A. V. Abbot in the revision of his book on "Electrical Transmission of Energy." He was for several years head of the Department of Electrical Engineering and Physics at the University of Alabama and was later assistant professor of Electrical Engineering at the University of Pennsylvania. During last summer he was associated with the Radio Division of the Bureau of Standards and was co-author of the book on radio written by the Bureau of Standards which has appeared as Pamphlet No. 40. In the summer of 1917 he was division engineer in the construction of Camp McClellan.

OBITUARY.

OSCAR OTTO, general superintendent of the South Philadelphia Machine Works of the Westinghouse Electric & Manufacturing Co., died at his home on June 30 as a result of fatal injuries received in an automobile accident on the previous Friday morning, while driving his car up a steep grade near Westgrove, Pa., where he met an army truck-train which was descending the hill. One of the trucks skidded, sideswiped his car and completely demolished it. Mr. Otto was born in Manitowoc, Wis., on Jan. 2, 1858. After finishing his apprenticeship course as a machinist in the Manitowoc shops of the Chicago & Northwestern Railway, and later serving several years at various places in the state of Wisconsin, he accepted a position with the Northern Pacific Railroad Co. at Tacoma, Wash., going from there to the Oregon Short Line at Salt Lake City. In 1898 he returned to the Chicago & Northwestern Railroad as superintendent of its Chicago shops, continuing in this position until June, 1909, when he was appointed superintendent of the Westinghouse Machine Works at East Pittsburgh. When the Westinghouse company opened its new plant at Essington Mr. Otto supervised the installation of the machinery, and later, in February, 1918, he was permanently transferred to the new works, where he remained until his death. The deceased is survived by his widow, a daughter and three brothers.

Financial News

Mexican International Corporation Formed.

Interest in Mexico as a field for future development and financing is evidenced in the announcement made July 15 of the organization of the Mexican International Corp. by a group which includes officers of important banking and business houses.

This corporation has been organized under the laws of the State of Delaware and officers will be maintained both in New York City and in Mexico City. Its purposes are set forth as: (1) the investigation of existing enterprises to determine their physical and financial condition, management and future prospects and the development therefrom of plans for refinancing and extension which will procure for the corporation an interest in the enterprise; (2) the investigation of proposed enterprises to determine their merit, probable cost and future prospects, and the development therefrom of plans for the financing, construction, management and ultimate disposition of the enterprise; (3) the investment in, underwriting and organization of underwriting syndicates for the development and operation of such enterprises in Mexico as may be approved by the corporation. Should developments indicate the necessity therefor, the corporation will establish a service department to furnish information and service of a character in keeping with its purposes.

The officers of the corporation will be: President, Thomas H. Gillespie, president of T. A. Gillespie Co.; vice-presidents, George J. McCarty, president of the Mercantile Banking Co., Ltd., of Mexico City, and H. S. Brown. Mr. McCarty will be in charge of the corporation's offices and organization in Mexico City.

Mr. Brown will be in charge of the corporation's offices and organization in New York City. He has had 17 years' experience in financial work in New York City and has spent considerable time in Mexico. During the war he was chief of the Finance Division of the Bureau of Aircraft Production in Washington and after the signing of the armistice became an assistant to the United States Liquidation Commission in Paris.

The capital stock of the corporation will be divided into two classes. There will be 10,000 shares of preferred 7% cumulative stock of the par value of $100 and 25,000 shares of common stock with a par value of $5. Both classes of the stock will be subscribed for in cash at par, 25% of the subscription being immediately payable and the remaining 75% being payable in whole or in part at such time as the directors may determine. Subscribers to the preferred stock will have the right to subscribe to an equal number of shares of the common stock.

In announcing the organization of the corporation, Harvey D. Gibson and Grayson M. P. Murphy, the syndicate managers, made the following statement:

"For the United States the course of Mexican affairs is particularly vital and if properly followed should offer unusual opportunities. Not only is Mexico so located as to afford a natural field for investment and development by our people, but she has unexploited natural resources, the mere scratching of which would provide the means to clear off all her national debt and place her on a sound financial basis. With a soil capable of producing all the cereal crops and 90% of all the known fruits of the world, with vast tracts of timber, including many varieties of precious hardwoods and dyewoods, with a wide range of climate, with every known mineral, and with oil fields which exported more than 63,000,000 barrels in 1918, Mexico needs only a return to normal conditions and the introduction of modern methods and modern machinery to bring her quickly into the front rank of the producing world."

Duquesne Light Bond Issue.

The Duquesne Light Co. has sold to a syndicate of New York bankers, comprising Harris, Forbes & Co., Ladenburg, Thalmann & Co., and Lee, Higginson & Co., $25,000,000 first mortgage, 30-year 6% gold bonds to be sold at par. The sale of these bonds will assure the erection without delay of the large electric power plant at Cheswick, which will guarantee all power needs of the Pittsburgh district for the future.

The company owns and controls in large part, directly operates properties, conducting the entire central station, electric light and power company business in Pittsburgh and throughout the major portions of Allegheny and Beaver counties in Pennsylvania. It controls a single interconnecting system which serves a total estimated population of 1,100,000 people. The net earnings of the company for the year ended April 30 were over two and one-half times the fixed charges including interest on the present bonds.

Dallas Power & Light Bond Issue.

An offering of $4,500,000 first mortgage 6% gold bonds is being made by Lee, Higginson & Co., and the Harris Trust and Savings Bank, Chicago, at 100 and interest, yielding 6%. They are dated July 1, 1919, and become due July 1, 1949, principal and interest being payable in Boston or New York. The bonds will be secured by a direct first mortgage on all properties and franchises of the company. The company will have no other funded debt upon completion of the present financing. The Dallas Power & Light Co. acquired by purchase on Sept. 29, 1917, all the properties of the Dallas Electric Light & Power Co., which has been conducting an electric light and power business in Dallas, Texas, for 16 years. The company does substantially all the electric light and power business in Dallas. The new franchise approved by popular vote of the city on April 3, 1917, established a definite "property value" now amounting to about $6,200,000, against which, the mortgage provides, not exceeding $5,000,000 of these bonds may be issued, including the $4,500,000 now offered. Under the new franchise the company is now authorized to reserve out of net earnings, as a first charge, 9% on the "property value." On $6,200,000, this 9% amounts to $558,000, or more than twice the $270,000 annual interest on these $4,500,000 first mortgage bonds.

Indiana Utility Commission Orders.

The Public Service Commission of Indiana, in a recent conference at which a number of orders were passed, authorized the Interstate Public Service Co. to buy the Indianapolis & Louisville Traction Co. This gives the Interstate Co. a direct line by actual ownership or leases from Indianapolis to Louisville.

The Interstate company acquires the I. & L. by paying $330,000 for the capital stock of the company and by assuming the $846,300 bonded indebtedness. The I. & L. property, consisting of 41 miles of interurban track between Seymour and Sellersburg, figured in the deal at $28,700 a mile or a total of $1,176,300, which is covered by the purchase price and the bonded indebtedness. The commission authorized the Interstate company to issue 31,200 bonds to retire a part of the $846,000 bonded indebtedness.

The commission authorized the Northern Indiana Gas & Electric Co. to issue $1,906,000 10-year, 7% notes at par. The notes are designated to take up $955,300 demand 6% notes issued by the company and to take up $950,855 of an open 8½% account with its holding company, the United Gas & Improvement Co. The new note issue will reduce the fixed charges of the company $4720 annually.

The commission directed the Brazil Gas Co. and the Terre Haute, Indianapolis & Eastern Traction Co. to make physical changes in their Brazil properties to prevent electrolysis of the gas company's mains because of escaping current from the traction company wires.

American Interests Ask Concessions in Mexico.

Applications filed by American and other foreign investment interests for concessions for the construction of electric and steam railroads and various other kind of industrial enterprises are now pending with the Department of Communication and Public Works of the Mexican government. It is indicated by the attitude of the Carranza administration toward outside capital that these applications may all be rejected. The government has already adopted the policy of not granting any new concessions for the construction of additional lines of steam railroad. It has announced its intention of doing on its own account whatever railroad building may be deemed necessary, adding such lines to the National Railways of Mexico. Recently application was filed with the Department of Communications and Public Works for a concession to construct an electric interurban railway through the oil fields of the Gulf Coast region, connecting Tampico and Tuxpan. The proposed line would be about 120 miles long. No action has as yet been taken upon this application.

Dividends.

Carolina Power & Light Co. has declared a quarterly dividend of 1% on common stock, payable Aug. 1 to stock of record July 15.

Directors of the Connecticut Railway & Lighting Co. have declared a quarterly dividend of 1⅛% on common and preferred stock, both payable Aug. 15 to stockholders of record Aug. 1.

Duquesne Light Co. has declared a quarterly dividend of 1¾% on preferred stock, payable Aug. 1 to stock of record July 1.

Railway & Light Securities Co. has declared dividends of 3% on both common and preferred stock, both payable Aug. 1 to stock of record July 15.

The board of directors of the Texas Electric Railway Co. has declared a quarterly dividend of 1¾% on second preferred stock, payable Aug. 1 to stock of record June 30.

West Penn Power Co. has declared a quarterly dividend of 1¾% on preferred stock, payable Aug. 1 to stockholders of record July 21.

West Penn Traction & Water Power Co. has declared a quarterly dividend on preferred stock of 1½%, payable Aug. 15 to stock of record Aug. 1.

Commonwealth Edison Co. has declared a quarterly dividend of 2%, payable Aug. 1 to stock of record July 15.

Edison Electric Illuminating Co. of Boston has declared a quarterly dividend of 3%, payable Aug. 1 to stock of record July 15.

Edison Electric Illuminating Co. of Brockton has declared a quarterly dividend of 2%, payable Aug. 1 to stockholders of record July 21.

Electric Securities Co. has declared a dividend of 1¼% on preferred stock, payable Aug. 1 to stock of record July 22.

Electric Bond & Share Co. has declared a quarterly dividend on preferred stock of 1½%, payable Aug. 1 to stockholders of record July 16.

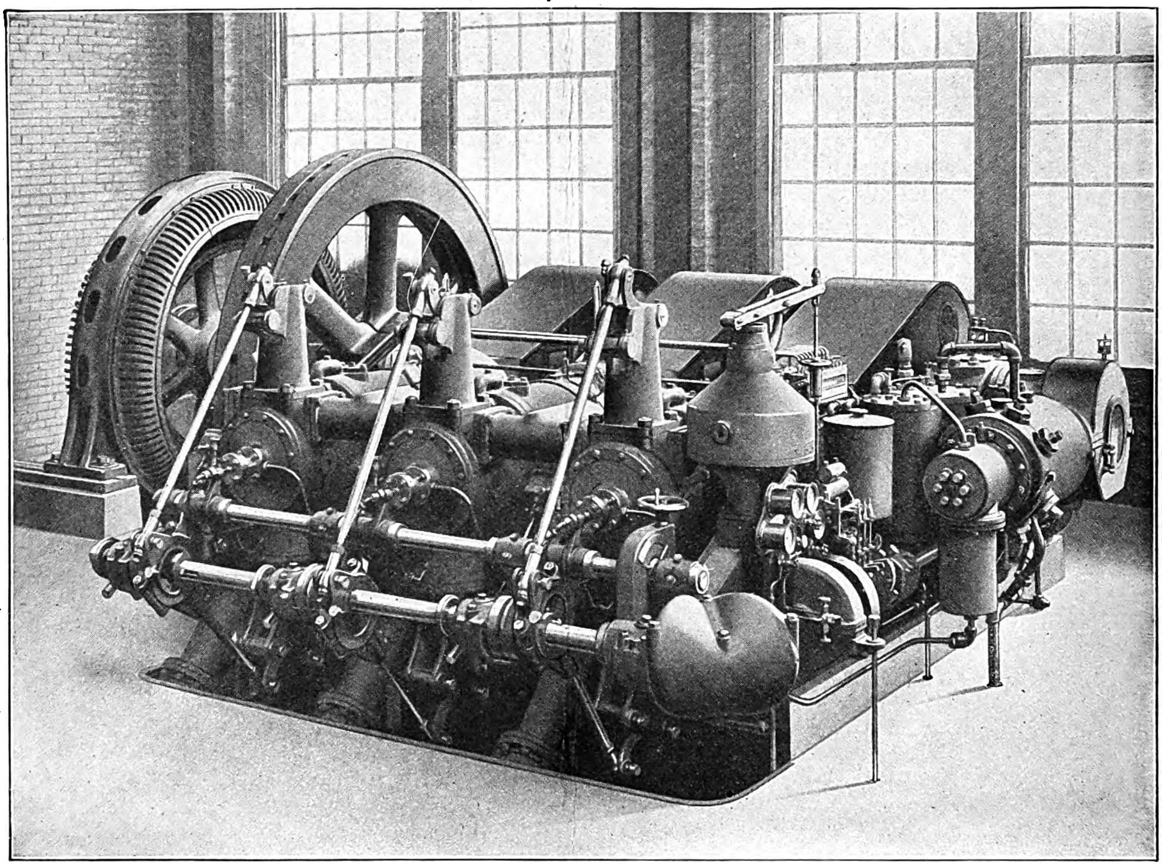
Illuminating & Power Securities Co. has declared a quarterly dividend of 1¾% on preferred stock, payable Aug. 15 to stock of record July 31.

Lowell Electric Light Co. has declared a quarterly dividend of 2½%, payable Aug. 1 to stock of record July 21.

Westinghouse Electric Export Co., 165 Broadway, has filed notice of an increase in its capital stock from $100,000 to $5,000,000, and a change in its corporate name to the Westinghouse International Co.

Electrical Review

Vol. 75. No. 5. CHICAGO, AUGUST 2, 1919 Three Dollars a Year



Triplex Diesel Type Oil Engine.

ALLIS-CHALMERS DIESEL TYPE OIL ENGINES ARE KNOWN FOR

SATISFACTORY OPERATION.

HIGH GRADE DESIGN AND WORKMANSHIP MAKE THEM

DEPENDABLE.

BOTH ENGINE AND GENERATOR BEING BUILT BY THE SAME

RESPONSIBLE MANUFACTURER

MAKES THESE RESULTS POSSIBLE.

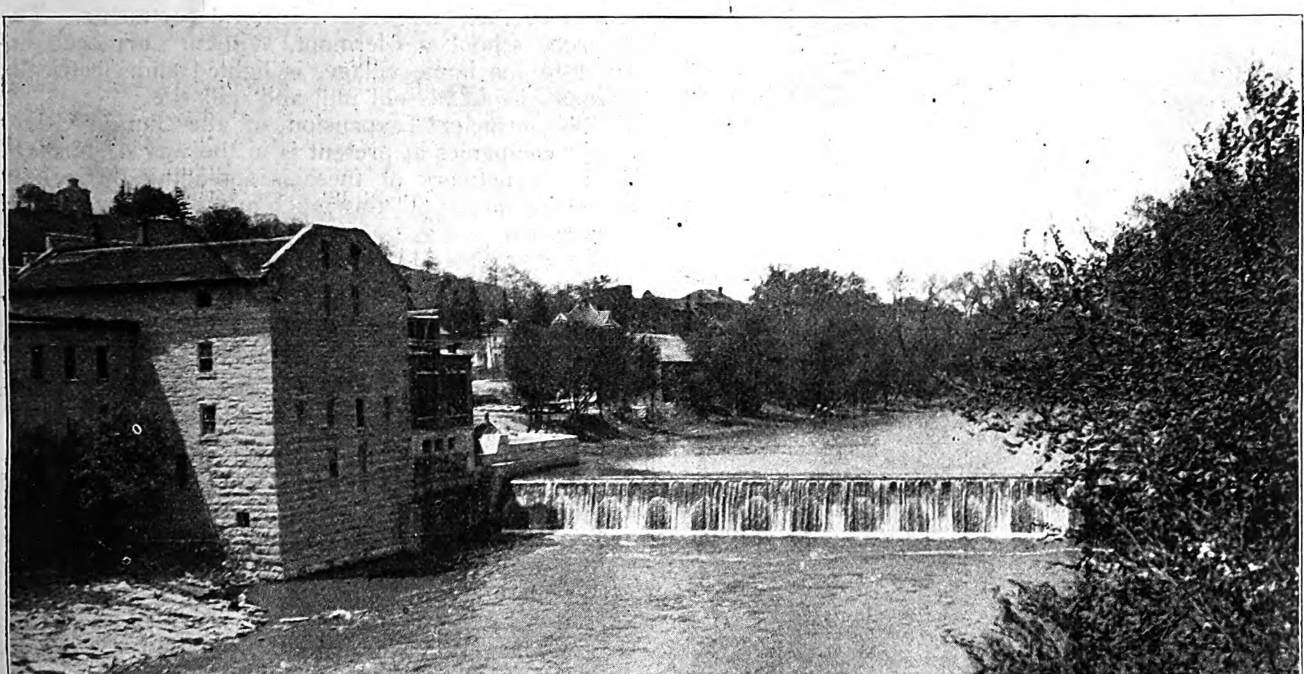
WRITE US—NOW.

ALLIS-CHALMERS

Milwaukee, Wis. U.S.A.

Electrical Review
WITH WHICH IS CONSOLIDATED WESTERN ELECTRICIAN AND ELECTROCRAFT.

VOL. 75—No. 5. CHICAGO, SATURDAY, AUGUST 2, 1919. PAGE 181.



First Mill Built North of Dubuque, Iowa—Now Housing the Electric Power Plant of Schmidt Brothers, Elkader, Iowa.

Utilizing Old Mills for Hydroelectric Power Plants

Famous Flour Mills in Northeastern Iowa Converted to Electric Service—Transmission Lines Supplying Extensive Farming Districts Are Fed from the Remodeled Mills—Features of the Modern Service

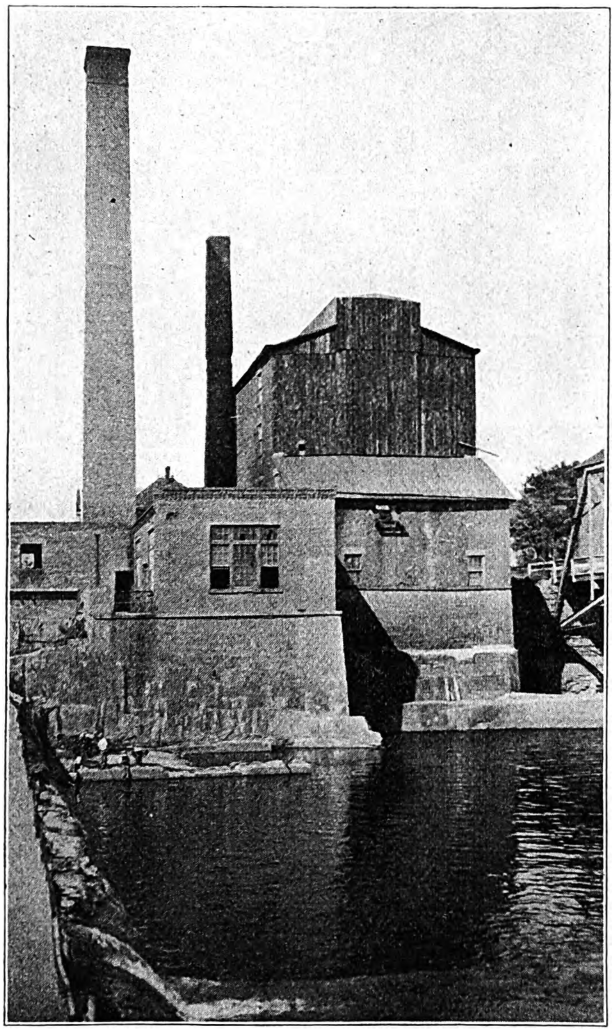
By F. L. CLARK

AN INTERESTING electrical development in Iowa is the utilization of old flour mills and mill sites in the northeastern part of the state as hydroelectric plants.

Most of Iowa is level or slightly rolling prairie, but the topography of the four most northeastern counties is quite different. The Switzerland of Iowa it is called. Many swift streams and rivers have cut deep channels in the bluffs and the gentle contour of the land breaks into rocks and crags, forested hills and fern-carpeted dells. In early days before the railroads had built west of the Mississippi, these swift streams played an important part in the settlement of northern Iowa and southern Minnesota. Wheat was the great crop of the pioneers but with no railroads they were without a market and the crop was worthless in the beginning. But the rocky-banked, swift running streams solved the situation. Mill sites were found everywhere and mills, big and little, sprang up all over the northeastern corner of the state. In just one of the four northeastern counties there were 58 at one time—saw mills and flour mills together. Most of these were small affairs serving only local uses and disappeared with the decline of wheat growing. A few of the larger ones continued doing business for a good many years.

Of this number the two largest and most famous were the mills built on the Turkey River by Messrs. Thompson, Sage and Davis at Elkader and Clermont. The Elkader mill was built 75 years ago and at the time was the largest mill west of the Mississippi in the Northwest. Some years later the Clermont mill was erected and was a great success. The proprietor of this mill, William Larrabee, later was twice governor of Iowa. Farmers came from as far as 150 miles to have their wheat ground at these mills.

Both mills were built out of rough rock dug from the hillsides of the Turkey River. They were well built to stand the test of time. After years of usefulness as flour mills, they have recently taken a new lease on life and entered upon a career of a new character. The old buildings, apparently good for a hundred years, are now housing electric power plants and on the site of the old log dams which used to hold the water to turn the big wooden water wheels of the mills, handsome structures of concrete and steel have been erected to generate electricity. The original purpose of helpfulness to the farmer is not lost, for electric light and power is supplied to many of the same farms which used to send wheat to the mills in former years.



Power Plant of C. C. Miller & Sons at Claremont, Iowa, Formerly Owned by Governor Larrabee.

The company at Clermont is composed of Chris Miller & Sons, who have recently incorporated with the name of the Northeastern Iowa Power Co. The Elkader power plant is owned by the Schmidt Brothers. The transmission lines of the two companies serve adjoining territory in northeastern Iowa. The Schmidt company supplies Guttenberg, Elkader, Garnavillo and a score of smaller towns and villages. The Northeastern Iowa Power Co. has over 200 miles of transmission lines and serves West Union, Fayette, Clermont, Elgin, Fort Atkinson, Lawler, Edgewood, Hawkeye and lesser towns in the same territory. In addition to their power plant at Clermont, the Millers now have a plant at Waucoma and have converted another old mill on the Volga River into a second subsidiary plant. The Schmidt Brothers have purchased a second power site on the Turkey River and expect soon to expand their system. The two power plants are supplying power to many creameries, cheese factories and small manufacturing concerns of various kinds, such as saw mill, planing mill, overall factory, excelsior mill, sash and door factory and ice plant. Several rural consolidated schools are provided with light and motor service and have electric stoves in their domestic science departments. The $100,000 school at Clermont, William Larrabee's bequest to the home village, is lighted and electrically equipped from his old mill and mill site.

The principal expansion of the Turkey River power companies at present is in the way of farmers' lines. A network of these is spreading throughout the region, accomplishing much in the improvement of country life.

MOVING FREIGHT TONNAGE ELECTRICALLY IN LARGE UNITS.

Pair of Pennsylvania Railroad's New 250-ton Electric Locomotives Can Haul 6300-ton Train Up Grade at 20 Miles an Hour.

The ability to increase track capacity for the rapid expedition of heavy freight trains is fast becoming a difficult problem, owing to the tremendous increase in train tonnages to be moved as a unit. In other words, the problem before many steam-railroad operators is how to increase the physical capacity of a certain heavy-tonnage division without prohibitive expense. At the same time, after such an expenditure in correcting alinement, grade reductions and other operating difficulties, there still remains the problem of operation, namely, hauling without delay the tonnage offered for transit.

With the introduction of the large type FF1, 250-ton electric locomotive of the Pennsylvania Railroad recently exhibited at the Master Mechanics' and Master Car Builders' convention held at Atlantic City, there dawns a new era in the possibility of moving heavy tonnage in large units over steep grades. Here is motive power equipment of tremendous capacity having a maximum accelerating power of 7600 hp., with a sustained capacity of 4800 hp. for one hour. With two of these big electric engines a 6300-ton train can easily be handled up long grades at constant speed as, for instance, on a 25-mile 1% grade, such a train could be moved at 20.6 miles per hour. Thus there exists equipment for hauling traffic in much larger units and with the rapid movement of such large quantities of freight the division can rapidly become cleared and made ready to handle considerable additional tonnage.

The Pennsylvania type FF1 locomotive was built within existing operating limits reaching the maximum starting draw-bar pull which average freight cars will permit; the maximum tractive effort consistent with the wheel arrangement used; the maximum weight on drivers; the maximum horsepower per unit weight and the maximum speed considered desirable with the contemplated operation.

This locomotive was designed under the general direction of J. T. Wallis, general superintendent of motive power, Pennsylvania Railroad, together with B. G. Lamme, chief engineer, Westinghouse Electric & Manufacturing Co.

Central-Station Rates in Theory and Practice

Fourth Article—Responsibility for Peak Load—Apportioning the Demand Cost Among the Customers—Theoretical Division of Demand Charges Based on Load Curves

By H. E. EISENMENGER

This is the fourth article of this series, which began in the issue of July 12, and will appear weekly practically throughout the present volume. A general outline of the entire series was published in the issue of July 5. In the first three articles the author first discussed costs in general, then the cost of electric service in particular, dividing the latter into three elements—energy, demand and consumer costs. The present article continues the consideration of demand costs and shows how they are apportioned among different classes of customers and among individual customers. This discussion will continue through several more articles. After a knowledge of costs has been obtained, the price of electric service (rates), which depends largely on the costs, will be taken up.

PART I—THE COST OF ELECTRIC SERVICE—Continued.

II—A. The Three Elements of Cost.

B. THE APPORTIONMENT OF THE DEMAND COST BETWEEN THE CUSTOMERS.

1. *The Peak Responsibility.*

SECTION 26. The most important object of the computation of the cost of service is the ultimate apportionment of that cost between the consumers, that is to say, the determination of the share of the cost which is caused either by an individual consumer or by a certain group of consumers, for instance by the power consumers. Unless we go into theoretical details of little practical importance, this apportionment is simple and easy in case of the energy cost, where it has to be made simply according to the number of kilowatt-hours, but it is less simple, theoretically as well as practically, in case of the demand cost.

Since the total demand cost is proportional to the central station's peak load, the demand of a group of consumers or of an individual consumer is apparently proportional to the share which is contributed by that group or individual to the peak load of the central station.

Now, the peak load of the central station is built up of the sum of the amounts of power required by the individual consumers at the central station's peak-load time, enhanced by the line and transformer losses and the power demand of the central station for its own operating purposes. If a consumer is using 100 kw. at the central station's peak-load time, the central station has to keep 100 kw. (plus a percentage enhancement for the above-named losses, etc.) of capacity ready for his use and for *his* use only, regardless of whether he is using these 100 kw. during the peak-load hours only or for 365 24-hour days a year[1]. If the total capacity of the central station and lines, etc., is, for instance, 10,000 kw., the demand cost of that consumer will be 1% of the total demand cost of the central station; if he uses 200 kw. at the central station's peak-load time, his demand cost will be 2%, and so forth; in short, it will be proportional to the capacity used by him at the central station's peak-load time.

[1]This statement will have to be revised and slightly modified in the following paragraphs (see also Insert VI), but for the purpose of a first introduction it is of sufficient accuracy.

The demand of a customer at the time of the central station's annual peak load is therefore a very important factor for the theory of the demand cost. It defines the measure in which the consumer is responsible for the building up of the central station's peak and it has therefore very properly been called the *"Peak Responsibility."* This very descriptive name will be used hereinafter for the consumer's demand at the central station's peak-load time. Thus, if the lower curve in Fig. 1 would represent the load curve of an individual consumer or the aggregate load curve of a certain group of consumers, and if the upper curve would be the total load curve of the

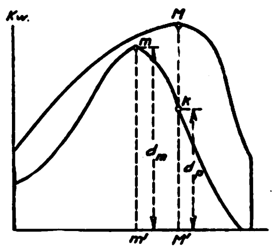


Fig. 1.

central station, $d_p = M'k$ would be the "Peak Responsibility" of that consumer or group of consumers.

2. *The Theoretically Exact Basis.*

27. If we give further thought to the problem of the demand cost, we will soon find that it is not the peak responsibility alone which has a bearing on the demand cost of a consumer. The following hypothetical example will explain the general idea.

Assume a 1000-kw. central station to have two consumers or classes of service only: *"A"* using 500 kw. from 5 to 6 o'clock every afternoon and nothing outside of that time, and *"B"* using 500 kw. for 24 hours every day. The peak load of the central station occurs then during the hour from 5 to 6 p. m., and the peak responsibility of each one of the two consumers is 500 kw. If we were to judge by the peak responsibility alone, the central station's demand charges would have to be equally divided between the two consumers. It is clear, however, that the central station could take on new consumers without increasing its total capacity and demand cost, if these new consumers never exceed an aggregate demand of 500 kw. and if all their demand occurs outside of the hour from 5 to 6 o'clock. They are then making use, so to speak, of the 500 kw. which are "charged" to *A*. (It should be remembered that we are dealing here with the cost and not with the price, so that the term "charge" is here not used in the meaning of "price-making" but only in the book-keeping sense of apportioning the cost.) The shape of consumer *B*'s load curve does not permit any other consumer to use the portion of the central station's peak load for which *B* is "charged," because, according to the assumption, *B* never releases that portion for the use of others. It seems logical, therefore, that *B* should be "charged" for a larger portion of the demand cost than *A*, although they both have the same peak responsibility.

We will always find corresponding conditions wherever there is a diversity between the consumers[2], in other words, where the load curve of the respective central station's load curve is more or less a sharp point, the peak responsibility of a consumer is of greater relative influence on his demand cost than if the central station's load curve has a well rounded-off top which extends over a comparatively long period.*

Insert VI—Appendix to Section 28.

Apportionment of the Demand Cost to the Individual Consumers, Considering the Shapes of the Load Curves (Diversity-Factor).

CONTAINING ELEMENTARY MATHEMATICS.

It is easily shown that the "Peak Responsibility"[1] is not the theoretically correct measure for the demand charge of a certain consumer.

Starting with the assumption of the simple case that the central station has only two consumers *A* and *B* with a plain rectangular load curve each, as per Fig. A, it might be believed at first sight that consumer *A* has to carry the demand charges alone, whereas *B* is using only a part of the central-station capacity which has to exist anyway in order to serve *A*. The possibility of serving *B* will therefore be only a by-product.[2]

That this way of reasoning is wrong can be easily seen if we assume that *B* is increasing his demand gradually up to 800, 900, 990 and 999 kw. As soon as he has gotten so far, the slightest increase of his maximum demand would throw the whole demand charges[3] onto his shoulders and *A* would just as suddenly be entirely relieved of demand charges, if the above way of reckoning were correct. If *B*,

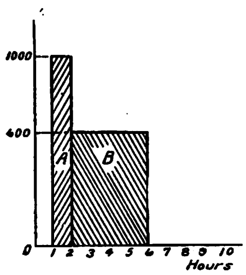


Fig. A.

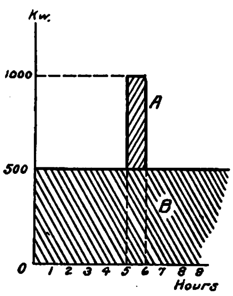


Fig. B.

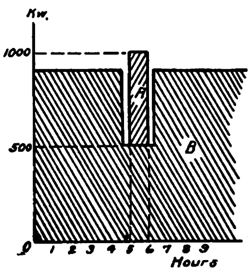


Fig. C.

consumer is not entirely similar in shape to the central station's load curve.

28. The solution of the problem to find the real value of the consumer's demand cost requires a rather complicated, though by no means difficult, mathematical analysis, which is given in Insert VI, together with the resulting full solution of the problem. A synopsis of the results of this mathematical analysis is contained near the close of Insert VI. Condensing these results still more and expressing them in non-mathematical terms with a corresponding loss of preciseness, we can say that a consumer's demand cost is not determined exclusively by his load at the central station's peak-load time but also by the amount of his load at such times when the central station has to carry a load which is nearly as large as the peak. The demand cost of a consumer is influenced by the amounts of his load *at every single moment of time,* but the influence decreases steadily according to a certain law as we proceed from the element of time at which the central station's load is a maximum (peak load) to such elements at which the central station's load is smaller. The influence of the consumer's momentary load at such moments of time when the central station's load is near its maximum is paramount, whereas at such times when the central station's load is not a large percentage of the peak load that influence becomes insignificant or practically imperceptible.

29. It follows from this that, if the peak of the

[2]For the explanation of the term "diversity" (diversity-factor) see Insert VI and later Sections 42 to 49.

then, should slightly reduce his demand by one or two kw. the whole conditions would be reversed again.

Evidently these unstable conditions are not only theoretically incorrect but also commercially unsound. The correct point of view can be obtained from the following reasoning:

Let us assume again that the central station has only two consumers *A* and *B*, each of which is using uniformly 500 kw., but, whereas *A* is using his demand only during one hour of the day, from 5 to 6 o'clock, *B* is using his load continually 24 hours a day (Fig. B). Evidently *A* should then be charged less for demand than *B* because such new customers as can be taken on without increasing the capacity of the central station will draw their demand

*The reader who, for one or the other reason, does not care to go into the mathematics of Insert VI may check this statement by considering the obvious facts in the following extreme example: If we assume the load curve of the central station to be a horizontal straight line (100% load-factor), then obviously we have the extreme case of the rounded-off peak and the demand cost of every consumer in that particular case is evidently proportional to his kilowatt-hour consumption because there is no particular moment discernible at which we could assume the peak responsibility to take place. The influence of the consumer's load at any particular moment is therefore in that case not larger than of that at any other moment.

[1]For the definition of this term see Section 26 of the main text.

[2]This would be as logical as if we would charge the first-coming passenger on a car with all the expenses of running that car and let the others ride free, arguing that the car has to run anyway in order to serve the first-coming passenger and the resulting possibility of carrying the later-coming passengers is only a by-product.

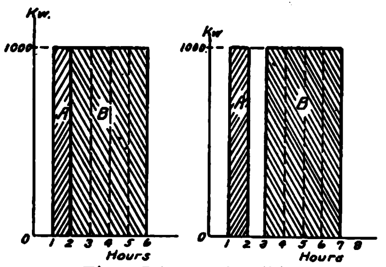
[3]Where the term "Charge" occurs in the text of this investigation it is always to be understood in the accounting sense of the word, that a consumer is considered to be the cause of a certain amount of demand cost but not in the sense that he ought to be made to pay that or any other amount. The cost, moreover, is the average cost and not the increment cost. Price-making is distinctly different from cost apportionment on account of the entering of the element of "Value-of-Service." (This will be taken up in Part II of this series of articles—"The Price of Electric Service.")

from that part of the central-station capacity which is being used by A, whereas B uses his part of the central station all for himself. If both the consumers, A and B, had the same load curve as B, the central station would not have the possibility of taking on any new consumers at any time without increasing its capacity. This principle becomes still more clear if we assume the load curve of the two consumers to be as represented in Fig. C. The "Peak Responsibilities" of A and B in this case still are 500 kw. each and yet it is evident that B should pay higher demand charges than A since by the shape of his load curve he is crowding out practically all possibility of taking on any new consumers with the given capacity of the central station. This possibility has been left open to a large extent by consumer A, but is utilized by B for his own purposes[4].

Finding the Proper Demand Charge Based on the Consumer's Load Curve.

The value of the proper demand charge which ought to be assessed to a customer as cost considering the shape of his load curve, will be found by the following line of reasoning.

Let us again assume two consumers only being on the lines, with a maximum demand of, say, 1000 kw. each, and the shape of the load curves of these two consumers be as indicated in Fig. D (a) or D (b). The total capacity of



Figs. D(a) and D(b).

the central station is then also 1000 kw., and the "Peak Responsibility" of each one of the consumers amounts to the same number of kilowatts. It does not need any elaborate proof that in this case 1/5 of the total charge will have to be charged to A and 4/5 to B[5].

The matter becomes a little more complicated if we assume two customers with the load curves as indicated above in Fig. A. There will be no doubt as to how the demand charges are to be distributed in this case, if we consider the central-station capacity as consisting of two parts, one of 600 kw. which is being used by both A and B, and another one of 400 kw. which is for the use of A only. A will then be charged for

$$(1/5 \times 600) + 400 = 520 \text{ kw.}$$

$$\text{and } B \text{ for } \quad 4/5 \times 600 = 480 \text{ kw.}$$

$$\text{Together} \quad 1000 \text{ kw.}$$

We see that the demand cost which is to be charged to a certain consumer may always be expressed by a certain number of kilowatts. This number of kilowatts will be called the *"equivalent demand."* If, for instance, we had two 24-hour consumers, one with 520 kw. continuous demand and the other with 480 kw. continuous demand, the demand cost would be distributed between the two consumers in the same way as in Fig. A and for that reason the term "equivalent demand" has been chosen. Obviously, the sum of all equivalent demands must be equal to the sum of the peak responsibilities or, in other words, to the central-station peak (disregarding in that latter case the transmission and distribution losses).

Some doubt might arise, however, as to whether the given load curve of B should be really drawn for that purpose as indicated in Fig. A, since there is an infinity of other ways in which a load curve might be drawn for the same load. Some typical examples of the different ways of drawing the load curve of customer B of Fig. A are shown in Figs. A(a) to A(g).* In the "Note"* at the end of this Insert it will be fully explained what effect these different methods of drawing the load curves would have on the distribution of the demand charges, and the proof is given there that the method as used Fig. A is the correct one. In other words, we arrive at the principle that all curves should be drawn in the customary way, that is starting all ordinates from the axis of the abscissae.

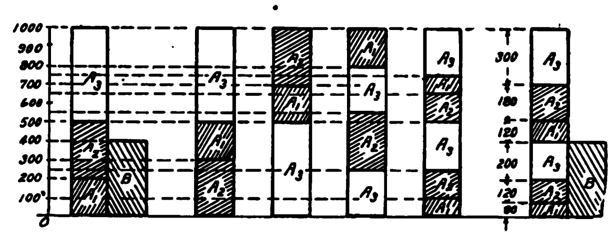
Let us assume as the next step that we have four consumers on the lines, and not more, all of which again shall have a plain rectangular load curve. Three of these consumers A_1, A_2 and A_3 have this in common that they are drawing their current all at the same hour, as shown in Fig. E. These consumers will, for convenience, be called "A-consumers" hereafter. The fourth consumer B is using his demand at some other hour for the same length of time. The amounts of the demand of each consumer in kilowatts can be seen from Fig. E. We can again subdivide the total capacity of the central station of 1000 kw. into two parts as has been done in Fig. A, one part-station of 400 kw. (lower part of Fig. E) being used by the A-consumers first and later by B, whereas the other part-station, of 600 kw. (top part of Fig. E), is used only by the A-consumers and then stands idle during the rest of the day.

The demand cost for the first part of the central station will have to be divided into equal parts, between B on the one hand and the A-consumers on the other hand. It is unknown so far in what proportion the three customers A have to divide their half of the charges for 400 kw. between them.

The second part of the central station has a capacity of 600 kw. and the demand charges for this have to be paid by the A-consumers to the exclusion of B. Here again it is unknown as yet in what relation A_1, A_2 and A_3 ought to divide up these expenses between themselves.

We can no longer, of course, resort to the expedient of just choosing the lower part of the load curve of the A-consumers as the part which is to be charged to the latter and to B in common (as has been done in Fig. A), since we can pile the load curves of the individual A-consumers upon each other in an infinite variety of ways, some of which are shown as examples in Figs. E (a) to E (d). Obviously, each of these methods would then have a different effect upon the distribution of the demand charges.

Evidently those A-consumers who are using that part of the central station which is also used at another hour by consumer B will find themselves at an advantage, so to speak, since they are charged only one-half of the amount



Figs. E, E(a), E(b), E(c), E(d), E(e).

per kilowatt as if they had to use that part of the central station which is used only by consumer A[6].

It appears logical, therefore, to allow each one of the A-consumers to partake of that favored 400-kw. portion in proportion to his own maximum demand. In other words, we divide the total capacity of 1000 kw. into two part-stations, one of 400 kw. which is used by the A-consumers and by B, and the other one of 600 kw. which is used by the A-consumers alone. We then allot a proportional share of each one of these two part-stations to each one of the A-

[4]Readers who have not given much attention to this problem may find it paradoxical that a consumer with a large load-factor (referring the load-factor to the peak responsibility instead of to the maximum demand, as usual) shall be charged with a higher demand cost per kilowatt than another consumer with a smaller load-factor. It has been our mental habit to consider the consumer with a high load-factor a "favorable" one who causes smaller cost than the low-load-factor consumer. We must, however, not confuse the "demand cost per kilowatt" with the "total cost per kilowatt-hour." Even under the theoretically correct principle, explained above, the total cost per kilowatt-hour will be considerably lower for the consumer with large load-factor than for the consumer who with a comparatively large peak responsibility consumes only a small number of kilowatt-hours.

[5]The reader should keep in mind that this Insert is dealing with the distribution of the cost and not with the apportionment of prices.

As regards price-making, the possibilities of using the same central-station capacity at different hours for different customers should be considered as co-ordinated by-products (see Section 4 of the first of these articles) and the price should be made according to the Value-of-Service principle (see later, Part II of this series of articles).

*To be printed in the next issue.

[6]It should be distinctly understood that this investigation deals with the computation of the demand cost which the consumer causes to the central station and not with the demand charges which the central station should make to the customer as a price. The cost, however, is an important, though not the only factor for determining the price (see Part II of this series: "The Price of Electric Service") and the consumer who causes a smaller cost is liable to be charged a smaller price on the average.

consumers. Thus, for instance, consumer A_1 who with his 200 kw. is using 20% of the total capacity of 1000 kw. shall get 20% (=80 kw.) of the 400-kw. station, and 20% (= 120 kw.) of the 600-kw. station. A_2 shall get 30% of each one of the two stations (120 and 180 kw., respectively) and A_3 50% (200 and 300 kw., respectively). This distribution is indicated in Fig. E (e). It is easy now to find out what the charges for each one of these four consumers ought to be, as follows:

A_1	80/2 + 120	= 160 kw.
A_2	120/2 + 180	= 240 kw.
A_3	200/2 + 300	= 400 kw.
B	400/2	= 200 kw.
		1000 kw.

Let it now be assumed as the next step that we have a larger number of consumers on the central station, as per Fig. F. During the first hour we have any number of consumers A_1, B_1, ... E_1, but all with rectangular load curves, using current during the whole hour; these load curves are piled on each other. During the second hour there are also a number of consumers, let us say three: A_2, B_2, C_2, with the same character of load curve as just explained. In the same manner we have a certain number of consumers in every following hour up to and including the n[th] hour (A_n, B_n). Let the small letters a_1, b_1, a_2, b_2.... indicate the number of kw-hr. (or maximum demand, or average demand, which in this case is the same) of every respective customer. Let it be further assumed that h_1, h_2, h_3 be the aggregate number of kilowatts used during each one of these periods as indicated in Fig. F. Let it be further

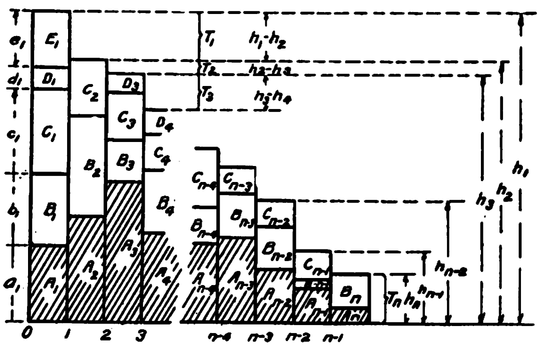


Fig. F.

assumed that the groups of consumers as indicated by corresponding indices are arranged in the order of their aggregate size so that $h_1 > h_2 > h_3 > h_4 >$ ....

What will then be the equivalent number of kilowatts, K_{a1}, for which customer A_1 will have to be charged?

The total capacity of the central station necessary for all customers mentioned will be h_1. Let the central station of this size be subdivided again into n small part-stations T_1, T_2 ......T_n of the respective sizes $(h_1—h_2)$, $(h_2—h_3)$, ... $(h_{n-1}—h_n)$, h_n (see Fig. F).

The first-named central station T_1, which has the capacity of $h_1—h_2$ kw. and is represented as the uppermost part in Fig. F, is being used not longer than during one hour, as can be seen from Fig. F. The second station T_2, of the size $h_2—h_3$ is being used during two hours. The n[th] central station or part central station of the capacity of h_n kw., which occupies the lowest part of the diagram Fig. F, is being used during all the n hours. According to what has been said above, we will have to apportion a certain part of the demand of A_1 to the first-named central station T_1, another part of A_1 to the second T_2 and so on, a certain part to each one of those past central stations. The size of the part of A_1 apportioned to the top central station T_1 will be $a_1 \times \frac{h_1 - h_2}{h_1}$. The part allotted to the second central station T_2 will be $a_1 \times \frac{h_2 - h_3}{h_1}$, and the part belonging to the last central station T_n will be $\frac{h_n}{h_1}$. The demand cost for the part apportioned to the first central station will have to be charged to A_1 alone. Of the demand cost of the central station T_2, only one-half will have to be charged to customer A_1, whereas the other half is charged to such other customers as are using central station T_2 during the second hour. In the same manner we will continue and finally find that the charges for that part of a_1 which is allotted to the n[th] or bottom central station are divided into n parts of which only one is to be paid by customer A_1.

The total charges of A_1 expressed in equivalent kilowatts (that is, the "equivalent demand" in kilowatts) are therefore

$$K_{a1} = \frac{a_1}{h_1}\left[\frac{h_1 - h_2}{1} + \frac{h_2 - h_3}{2} + \frac{h_3 - h_4}{3} + \frac{h_m - h_{m+1}}{m} + \ldots \frac{h_{n-1} - h_n}{n-1} + \frac{h_n}{n}\right]$$

In the same manner the equivalent maximum demand for A_2 will be found as

$$K_{a2} = \frac{a_2}{h_2}\left[\frac{h_2 - h_3}{2} + \frac{h_3 - h_4}{3} + \ldots \frac{h_m - h_{m+1}}{m} + \ldots \frac{h_{n-1} - h_n}{n-1} + \frac{h_n}{n}\right]$$

or, in general, of the customer A_m

$$K_{am} = \frac{a_m}{h_m}\left[\frac{h_m - h_{m+1}}{m} + \ldots \frac{h_{n-1} - h_n}{n-1} + \frac{h_n}{n}\right]$$

Let now all the consumers characterized by the letter A (that is A_1, A_2, ... A_n) be combined into one new consumer A, whose load curve is represented by the shaded part of Fig. F. Then evidently the demand charge of this consumer A is the sum of the demand charges of A_1, A_2, ... A_n, and the equivalent maximum demand of A is the sum of $K_{a1} + K_{a2} + \ldots + K_{an}$.

If we call the quotients $\frac{a_1}{h_1}$, $\frac{a_2}{h_2}$, ... $\frac{a_n}{h_n}$ for the sake of brevity q_1, q_2, ...q_n, then we get by carrying out the addition of $K_{a1} + K_{a2} + \ldots + K_{an}$:

$$K_a = (h_1 - h_2)q_1 + (h_2 - h_3)\frac{q_1 + q_2}{2} + \ldots + (h_m - h_{m+1})\frac{q_1 + q_2 + \ldots q_m}{m} + \ldots + (h_{n-1} - h_n)\frac{q_1 + q_2 + \ldots + q_{n-1}}{n-1} + h_n\frac{q_1 + q_2 + \ldots q_n}{n} \ldots (1)$$

In order to get a method of geometrical construction for this formula we proceed as follows: q is an abstract number and in order to represent it geometrically we have to select a certain length as unity. For reasons which will become obvious later it is most convenient to select the capacity of the central station h_1 as unity. The construction of the value $q_m = a_m/h_m$ is then a simple elementary procedure.

Those parts of Fig. F which are essential for the following have been repeated in Fig. G, that is, the total load curve (staggered curve h) and the load curve of customer A (staggered curve a). The amounts for q are entered into Fig. G as dash and dot lines. Evidently for the first interval of time $o1$, q and a are identical on account of the choice of the unity.

The term $(q_1 + q_2 + \ldots + q_m) / m$ obviously represents the arithmetical mean of the ordinates q between the abscissa O and the abscissa of the end of the m[th] interval of time. This term will, for the sake of brevity, be called f_m hereafter. Thus, for instance, f_3 in the third interval of time is found as the arithmetical mean of q_1, q_2 and q_3 or $(q_1 + q_2 + q_3) / 3$. The curve of f is also entered in Fig. G.

Introducing the term $f_m = (q_1 + q_2 + \ldots q_m) / m$ into equation (1) we have

$$K_a = (h_1 - h_2)\, f_1 + (h_2 - h_3)\, f_2 + \ldots\ldots (h_m - h_{m+1})\, f_m + \ldots (h_{n-1} - h_n)\, f_{n-1} + h_n f_n \qquad (1^*)$$

If we step off now (Fig. G) the length $f_1 = OF_1$ horizontally to the left from the point H_1 (situated on the axis of ordinates) as $H_1\, g_1$ the rectangle $H_1\, g_1\, G_1\, H_2$ will by its area represent the first term $(h_1 — h_2)\, f_1$ of equation (1*).

In the same manner, if $H_2\, g_2$ is made equal to f_2 of the second interval 1-2 of time, the rectangle $H_2\, g_2\, G_2\, H_3$ represents by this area the second term $(h_2 — h_3)\, f_2$ of equation (1*).

By stepping off the lengths f_1, f_2, f_3 ......f_n horizontally in the manner indicated, we get the shaded surface in Fig. G, the area of which is a measure of K_a according to equation (1*). The length OH_1 has been assumed as unity. If, therefore, the shaded area in Fig. G is transformed into a rectangle over the base OH_1, the height of this rectangle will be equal to the equivalent demand K_a of customer A. The kilowatt scale will be the same as that of the load curves.

The intervals of time 0-1, 1-2, 2-3,......(n — 1)-n, in Figs. F and G have been assumed so far for the sake of convenience to be of one hour's duration. Evidently, however, the absolute lengths of these intervals have nothing to do with the above reasoning as long as the intervals are equal among each other. We can, therefore, without influencing the result, reduce the lengths of these intervals more and more, at the same time increasing their number, until we get down to differentials. This will change the staggered curves of Fig. F and G into smooth continuous curves (Fig. H†).

Nor has the order in which the intervals of time follow upon each other any influence on the amount of the equiva-

†See continuation in next week's issue.

lent demand. So far it has been assumed that the load curve of the central station is of such nature that it starts with the peak load and that the load curve of the central station is steadily falling from the left to the right. This, however, is an assumption which in practice will hardly ever be fulfilled. The load curves go up and down in an irregular manner and have one or more peaks and valleys (maxima and minima).

We might now just as well have had the time intervals of Fig. F arranged in any other order than what Fig. F shows without causing any change thereby in the amount of the equivalent demand, as long as the demands themselves are not changed. For instance, the time intervals might be arranged so that the staggered duct of lines first rises and then, after reaching a maximum h_1, falls again or they might be arranged to form several peaks and valleys in the central-station duct of lines. The resulting equivalent demand will not be changed by this, because it is not essential that, for instance, the interval with the central-station load h_2 is to the right of the interval with load h_1 (Fig. F) nor that it immediately adjoins it. We can follow exactly the same line of reasoning and come to the same conclusions if this is not so. But it is more convenient to have the intervals arranged in the order of the magnitude of their respective central-station load, especially where the load curve is no longer a duct of horizontal straight lines but a steadily curved line, in other words, where we have an infinitely large number of infinitesimally small time intervals.

The first problem to be solved in a practical case is, therefore, the transformation of the load curve of the central station into another curve by a transposition of the time elements so that the latter are arranged in the order of the corresponding central-station loads, beginning with the highest load (peak load) at the extreme left and ending with the lowest. Designating the original central-station load curve as curve B (Fig. I†), we will by this rearrangement transform the B curve into a curve corresponding to the duct of lines with the ordinates h_1, h_2, ... (Fig. F). The

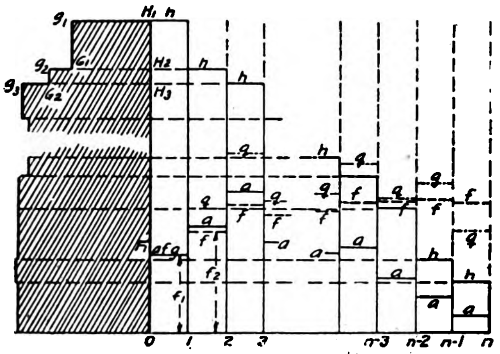


Fig. G.

resulting curve will for that reason be designated as the h-curve. It will steadily fall from the left to the right, or at least rise nowhere to the right.

This transformation of curve B will also result in a transformation of curve b, that is, of the load curve of the individual consumer whose equivalent demand we wish to determine. Every moment of time—to whichever position it has been shifted—must always remain connected, not only with the same central-station load which it had originally as per curve B, but also with the same load of the individual customer as given by curve b.

The customer's load curve thus changes into another curve to be called curve "a" hereafter because it corresponds to the shaded part of Fig. F, that is, to the aggregate of the load curves of all consumers A.

From "h" and "a" the curves "q," "f" and "g" will be found successively, the meanings of which have been explained before. Finally, by transforming the area under curve "g" into a rectangle the equivalent demand of the customer with the load curve "b" is obtained as the height (or rather width) of that rectangle in the horizontal direction.

These operations, although not very simple, still are not as intricate as it may appear at first sight and they are made in less time than it takes to describe them. The construction of the various curves will be described in the continuation of Insert VI in the next issue.

†To appear in the next issue.

(To be continued.)

REPORT ON GOVERNMENT WIRELESS TELEGRAPH STATIONS.

Extracts from Census Bureau's Report on Telegraph Systems of the United States in 1917.

The United States Bureau of Census has issued a report on the telegraph systems of the country during the year 1917 and the five-year period 1912-1917. Extracts from that report were published in our last issue. The following data, also from this report, deal with the Government's radio stations.

The Government has erected wireless plants at various points along the Atlantic and Pacific coasts and at Pearl Harbor, Hawaii, and Cavite, in the Philippines. The Government shore stations, according to the reports of the Bureau of Navigation numbered 135 on June 30, 1918, of which 88 were in continental United States, 20 in Alaska, 19 in the Philippine Islands, 3 in the Canal Zone, 2 in Hawaii, and 1 each in Porto Rico, Guam, and Samoa. The Government ship stations totaled 470.

The station at Arlington, Va., has been in regular communication with the station at Chollas Heights, near San Diego, Cal., since May 1, 1917. Direct communication with an Italian Government station in Rome was also established. On Sept. 29, 1917, radio communication was established between Arlington and Pearl Harbor, Hawaii, via Sayville, N. Y. Messages are now transmitted between Arlington and the Philippines through San Diego, Cal., and Pearl Harbor, Hawaii. Under favorable conditions, at night, the Arlington station can communicate directly with the Pearl Harbor station, but the usual practice is to relay through San Diego.

IMPORTANCE OF CO-ORDINATING POWER SUPPLY RECOGNIZED IN ENGLAND.

One of the matters given much attention at the recent convention of the Incorporated Municipal Electrical Association of Great Britain was the proposed interconnection and rehabilitation of that country's power supply systems, which was referred to at length by President Frank Ayton.

In Mr. Ayton's opinion, the need for the reorganization and the co-ordination of electric supply had been abundantly proved. The electric supply industry was now, as it were, part and parcel of the manufacturing organization of the country; its future and its prosperity were indissolvably linked up with that of the nation's industries. Electric power, cheap and abundant, was clearly one of the main necessities for export trade.

PENNSYLVANIA ASSOCIATION PLANNING IMPORTANT CONVENTION.

The annual convention of the Pennsylvania Electric Association, which is a geographic section of the National Electric Light Association, will be held at the Bedford Springs Hotel, Bedford Springs, Pa., on Sept. 3 to 6, inclusive. Although no definite features of the technical program can as yet be announced, it may be safely stated that the convention will be along the lines of those that were so successfully conducted and so largely attended before our entry into the war. An exhibit by manufacturers of electrical equipment is to be held as an important feature of the meeting. H. M. Stine, 211 Locust street, Harrisburg, Pa., is secretary of the association.

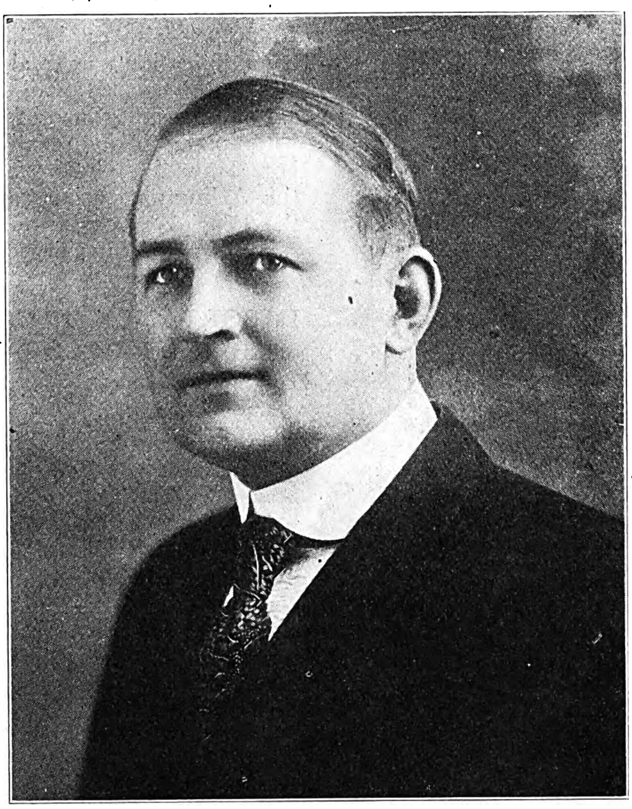
Complete Electrical Equipment for the Home

Paper Read Before National Association of Electrical Contractors and Dealers Describing Plan to Popularize Use of Convenience Outlets

By JOHN G. LEARNED

Chairman, Commercial Section, National Electric Light Association.

THERE exists a community of interest among electrical manufacturers, jobbers, dealers, contractors and central stations in the fostering of the complete electrical equipment of the home. Therefore, the plan of the National Electric Light Association, Commercial Section, to bring about a nationwide educational campaign for the purpose of creating a greater demand for complete installations of wiring and appliances in the home should meet with favorable consideration.



John G. Learned.

Assistant to the Vice-President, Public Service Company of Northern Illinois.

Although the electrical industry has made most remarkable strides in the last 25 years we have been woefully deficient in focusing our efforts on educating the public to the unit idea of electrical equipment in the home. Electric lighting installations are fairly well handled, although there is vast room for improvement, whereas the necessity of an adequate number of outlets for the use of portable and electrical appliances has been sadly neglected by comparison. The future permanent success of the "Residence Service" of our business depends largely on our ability to so thoroughly educate the public that the layman and laywoman will be as conversant with the complete unit electrical equipment of the home as they are now with the electric starter, the electric headlight, the electric horn and the other refinements of the automobile. There never was a more opportune time than now, especially on account of the present shortage of household help.

The Commercial Section of the N. E. L. A. plans to get the manufacturers of electrical heating appliances, washing machines, vacuum cleaners, portable lamps, fans, vibrators, hair dryers, sewing machines, etc., accessories and other appurtenances used in the home, to include in their national advertising an illustration of the baseboard or wainscoting receptacle. The idea being to show the particular appliance advertised and the cord connecting it to a receptacle, which can be done without any additional expense. Those manufacturers who have had this matter brought to their attention are very enthusiastic and have already taken steps to co-operate.

Central-station companies are having this matter brought to their attention and are being urged to feature appliance outlets along the same lines in local newspaper advertising, on billboards, customer's bills, and salesroom advertising. Department stores will be urged to follow suit. Jobbers, dealers and contractors should also get behind this campaign, which is not for a week or a month, but continually. The results will be accumulative.

Another method of bringing the message home is to make up window displays of appliances with their cords connected to receptacles mounted on sections of baseboard or wainscoting.

Coffee dealers, packers and other manufacturers will be asked to use electrical appliance illustrations showing the cord attached to a receptacle in their national advertising, instead of the alcohol appliance now used. Special attractive advertising in pamphlet form on this subject—receptacles—will be prepared for distribution to architects by the central stations.

Below is quoted the advertising manager for a well-known electrical manufacturer who is particularly enthusiastic on the subject:

One way to increase the interest and therefore the installation of more adequate provisions for use of electrical appliances in the home is to form a small committee to outline a complete campaign to cover a given period of months. Some of the things to be done are as follows:

1.—Prepare cuts of several sizes and kinds to be furnished to all manufacturers of electrical goods and to have these cuts used similarly to the Liberty Bond and War Savings Stamp cuts in advertisements over the period selected. These cuts will therefore act as constant reminders to all of us in the electrical industry and those cuts used in the national media by the various manufacturers who advertise in such publications will help to bring home this campaign to the public in general. These cuts can also be used in the various folders, literature and on letter-heads, during this same period regardless of what the folders or other literature describe.

2.—Special Folders and Other Printed Matter.—Folders and other small pieces of printed matter to be prepared especially on this subject of the advantages of more adequate equipment for the use of electrical appliances, and this material used as envelope stuffers by lighting companies, manufacturers and their district offices, engineers, electrical jobbers and electrical contractors and dealers. A good portion of these stuffers would therefore reach the hands of the public also.

3.—Small Stickers for Letterheads.—A series of these could be prepared, covering the subject which could be used over a period specified in the campaign by the same groups mentioned above. Many of these, in this way, would come to the eyes of those interested in building.

4.—Manufacturers making such devices which would be used in installing adequate equipment in the home would be urged to extend their advertising and concentrate on devices such as receptacles, etc., during the period decided upon for this campaign. These same manufacturers will furnish to the dealers, contractors and lighting companies small electros and other suggestions, advertisements and folders, which could be used for local and newspaper advertising by these concerns.

Recent Advertisement showing how other industries apply electrical idea to their advertising. In accordance with the new plan such advertisements will show the washing machine connected to a convenience outlet.

5.—Little stories, articles, and illustrations could be prepared for the various electrical journals as well as some specially prepared for the general publications and particularly for *Good Housekeeping, The Woman's Home Companion, The Ladies Home Journal, House and Garden, Woman's Magazine, Today's Housewife, Delineator,* etc.

Undoubtedly the persons preparing these articles for such magazines will co-operate and have the need for adequate outlet equipment emphasized in these articles and, possibly, have at least one article devoted just to that one subject alone.

6.—Electric lighting companies during this period could also be instructed to attach slips to the electric lighting bills, such slips to carry a message concerning the convenience of more adequate wiring of the home.

7.—At the same time, the architects and electrical contractors figuring on wiring jobs should be urged to bring the matter of convenient outlets to the builders' attention, since a good many people still are not familiar enough with electrical work to appreciate the wonderful convenience of having many outlets, as for instance, in the baseboard and do not realize that the addition to these outlets does not mean very much greater cost when figured over a period of say five to ten years.

8.—Short Movie Films and Slides.—There are a number of companies prepared to make up movie films which are produced in such a satisfactory manner that the moving picture houses throughout the country are glad to make use of them in connection with their usual programs. In such films, a very forceful appeal can be made and the convenience of many outlets can be played up in a pleasant though distinct manner and the disadvantage of a poorly equipped home emphasized. The mind of the theatre goer is in a particularly receptive state when looking at the screen and such films in connection with other slides advertising the installation of various receptacles by local contractors and lighting companies will tie up very strongly with the other promotion work.

9.—The subject matter for advertisements might play up the saving in wear on electrical fixtures; the great convenience of electrical appliances made still greater by the provision of adequate outlets or attaching places for the ready connection of electrical appliances in various rooms, to electrical circuits. Safety could be emphasized also.

10.—Various little stickers for use on letter-heads might have subjects similar to the following:

When Wiring Your Home Have Outlets Arranged for Your Electrical Appliances.

Double Electrical Conveniences—Have Extra Outlets for Electrical Appliances.

Save the Wear on Electric Fixtures—Connect Your Electrical Appliances to Baseboard Outlets.

Have Extra Outlets in Your Laundry as Well as in Your Living Rooms for Your Electrical Appliances.

Electricity Is Your Servant—Have Outlets Installed for Your Electrical Appliances.

In Wiring Old Houses Install Well-located Electrical Outlets Generously.

Provide Complete Electrical Installations in New Houses—Especially Outlets for Appliances and Lamps.

Numerous Faucets Are Provided in the Home for the Convenient Use of Water. Why Not More Outlets for the Use of Electrical Appliances and Lamps?

More Outlets for More Business.
More Electrical Outlets—More Satisfied Customers.
Extend Electric Service by Installing More Outlets.
Don't Rob Peter to Pay Paul.
Install more outlets for the simultaneous use of Electrical Appliances as well as Electric Lighting.
The Modern Home Uses Electric Service.
Extra outlets in each room for the convenient use of Electric Appliances
Solve the servant problem.
For Quick Convenient Use of the Electric Heating Pad Provide an Extra Outlet in Your Bed-room.
In Nearly Every House Now-a-days Some Provision is Made for the Use of Electricity, but Very Often too Few Outlets Are Installed for the Convenient Use of Electrical Appliances and Portable Lamps.
To Rectify Such Omission After the House Is Built Is Expensive.
MORAL: Make your Electrical installations complete at first. Install extra outlets in every room.
Electricity Will Increase the Value of Your Property Many Times Over the Small Cost of the Investment. Be Sure Your Installation Is Complete. Install One or More Extra Outlets in Every Room for the Use of Electrical Appliances and Portable Lamps.

These ideas are formed only in part but they can serve as a starting point and could be developed into a more complete form and augmented after a little conference on the subject. With any kind of work it is easier to have some actual start than to just talk the matter over.

In addition the following are some ideas intended to suggest slogans and text matter which might be further developed for use in support of a campaign for more electrical outlets.

Let out Pent-up Electric Service by Installing More Outlets.
Electrical Outlets Increase House Values
Provide one or more extra outlets in the floor, baseboard or wall in every room for the convenient use of Electrical Appliances and Portable Lamps.
Modernize Your Home with extra outlets for the use of Electrical Appliances.
Take Full Advantage of Electric Service Install extra outlets in every room for the use of Time and Labor-Saving Devices—Electrical Appliances.
Extra Outlets for Electric Portable Lamps —for Utility and Beauty.
Extra Outlets Promote Sale and Use of Electrical Appliances and Lamps.
Insufficiency of Outlets Restricts Use of Electric Service
Increase sales of Electrical Appliances and Lamps. Install one or more outlets in every room of every home.
Mr. Business Man—You use several telephones in your office for good business reasons; also for convenience. How about your Home? Extra Outlets in each room permits the convenient use of time and labor-saving devices—Electrical Appliances
Give a thought to the wife. Install more electrical outlets.
For Comfort, Convenience and Economy Install Extra Outlets for Electrical Appliances and Portable Lamps.
Do a Good Job While You Are About It.
Don't Skimp on Electrical Outlets.
An Extra Outlet or Two Installed on the Porch Will Be Found Useful for Attaching the Electric Fan or Portable Lamp.
Install Outlets in the Halls for Use of the Electric Vacuum Cleaner.
The Completely Electrified Home Will Remain Modern for Years to Come. Install Plenty of Outlets.

In conclusion, what has been stated only skeletonizes some of the ways of doing that which we have in mind. It remains for the contractor-dealer to get behind this movement, as it is self evident that although the central stations are the principal beneficiaries, it is to the mutual advantage of every one engaged in the industry. It follows as a matter of course that if this work is taken up in a big way as outlined that the public will be educated to the necessary degree, with the result that a big demand will be created for wiring, receptacles and appliances.

And, as a result, the contractor will do more wiring, the dealers will sell more appliances, the jobber will do more business, the manufacturers will turn out a larger volume of products, the central station will enjoy more revenue, and last, but not least, the consumer will enjoy complete "Residence Service."

JAPANESE COMPETITION IN ELECTRIC CABLES DECLARED TO BE FAIR.

A Japanese Electrical Engineer Connected with General Electric Co. Denies Statements of Our British Correspondent.

To the Editor:

In the June 28, 1919, issue of the ELECTRICAL REVIEW there was made public an article entitled "Japanese Competition in Electric Cables," which aroused my keen interest or rather regret because of the misleading information quoted in it.

It is true that little inroads were made by Japanese cable manufacturing concerns during the past two or three years into the British trade connection with India and the British colonies, but it is utterly false that Japanese workpeople receive 12 cents per day of 12 working hours or 1 cent per hour. No page of Japan's labor history gives any record of such a cheap payment. The average wage at present is, roughly, $1 per day of 9 working hours.

That article further says that the Japanese copied the British labels as well as the British cables. Although I am not connected with any Japanese cable manufacturer economically, this remark could never be passed lightly over because it is an insult to our national fame. Electric cables exported to British oriental colonies were solely manufactured by the Yokohama Electric Wire Works, which is located in Yokohama, Japan, and that company has never used an inspection "C. M. A.," the mark of the British Cable Makers' Association, with the little word "not" which might easily be overlooked, as described in your magazine.

Schenectady, N. Y., July 15, 1919.

F. OHASHI.

GOVERNMENT OF CHILE APPOINTS HYDROELECTRIC COMMISSION.

According to recent press notices the Government of Chile has created a commission to study the hydroelectric possibilities of that country with a view to developing its natural water-power resources for this purpose. It is the intention to construct a series of hydroelectric power stations which will be tied together through an extensive longtiudinal system. In this way the electric power derived from the waterfalls will be made available over a long stretch of territory.

This country is particularly well adapted to such development for many of its vast water-power resources are but a short distance from its larger cities and industries and there is also a considerable demand for power for mining purposes. In addition, coal and other forms of fuel are comparatively scarce and expensive.

A Perspective Glance at the Future of American Business

Calm Survey of Conditions in Europe and the United States—Unfortunate Letting Down of Production Here —Need Is to Increase Effort Rather than the Reverse

By CHARLES G. DU BOIS

President, Western Electric Co., Inc.

EVIDENCES are plentiful that a considerable portion of the American public does not recognize the opportunities and responsibilities before it in the industrial and commercial field. Leaders in American business feel that the country must be aroused on this matter. One of the clearest statements on this topic yet presented is the one by Mr. Du Bois published herewith. The points he makes should be carefully and thoughtfully considered by not only electrical men, but by those in other industries, and by labor as well as by capital.

THE Great War is ended and the day of reckoning has come. The victorious allies rightfully hold the criminal German rulers to account for their crimes and the German nation to make reparation up to the limit of its ability. But even while we continue to rejoice in this victory, we should be seeking to see as clearly as we can, and in its true perspective, the economic situation that is immediately before us. It is not a problem to be worked out only by a few statesmen, assisted by experts. We all need to understand it because we shall all have a part in it and its solution is fraught with incalculable importance to ourselves and the generations that are to follow us.

At the risk of attempting too much, let us consider in their relations to each other the main features of the present economic and social situation as they bear on our own material prosperity.

By reason of the much longer and greater strain on the European nations during the war, they are in a far more disorganized condition now than America and they are thus unable to proceed as rapidly with the conversion of war activities into normal peace activities. Europe needs our products and, until its own industries are completely re-established, we must take our pay, not in money or goods, but in securities—that is, promises to pay at some future date. From a purely selfish standpoint, America as a creditor nation wants other nations to prosper so they can buy our goods, can pay the interest on their debts to us, and can eventually liquidate the principal.

And as to our domestic situation, we have to remember that our war activities created employment for everyone, and to that extent made for generally prosperous conditions. It remains to be seen to what extent such prosperity was merely temporary. Even while it lasted, some of it was more apparent than real. Wages increased as the cost of living went up and the cost of living in turn increased as the wages that constitute most of the cost of every article went up. This process, as everyone knows, can create no prosperity for us as a whole, for though it has affected many individuals favorably, many others have been compelled to seriously curtail.

During the war there undoubtedly was a greater prosperity than normal, but it had another cause. This was that everybody worked and everybody, whether voluntarily or by compulsion, saved. Since we worked harder, we produced more than ever before, while at the same time we consumed less and wasted much less. This greater net production aided considerably toward paying our war cost but still it left an enormous amount—judged by pre-war standards—to be paid in the future.

We are only now really facing this future. The great joy and relief we all felt when the armistice was signed last November and we knew that at last all fear of German world domination was over, has been followed in the succeeding months, as was only natural, by a letting down of effort which, though it may be small in each individual, has been and is, in the aggregate, stupendous.

That part of the war production which was at the cost of undue strain and fatigue is, of course, no longer necessary or justifiable, but, making full allowance for this, the present let down of effort from the war standard represents a serious loss in production.

Moreover, this material loss is accompanied by a mental unrest that threatens even more serious consequences. The relief from the emotional strain of war affects us all. Some realize soberly the difficulties that must be surmounted and appreciate that the only practical course of action is to work steadily ahead under the existing conditions. Others, who are less practical or whose minds have been inflamed by visionary ideas or strained perhaps by personal misfortune, think they see the dawn of a millennium and demand swift and radical economic changes in the unreasoning hope that somehow a great betterment will result.

The desperate conditions in eastern Europe have produced the most violent reactions. Where society has become so disorganized that the ordinary methods of production, distribution and trade have broken down, idleness results from the disorganization, and hunger inevitably follows idleness. To starving men, anything seems better than starvation, so bolshevism, which promises everything and by criminality gets something for a while, seizes its opportunity.

All this is like jumping off the precipice because the road is rough. Civilization itself depends on the maintenance of law and order. Without them the world would quickly fall into chaos, so that governments only fulfill their primary function by dealing swiftly and sternly with all attempts to overthrow by force this fundamental principle. This must be so, whatever sympathy may be felt for those whose misfortunes or weak judgment have made them the dupes or tools of criminal fanatics.

The conditions in America are so much better than in any of the war-stricken countries, are indeed so prosperous, that we need not really fear any large movement here toward any form of anarchy. But the great safeguard against it is to preserve our present prosperity till the strain in Europe has passed.

It is idle to suppose that material prosperity can be maintained except by continuous production; in fact, the extent by which we can intelligently increase production measures the increasing volume of prosperity.

The modern organization of industry by which goods are designed, produced, sold and transported has undoubtedly been the foundation of a material prosperity, such as was never before conceived. It has its imperfections, as have all human affairs, but it has, in a democracy at least, the means of self-correction, it has greatly stimulated invention and scientific research, and above all, it does operate the machinery of production and distribution so that men have food, clothing and shelter and a chance to improve their condition. This machinery has just successfully stood the unprecedented strain of war demand for production. The real problem before us is to keep it in adjustment under the less spectacular conditions of peace. And yet perhaps these conditions rightly considered are no less inspiring.

For we look not only to helping Europe and so safeguarding ourselves but, by the means of material prosperity, we think of a better America than we knew before the war. And that better America to deserve the name, must mean better working and living conditions, so that all who are willing to work may have continuous opportunity to do so and may participate fully and fairly in the product of their labor. We want better cities, better homes, better schools, better rural conditions. But we know such betterments can only come by greater efforts than we have yet made.

The achievement of all these objects seems clearly possible if we can get a clear perspective of the situation so that we see all its parts in their true relations to each other and as together making one complete picture. If we can get that perspective, we shall see what our course of action ought to be.

Does it not point directly toward increasing just so far as we can the total production of the country? Rather than a lessening of effort, is it not the time to increase our effort, both for quantity and quality? Shall not such effort be toward wresting from nature more of her secrets, and by applying to them the work of our brains and our hands get a future yield which will make that of the past look meager? Or shall we be content with the total of what we have had and spend the rest of our strength in quarreling over its division? The one way is full of inspiration and promise, not only for a better America but for a better world. The other is both toilsome and unfruitful and only seems easy because we are used to it.

Can there be any doubt that America, in this hour of her opportunity for economic leadership, as well as moral leadership of the world, will choose what seems the harder but viewed in the whole perspective is both the easier and the greater course?

ELECTROCHEMISTRY IN ITS HUMAN RELATIONS.

Timely Extracts from Presidential Address Before Last Meeting of American Electrochemical Society.

By F. S. Tone.

We are human beings as well as electrochemists, and we may well study the relations of our science to the world problems of today and how we can give most immediate and most effective service for the betterment of human society.

For four years we have been in the thraldom of a great war. We have been passing through a period of violent evolution, the nature and extent of which we have hardly begun to measure or realize. Science and industry and, in fact, every human activity emerges from this world turmoil with new and rapidly shifting viewpoints and new responsibilities, and electrochemistry forms no exception. It is therefore profitable at this time to take some survey of our present situation and to forecast our future activities and responsibilities in the new alinement of human relationships. If a new era has begun, what is our part in it?

As one of the big results of the war, new and better conditions of living are demanded by the masses of the people in all countries. If a higher plane of living in the matter of food, clothing, housing, fuel and sanitation is to be established, and if shorter hours of labor and more opportunity for recreation and self-improvement are to be the order of the new day, this can only be brought about by vastly increasing the production of all the essentials which enter into the needs of modern society. Not forgetting such factors as co-operation, efficiency of organization and distribution and elimination of wastes, production can be increased principally in two ways: First, by using labor more efficiently, and second, by further supplementing and supplanting labor by the chemical and mechanical instrumentalities of industry. Either we must get more out of labor or we must stimulate the discoveries that will make labor more productive than before. If the world is going to work less, science must work more. The work of the world cannot be done in a 6-hour day and 32-hour week unless applied science gets in a lot of time-and-a-half on weekdays and double time on Sundays.

Food and Fertilizer.

Among the problems of first importance is that of the world's food supply. The crop yields of the world must be vastly increased, and this in the face of a decreasing labor supply. If cereals, cotton and animal fodder must be produced in greater quantity and more cheaply, the answer can only be found in improved transportation and traction for the farmer and in a vastly extended use of fertilizer, and here rests a big problem with the electrochemist. Judged by European standards, the American farmer is inefficient. He produces 14 bushels of wheat to the acre while in Europe the same acre yields 30. European yields all along the line average from 50 to 100% greater than American yields, and while this increase is in part due to intensive farming, better selection of seed, and crop rotation, the big difference is in the enormously greater use of fertilizer. It is of the highest economic importance that the American farmer shall use more fertilizer.

The three main elements of plant food are nitrogen, potash and phosphoric acid, and each one of these carries a problem for the electrochemist. The fixation of nitrogen is one of the great triumphs of electrochemistry, and the possible exhaustion of the natural nitrate fields is to us no longer a matter of any anxiety. So long as we have energy and air the land need never want for ammonia. Still the efficiency of the arc process of fixing nitrogen is today less than 5%, and between this figure and the best efficiency attainable, there is certainly breathing space for the most energetic of our research workers. The extension of the cyanamid process has been one of the remarkable chemical events of the war. Its opportunity for peacetime accomplishment is no less, but we still have some distance to go before artificial nitrates can be laid down to the farmer in such quantity and at such price as will mean the doubling of our crop yield.

The potash problem during the war has been brought into the field of electrochemistry. The Cottrell system of electrostatic precipitation has been successfully applied to gases from blast furnaces and cement plants, and if the waste gases from all such plants were treated by the Cottrell process, the possible recovery of potash would be equal to our pre-war consumption. We can hardly hope that this is commercially possible, but in many localities it will give a permanent source of potash which will maintain its existence under competitive conditions. What the electric furnace can do in phosphoric acid recovery is not so well proved. But passing over this, we see that the solution of our national food problem is one in which, despite our past accomplishments, we still have large responsibilities.

Sanitation Through Use of Chlorine.

In the new order of things we are going to banish the slums and have more healthful living conditions, and the role of the electrochemist in sanitation is told in the story of chlorine. We learn that when the armistice was signed we were just ready to deliver each day to our fighting forces on the western front over 200 tons of poison gas. The basis of this great offensive weapon was chlorine, and it was denied its opportunity to demonstrate in a big way what it could do to win the war against the Huns, but I believe it has a far greater opportunity in the germ warfare of peace times.

In starting to investigate the work that chlorine is doing in sanitation, I knew in a general way that it was of growing importance in the purification of drinking water, but upon assembling all the data it was astounding to find that chlorine is today making safe the drinking water of more than 20,000,000 people of this country who dwell in cities. Chlorine is safeguarding one-fifth of our population from typhoid. We learn that a military force or an industrial expedition can go anywhere in the tropics and be at all times assured of potable water if it carries a few pounds of hypochlorite. In the Carrel-Dakin solution for the treatment of wounds, the use of chlorine is defined by a recent authority as the greatest discovery of surgery in the whole war. During the recent epidemic of influenza, the number of cases in the cell rooms of two electrolytic chlorine plants, located in different states, was one-half of that in any other portion of the plants. Starting with a few such facts as these, what more is needed to build up a great structure of organized sanitation with chlorine as its basis? We are looking for an outlet today for a huge producing capacity brought about by the demands of the war. Do not these examples of what chlorine is doing in germ warfare clearly point the way?

The sterilization of sewage is as logical a measure of sanitation as the sterilization of drinking water. To be sure, no city drinks its own sewage, but some other city generally does. Why permit Chicago and Milwaukee, Detroit and Cleveland to pollute the waters of Lake Erie, Lake Ontario and the St. Lawrence Why should Pittsburgh pass its germ-laden water on to Cincinnati and Louisville when an adequate remedy is available at reasonable cost? One hundred and twenty pounds of hypochlorite will sterilize 1,000,000 gallons of screened sewage. A city of 1,000,000 inhabitants can sterilize its sewage at a cost for its chemicals of $360 per day. The cost per single inhabitant for one year would be about 12 cents. But the work of chlorine does not stop with water supply and sewage. It should be used to flush and sprinkle our streets, to clean our cars and public buildings, and to sterilize our dairies. The organized use of chlorine in sanitary milk production will do more to give our children a pure milk supply than any possible system of inspection.

We are searching for an outlet for our excess chlorine in metallurgy and in organic chemicals. If our electrolytic chlorine friends would begin telling people how they can live in a prophylactic environment, how they can feed their babies pure milk, and how they can avoid poisoning their neighbors who live lower down on the same watershed, conditions in the chlorine market would soon be such that they would no longer worry about what the Government is going to do with Edgewood.

Electric Steel and Alloy Steels.

Again, in the metallurgy of steel, if electrochemistry has made great contributions to the art, its responsibilities are no less clearly defined. No one now doubts that we shall soon attain to the super-steel, and it is no less clearly indicated that this will be accomplished by the electric steel furnace and electrically produced alloys. The triplex process using the electric furnace as the third step for the refining operation produces a steel of crucible quality at a cost of a few dollars a ton more than open-hearth steel. When it is understood that such steel produces rails which do not break and plates which do not fracture, it will require no advertising campaign in the popular weeklies to bring this product into universal use: public opinion will demand it. The alloy steels have made possible the modern automobile, the airplane engine and the farm-tractor motor. Alloy steels have been a luxury. They have been used only in the vital parts of the mechanism where enormous strains must be met with a minimum weight of material, but their use must be extended. High quality is not incompatible with tonnage. It is the work of the electrochemist to make possible their use as common materials of engineering, thus contributing vastly to improvements in transportation and the mechanical arts. No one needs to have pointed out what this signifies as an economic gain in modern life.

But the field of alloy steels has by no means been fully exploited. The results which the steel maker has achieved with tungsten, molybdenum, chromium and vanadium, marvelous as they are, by no means mark the limit of the art. We now seem to be on the eve of still more important advances based on the use of new alloys, including ferro-uranium and ferro-zirconium. We hear whispers about a zirconium steel of 300,000 lb. tensile strength and 30% elongation. Not being a steel-maker and having no metallurgical reputation to lose, I may venture in my imagination to build an ocean liner or a freight train of this super-steel in which the dead weight is cut in half and the carrying capacity is increased 25%; or, I may visualize the super-steel bridge and finally the super-steel Pullman car, but in the latter case we are not so anxious to reduce the weight of the car and save steel. Rather we will make the super-steel Pullman four times as strong with the same weight of steel and then sleep soundly in the rear section of the rear car while the second section of the train follows one short block behind. Briefly stated, the job of the electrometallurgist is to put super-steel on a big tonnage basis.

Coal and Water-Power Resources.

Let us now consider our energy resources. These are fuel and water power, and their proper utilization will not only reduce the sum total of human toil necessary to run our industrial machine, but will be a measure of vital importance to coming generations. Our energy resources are necessary to the functioning of every other resource. They are at the very basis of industrialism, transportation and domestic well-being. Thus they concern society broadly, but they peculiarly concern the electrochemist because cheap electric power is a basic element in electrochemical production. The electrochemist was responsible for the success of the world's first great hydroelectric development, at Niagara, and became the natural champion of the utilization of our water-power resources. But why have we failed to sell this proposition to the man in the street and to those whom in his wisdom he has chosen to legislate for him? There may be many reasons for public indifference to coal economics and the waste of water power, but the fact remains that we have as yet failed to state the simple facts and principles of our energy economics in a way which carries conviction to the people with whom responsibility for action lies. Here are some of them:

1. Coal is our greatest energy resource. It is irreplaceable and, notwithstanding an apparent popular belief to the contrary, it is not inexhaustible. The amount available for present and future generations is known to be very definitely limited. The curve of consumption is rising regularly and rapidly, and we can compute with a fair degree of accuracy when our magnificent coal reserves will be exhausted.

2. Coal is wastefully mined, wastefully transported and wastefully utilized. If the bituminous coal used for domestic heating alone was first converted into artificial anthracite and the by-products recovered, it would represent a saving of more than twice our entire output of gold for 1917. If our railroads were electrified and fed from central stations recovering the by-products from the coal, this saving would be doubled.

3. Fuel and water power are practically interchangeable in industrial economics. The failure to use water power is just as truly a waste as would be the burning of our coal mines and oil wells. If Congress were to enact legislation to set the torch to one-third of all of our coal that was mined in the country last year, it would be no greater act of folly or crime than to obstruct water-power development. The utilization of water-power resources will save coal and oil for future generations and release for other useful work in the present generation hundreds of thousands of miners, vast transportation facilities and thousands of railway workers.

Having convinced the people that water power must be developed, the most difficult part of the problem remains to be solved, which is to arrive at a form of legislation in which the people and the capitalist believe that their respective interests are protected. Passing over the question of government ownership of water powers, I believe we must all now agree that no legislation for private development stands any chance of enactment which does not carry with it a very much larger measure of public control than would have been acceptable a few years or even a few months ago. Political ideas have changed, and one can plainly observe that public sentiment will not again consent to the development of its water powers as an unrestricted private monopoly. It would not so consent even when awakened to the great economic crime of letting them run to waste. After all, what we want is the power and I believe this Society cannot do less than endorse legislation in which public interests are fully protected by control of rates and proper limitations of charter rights. Following this, we want government surveys covering our complete energy resources and their utilization.

My conclusion shall be brief. It is plain that our science faces some of the big human problems of the day. Our opportunity for service was never greater, and I believe it will not be passed by.

SWISS RAILWAYS EXTEND ELECTRIFICATION OF THEIR LINES.

Further Particulars as to What Has Been and Is Proposed to Be Done.

In our issue of June 28 we published some data on Swiss railway electrification that appeared in a recent publication of the British Board of Trade. The following additional information has been kindly furnished by F. Dossenbach, director of the Official Information Bureau of Switzerland, 241 Fifth avenue, New York City.

The introduction of electric traction on the lines of the Swiss Federal Railways has in these latter years, on account of the acute shortage of coal occasioned by the war, received the foremost attention of the authorities and has now emerged as a very practical economic question.

The principal nerve of the Swiss railway system is Government-owned. Electrification of these lines is simplified by the vast store of unused water power which the country possesses. According to an official survey, verified in 1914, including the stowing and improvement of lakes, the water power of Switzerland is capable of producing an energy equal to 2,173,000 hp. If old plants were replaced by new ones, it is even estimated that the highest capacity of the total water-power reserves could be raised to as much as 8,000,000 hp. On January 1, 1914, the electric power already in use in Switzerland amounted to 887,000 horsepower.

The Swiss Confederation owns some 1800 miles of the entire railway system of the country, which covers 3216 miles. Of the 1416 miles owned by private companies 622 miles are already electrical, but only an insignificant percentage of the Government railroads has so far been operated by electricity.

The first important Federal standard-gauge road to be chosen for electrification was the Gothard Railway, one of the important international highways, and featuring, moreover, in many sections the brilliantly conceived engineering of mountain railways. The electrification of the 68 miles section Erstfeld-Bellinzona was approved in 1913 and it is expected that it will be opened this fall. This section, with

28% of its length consisting of tunnels and a grade of 2.5 to 2.7% for 25 miles, was chosen for an experiment because of its enormous traffic with Italy, which caused large consumption of coal with resulting smoke in the tunnels.

The sections Bellinzona-Chiasso and Erstfeld-Lucerne are expected to follow in 1921 and the consulting experts have found that the big power stations at Amsteg and Ritom, the first yielding 26,000 hp. and the latter 32,000 hp., will also suffice for these lines, even if the traffic should increase some 60 to 70%. Another series of plants yielding 70,000 hp. is planned for eastern and central Switzerland. The cost of electrification of the Erstfeld-Bellinzona line is estimated at $8,000,000. The cost of electrifying the entire Federal railway system is estimated roughly at $200,000,000.

In 1918 the electrification of the following railways using steam traction was decided upon and work on them commenced at once: The sections of the Federal Railroads Sion-Brigue and Berne-Thun; the section Hasle-Langnau of the Emmenthal Railroad and the section Bevers-Filisur of the Rhaetian Railroads. The section Sion-Brigue to be electrified will be a continuation of the electric line through the Simplon tunnel which was opened for traffic in 1906, with its northern exit at Brigue.

The electrified Berne-Thun line, connecting with the electric Berne-Lötschberg-Simplon railway, which latter was inaugurated in 1913, has already been opened for traffic in May last. It now provides excellent and frequent train connections between the Swiss capital, the Bernese Oberland resorts and—in connection with the Lötschberg line—the Valais and Northern Italy.

The new locomotives which are being used by the Swiss Federal Railroads on the section Berne-Thun, besides those of the Berne-Lötschberg-Simplon line, are each equipped with four single-phase alternating-current motors, each of 450 hp. All the electric parts were furnished by Brown, Boveri & Co., of Baden, and the mechanical parts by the Swiss Locomotive & Machine Co. of Winterthur.

Electrification work on the Bevers-Filisur line was completed by middle of last April and from April 16 steam engines have been duly replaced by electric motors, the current being supplied by the power station of Bevers, which furnishes the necessary energy for the Engadine lines that were electrified in 1913.

ALTERNATING-CURRENT EQUIPMENT ON NAVAL AND MARINE VESSELS.

Interesting Elementary Notes on Alternating Currents of Value to Electricians and Officers in the Naval and Marine Services.

Rapid developments in the use of electricity on shipboard have taken place in recent years. Formerly all electrical ship equipment was of the direct-current type and very seldom exceeded 125 volts. Recently the use of alternating-current machinery and apparatus has been introduced on naval vessels, which always have led in the use of electricity for a variety of purposes. In the July number of the United States Naval Institute *Proceedings*, Lieut Commander Lesley B. Anderson, U. S. N., states:

"There is no doubt that alternating currents have come in the navy to stay. At present they are applied to ship propulsion, radio, gyro-compass, submarine signaling, navy-yard light and power, and, on a smaller scale, to gun firing, three-wire generators, testing sets, magnetos, engine-speed indicators, and electric welding. There is such a large field for development that the use of alternating currents will probably be greatly extended within the next few years."

Since relatively very few naval or marine electricians are conversant with the subject of alternating currents, Lieutenant Commander Anderson gives in the article mentioned a simple and very clear outline of the main principles of alternating currents as they apply chiefly to the equipment being introduced for ship propulsion and radiotelegraphy. The article should be read by all interested in up-to-date electrical equipment on shipboard, if they wish to get a good conception of the important apparatus now already employing alternating currents. The notes included in the article were mostly explanations given to midshipmen and reserve officers, both in lectures and talks.

ELECTRIC SUPER-SUBMARINES DESIGNED BY BRITISH ENGINEER.

Designs for a new type of super-submarine have ben elaborated by Capt. Norman Wood, R. A. F., who recently read two papers on the subject before the Institute of Marine Engineers in London. Previous to his connection with the Royal Air Force, Captain Wood was engaged on submarine work and had practical experience of the deficiencies which exist in the design of even the latest vessels. On the surface submarines are driven by Diesel oil engines; under water they are driven by electricity from storage batteries which must be charged when the vessel is on the surface. These conditions are usually met by arranging the following chain: (1) Diesel engine, (2) clutch, (3) electric motor, (4) clutch, (5) propellor shaft. It is not difficult to see that this equipment involves a complex series of operations at critical times as, for instance, when the vessel is caught by an enemy searchlight when the batteries are being charged. Captain Wood proposes to simplify the transition from engine drive to motor drive (or *vice versa*) by adopting an all-electric drive, using, in a 1200-ton boat, two oil engines to drive electric generators supplying current to electric motors used on propellor ships, both naval and mercantile, on the ground that the growth of air power will render submersion the only means of escape from aerial attack. From this standpoint sea power will include air power and submarine power as well as strength in ships of the old type.

FRENCH NEWSPAPER URGES DEVELOPMENT OF WATER-POWER RESOURCES.

The *Echo de Paris* recently stated that the necessity of purchasing foreign coal might be relieved by developing the water power of France, which is estimated at 10,000,000 hp., as compared with 7,000,000 hp. for Norway, and 6,000,000 hp. for Sweden. Before the war only about 750,000 hp. was used, but a further 450,000 hp. was developed during the war, and by the end of 1921, 1,600,000 hp., or 16% of France's resources will be worked. This leaves a huge amount of water power in reserve and, in addition, there are large potential resources in the rivers of Indo-China and French West Africa. One million horsepower would lessen the consumption of coal for power production by at least 3,250,000 tons, costing about 300,000,000 francs, and the comparison is more striking when the greater average efficiency of the hydroelectric installation is considered.

Editorial Comment

Harmony in Conduct of a Meeting

EVERY association that amounts to a "tinker's damn" is bound to be confronted at times with problems over which a decided difference of opinion arises among the membership. On such occasions and by its handling of such problems the true caliber of the organization and the loyalty of its members are really shown. Such a condition arose in the spirited discussion of the labor problem at the Milwaukee convention of the National Association of Electrical Contractors and Dealers, and if any doubt existed prior to that time as to the real worth of this association it can now be dispelled.

It is not our intention to back either side in this issue in these comments as we believe that both sides had the best interests of the association at heart. When the members of any association are concerned in its welfare to the extent shown on this occasion and when the majority finally rules as was the case, there can be no doubt of the association's success.

The most impressive feature of this discussion, however, was the admirable way in which it was conducted and for this Chairman W. Creighton Peet deserves full credit. The position of the presiding officer is indeed a trying one in such situations and Mr. Peet is to be congratulated for the spirit of fair play, harmony and order that prevailed throughout the discussion because of the able manner in which he presided. A less calm and tactful chairman might have allowed such a discussion to get out of hand, leaving serious dissensions to develop that might disrupt an organization.

The Opportunities Before American Business

UNUSUAL opportunities are offered to American business and industrial interests to supply the many wants of war-stricken Europe and incidentally extend the period of recent prosperity. These opportunities have been pointed out by several leaders of industry. One of the most far-sighted views of the situation has been presented by Mr. Charles G. Du Bois, who recently became president of the Western Electric Co.; his clear statement is reproduced in this issue.

He shows that we are in much better physical and economic condition than nearly all other countries. The latter look to us to help them secure food and other much needed supplies. It is our opportunity as well as obligation to do this. But this involves a continuance of the intense industrial application that helped so much to equip and to keep our armies supplied. Recently there has been a relaxation of effort and the spread of industrial unrest, largely imported from bolshevist Russia, has led to countless strikes and other interference with production. What we need is stimulation of production. Idleness very seldom improves the prosperity of a country. The problem before us, therefore, is to redouble our efforts or else fail when the world is looking to us for help.

Similar ideas were also expressed recently by President F. J. Tone of the American Electrochemical Society, part of whose address is printed in this issue. He also emphasized the need for intensified production if the general welfare of the people is to be enhanced. We must make labor apply itself more or we must apply to it scientific and mechanical developments to make it more productive. It is to be hoped that both labor and capital will study the problem in the light of economic and scientific truth and by stimulation of production grasp the opportunities that now present themselves.

Strike Demonstrates Value of Traction Service

CHICAGO has been very seriously hampered and inconvenienced for a period (at the time this is being written) of fully four days this week due to a complete stoppage of all electric street-car lines and elevated railways in the city. When there was every prospect that the negotiations between the employes, the companies and the State Public Utilities Commission would lead to a fair and satisfactory solution of the controversy, the employes of the traction companies called a meeting that apparently was dominated by a small minority which refused to hear the report of the compromise offer and suddenly ordered a strike of all of the employes.

Although the threats of such a strike made during the preceding weeks had led to some efforts to provide emergency service in case the electric lines actually were tied up, the precipitate action of the employes in going on a strike at only a few hours' notice left the public in general entirely unprepared. All sorts of automobiles, motor trucks, buses, taxicabs, horse-drawn vehicles, motor boats, and even some airplanes were pressed into service; among these electric pleasure and commercial vehicles did their due share. The multitude of automobiles, suddenly rushed into the streets, was beyond the capacity of these arteries of travel and very many blockades and accidents resulted. The travel was uncertain, far from comfortable and considerable profiteering was resorted to, many persons being compelled to pay from five to ten times the ordinary street-car fare in order to reach their places of employment. The steam railroads, through increase of their suburban service, carried a considerable percentage of the persons compelled to travel to and from the central business district. Crosstown travel between outlying districts ceased almost entirely. An extremely large part of the city's two and one-half million inhabitants resorted to the ancient and wearisome method of traveling on foot.

Aside from the inconvenience to those who could not afford to lay off for the period of the strike, the business of the city suffered to the extent of perhaps millions of dollars due to a general slacking up of all work because employes could not reach business houses and factories at the usual hours and to a still greater extent because of the great falling off in business caused by difficulty on the part of purchasers in reaching stores and other places of business. The telephone company came to the rescue in this respect and as soon as it could get sufficient operators to the various exchanges did its utmost to speed up telephonic service. No figures are as yet available as to the enormous excess business carried on over the telephone, which if this means of communication had not been available would have left the city almost prostrate.

The entire city has through this strike again received a very positive demonstration of the extreme value of electric traction service, its low cost in comparison with substitutes therefor, and its indispensability to the business as well as social life of the community.

Responsibility of Utility Employes to the Public

NO EMPLOYE, nor any employer, can afford to ignore the interests of the public upon whose good will depends the success or failure of the business or industry that furnishes his sustenance. This simple truth will be generally accepted by the calm judgment of both workmen and business men. It applies alike to all lines of private business as well as to the quasi-public business commonly called public utility service. To the latter it applies with special force and directness, however, because the general public is so intimately concerned with the character and price of this service, as is shown by its assumption of regulatory control over public utilities.

In the early days of public utilities the importance of accepting responsibility to the public was not generally recognized. The usual attitude, in fact, was the very opposite as was so forcibly but tactlessly shown in the historic remark of a railroad capitalist of the last century—"The public be damned." These ideas ruthlessly carried out in such utility service as was rendered did not take long to stir up most vigorous public resentment. Not only were the utility corporations held in low esteem but they had imposed on them severe legal restrictions, from both of which many have not yet fully recovered. Nowadays, no manager of a public utility would think of committing business suicide by adhering to this obsolete and contemptuous policy.

It is strange, therefore, that this discarded attitude should be taken up by anyone connected with a public utility in any capacity. And yet on Monday evening of this week a meeting of employes of the electric street-car and elevated-railway companies in Chicago was disgraced by a small but vociferous element that drowned out the efforts of the calm and rational speakers by cries of: "To hell with the public." It is believed that this element with its radical or bolshevist ideas represents no more than 10% of the entire employes of these utility companies, yet it dominated the meeting and forced it to suddenly impose a strike on all the electric transportation lines of the city.

Some features of this strike are referred to in another column, and in our last issue we commented on the laudable efforts instituted by the Governor of Illinois to secure a peaceful and equitable solution to the controversy. There was every reason to believe that the compromise offer resulting from these efforts would be looked upon as not only fair, since it introduced better working conditions and wages than prevail in other cities in such service, but that it would be accepted. Yet the radical element referred to prevented deliberate consideration of the matter and brought odium upon all the organized employes by its contemptuous disregard for the interests of the public.

Quite early in this controversy this same element when presenting its extreme demands declared that it cared not where the funds required to meet them would come from, it was no concern of theirs, they knew what they wanted and were determined to have it. It was generally known that the companies were at the ends of their resources and any additional operating expenses would have to be met through increased fares. Moreover, the demands, if granted in full, would have required probably over 50% increase in fares with the inevitable result of greatly diminished traffic.

All these matters it was to be expected should have been given due consideration before the demands were first presented. Various evidences show that the public was little thought of, however. It is not necessary to dwell on other aspects of the case. One thing is certain, however. The strike that was called was entirely unnecessary and its effects will injure the men as much as the companies, if not more. The public has taken the inconveniences and loss due to the strike good naturedly, but it is showing little sympathy with the arbitrary attitude of the men. A very considerable number of passengers have been lost to the traction lines permanently. It is time that the men realize it is folly to kill the goose that lays the golden eggs. Contempt for the interests of the public has never paid to utility capitalists nor will it pay to utility employes.

Current Events

New N. E. L. A. Administration Begins Work—Improving Industrial Relations—Frederick Sargent Passes Away

NEW ADMINISTRATION, N. E. L. A., GETS DOWN TO WORK.

Considerable Activity Shown by Reports Presented at First Meeting of New Executive Committee.

The first meeting of the Executive Committee of the new administration of the National Electric Light Association was held at the association's headquarters, New York City, on July 10. In the absence of President Ballard, Vice-President Martin J. Insull presided.

On motion Everett W. Burdett was re-elected as general counsel. The following committee chairmen were also appointed: Accident Prevention, Charles B. Scott; Company Sections, Frank A. Birch; Constitution and By-Laws, W. C. L. Eglin; Doherty and Billings Prizes, A. S. Loizeaux; Exhibition, C. L. Pierce, Jr.; Finance, Joseph B. McCall; Lamp, Frank W. Smith; Membership, Walter Neumuller; Class C Membership Applications, Walter Neumuller; Public Policy, John A. Britton; Rate Research, Alex Dow; Relations with Educational Institutions, John F. Gilchrist; Safety Rules, W. C. L. Eglin.

A letter from President Ballard was read outlining plans for the year's work, and suggesting the following subjects which might be considered: Electrical resources of the Nation, electrification of steam railroads, rules of regulatory bodies, public information, employes' participation.

In connection with the subject of electrical resources of the Nation, the committee called attention to the fact that both the Department of the Interior and the War Industries Board have compiled considerable data relating to this question and that it might be well to appoint a committee to bring together all of the data and material on the subject collected by different bodies and put them in shape for the central stations to use.

It was announced that the Technical Section had reappointed the Committee on Electrification of Steam Railroads, which was discontinued several years ago, and that Peter Junkersfeld would serve as chairman. Mr. McClelland stated that statistics as to the savings effected by electrified roads should be collected and publicity given to them. It was also suggested that a National Committee might be appointed on this subject to work in conjunction with the Technical Section Committee.

Mr. McClelland advised that the National Industrial Conference Board has been doing a great deal of work on the subject of employes' participation, and that if the Association appoints a committee to study this question it should utilize the data collected by the Board.

President Ballard's letter regarding the year's work also covered the representation of the Association at all Geographic Section and other electrical conventions.

Chairman Moultrop, of the Technical Section, reported that his Executive Committee had held an all-day meeting on July 9, at which time the committees were appointed, the work of each outlined and their meetings scheduled for the next 12 months. In order to enable the western committee members to attend, the meetings will be held as far west as possible, one or two being scheduled for Denver. By the appointment of O. B. Coldwell, of Portland, Ore., as a member of its Executive Committee, the Technical Section now has a representative from both the northwest and the southwest, H. A. Barre, of Los Angeles, also being a member.

Mr. Moultrop reported that in compliance with a request received from R. S. Hale, chairman of the Wiring Committee, he is arranging for technical representation on that committee. He also reported that the Committee on Overhead Lines and Inductive Interference has been divided into two committees, with W. K. Vanderpoel chairman of the Overhead Systems Committee, and A. E. Silver chairman of the Inductive Interference Committee.

At the suggestion of Vice-President Bump, the following committee was appointed to make a report to the Executive Committee at its next meeting on a definite division of the states into Geographic Sections: Chairman R. J. McClelland, H. E. Brandli, J. E. Davidson, L. D. Gibbs, Robert Lindsay, E. W. Lloyd, O. H. Simonds and F. M. Tait.

Acting Secretary Sewall read a report on the work of the Company Sections and the plans of the Company Sections' Committee for the year, which report was prepared by Vice-President Johnson and also the report of the Committee on Managing Director, which stated that the committee considered it necessary that such a director be appointed.

Chairman Symes of the Accounting Section reported that one meeting of his Executive Committee had been held at which time the committees for the year were considered and some of the less active ones discontinued. The Committee on Accounting Relations with Other Associations was merged with the Committee on Classification of Accounts, and the Committee looks for marked progress in the national standard classification of accounts. He also reported that four new committees had been added: Bonus System, Federal Income Tax Return Procedure, Credits and Collections, and Insurance.

For the Commercial Section, Chairman Learned reported activities are well under way and the committees have been appointed, some of which are already functioning. The general plan is to handle the work of the Section as formerly with the addition of the following two new committees: Committee on Relations with Geographic Sections, Company's Sections and State Electric Associations, and Committee on Relations with Contractors, Dealers and Jobbers. It is planned that representatives of this latter committee will attend all state and national meetings of contractors, dealers and jobbers. This plan has already been put into effect.

For the Electric Vehicle Section, Chairman Foster reported that the Section was considering appointing an advertising man, but that if a publicity man were engaged for the Association this might not be necessary. Mr. Foster stated that as a result of some recent co-operation in Chicago the electric garages have been able to effect considerable saving in insurance premiums and have also been made agents for the insurance companies, thus enjoying commissions on this work. He reported that the Transportation Engineering Committee is now conducting correspondence with 155 colleges in the matter of developing further transportation engineering courses and is compiling a list of electric truck users to which questionnaires are to be mailed to secure operating cost data, etc.

Mr. Foster also spoke of the indifference of central station employees toward the electric vehicle, and said that it was hoped to overcome this feeling by the publication of articles in the Association's *Bulletin* and other ways. He also mentioned the great benefits that might be derived from what he styled a spectacular campaign to introduce electric vehicles, suggesting the possibility of selling them to some city for use in its departments generally, with the particular object of giving wide publicity to such a sale.

John A. Britton, vice-president and general manager of the Pacific Gas & Electric Co., San Francisco, a regent of the University of California and one of California's most prominent citizens, has been appointed by President Ballard, chairman of the Public Policy Committee. W. W. Freeman has been appointed vice-chairman.

SPRAGUE SHOP COMMITTEE DECIDES ON THRIFT AMONG EMPLOYES.

General Shop Committee of Sprague Works of General Electric Co. Adopts Thrift Bond Savings System.

An interesting example of the actual working of the "shop committee" in industrial plants was afforded by a meeting of the General Committee of the Sprague Electric Works of General Electric Co. at Bloomfield, N. J. In the organization of the plant there are committees covering each of the various shop activities and the General Committee, which is composed of these subcommittees and consists of about 35 employes.

The meeting was called to consider the question of making thrift among the employes permanent—a subject receiving increasing attention in industry because of the stabilizing effect of thrift on the workers and the big impetus given to thrift by the war which threatens to be lost.

The committee decided unanimously that regular saving makes for the well-being and contentment of the worker. Various methods of saving were discussed, including savings banks, building and loan associations, War Saving Stamps and the Thrift Bond savings system. The committee did not favor methods involving periodical deposit of money or the purchase of securities because of inconvenience, difficulties of withdrawal and irregularity. The committee unanimously decided in favor of "automatic saving" through pay-envelope distribution. This is the principle of the Thrift Bond savings system installed by the National Thrift Bond Corporation, New York City, for the General Electric Co.

In this system the employe signs a subscription form promising to save a certain amount regularly and thrift receipts to that amount are inserted in his pay envelope instead of cash. The saving is thus automatic and requires no further initiative on the part of the worker. Ten dollars' worth of these thrift receipts may be exchanged for a $10 Thrift Bond, which bears interest paid through coupons attached. Ten of these Thrift Bonds may be exchanged for a $100 registered Thrift Bond. Taking up the question of continuous encouragement of the idea among the employes, the committee disapproved of solicitation by volunteers in the works' organization and preferred the work being carried on by paid agents of the banking corporation.

According to the executives, the opinions of the employes' committee were of value, because in such cases best results are obtained by using methods endorsed by the workers.

PROGRAM FOR AMERICAN ELECTRO-CHEMICAL SOCIETY MEETING.

Fall Meeting to Be at Chicago, Sept. 23-26 and Include Joint Session With American Institute of Mining and Metallurgical Engineers.

The fall meeting of the American Electrochemical Society is to be held at Chicago on the four days, Sept. 23-26. Headquarters will be at the Congress Hotel. The tentative program calls for four joint sessions with the American Institute of Mining and Metallurgical Engineers, which will hold its convention at the same time and place. At present the tentative program is as follows:

Tuesday, Sept. 23: Excursion by boat with American Institute of Mining and Metallurgical Engineers to Gary, Ind., and trip through United States Steel Corp.'s plant. Joint technical session, on the boat, returning from Gary, subject: Electrometallurgy of Iron and Steel. Joint technical session, at Congress Hotel in evening at 8:30 p. m.

Wednesday, Sept. 24: Morning—Session for reading and discussion of papers. Afternoon—Joint Ferrous Metals. Evening—Inspection of the electric furnace exhibits at the Chemical Exposition.

Thursday, Sept. 25: Morning—Symposium of Catalysis. Afternoon—Symposium of Catalysis, continued. Evening—Smoker and entertainment.

Friday, Sept. 26: Morning and afternoon—Joint session; subject: Symposium on Pyrometry.

The secretary of the Society is Prof. Joseph W. Richards, Lehigh University, Bethlehem, Pa.

ACTIVE WORK PLANNED BY OVERHEAD SYSTEMS COMMITTEE, N. E. L. A.

Committee Seeks Co-operation of Member Companies' Engineers and Others in Bringing All Overhead Line Data Up to Date.

The Overhead Systems Committee of the National Electric Light Association, formerly called the Overhead Lines Committee, desires the co-operation of all members and member companies in this year's work of the committee. It plans to bring up to date the descriptions, specifications and other matter previously published relating to overhead line construction. Information will be compiled regarding recent experience and new practices, with especial attention to any innovations and other features developed during the war period.

To make this work complete, the committee needs active assistance, and it would be much appreciated if members will communicate freely with the committee, furnishing any information which would be useful to the industry. Members are also invited to suggest any features which they think should be developed in the next report. Matter of this kind should be presented in sufficient detail so that the committee can work to the best advantage in securing the desired information.

It is suggested at this time that the previous reports of the committee be reviewed by members in order to determine the character of the recommendations and information still required. If such attention is paid to this subject, the committee's activities will be guided by the real necessities of the industry and there will be a greater production of valuable construction data, without repetition of information already available.

It is hoped the work of the committee will not only be facilitated by these contributions; but that members will avail themselves of this opportunity to make use of their committee by indicating the kind of assistance they desire.

W. K. Vanderpoel, superintendent of the Public Service Corporation, Newark, N. J., is chairman of the Overhead Systems Committee.

MAY ELECTRICAL EXPORTS MAINTAIN HIGH LEVEL.

Monthly Total Only Slightly Below March Record—Eleven-Month Aggregate Is Nearly $70,000,000.

Another high monthly total in electrical exports has been recorded in the figures for last May which have been made public by the Bureau of Foreign and Domestic Commerce, Washington, D. C. The electrical shipments from the United States for that month totaled $7,717,518, or only 2% below the record set last March. The May total was a few thousand higher than that of last April and it was also nearly 54% higher than May of last year.

In the following table are given the detailed figures for last May and the corresponding month of 1918:

Articles.	May 1919.	May 1918.
Batteries	$ 516,001	$ 308,895
Carbons	130,982	112,902
Dynamos or generators	257,908	443,351
Fans	201,125	120,980
Heating and cooking apparatus	146,765	48,492
Insulated wire and cables	838,188	344,186
Interior wiring supplies, including fixtures	179,931	140,050
Lamps—		
Arc	1,300	1,085
Carbon-filament	44,157	10,459
Metal-filament	434,894	308,908
Magnetos, spark plugs, etc	291,415	160,395
Meters and measuring instruments	245,589	161,431
Motors	817,118	574,437
Rheostats and controllers	64,478	28,516
Switches and accessories	255,099	148,359
Telegraph apparatus, including wireless	70,296	32,339
Telephones	285,785	251,785
Transformers	326,224	214,958
All other	2,610,263	1,601,920
Total	$7,717,518	$5,013,379

The above figures do not include electric locomotives, of which there were exported last May five valued at $37,000. For the first 11 months of the present fiscal year—that is, for the 11-month period ended May 31, 1919—the total electrical exports aggregated $69,698,590, as against $49,527,442 for the corresponding period ended May 31, 1918, and $46,323,381 for the similar period ended May 31, 1917.

GOVERNMENT RETURNS WIRE LINES TO COMPANIES.

Postmaster General Burleson Expresses Satisfaction Over the Manner in Which Government Has Controlled Telephone and Telegraph Facilities.

On order of Postmaster General Burleson government control over telegraph and telephone systems of the country ceased at midnight, July 31. In his statement to the public, Mr. Burleson said he is satisfied with the result of government control, despite widespread public criticism of the telegraph and telephone service for more than a year.

The order of release directed that all telegraph and telephone systems and all property thereof taken over by order of Congress July 16, 1918, be "returned and delivered to the respective owners thereof at midnight on July 31, 1919, and the supervision, possession, control and operation exercised by the postmaster general will cease at that date and hour." The order further directed how outstanding accounts of government operation are to be settled with William H. Lamar, chairman of the Finance Committee of the Wire Control Board, and gave instructions for closing up relations between the Government and the companies.

"With the issuance of Order 3380, providing for the auditing and accounting division," Postmaster General Burleson said, "the first government control of the wire systems of America is brought to an end. Sound public opinion will ultimately demand how this trust has been met, and the Postmaster General is content to abide the result.

"The Postmaster General desires to express to the officers of the telephone and telegraph companies grateful appreciation of the uniform co-operation given during the period of government control."

CHEAPER ELECTRIC WIRING PROPOSED IN ENGLAND.

Committee Formed to Consider Whether Relaxation of Standards Is Justified.

A special committee of the Institution of Electrical Engineers (Great Britain) has been formed to consider the revision of the existing rules for electric wiring in buildings. This committee is the outcome of a growing conviction that the high quality of British cables and accessories justifies a relaxation of the standards hitherto imposed. During the war an enormous number of army buildings have been wired on the surface and in other ways not consistent with standard British practice, and the experience thus gained will be turned to account in cheapening the cost of installation and materials. British manufacturers of wires, switches, insulators and other accessories will thus be led to expand the production of types which will be peculiarly adapted to meet the needs of the overseas markets. Satisfactory quality will be insured by the National Electric Provng House which is about to be established in Great Britain. The Proving House will put the standard of good design, material and workmanship on every class of electrical apparatus, thus giving British productions the full benefit of the high reputation they have always held.

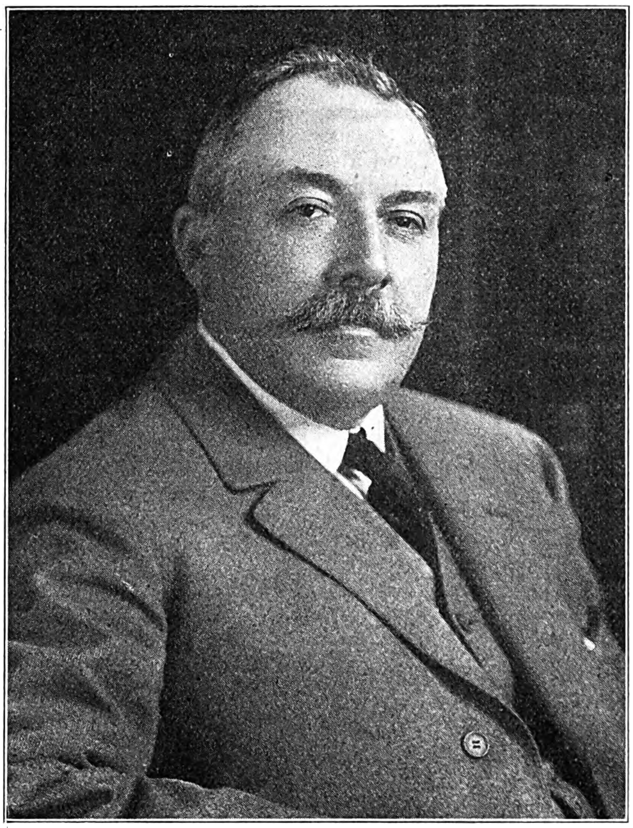
As all attempts made thus far to cheapen wiring in this country have met with disfavor the results of the British committee's investigations will be watched with interest.

FREDERICK SARGENT, PROMINENT POWER ENGINEER, IS DEAD.

Famous Engineering Career in the Design of Large Power Stations Brought to a Close.

Frederick Sargent, senior member of the firm of Sargent & Lundy of Chicago, and probably the most prominent consulting engineer in the United States specializing in the design of electric generating stations, died at his home in Glencoe, Ill., early in the morning of July 26. An Englishman by birth, Mr. Sargent had made numerous trips to his native country and on one of these, made in April and May of this year in company with his close friend, Samuel Insull, president of the Commonwealth Edison Co., Chicago, he was taken seriously ill while abroad. On his return he was removed to a hospital but the doctors were able to do but little for him, and he was taken to his home, where the end came.

Frederick Sargent was born in Liskeard, Cornwall, England, on Nov. 11, 1859, which is also the exact date of the birth of Samuel Insull, also an Englishman and Chicagoan, with whom Mr. Sargent was destined to be intimately associated during practically all of his engineering activities. His people were of the farming class but young Sargent developed a decided mechanical bent, and eight years of his boyhood and youth were spent in acquiring practical mechanical knowledge and experience in the works of John Elder & Co., the great shipbuilders on the River Clyde, near Glasgow. During this time he gained an extensive and practical knowledge of mechanical engineering, paying particular attention to heavy machinery. The young engineer also improved his education at this time by going to night school at Glasgow University.



Frederick Sargent.

Coming to the United States about 1880, the young man found ready employment in eastern shipbuilding yards as a designer of steam engines. He then came west as a designer for the Sioux City Engine Co. of Sioux City, Iowa. A year or so later he accepted a position with E. P. Allis & Co., engine builders of Milwaukee, predecessors of the present Allis-Chalmers Manufacturing Co. Here he attracted the attention of the officers of the Western Edison Light Co., organized in Chicago in 1882 to exploit the electric lighting inventions of Thomas A. Edison in the West, and in the fall of 1884 Mr. Sargent came to Chicago and began his career as an electrical engineer in this city.

Succeeding the Western Edison Light Co., the Chicago Edison Co. was formed in 1887, the first distinctively Edison central-station company in Chicago. Mr. Sargent became its consulting engineer and he has been consulting engineer of that company and its successor, the present Commonwealth Edison Co., ever since.

About 1889 Mr. Sargent went to New York under contract with the Edison United Manufacturing Co. In this position he had general charge of all the work done by that company in the United States and Canada. Shortly after this, the company in New York was reorganized as the Edison General Electric Co., and the subject of this sketch was made assistant chief engineer of the new corporation of which Samuel Insull was vice-president in charge of manufacturing. But Mr. Sargent had determined to open an office of his own, and in August, 1890, he returned to Chicago to establish himself as an independent electrical and mechanical engineer. The firm of Sargent & Lundy was formed in 1891.

In 1891 and 1892 Mr. Sargent was consulting electrical engineer for the World's Columbian Exposition of Chicago, and he designed the power plant and had much to do with the other mechanical and electrical features of the great World's Fair of 1893.

The original Edison central station in Chicago was at what is now 120 West Adams street, and was built in 1887 and 1888. Mr. Sargent made the plans for the machinery layout of that station. In 1892 Samuel Insull came to Chicago as president of the Chicago Edison Co., and that company at once took on a new lease of life. Under Mr. Insull's direction the old Harrison street generating station was built in 1893. Mr. Sargent was the designer of that station, also the Fisk street, the Quarry street and the Northwest generating stations of the Commonwealth Edison Co.

Mr. Sargent was one of the first electrical and mechanical engineers who recognized the great part that the steam turbine was destined to play in the development of electric generating stations. The Fisk Street station was the pioneer of all the large turbine central stations of the world and it became deservedly famous for its many original features of design and for the simplicity and economy of operation. After this station had been in operation for a short time Mr. Sargent was sent to London as a representative of the United States on the hearing in Parliament in connection with the London power-supply bill. This hearing crystallized in Mr. Sargent's mind some ideas he had been developing about the importance of unified power supply for great industrial centers so as to reduce the cost of production, and on his return he submitted his ideas to Mr. Insull and they were worked out in the power-station development of the Commonwealth Edison Co.

Mr. Sargent's engineering work, however, was not confined to Chicago. He was consulting engineer for many of the important electric light and power companies throughout the country, including the Edison Electric Illuminating Co., Boston; American Gas & Electric Co., New York; Electric Bond & Share Co., New York; the Union Gas & Electric Co., Cincinnati, as well as many other smaller organizations. He designed the great combined central power station of the American Gas & Electric Co. and the West Penn Power Co., located on the Ohio river north of Wheeling, W. Va., which is the first large electric station to be built in a favorable locality near a coal mine for the distribution of power to industrial centers at long distances. He designed the new station of the Union Gas & Electric Co., at Cincinnati, which has recently been completed. He also designed the new station for the Kansas City Light & Power Co., which is soon to be put into operation. He went to Chile in 1916 as consulting engineer for the Guggenheim mining interests on the development of a power supply for their mine at Chuquicamata. During the recent war Mr. Sargent was consulting engineer for the power station at the Edgewood Arsenal at Edgewood, Md., and also consulting engineer for the United States Government in other war-time projects demanding the application of power on a large scale.

The decedent was awarded a medal by the World's Columbian Exposition in 1893. He was also a member of the jury of awards in power engineering at the St. Louis Exposition of 1904. He was a member of several societies and clubs, including American Society of Mechanical Engineers, Western Society of Engineers, University Club, Chicago Yacht Club and Skokie Country Club, and Engineers' Club of New York.

Mr. Sargent was married to Miss Laura S. Sleep at Sioux City, Iowa, in 1885. The widow, one daughter, Miss Dorothy Sargent, and two sons, Chester Sargent and Ralph Sargent, survive.

In his profession Mr. Sargent was noteworthy for the clear vision and strong common sense with which he grappled with the essentials of an engineering problem. He was simple, clear, direct and practical. He was a man of broad outlook, tolerant, modest, seeking results rather than to uphold theories. And he was eminently successful in obtaining results, for his electrical generating stations were milestones of achievement in the economical production of electrical energy. He stood in the front rank of those men whose efforts have made electricity cheap for the people—an everyday necessity in the home and factories of the United States.

An idea of the esteem with which Mr. Sargent was held by his business associates was shown in an interview with Wm. S. Monroe, his friend and partner in business for many years, who said:

"Mr. Sargent had an exceptionally keen and active intellect and a vigorous and forceful personality. He was a man of absolute integrity and fearless independence and high idealism in his work. He had an infallible intuition regarding engineering and scientific matters, and the responsible men in the companies for which he was doing his engineering learned to place the utmost confidence in his judgment. He had a remarkable combination of extreme daring and careful conservatism. With a broad and ambitious view of important and fundamental principles of his engineering work, Mr. Sargent combined an accurate knowledge of all the underlying details, and no detail was too small for his personal attention.

"He kept in close touch with everything that was new in the engineering profession. He was a great traveler and made repeated trips to Europe as well as through this country in order to post himself on the important developments—not only in the direct line of his own work but in all departments of the engineering field.

"His idealism was at times almost prophetic and he was very ambitious for the highest achievements in his work, but his idealism was held in restraint by a practical common sense judgment, which combined to give a distinct originality to every new power station which he designed, and made it systematic and harmonious, economical and a perfect working machine."

Samuel Insull, for whom Mr. Sargent did most of his important work, held his engineering ability in high estimation. In a speech delivered in December, 1911, Mr. Insull spoke of Mr. Sargent as "at the head of his profession, the electrical engineering profession, in this community, and the designer of our wonderfully economical central stations." In many other speeches he also took occasion to praise Mr. Sargent and his ability.

A large number of messages, further evidence of the esteem in which he was held by his associates and friends, was received by Mr. Insull and the family from men prominent in the electrical industry and the engineering profession among whom were the following: C. A. Coffin, J. B. McCall, Guy E. Tripp, E. W. Rice, Jr., and J. W. Lieb.

SURVEY ON PLANS FOR IMPROVING INDUSTRIAL RELATIONS.

National Association of Corporation Schools Issues Statement on Results Achieved in Various Industrial Organizations.

To what extent the readjustment of working conditions in the industries of the United States is giving the workers a voice in management at the moment is difficult to determine. The effort to democratize the industries is making steady progress, but so far results are not conclusive.

The National Association of Corporation Schools, with headquarters in New York City, is studying the problem of a more equitable distribution of created wealth through industrial pursuits, and also attempting to eliminate present wastes due to lockouts, strikes and other forms of industrial strife, through scientific employment, training of the industrial workers and other personnel problems. This association, in which some 133 of the larger industrial institutions of the United States have membership, including prominent electrical utility companies, advises that a recent inquiry among several hundred industrial corporations reveals that there are three plans that are being used, all designed to give employes more voice in management, especially as relates to working conditions, hours and wages. The results of the inquiry indicate that a considerable majority of the larger industrial institutions have either inaugurated some one of the three plans or are studying the various plans and gathering data on results so far obtained, with a view to determining which of the plans they will inaugurate.

These three plans are known as the "Works' Committee" plan, the "Industrial Council" plan and the "House and Senate" plan. The purposes of the three plans are practically the same, but the method of operation differs. So far as known, none of these plans involves direct representation on the part of the workers on the board of directors. However, it is anticipated, if it is found as a result of experiments that employes assume the responsibility, which logically they must assume if they are to have a continuing voice in management, that ultimately employes will be permitted to name a minority representation upon the board. Such action probably will occur only in industrial institutions where a considerable number of employes are stockholders, and the representation which they secure upon the board of directors will be dependent upon the amount of shares of stock represented by the employes who have a right to vote for such representation.

In one of the largest industrial institutions, where the "industrial council" plan has been made effective, the immediate result was a request on the part of the employes' representatives in the industrial council for an increase in wages and shorter working hours. This was followed by an avalanche of requests from individual employes for increases in wages. When it was pointed out to the representatives of the employes by the members of the industrial council representing the stockholders and management, that such action would necessarily involve an increase in the cost of the product of the company, and that this increase would bring the selling price of the company's product to a figure considerably higher than the selling price of its competitors, the request for shorter hours and increased wages were temporarily, at least, withdrawn. In other words, the immediate results of giving a voice to employes through delegated representatives were wholly selfish and not based upon investigation as to conditions, and were made without any assumption of responsibility whatsoever.

In at least three large industrial institutions where some one of the three plans has been introduced, strikes have followed within a period of one month. In other companies the plans have worked well, although the period of trial is of too short duration to admit of any conclusions as to what will be the final results and as to what definite attitude the representatives of employes may ultimately take. The assumption may be safely made, however, that employes of industrial corporations will continue to demand a voice in those problems of management which affect wages, working conditions and hours of labor. Whether or not the representatives of the workers in industrial councils will assume a fair portion of responsibility remains to be determined. So long as shorter hours and higher wages can be secured through strikes, it is probable that the new co-operative plans will make slow progress, but when the time arrives, as it inevitably must arrive, that strikes are no longer so successful, and when the public will demand to be heard in the settlement of wage disputes, it is believed that more constructive progress can be made in the working out of co-operative management, and that the workers will then assume a more definite responsibility for production. It is obvious that responsibility must be assumed by the workers if the industries of the United States are to be placed upon a more democratic or co-operative basis. Efforts to introduce better training systems and more scientific employment methods are meeting with no opposition and are progressing steadily. Also, efforts to encourage thrift (to include home owning), group insurance and sick and death benefit features are meeting with encouragement.

The survey also disclosed that plans to insure stock ownership by employes in the company by which they are employed are rapidly becoming installed, the number of companies now installing this feature being far in excess of the number that were working on similar plans prior to the reconstruction period. Stock-ownership plans almost invariably include provision for service annuities or retirement pensions.

The belief expressed by Judge Gary, chairman of the United States Steel Corp., that efforts to unionize the employes of the various subsidiary companies of that corporation would not succeed because the men realize they are better off under "open shop" conditions than they would be under the control of unions, is assumed by many other industrial executives. In fact the present effort is not only to secure employe or co-operative effort in management, with proportionate responsibility, but also to provide conditions whereby the workers of the larger industrial institutions will receive a greater degree of advantage than would be possible under the customary unions' control and direction.

The crux of the situation seems to be acceptance of responsibility by the representatives of the workers for greater output commensurate with shorter hours and higher wages.

FORTHCOMING MEETINGS OF THE AMERICAN INSTITUTE.

Dates of Pacific Coast Convention and Other Meetings Announced.

Pacific Coast Convention.—The Pacific Coast convention of the American Institute of Electrical Engineers will be held September 18-20, 1919, at Los Angeles, Cal., under the auspices of the Los Angeles Section.

New York Meeting.—A joint meeting with the Institute of Radio Engineers will be held in New York City on October 1, 1919. The subject of this meeting will be Radiotelegraphy.

Philadelphia Meeting.—On October 10, 1919, a regular meeting of the A.I.E.E. will be held in conjunction with the American Physical Society. This meeting will be under the auspices of the Electrophysics Committee.

New York Meeting.—A regular Institute meeting under the auspices of the Power Stations Committee will be held in New York City on November 14, 1919.

CHICAGO CONTRACTORS HOLD ENJOYABLE OUTING.

The Chicago Electrical Contractors' Association held an outing at the Olympia Fields Country Club on July 30 which proved to be one of the most enjoyable affairs ever conducted by this association. On this occasion the members and their guests competed in numerous athletic events, the most interesting of which were the golf tournaments. Many valuable prizes were presented to the winners of these contests and tournaments.

In addition to the members, there were present representatives from practically every branch of the industry who took a prominent part in the events.

Commercial Practice

Review of Electric Range Handbook—Priority in Event of Service Curtailment — Rates for Service Extensions

NEW HANDBOOK CONTAINS VALUABLE INFORMATION AND DATA.

Brief Review of "Electric Range Handbook" Published by Society for Electric Development.

The Electric Range Handbook prepared and published by the Society for Electrical Development, United Engineering Societies building, New York City, is a complete compilation of authentic information and data on this electrical appliance. As the rapidly growing interest in electric cookery, and the many advantages that electric cooking apparatus offers as a load builder have made the electric range one of the most important and prominent factors in the industry at the present time, the value of such a book can readily be appreciated.

It consists of 208 pages, attractively illustrated, bound in flexible leather, and is dedicated "to the national conservation of fuel, food and labor and to greater efficiency and economy in the home."

Its purpose is to guide and assist central-station managers who have realized the importance and profit of the electric range load and are contemplating the establishing of a special service rate and the merchandising of ranges. A secondary purpose is to stimulate greater range activity in general and to show the way to more extensive sales to manufacturers, jobbers and contractor-dealers.

The information and recommendations are based on the experiences and policies of a number of central stations which have pioneered and placed the sales and service of the electric range on a definite, successful and profitable basis. The text has been reviewed and approved by range authorities and cannot be materially affected by changing conditions, as the fundamental methods of merchandising and maintaining this load builder will remain unchanged.

In the first chapter the fundamental facts concerning the electric range are stated. Its value and desirability as a load to central stations are clearly shown and compared with other household appliances, followed by a general discussion of the advisability of establishing special rates for such service and the justification of such rates as shown by public service commission rulings. In addition, the various methods of financing extensions for such service that have been developed by many companies are reviewed and a valuable collection of data from 100 central stations is presented.

In the second chapter the modern electric range, its practicability and supremacy, construction and price, operating cost and economy, and its many advantages when used in the home are described. In addition, kitchenette ranges, which are in considerable demand for smaller and more compact apartments, and the many ingenious methods of installing them are also shown.

The third chapter is devoted to electric cookery, its development, advantages, characteristics, methods of application and principles, while the fourth chapter is a study of the desirability and advantages of the range load and its characteristics.

Chapter five explains the methods of installation with special attention being given to the methods of determining the proper size of conductor and the necessary wiring connections.

Chapters six, seven and eight are devoted to the merchandising of electric ranges and are entitled: merchandising methods, selling points, and advertising, respectively. Each of these chapters contains a fund of information on its particular subject and should prove of great assistance to the central-station manager and salesman in the conduct of their range business.

Service and maintenance are the subjects discussed in chapter nine. Selling a range, it is explained, is 10% salesmanship and 90% service and there are four divisions to this service: buying service, installation service, current service and maintenance service. The advantage of educating the new user in the proper methods of range operation and its fundamentals is also shown.

Every company attempting to encourage the use of electric ranges is confronted with the problem of heating water electrically in conjunction with the range and for this reason the various types of water heaters, their advantages and application are described in chapter ten.

Commercial cooking and the heavy duty apparatus designed for this apparatus are described in chapter eleven, while the final chapter consists of a compilation of general information on the subject.

The book is being sold by the Society for Electrical Development for $1.50 per copy and at least one prominent electric range manufacturer has purchased a supply which will be distributed in connection with its sales work.

COMMISSION RULING GOVERNS PRIORITY IN SERVICE CURTAILMENT.

Public Service Commission of Missouri Includes This Important Feature in Recent Decision.

The ruling of the Public Service Commission of Missouri in its proceeding against the St. Joseph, Light, Heat & Power Co. of St. Joseph, Mo., recently, brought out one especially interesting and important provision governing the conduct of such combined utilities. This provision states the priority to be given in the rendition of the different classes of service such as electric service, heating service and the street railways in the event of an occasion arising which prevents the rendering of all three classes. This ruling is particularly significant at the present time as many authorities predict a serious fuel shortage during the coming winter which may bring some utilities face to face with extreme conditions that demand a curtailing of service.

The proceeding was instituted by the commission to determine whether the service rendered to the public by the company was adequate and sufficient. The company conducts a combined plant supplying electric service and heat, and operating the street railways of the city.

According to the evidence it was found that the service until early in 1918 had been entirely adequate. At this time an interruption occurred due to failure of some plant equipment. This failure was remedied and no further trouble was experienced until Jan. 2, 1919, when a failure in the local water supply, caused by an ice gorge, required the complete suspension of the operation of the plant. An emergency pipe line was run to the river to overcome this difficulty but due the large amount of sand and gravel in the river water which clogged the boiler feed-pipes and pumps and resulted in low water in the boilers and the blowing out of boiler tubes, the interruptions to the service still continued.

The commission therefore ordered the company to provide additional equipment as a precaution against such failures in the future and also to provide a sufficient auxiliary water supply, independent of the city water supply, for boiler feed purposes.

The commission also ruled that in the event it became necessary to curtail the service in the future, priority shall be given as follows:

"A.—Steam-heating service, except during the morning and evening rush hours of the street railway service.

"B.—The street railway service in general.

"C.—The lighting service.

"D.—The power service.

"Before cutting out the power circuits, the company shall notify the power users for such reasonable time in advance as may be necessary to prevent undue amount of damage."

The commission also made the following statement relative to the efficiency and ability of the company's organization: "It is only fair to state in connection with the investigation that the manager and the supervising engineers are thoroughly competent and are making every effort to restore adequate service."

In conclusion, the finding states:

"The Commission has recently authorized a general rate increase for the various public services rendered by the defendant company. This increase has been granted upon the assumption that the service rendered was then and would continue to be fully adequate and sufficient. A continuation of inadequate service to the public may necessitate further consideration by the Commission of the reasonableness of the present rate schedules, since the charging of just and reasonable rates must be accompanied by the rendition of adequate and satisfactory service."

Commission Also Permits Company to Discontinue Service.

The commission, feeling that the broad and comprehensive powers conferred upon it necessarily imply the power to relieve a utility from rendering service where the facts warrant such action, also delivered a decision permitting the Marshfield Electric Co. of Marshfield, Mo., to discontinue operation at the end of a six-month period. The evidence in this case showed that the company was operating at a decided loss and that an adequate rate increase would not remedy this condition.

The real difficulty at Marshfield appears to arise because of the small proportion of citizens using electricity. While the city has a population of about 1500 and approximately 300 homes, there are only 190 connected consumers. An increase of rates would certainly not tend to increase the number of consumers but would reduce the number of present consumers and the quantity of current consumed. Therefore the Commission held that a rate increase within practicable limits offers no solution of the difficulty.

NEW MINIMUM RATES FOR SERVICE EXTENSIONS.

Puget Sound Traction, Light & Power Co. Files New Minimum Monthly Charges.

Proposing a plan by which the cost of extension of electric light service to residences not located on established circuits of the company will largely be borne by the consumer for whose benefit the extension is made, the Puget Sound Traction, Light & Power Co., of Seattle, has filed a schedule of rates with the State Public Service Commission of Washington, which under the 30-day provision of the law are not changed as to the kilowatt-hour consumption, but the new schedule affects the minimum charged the consumer who requires an extension to secure service.

For one customer, where one pole and service extension is required, a minimum rate of $2 a month is to be charged. For one customer, two poles and extension, the rate is $3 minimum. For two customers, one pole and extension, a minimum of $2 each is charged and for two customers, where two poles are required the minimum rate is $2 each per month. All contracts under the new tariff are for a period of three years. Under the present schedule the minimum charge is $1 a month.

The new tariff is filed on behalf of the subsidiaries of the Puget Sound Traction, Light & Power Co. and affects Seattle and King county, Tacoma and Pierce county, Everett and Snohomish county, Bellingham and Whatcom and Skagit counties.

BIG GAINS IN BUSINESS AT MINNEAPOLIS.

More Electrical Appliances Sold in First Six Months of This Year Than All of Last Year.

During the first six months of 1919 the Sales Department of the Minneapolis General Electric Co. disposed of more electrical appliances than during the entire 12 months of 1918. A comparison of these figures and other new business secured for the first six months of 1919 with the corresponding period of 1918 is as follows:

	1918	1919	Increase
Already built houses wired	1847	2067	12%
Appliances sold (number)	1701	1964	15%
Appliances sold (value)	$15,656.32	$47,861.03	205%
Ranges sold (number)	62	208	235%

During the week ended July 4, the sales department took contracts for 345 new electric light and power customers with 191 kw. of light and 607 hp. in motors. The net gain in business connected for the week was 165 customers with 179 kw. of lighting and 162 hp. in motors. The electric energy output for the week was 36.6% greater than for the corresponding week of last year.

Operating Practice

Instantaneous Detection of Generator Fire—Knife-Switch Inspection—Advantages of Parallel Feeders—Line Costs

PROPOSED METHOD OF DETECTING FIRES IN TURBOGENERATORS.

Outgoing Air to Be Used as Tell-Tale of Conflagration in Big Machines.

Turbogenerators may have caught fire and be burning for some considerable period of time, comparatively speaking, before the fact is discovered by the operating force. And by that time affairs have well advanced and damage that leads to still worse damage has usually occurred.

One way of enabling the internal conditions of turbogenerators to be watched is to enable the condition of the outgoing air to be made visible; another is to have some sort of indicator installed so as to indicate the passage of smoke or flame with the outgoing air. In some instances glass windows, of leaded glass, have been used, and in this way enable the operating force to see into the outgoing air passage. However, such a practice is unreliable, since inspection is necessary to make the practice reliable; and at best an inspection may not tell the whole story.

In one recent instance of a company operating a large number of turbogenerators, several of which have caught fire and destroyed themselves during the last three or four years, the outgoing air is passed to the boiler room, where its heat is used by the fuel beds of the furnaces, thereby increasing the efficiency somewhat. To prevent an internal turbogenerator fire existing unnoticed in this installation it has been proposed to install an indicator by which any abnormal condition of the outgoing air can be readily detected. This indicator will consist of a metallic pipe, of a cross-section small compared to the total cross-section of the air duct, for example about 1 ft. diameter, which would be located at the exhaust of the generator in the turbine room. In this way any sparks, flame or smoke going through the air duct would come to the attention of the operating force in the operating gallery or on the turbine-room floor.

PERIODIC INSPECTION OF KNIFE SWITCHES ADVOCATED.

Reduction of Energy Loss and Better Regulation at Heavy Amperage.

By B. Hamilton.

In stations transmitting heavy amperage as, for example, substations supplying Edison three-wire systems, there are many heavy-ampere knife switches, most of which are loaded a considerable portion of the 24 hours. Also in many large industrial establishments using either alternating or direct current, the former at 220 or 440 volts, the current values may attain considerable magnitude.

Heating occurs at the knife switches, sometimes because the current exceeds the switch rating and more often because the surface of contact between the blade and the clips is not the best. With alternating current there is an added loss due to eddy currents.

The heating at switches, when excessive, represents a waste of energy; it causes a voltage drop that tends to interfere with voltage regulation and often times causes injury to the switch. The writer has found switches where the blade and the clips had become so heated as to be almost welded together so that the switch could not be opened readily, nor when once opened closed again.

The remedy is to make periodic inspection of switches carrying heavy currents. This inspection may merely consist of feeling the switch by hand to determine temperature or may consist of taking measurements of voltage drop across the switch and between blades and clips. Heating due to poor contact can be reduced by cleaning the surfaces of contact. Wiping these surfaces with a thin layer of vaseline also reduces the drop, although but only a small quantity of the lubricant should be employed. Some of the larger companies handling heavy currents over many switches have determined limits of heating and voltage drop above which they do not allow their switches to go. The practice is a worthy one.

PARALLEL OPERATION OF FEEDERS REDUCES CABLE BREAKDOWNS.

Reduction of Investment Also Additional Benefit Obtainable from Parallel Feeders.

The savings which can be effected by a parallel operation of feeders depends in a large degree upon the design of the transmission system and the ratio of the capacity of the line to the capacity of the individual synchronous converters or transformers, which are supplied by this feeder. In one system supplying converters varying from 500 to 4000 kw. in size together with step-down transformers in substations of 1500 and 3000 kw. capacity and also industrial substations on the premises of customers ranging from about 500 to 4000 kw. in capacity, it was estimated that if the feeders could be operated in parallel then a saving of 20% could be made in the amount of investment. This fact was brought out at the recent A. I. E. E. convention. As the installation in question had a book value of about $5,000,000, there was a possible saving estimated at $1,000,000. This company has been operating feeders in multiple for about two years. During this period they have realized nearly 40% of the possible saving in the investment in feeders, and this has been secured by an actual reduction in the number of feeders, notwithstanding a considerable increase in the maximum load.

The same company also reports in the four years preceding the installation of the relays permitting parallel operation of feeders that they averaged 27 burnouts per year which could not be definitely ascribed to external causes, while in the two years since the feeders have been operated in parallel, the corresponding figure was 16 burnouts. This would indicate a reduction of 40% in the burnouts of cables due to operation of the feeders in multiple, although the cables were actually more heavily loaded. While the time is rather too short to accept these figures as final and conclusive, it apparently indicates that the operation of feeders in parallel reduces the number of troubles due to internal causes.

ITEMIZED COST OF 33,000-VOLT TRANSMISSION LINE IN CENTRAL ILLINOIS.

Line Built During War to Supply Coal Mine with Central-Station Service.

The itemized cost of constructing this transmission line, together with a list of material, is appended:

Poles.

430	6-in. by 35-ft. steel poles with single arms and bayonets	@	$33.00	$14,190.00
10	6-in. by 35-ft. steel poles with double arms and bayonets	@	37.80	378.00
13	6-in. by 35-ft. steel poles with corner equipment and bayonets	@	31.80	413.40
42	6-in. by 40-ft. steel poles with single arms and bayonets	@	40.82	1,714.44
2	6-in. by 40-ft. steel poles with double arms and bayonets	@	45.62	91.24
4	6-in. by 40-ft. steel poles with corner equipment and bayonets	@	44.42	177.68
7	6-in. by 45-ft. steel poles with single arms and bayonets	@	45.03	315.21
3	6-in. by 45-ft. steel poles with corner equipment and bayonets	@	43.83	131.49
3	6-in. by 50-ft. steel poles with single arms and bayonets	@	75.90	277.70
4	6-in. by 50-ft. steel poles with double arms and bayonets	@	80.70	322.80
1	6-in. by 50-ft. steel poles with corner equipment and bayonets	@	74.70	74.70
24	7-in. by 30-ft. cedar poles for guy stubs	@	5.25	126.00

Total cost of poles............................$ 18,212.66

Material for Line.

1,675	No. 5005 Victor insulators	@	$ 3.258	$ 5,457.15
1,675	No. 44661 Keystone truss pins	@	0.8583	1,437.65
500	No. 11535 Ohio Brass disk insulators	@	2.34	1,170.00
166	No. 11541 Ohio Brass dead-end clamps	@	2.09	346.94
138,000	lb. No. 1 B. & S. solid copper wire	@	0.275	37,950.00
160,000	lb. 5/16-in. double galvanized ground wire	@	0.0165	2,568.00
450	sacks cement	@	63.75	318.75
5	cars of gravel			161.77
	Miscellaneous small material			2,587.39

Total cost of material............................$ 51,997.65

Labor Costs.

Engineering surveying for pole line	$ 822.30
Unloading poles and material	345.45
Hauling poles	910.57
Hauling gravel	192.71
Cutting and removing trees within 30 ft. of line	1,197.56
Distributing arms, pins and bayonets	366.80
Fitting poles with arms, pins and bayonets	871.83
Digging pole and anchor holes	1,180.39
Erecting poles	2,032.55
Hauling cement	93.05
Mixing cement and gravel and tamping poles	1,597.90
Miscellaneous hauling	740.28
Placing guys	711.98
Putting on insulators, stringing wires, tieing in conductors and clipping in ground wire	3,534.97
Moving telephone lines to clear right-of-way	822.40
Storm guying	432.00

Total cost of labor .... $ 15,852.74

Right-of-Way.

Pole line right's	$ 3,832.00
Trees	827.50
Labor and purchase of right-of-way	841.58
Livery and expense	978.03

Total cost of right-of-way	$ 6,479.11
	$ 92,542.16
Overhead expense	9,254.21
Total cost of line	$101,796.37
Cost per mile	$ 3,181.14

POWER TRANSMISSION AT 220,000 VOLTS.

Much interest has been aroused in the paper by A. E. Silver before the recent Lake Placid convention of the A. I. E. E., in which he discussed the possibilities, theoretical and practical, of power transmission at 220,000. An abstract of this paper appeared in Electrical Review July 12. The following gives another aspect of this subject.

Certain features of the problem are high reactance of generators and transformers, ample insulation of transformers and an efficient oil circulation system, high mechanical strength of oil switches, avoidance of low-voltage buses and low-voltage paralleling, and an effective and dependable system of relay sectionalizing. All line switching, automatic or manual, should be done on the high-voltage side of transformers. The amounts of power involved, particularly under abnormal conditions, are so tremendous that the current values obtaining at lower voltages impose switch duties and heavy stresses generally which could be handled only with great difficulty and at an expense materially higher than would be required at 220 kv., when the currents involved are relatively small. No equipment of any character is contemplated for protection against over-voltages.

Contracting-Construction

How to Make Old House Wiring Pay—New York Contractors Hold Outing—Evansville Electrical Firm Reorganized

SUCCESSFUL METHODS OF CONDUCTING OLD HOUSE-WIRING BUSINESS.

How Dempsey & Meade, Chicago, Makes This Class of Work Pay Real Profits.

Among the electrical contracting firms in Chicago that specialize in the wiring of already built buildings, one of the most successful is Dempsey & Meade, located at 3153 W. Madison street. Organized in 1908, this firm through the persistent efforts of its owners and the up-to-date business policies they adopted, has grown rapidly until at the present time it occupies a prominent place in the local contracting fraternity and enjoys an enviable reputation throughout the city.

Schedule..........

Dear Sir:-

We wish to respectfully submit you an estimate of..........
for wiring your .... story.......... residence for electric light at the above address, and..........for furnishing and installing fixtures for same as hereinafter noted:

The work to be done under this contract will consist of wiring ....outlets for..........lights;..........outlets for single and double pole switches; and..........outlets for 3 way switches, as follows: Ceiling height..........ft..........in..........meters.

LIGHT OUTLETS Telephone No..........

Location Ceiling Wall Baseboard Lights Switches	Fixtures
Porch	Ceiling holder, bracket or chain pendant
Vestibule	Ceiling holder, bracket or chain pendant
Hall	Chain pendant or bracket
Hall	Chain pendant or bracket
Stairs	Chain pendant or bracket
Parlor	Semi-direct bowl or shower
2nd Parlor	Semi-direct bowl or shower
Dining room	Shower or bowl with ( ) drop shades to match
Library	Shower, bowl, or chain pendant
Sitting room	Shower, bowl, or chain pendant
Pantry	Drop cord and guard
Kitchen	1-1x1 pendant
Basement	Drop cord
Laundry	Drop cord
Upper hall	Chain pendant or bracket
Bedroom	Chain pendant or bracket
Bedroom	Chain pendant or bracket
Bath	Chain pendant or bracket
Attic	Drop cord

Fig. 1—Contract Form That Provides for Description of Work to Be Done.

One factor contributing to the success of this concern is that it has specialized in this particular field of electrical work, educating its workmen in this line and building up its organization to best meet its special requirements. Just now, this organization has been developed along this line to such an extent that it has not as yet been deemed advisable to branch out into new building work although recently the opportunities for such work have been very good.

Another is its policy with relation to its customers, competitors and the electrical industry as a whole. Early in its existence the firm began a policy of good service in addition to a high quality of work and its acitvity in this respect is largely responsible for its present position. In order to avoid any misunderstanding with its customers and to correct any difficulties that may arise as soon as possible, arrangements have been made so that the customer must sign forms stating that the work already done is entirely satisfactory before any job can proceed or is considered completed. It has also co-operated in many ways with the other local branches of the industry and its members are very active in local electrical organizations, Mr. Meade being president of the Commercial Electrical Contractors' Association.

A third and equally important factor is its policy to determine accurately and promptly the exact cost and profit on every job and not to take any work at a price which will not show a suitable profit. Its attitude in this matter is ably expressed by Mr. Meade, who says "If you want to gamble on a building, buy it."

To accomplish this every job is costed immediately upon its completion which shows whether the method of estimating is correct or not and also the performance of the workmen on that job. The firm endeavors to employ only the best and most efficient workmen and as a reward endeavors in turn to keep them employed as continuously as possible.

	Materials out	Materials in	Materials used	Materials cost		Materials out	Materials in	Materials used	Materials cost		Materials out	Materials in	Materials used	Materials cost
½ inch Conduit					2 Pole knife switches					Flat ceiling plates				
¾ inch "					3 Pole knife switches					B. B. Switch boxes				
1 inch "					½ Cut-out block					B. B. Shal. switch box				
Lag Bolts					No. 2587 Cut out blocks					B. B. Spacers				
Porch Braces					No. 2199 " "					S. P. Push switches				
1900 Bracket Covers					Panel Cut out					D. P Push switches				
8 R. Boxes					10 Ampere fuses					3 Way Push switches				
Closed Covers					Fuse links					S. P. Plates				
Spider "					½ inch Meter fitting					2 or 3 way plates				
Bushed "					¾ inch Meter fitting					¾ inch Key sockets				
Receptacle covers					¾x¾ inches Meter fit.					½ inch				
17 A. Boxes					1x1 inches Meter fit.					¾ inch Pull sockets				
Closed covers					No. 14 Wire S. B					½ inch " "				
Spiders "					No. 12 Wire S. B					Key wall sockets				
Bushed "					No. 10 Wire S. B					Federal sockets				
Receptacle "					No. 8 Wire S. B.					Lamp cord				
1900 Boxes					Ground wire					Reinforced cord				
Closed covers					Solder and paste					Base recept. complete				
Spider "					Friction tape					2 Wire Gear blocks				
Bushed "					Rubber tape					3 Wire Gear blocks				
Receptacle "					Candles					Hack-saw blades				
½ inch straps					Wood screws					Batteries dry				
¾ inch "					Stove bolts					2 wire Pierce brackets				
¾ inch "					Perforated metal					Elbows				
1 inch "					Plaster board					Couplings				
Minerallac straps					Plaster Paris					Weatherproof sockets				
½ inch Locknuts					10 Penny nails					Service heads				
¾ inch "					Finishing nails					Transformer				
1 inch "					2 wire B. X.					Bell wire				
½ inch Bushings					3 wire B. X					Staples				
¾ inch "					Str. B. X. Bushings					Lock switches				
1 inch "					90% B. X. Bushings					Bell				
Federal Bushings					½ inch Bounding clamps									
Pierce bolts					¾ inch Bounding clamps					W. P. Wire				
Ground clamps					¾ inch Fixture studs					Lugs				
10x12x4½ Boxes					Box Hangers					1900 Switch covers				
12x15x4 Boxes					Ceiling boxes					Extra				
12x18x4½ Boxes					Ceiling boxes with ears									
6x8x4 Boxes														

Remarks..........

Fig. 2—Material Sheet Used by Dempsey & Meade, Chicago, for Keeping a Record of All Materials Used.

The methods and forms which it has developed for its use are very simple and designed to eliminate confusion or duplication as much as possible. The form shown in Fig. 1 is the first page of its contract. On this form space is provided for the price of the job, a brief description of the building and the total number of outlets, lights, switches, meters, etc. Below provisions are made for the listing of each outlet and switch, together with its location in the room. On the right is listed a description of the fixtures ordinarily used in such rooms, the ones not selected being scratched out by the estimator. Space is also provided to insert the number of sockets desired in the fixture. The second page of the contract provides for the method of payment, and the signatures.

When the contract is received at the office it is given to the foreman who goes to the job and orders out the material on the form shown in Fig. 2. On this form practically every class of material used in this work is listed with four columns opposite marked Materials Out, Materials In, Materials Used and Materials Cost. The first of these columns is used by the foreman in ordering the material for the job. The second and third are filled in by the workman after he has completed the job and records the amount of materials left over to be picked up and the amount used which is obtained by subtracting the quantity shown in the second from that in the first column. The materials used are costed at the office and recorded in the last column.

The labor charges are recorded on the form shown in Fig. 3. On this, spaces are provided for the journeymen's name, the total number of hours of labor on the job. Below this is a space for listing the number of outlets or fixtures, their description and location as taken from the contract form. A separate labor slip is provided for the different wiring operations. Below the description of the installation space is provided for the customer's signature stating that the work as done is satisfactory.

The form shown in Fig. 4 is a small card used

Dempsey & Meade Time and Material Ticket

Name ....

Address ....

Workman	Labor .... hours
Job taken	....
Job started	....
Job completed	....
Inspection	....

MATERIALS

This certifies that this work has been satisfactorily completed

Customer's Signature__________

Fig. 3—Time and Material Ticket.

for recording the time and materials used in small repair or additional jobs. As on the previous forms space is also provided here for the customer's signature.

A large percentage of the wiring jobs done by the firm is taken on a time-payment plan. The financing of this plan is done through the Commercial Electrical Contractors' Association by a local banking house. The method employed in the operation of this plan is for the customer to sign interest bearing notes, for which suitable forms have been devised, which are purchased from the contractor by the bank. At present the company itself is making the collections on these accounts.

In spite of the success that the company has achieved in this field of contracting, the members

DEMPSEY AND MEADE

Time and Material Ticket

Name __________

Address __________

Labor ______*hours*

*Materials used*__________

____

This certifies that this work has been satisfactorily completed.

*Customer's Signature*__________

Fig. 4—Form Used for Keeping Records of Time and Material on Small Repair Wiring Work.

are convinced that the real opportunity lies in the merchandising field and for this reason it has already started to build up an organization to carry on this work on an extensive scale. The possibilities of merchandising were quickly realized by this concern when it first took part in the co-operative sales campaign inaugurated in Chicago about two months ago. The results obtained thus far without any intensive sales effort being made have greatly exceeded all expectations. For this reason the company plans to double the size of its present quarters, hire salesmen and solicitors and to develop another organization to work in conjunction with its present one as quickly as possible.

NEW YORK CONTRACTORS HOLD ANNUAL OUTING.

The fifteenth annual outing of the Independent Electrical Contractors' Association of Greater New York was held at Grant City, on June 21. On this occasion the members and their guests participated in numerous athletic events which were closely contested and in addition several novelty and entertainment features were introduced, including running the prohibition law. About 400 men representing the various branches of the electrical industry were present and the consensus of opinion seemed to be that this was the finest affair of its kind ever held by the association.

EVANSVILLE ELECTRICAL CONCERN REORGANIZED.

The A. L. Swanson Co. of Evansville, Ind., one of the largest concerns in that section engaged in electrical construction, repair and maintenance, and jobbing work, has recently reorganized and in the future will be known as the Swanson Electric & Manufacturing Co. The purpose of the reorganization was to increase the capital of the company in order to extend its jobbing and manufacturing facilities. A. L. Swanson, chairman of the Indiana State Association of Electrical Contractors and Dealers, will remain as president of the new concern.

Contractor-Dealer

New Merchandising Companies Formed—Successful Window Displays—Methods of Securing Children's Friendship

COMPANY FORMED TO RETAIL ELECTRICAL PRODUCTS IN CHICAGO.

Home Appliances, Inc., Plans to Open Several Attractive Retail Electrical Stores.

The Home Appliances, Inc., has recently been organized in Chicago for the purpose of merchandising electrical household appliances on an extensive scale. The company plans to open three attractive stores in this connection, one on the north side of the city, one on the west side, and one on the south side. The north side store is to be located at 3301 Lawrence avenue and is expected to be ready for business shortly. The one on the south side will be located at 6530 South Halsted street. Both of these locations are in the heart of thriving business districts where the need of attractive electrical stores is evident. The location of the third store has not as yet been decided upon but it is expected that a prominent store in one of the numerous business communities of that section will be arranged for shortly.

The new firm will handle the complete line of Western Electric Co. products for home use and will also carry a large stock of other merchandise, such as ornamental floor and table lamps. The stores will be made as attractive as possible and conducted along the most approved modern merchandising methods.

George Ledell, formerly of the Electric Shop of the Commonwealth Edison Co., has been appointed general manager of the new company. Mr. Ledell has had considerable experience in the retailing of electrical merchandise, which insures the success of the new enterprise to a large extent.

NEW ELECTRICAL FIRM ORGANIZED IN ROCHESTER, MINN.

Rochester Electric Co. Plans to Carry on an Extensive Merchandising and Construction Business.

A new company to be known as the Rochester Electric Co. has recently been incorporated at Rochester, Minn., for the purpose of conducting an electrical contracting and merchandising business in that section. The incorporators are E. M. Raety, William F. Hines and Henry Blink, all of Rochester, and who have been intimately associated with the electrical industry for many years and have had considerable experience in their particular lines.

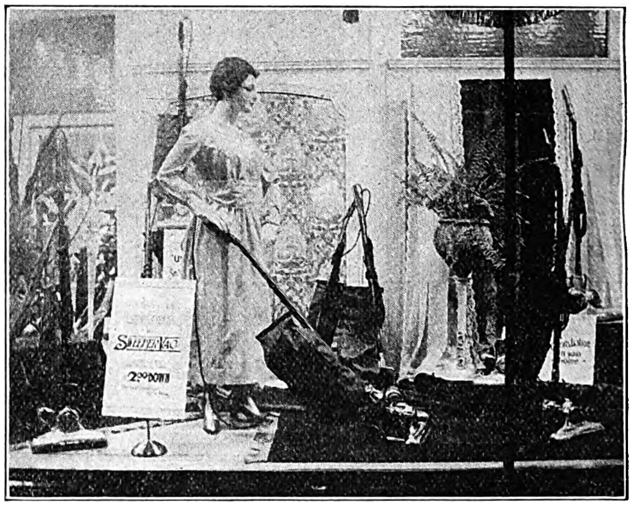
The new firm has already secured a considerable amount of construction work, one of its most important jobs being the men's dormitory at the Rochester State Hospital. In the merchandising field it is the present intention to specialize on Hughes ranges, Packard lamps, Columbia dry cells, Emerson fans, Simplex ironers, Thor washers and the Hotpoint line, and in the thriving city of Rochester with its many hospitals and hotels the company anticipates a good patronage.

ATTRACTIVE WINDOW DISPLAYS THAT PROVED SUCCESSFUL.

Recent Advertisements and Window Decorations That Have Produced Results.

By W. B. Stoddard.

Comparisons may be odious but when they point such an effective moral as the comparative displays of the Bureau of Power, Los Angeles, Cal., they are decidedly to be commended especially from a publicity standpoint. In urging the wiring of the house for electricity, and playing up the advantages of electrical equipment, this company recently arranged two windows. The first showed the old fashioned household conveniences,—the candle, the kerosene lamp, and the open flame gas jet; the frazzled broom; the rusty flatiron; the coffee pot; and the gas toaster that always burned the toast. A card on the floor observed: "The Old Way." The second window showed the Mazda light; in an art metal stand lamp; the capable vacuum cleaner; the electric iron; the aluminum percolator; and the electric toaster that toasts so evenly and crisply. A card at one side observed: "Be Up-to-Date—Wire Your Home Now." On the wall was a big white disc with the figure "5 Cents." Beneath this was another card advising what this small amount of money can accomplish in comfort and convenience when used to purchase electricity.



Attractive Vacuum Cleaner Display by Portland, Ore., Contractor-Dealer.

The Brooklyn Edison Co., Brooklyn, N. Y., gave a practical demonstration of the ease and comfort with which the family ironing is done by the use of electricity. A little girl of about 12 was shown manipulating an electric iron on a piece of soft white goods, the motive power being a fancy electric lamp which stood on the end of the ironing board. Piled up in front were boxes containing these electric irons, as well as several of the irons unboxed, so that they could be seen to better advantage. Cards set up at different points in the window gave definite advice as to the advantage of electricity compared to the old fashioned iron:

> No steps to and from the hot stove—
> all the heat is in the iron.
> One iron does all the work—
> no tiresome changing of handles.
> Average family ironing done at a cost of
> less than 15 ct. a week.
> Prepare in advance for the hot summer days. The electric iron shortens the labor—saves the strength.

The solution of the wash day problem that is puzzling the housewives in every part of the land is suggested by the Wilmington Traction Co., Wilmington, Del., in their decidedly effective display window. On the glass was pasted a clipping taken from one of the local papers:

CITY SHORT OF WASHERWOMEN

IN CONSEQUENCE, MANY HOME TRAGEDIES ARE BROUGHT TO LIGHT—WON'T COME BACK TO THE TUBS.

A washerwoman in Wilmington is as scarce as hen's teeth. The lack of this Pride of the Tubs is causing many tragi-comedies in domestic life. The 5-cent stores are doing a tremendous trade in paper table cloths and napkins, as many women have adopted these don't-have-to-be-washed substitutes for table linen until Dinah comes back to the washboard. What is puzzling the housewives is that, although munition work has stopped, the washboard ladies show no signs of returning to their tubs.

In the middle of the display was shown an electric washing machine in operation, churning the suds at a great rate, and red ribbons ran from it to cards set in racks which read,—"Let the Electric Washing Machine be your dependable washwoman—always on hand and always cheerful"; "An Electric Washing Machine will save you all the troubles and worries of wash day, and will always be on hand when wanted"; "An Electric Washing Machine doesn't require three meals per day, and doesn't ask for car fare." The inference was so plain that he who ran might read, that the way to offset the shortage of laundresses was to buy an electric washing machine and do the work one's self in half the time.

The handy vacuum cleaner was attractively shown by Olds, Wortman & King, Portland, Ore., who showed a young woman in blue morning dress operating with ease one of the latest models. The window was fitted up to represent a drawing room with an Oriental rug, curtains of maroon, with over-draperies of lace, and a wicker flower stand holding a fern. A card down in front said: "Make play of your work by using a Vacuum Cleaner," and another suggested that the observer ask for a demonstration of the work of the vacuum cleaner in her own home.

During the summer mother is planning the clothes of the family for fall and winter, and a campaign for electric sewing machines should be gotten under way without delay. A decidedly successful one is being conducted by Barker Bros., Los Angeles, Calif. In order to arouse interest from the beginning they placed a modest advertisement in the paper:

HOW MANY TIMES CAN YOU WRITE OUR NAME ON A CARD?

A series of prizes will be given to the persons writing it the greatest number of times in a legible manner, without writing it over or across other letters. Come in and ask us about it.

This announcement of course piqued the curiosity and scores came to the store to learn about the offer. Each enquirer was handed a card with the name of the firm printed at the top, the remainder of the space being left free for the contestant to exercise his skill. On the opposite side was printed: "Write the name of three electrical household appliances which you do not possess." The rules of the contest were simple: All writing must be done with ink; all words must be legible; all cards must bear the name and address of the writer, together with those of three electric household conveniences. The addresses were tabulated, and the writers circularized with pamphlets describing the advantages of the electric articles mentioned on their cards. The prizes offered were electric household conveniences, displayed in the window prior to the decision of the judges.

This contest was followed by a concise, pointed newspaper advertisement, adorned with cuts of vacuum cleaner, sewing machine motor, and electric washing machine, all operated by young matrons in neat morning dresses. These were forceful; worded as follows:

LET MODERN ELECTRIC EQUIPMENT MAKE MORE SPARE HOURS FOR YOU—COME TO BARKERS

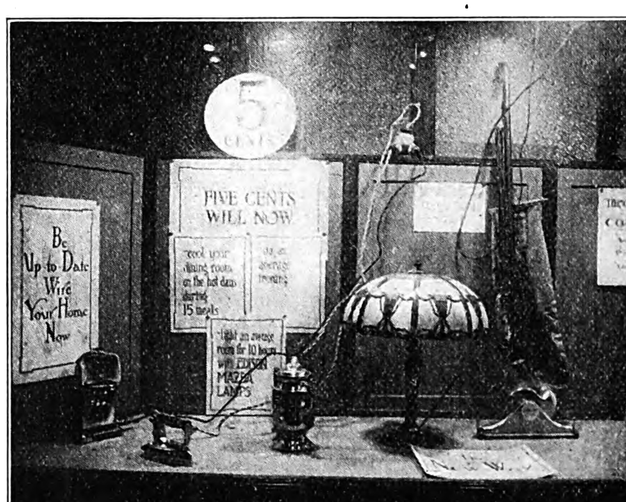
Let us show you how quickly, easily and pleasantly you can do all your housework with better equipment—electrical, of course.

THESE ARE THE IMPORTANT TIME SAVING NECESSITIES

Electric Sewing Machine Motors Electric Vacuum Cleaners
Electric Washing Machines

The window was fitted up as a sewing room, in

"The Old Way" as Displayed by a Los Angeles Company.



And "The New Way" Shown in the Next Window.

which sat a woman making a child's dress, using an electric motor to operate the machine. A card suggested: "One can operate this sewing machine all afternoon without fatigue, as it requires head power, instead of foot power, to run it." At certain hours of the day, when traffic was heaviest, a neat maid could be seen going over the room with a vacuum cleaner; while a large card in the window advised: "Be sure to visit our model electric laundry on the second floor." This laundry was fitted up with electric washing machine, ironer, and well arranged lighting system. There was also an electric fan on a stand, and a card said: "There will be no Blue Mondays when one has a model electric laundry in which to pleasantly and swiftly do the weekly washing."

GETTING IN GOOD WITH THE CHILDREN.

Methods Employed by Merchants to Secure Children's Friendship and Its Value to the Store.

By Ernest A. Dench.

Children are more susceptible to bribery than anybody else, crooks excepted. Of course, children cannot be put in the same category as crooks, for the good and simple reason that youngsters are totally innocent of any wrong doing. If it is bribery, it is a commendable and totally inoffensive form of bribery, for it makes the children happy, eases things for their parents and attracts trade for the merchant.

Following this idea, a merchant in Tupper Lake, N. Y., secured an excellent assortment of cunning, happy dolls with cheerful faces. The customer spending $1 in the store during the three weeks set aside for the campaign received one neatly dressed doll, 11 to 14 in. high. If the purchase amounted to $5, the little girl who accompanied her mother was given a medium size, neatly dressed doll, 17 in. high. But if the little girl succeeded in inducing her mother to spend $10, she was rewarded with one large size, finely dressed doll, 20 in. high.

Charles Mayer & Co., Indianapolis, Ind., made a certain Friday a "Red Letter Day" for little girls. On this particular morning every girl in Indianapolis who possessed a doll was invited to bring her doll to the store. There was no distinction and it was pointed out that it did not matter whether the doll's clothes were torn or faded, whether the face was chipped or dirty, or the doll big or little, pretty or homely, light or dark, so long as it resembled a doll.

The only rule every girl had to observe was to pin a piece of paper to the doll with her name and address plainly stated. On Saturday the dolls were placed in the window and the overflow placed on exhibition in a prominent place inside the store. Every girl was invited to see the exhibit. On the following Monday a group picture was taken of the dolls. On Tuesday morning each girl calling at the store for the return of her doll was presented with a copy of the doll window picture.

As can be imagined, the stunt got the store talked about in thousands of Indianapolis homes solely by the mouth-to-mouth publicity of the children. It got every girl's goodwill, and aside from getting the parents interested in the store it must be remembered that the stunt will do the store good in years to come, when the little girls are grown up and have little girls of their own.

Evans, Indianapolis, Ind., recently ran a series of "Flags of Our Allies" in the local newspapers. Half of each advertisement was devoted to a reproduction of a flag and a brief description of it and the other half of the ad was devoted to the store.

In the public schools at the present time most of the history and geography lessons are being devoted to our gallant allies in the great war. This has resulted in every teacher availing herself of every means to inform her pupils more about these countries. She grasps every opportunity to get home the facts as a cat pounces upon a mouse, so the electrical dealer who assists her in this connection is sure of her hearty co-operation. Children hate to have knowledge crammed into their systems, but it is surprising how much knowledge they will pick up if there is an inducement connected with it. This Evans realized in inviting the school children to cut out the advertisements, which appeared every Tuesday and Saturday. The children were then told to color the flags with crayon or paint and they would soon have a full collection of the flags of our Allies. This stunt might be improved upon by offering prizes for the best colored flags.

The Live and Let Live Store, Chattanooga, Tenn., knowing how children worship their war idols, offered a photograph, size 15 by 18 in., of President Wilson or General Pershing with every purchase amounting to $2.

It will always pay the electrical dealer to take the children into consideration for, in addition to affording a valuable medium of gaining immediate publicity, it assures the future growth of the store. For the child will be grown up some day and the favorable opinion thus formed of a merchant while the child is in the impressive age, will remain long after it is old enough to utilize its own judgment of things.

PREPARING FOR THE AUGUST CLEARANCE SALE.

August has been generally accepted by the electrical retail trade as the "clearance sale" month, when the wideawake electrical dealer cleans out his slow-moving stock. Several valuable suggestions for the preparation and conduct of such a sale were given in an article in the Monthly Sales Service of the Society for Electrical Development recently.

Before starting a sale of this kind the merchant should carefully analyze his stock to determine what goods were moving too slowly and must therefore be sold, and also the reason in order that he may avoid such difficulties in the future. After selecting the goods to be sold at reduced sale prices he should choose a suitable name for his sale. "Clearance Sale" alone has some advantages but its value may be considerably increased by the addition of some other word, such as "Electrical" or "Combination," while a distinctive name, such as "Red Letter Sale" or others commonly employed by department stores is even better. This name should be featured in all the dealer's advertising during the month and special pains should be taken to keep up interest in the sale by always featuring some especially attractive article.

In pricing the goods it should be remembered that they have no value as long as they remain on the shelves and that their sales possibilities grow less every day. For this reason the prices should be made low enough to insure their sale. But the selling price should never be reduced without giving some reason for otherwise the customers will think that the prices were too high in the first place.

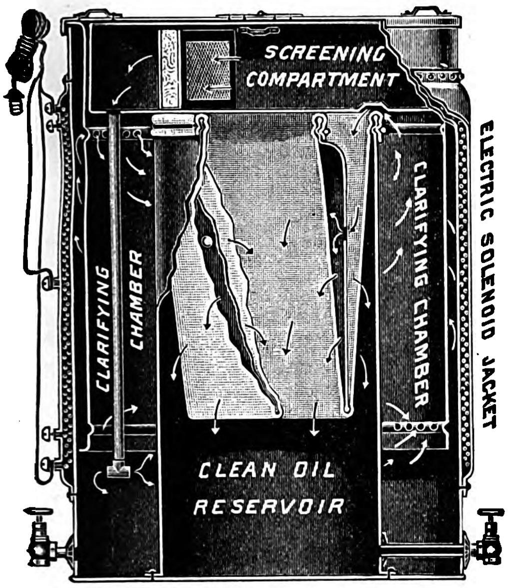
New Appliances

Oil Filter for Screening, Clarifying and Filtering Oil—Triple Die Stock for Facilitating Pipe and Conduit Work

The Electrically Heated Simplex Oil Filter.

The bearings of electrical and other rotating, reciprocating and oscillating machinery must be thoroughly lubricated to minimize friction. Oil used for this lubrication should be frequently filtered and cleaned of sediment or other impurities if it is to be used over and over again, as is now customary for economy. Removal of the particles of metal, dirt, etc., maintains the oil at its best lubricating quality and prevents cutting of the bearings and thus reduces friction.

Oil is also extensively used in electrical apparatus, such as transformers, oil switches and circuit-breakers, etc., for its insulating and heat-dissipating properties. Such oil should also be frequently filtered and purified, if it is to retain its dielectric quality at a reasonably high value.



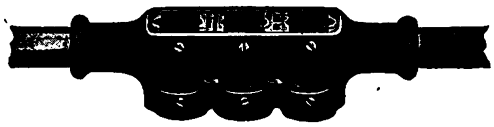
Electrically Heated "Famous" Oil Filter, Which Screens, Clarifies and Filters Oil for Reuse.

In the accompanying illustration is shown an oil filter designed especially for treating oil used for lubrication. It is also useful, however, for filtering oil for electrical purposes. It is known as the electrically heated simplex type of the "Famous" oil filter manufactured by the Famous Filter Co., 116 Pine street, St. Louis, Mo.

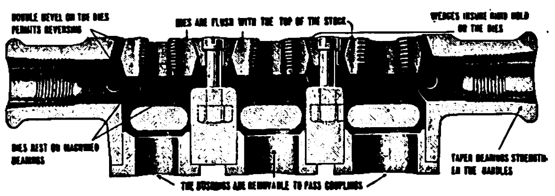
Operation of this filter is very simple. The dirty oil is poured into the removable screening compartment and percolates through the strainer wall and screening material. This thoroughly screened oil then descends through the feed pipe and spreading tee and enters into the clarifying chamber, near the bottom thereof at the left-hand side. As this chamber is always full of the oil which is undergoing the clarifying process, filtration takes place only after the oil level reaches the top of the clean oil reservoir, thus every drop of the oil must take its course and gradually travel upward and across to the other side during the clarifying process, so that all heavier particles of impurities and entrained water are separated from the oil and precipitated upon this chamber, whence they are withdrawn, occasionally, through the water and dirt drain valve at lower left side.

From the upper right-hand side of the clarifying chamber the oil passes into the filtering receptacle in the middle and filters through this dense filtering cloth, finally flowing into the clean oil reservoir, whence it is delivered as a high-grade oil at the clean oil valve shown in the lower right corner. By this process of first screening and clarifying the oil the cloth has to remove merely the few lighter impurities as only the cleanest oil filters through the exceedingly large area of washable high-grade filtering cloth surface presented by the patent self-contained and easily removable, double filtering-wall tension-truss receptacle.

It has been found that clarification or precipitation of particles in the oil is considerably facilitated by having it moderately warm as this increases its fluidity. For this purpose in the type illustrated there is provided an electric heating jacket that can be operated on either 125 or 250 volts, taking only 60 watts per gallon of oil reclaimed in either case. For 125 volts the two valves of this element are connected in parallel and for 250 volts they are connected in series. Since this heating coil is in the form of a solenoid, it possesses considerable magnetic properties causing particles of iron to be withdrawn from the oil more readily and completely than by slow gravity precipitation alone.



Trio Die Stock Complete.



Sectional View of Trio Die Stock, Showing Details of Construction.

Trio Die Stocks for Conduit Work.

Among the pipe tools which have been gaining in prominence until they have finally assumed the position as leaders in their line are the Trio die stocks, manufactured by the Greenfield Tap & Die Corp., Greenfield, Mass. This rise to prominence is due in a great measure to their excellent work during the war, when results were imperative.

The Trio die stock, as its name implies, contains dies and bushings for threading three sizes of pipe, all mounted in a single stock. This tool is therefore unique in the conduit and pipe-threading field. It is always ready to thread any one of its three sizes without any change or adjustment of any kind.

The next important feature of the Trio die stocks is that they are fitted with the well-known "Little Giant" pipe dies. These dies are made with a double bevel, a patented feature which permits the dies being reversed. This makes it possible to thread pipe projecting only a short distance up to a shoulder. By reversing the dies, the throat or chamfer is turned out. Adjustment of the dies is possible, as they are of the two-piece type and can be set to cut either exact or undersize by means of the set screws at each end of the die halves.

The simplicity of this tool, combined with its compactness, makes it extremely easy to use, and the fact that it accomplishes its work with a minimum of effort proves that its design is fundamentally correct. That this tool was designed with the user constantly in mind is evidenced by the choice of sizes included in the various models, there being one model with three sizes which are of extreme usefulness to the plumber and another with three sizes which are used continually by the electrician. The complete tool is surprisingly light in weight and can easily be carried in a kit bag by simply removing the handles.

The bushing guides used in this stock are so arranged that it is practically impossible to start anything but a straight, true thread and these guides, being removable, make possible the threading of nipples.

The manner in which the dies are held in place is worthy of notice as the well known three-angle principle is made use of. The dies bottom on a ground surface and are held absolutely rigid against the beveled side locating surface by wedges having bevels of the same angle as the side bevels on the die. Extremely accurate adjustments are possible as all the surfaces of the stock against which dies rest are machined.

Lately Approved Appliances

Underwriters' Laboratories, established and maintained by the National Board of Fire Underwriters (for service—not profit), have examined, tested and listed these electrical appliances in accordance with the Laboratories' Code for Construction and Test of Electrical Appliances. Copies of complete lists of standard applances may be obtained from local inspection departments or from offices of the Laboratories in the principal cities.

Armored Cable.—The Pratt-Chuck Co., Frankfort, N. Y.
Marking: Blue paper cord between wire and armor.
Listed June 30, 1919.

Attachment Plugs, Fuseless.—The Chelten Electric Co., 4859 Stenton avenue, Philadelphia, Pa.
Separable attachment plugs having composition bases and plain or brass-covered composition caps.
660 watts, 250 volts, Catalog No. 2500.
Listed June 5, 1919.

Autostarters. — The Electric Controller & Manufacturing Co., Cleveland, Ohio.
Automatically operated, oil-immersed switch and transformer mounted as unit in metal case, with no-voltage release coil and either with or without overload protective panel. In "off" position motor windings are disconnected from line. Separate switches are required to disconnect line wires.
Capacities, 150 hp. or less, 550 volts or less.
Listed May 21, 1919.

Cabinets and Cutout Boxes, Sheet-Metal. — Large-Dail Manufacturing Co., 114 North 13th street, Philadelphia, Pa.
Listed June 23, 1919.

Cabinets and Cutout Boxes, Sheet-Metal.—Massachusetts Electric Co., 18 Grafton street, Worcester, Mass.
Listed June 13, 1919.

Conduit Boxes.—Appleton Electric Co., 212-14 North Jefferson street, Chicago, Ill.
"Unilets." Pressed steel. Series FSP, FSW, Y, Z.
Note: These boxes, if not entirely exposed, must be securely fastened in place independently of support afforded by conduit. In all cases covers and attachments must be exposed and easily removable.
Listed June 14, 1919.

Conduit Boxes. — Cameron Overbagh & Co., 231 North Wells street, Chicago, Ill.
Listed June 24, 1919.

Conduit Boxes, Fittings for—Covers.—Cameron Overbagh & Co., 231 North Wells street, Chicago, Ill.
Catalog Nos. 312, 313, 400, 412, 413, 418.
Listed June 24, 1919.

Cutout Bases, Plug-Fuse.—Metropolitan Engineering Co., 1250 Atlantic avenue, Brooklyn, N. Y.
Combination service and meter-testing cutout bases, designed to facilitate meter testing.
M. E. Co., 0-30 amperes, 125 volts. Catalog No. 952 with wire conduit connectors, Catalog Nos. 9250-59 inclusive.
Listed June 3, 1919.

Cutout Bases, Plug-Fuse.—The Arrow Electric Co., Hartford, Conn.
"Arrow E." 0-30 amperes, 125 volts. Catalog Nos. 8020, 8042, 61935, 62135, 62165, 62199, 62569, 62587, 62965.
Listed July 1, 1919.

Electromechanical Gongs. — W. R. Ostrander & Co., 371 Broadway, New York, N. Y.
"Ostrander." Electromechanical gongs for fire-alarm or other signal circuits, 125 volts or less. Normal operating current 100 milliamperes.
Listed May 4, 1919.

Fixtures.—R. R. Cosby Electric & Machine Co., 1705 East Broad street, Richmond, Va.
Listed May 21, 1919.

Panelboards.—Massachusetts Electric Co., 18 Grafton street, Worcester, Mass.
Consisting of assembly of busbars, with or without cutout parts or with or without standard switches, mounted on insulating bases. Designed for use on low-potential circuits.
Listed June 13, 1919.

Receptacles for Attachment Plugs, and Plugs.—The Hart Manufacturing Co., Hartford, Conn.
"Diamond "H." 7½ amperes, 250 volts, 15 amperes, 125 volts, Catalog No. 1650.
Listed June 12, 1919.

Receptacle for Attachment Plugs, and Plugs.—V. V. Fittings Co., 1910 North 6th street, Philadelphia, Pa.
"V. V." 10 amperes, 250 volts, Catalog No. 43-H.
Listed March 31, 1919.

Sockets, Medium-Base.—Despard & Gordon Co., Chicago, Ill.
"Levolier." Metal Shell.
Pull, 660 watts, 250 volts, Catalog Nos. 1, 2, 3.
Listed June 19, 1919.

Switches, Knife. — Westinghouse Electric & Manufacturing Co., East Pittsburgh, Pa.
"Westinghouse." Motor-starting knife switches, 30-60 amperes, 250 volts or 500 volts alternating current, 30 amperes, 600 volts, Type A. 30-60 amperes, 250 volts or 500 volts alternating current, and 100 amperes, 250 volts, Type C.
Listed April 25, 1919.

Switches, Push and Rotary Flush.—General Electric Co., Schenectady, N. Y.
Two-circuit, Catalog No. GE637.
Three-circuit, Catalog No. GE638.
Listed Jan. 30, 1919.

Transformers, Lighting.—Western Transformer Co., 329 East 18th street, Oakland, Cal.
"W. T. C." Air-cooled indoor transformers designed to supply current at following voltages to incandescent lamps for sign or house lighting. For use only when installed and wired in both primary and secondary circuits in accordance with Class C rules, National Electrical Code.
60 cycles, 1500 volt-amperes. Autotransformers 220-110 volts.
Listed April 5, 1919.

Wire Connectors. — Walger Connector Co., Bolton, Ont., Canada.
Wire connectors consisting of metal terminal plate with binding screws enclosed in molded insulating composition sleeve having threaded cap of same material. Straight Type S and three-way Types A and C. For use in joining wires of No. 12 B. & S. gauge or smaller, where such joints are accessible for inspection at all times. "Walger."
Listed April 26, 1919.

Wire, Rubber-Covered. — Astoria Wire Co., Astoria, N. Y.
Marking: One red and one yellow thread parallel to and between insulation and braid.
Listed July 2, 1919.

Wires-Miscellaneous.—Belden Manufacturing Co.. 23rd street and Western avenue, Chicago, Ill.
Pendent cord composed of two conductors, each of which is made up of stranded copper conductor of No. 18, 16 or 14 B. & S. gauge, insulated with cotton wrap, wall of rubber with asbestos covering. Conductors are twisted and provided with rubber reenforcement or filler to give round exterior and provided with outer braid of cotton.
Marking: Blue and yellow threads laid parallel with wire between rubber insulation and braid.
Listed May 23, 1919.

Wires, Slow-Burning. — Marlin-Rockwell Corp., Insulated Wire Division, New Haven, Conn.
Fixture wire consisting of stranded conductors, having felted asbestos insulation. This wire is furnished in single conductor with or without outer silk or glazed cotton braid and in twisted pair or twin wire with outer silk or glazed cotton braid. For use in fixtures within buildings, including fixtures for gas-filled incandescent lamps. "Rockbestos." Nos. 14, 16 and 18 B. & S. gauge.
Listed March 12, 1919.

Trade Activities

Tri-State Electrical Supplies Organized — New Branch Offices Opened by Manufacturers — Literature Distributed

Beaver Electric Co., Portland, Ore., has purchased the electric fixture business of the Kingery & Marrs Fixture Co., and is greatly enlarging that feature of its activities.

Burgess Battery Co., Madison, Wis., is establishing a branch at Winnipeg, to manufacture dry cells, flashlights and cases for its Canadian market, which has been growing rapidly. This new branch is being incorporated as the Burgess Batteries, Ltd., under Canadian laws, but it will be closely allied with the Madison organization through officers and engineering and sales departments. The manager is L. R. Baker of Winnipeg.

Westinghouse Electric & Manufacturing Co., East Pittsburgh, Pa., has just recently issued quite an elaborate publication covering the process of electric arc welding and the necessary apparatus required for this process. This publication compares the different processes of welding, such as autogenous welding, forge welding, oxy-acetylene welding, thermit welding and shows the advantages of electric arc welding over these. Some of the advantages of electric arc welding shown are: Economy, ease and convenience of application, speed of operation, reliability of results, reclaiming defective material, safety, conservation of material, and less skilled labor required. The field for electric arc welding is unlimited and the process has made enormous strides during the last few years until now it is widely used throughout those branches of the metal industry in which work is done on iron or steel in rolled, cast or fabricated forms. New fields for its successful application are being discovered every day.

The Electric Auto-Lite Corp., Toledo, Ohio, has opened a new branch of its business at 221 Cherry street. This will be known as the Willys-Light division of the company and will market a home lighting plant for districts not supplied with current. At the sales room is a section fitted up in the fashion of a country home, which is fully electrified and modernized by the home power plant, and is as convenient and fully equipped as if it were located in a metropolitan community. This plant, which occupies 8 sq. ft. of floor space, will provide power to light a home, supply water pressure and operate such home electrical appliances as flatirons, percolators, washing machines and vacuum cleaners. It is estimated that 15,000,000 American homes are lighted by means other than electricity, and of these 6,000,000 are the homes of farmers. It is in districts not supplied with current that the corporation expects an especial demand. Distributing agencies for the plant will be located in some 20 cities.

Page Steel & Wire Co. has opened a branch office in Chicago, at 29 South LaSalle street. This office will handle all Armco iron products, including Armco welding rods, twisted pairs, plain and galvanized strand, bond wires, Armco iron fence and barbed wire and other brands of fence wire manufactured by the Page Steel & Wire Co. This company has opened another new branch office in the Book building, Detroit. Distribution in Canada is in the hands of Taylor & Arnold, Ltd., Montreal, Toronto, Winnipeg. Local distributers for Armco iron welding rods are located in all principal industrial centers. The sales of the Armco iron department are under the supervision of W. T. Kyle, sales manager, at 30 Church St., New York.

Vulcan Soot Cleaner Co., DuBois, Pa., has just published Bulletin 541, which illustrates and describes the Vulcan patented diagonal method for cleaning soot from the tubes of horizontal water-tube boilers. It embraces the following features: Thorough cleaning efficiency, long life, low maintenance cost, accessibility for inspection and repairs, ease of installation without interference with present boiler equipment and low first cost. Illustrations in two colors show typical designs as applied to horizontal water-tube boilers with vertical baffling. This bulletin also contains a discussion entitled "The Cost of Vulcan Cleaners and an Analysis of Their Value as Investments." This publication is free upon request.

Tri-State Electrical Supplies Co., Sioux Falls, S. D., is the name of a recently organized firm with an authorized capitalization of $250,000. Plans of the company contemplate making Sioux Falls the distributing point for electrical equipment of all kinds in the vast territory including South Dakota, Iowa and Minnesota. G. Denton is president and manager of the new organization. Associated with Mr. Denton as officers are N. C. Draper, formerly of the Northern States Power Co., as vice-president and electrical engineer; John C. Farley, secretary, and Miss M. E. Barrick, assistant secretary and treasurer. Mr. Denton will have executive charge of the business of the company, while Mr. Draper, who is an electrical engineer of long experience, will have charge of the sales department. It will handle construction material and manufactured electrical articles on a strictly wholesale basis. Electrical products, including motors, generators, telephone supplies, plant equipment and a wide range of electrical household appliances. A large modern warehouse will be erected, with trackage facilities for handling the enormous stocks that will be maintained.

The Cutler-Hammer Manufacturing Co., Milwaukee, Wis., has recently opened an office in Detroit, located at 905 Kresge building, to expedite the handling of orders and to give the company's customers in and about Detroit better engineering service. The Detroit office is, in reality, a branch of the Chicago office and bears the same relation to it as the Cincinnati office. H. S. Kinsley, who is in charge at Detroit, has taken with him from the Chicago office Messrs. C. W. Greenman and M. Dugliss, both of whom were recently mustered out of service. This trio will form the nucleus for the Detroit organization. Prior to going to Chicago, several years ago, Mr. Kinsley was connected with the engineering department at the Milwaukee plant.

The Trumbull Electric Manufacturing Co., Plainville, Conn., announces that the General Electric Co. has acquired a financial interest in the company, which, however, entails no change whatever in the present management, or personnel of the company. It will be the policy of the company to sell its material through the same distributers as in the past and on the same basis as to terms, price and service. The business of the Trumbull Electric Manufacturing Co., will be carried on in the future exactly as in the past in every particular. Work has been started on a new factory for the manufacturing of safety switches, which will increase the floor space of the plant about 33⅓%. This addition was made necessary by the rapidly growing demand for Trumbull safety switches, and the entire new building will be devoted to the production of this one line.

Marron Manufacturing Co., Rock Island, Ill., has brought suit for injunction against the Phelps Motor Co., of the same city, to restrain it from forfeiting a contract entered into between the two companies on Sept. 5, 1918, in which the selling of complete farm lighting lamps manufactured and assembled by the defendant was placed exclusively in the hands of the complainant. In entering into the contract the Marron company disposed of its previous rights in the manufacture of electrical apparatus used in connection with the complete lighting lamp, and turned this over to the Phelps company under the conditions cited. The complainant charges that the Phelps company has been violating the contract by selling and installing complete plants. A further feature of the contract was that the Marron company would take over the Phelps company at an agreed price in case the latter was unable to manufacture and deliver engines in certain quantities. This the Marron company is ready to do.

Current News

Weekly Record of Construction Activities—Conventions

EASTERN STATES.

Wellesley Hills, Mass.—The Academy of Assumption, Oakland street, is planning for the construction of a boiler plant at the institution. With mechanical laundry plant to be installed, the work is estimated to cost about $50,000.

Wallingford, Conn. — Plans and specifications are being prepared for the installation of an additional 250-hp. boiler purchased nearly two years ago by the municipal electric light plant. Installation and piping, contract for which has not yet been awarded, will cost approximately $13,000. A. L. Pierce, engineer.

Providence, R. I.—A hydroelectric power plant to cost about $80,000, will be erected by the Nightingale-Morse Mills at their branch works at Putnam, Conn.

Brooklyn, N. Y.—Julius Kayser & Co., 45 East 17th street, New York, are making rapid progress on the construction of the large new power house at their plant on Classon street, Brooklyn, and it is expected that the work will be completed at an early date.

Brooklyn, N. Y.—Work has been practically completed by the Transit Development Co., 24 Broad street, New York, on the construction of the new addition to its power plant and electrical gallery on Kent avenue, near Wallabout Canal. Brooklyn, and it is expected that operation will be inaugurated at an early date.

Long Island City, N. Y.—In connection with the construction of the proposed four-story addition to the local plant of the Patterson Sargent Co., 8 Jay street, New York, estimated to cost about $300,000, large quantities of electrical equipment for operation will be required. Final contracts for the proposed structure have been awarded.

New York, N. Y.—Edwards & Co., Inc., manufacturer of electrical equipment, alarms, etc., with works at Exterior and 140th streets, has filed plans for alterations and extensions in its five-story factory to increase the present capacity. The work will cost about $40,000.

New York, N. Y.—American Precision Works, manufacturer of electrical, surgical and dental instruments, plans to remove its works to one of the suburbs of New York, where it will increase its manufacturing schedule and take up the production of instruments and apparatus for other industrial purposes. K. G. Frank is president.

New York, N. Y.—Loriam W. Young has leased the entire building at 214 East 40th street, and will establish a new works for the manufacture of electric lighting fixtures.

New York, N. Y.—In connection with its note issue of $6,000,000, to be used for the plant extension and improvements, the Sloss-Sheffield Steel & Iron Co., 56 Liberty street, is planning for the erection of a large central electric power plant. The new station will be used for service at its ore and coal mines, which are to be electrified.

Niagara Falls, N. Y.—Niagara Falls Gas & Electric Co. is planning for the erection of a new plant, to consist of seven buildings at Buffalo avenue and 22nd street, to cost about $200,000. A. H. Merritt is superintendent.

Persia, N. Y.—Application has been filed with the Public Service Commission by the Iroquois Utilities, Inc., for permission to make extensions and improvements in its electric plant and system in Persia and Leon, Cattaraugus county.

Poughkeepsie, N. Y. — Smith Brothers, North Hamilton street, are having revised plans prepared for the construction of the proposed industrial plant to be located at Michigan City, Ind. The works will comprise main manufacturing building, three-stories in height, with large power plant for general works operation, the project being estimated to cost $150,000.

Westfield, N. Y.—Armour & Co., Chicago, Ill., are making rapid progress on the construction of their two-story local plant and power house, about 200x1170 ft., and it is expected that operations will be inaugurated at an early date. The new plant when completed will cost about $300,000.

Boonton, N. J.—Boonton Electric Co. is arranging a new contract with the city officials for furnishing light and power service, including street lighting, for three years, commencing January 1, 1920, at present rates.

Dover, N. J.—New Jersey Power & Light Co. is making efforts to complete its new transmission line to Newton at the earliest date. Increased service is to be supplied at this point. The company has commenced the installation of new street lighting systems at Ledgewood, Succasunna and Kenvil. It is proposed to have the systems ready for operation early in October.

Newark, N. J. — Modern Electric Co., 518 South 19th street, has filed notice of organization to operate an electrical engineering and contracting business. Abraham Reichenstein, 347 South 12th street, heads the company.

Allentown, Pa.—To offset the construction of the proposed municipal electric power plant as now contemplated by the city, the Electric Light & Power Co. has tendered an offer to the city for a reduced schedule of charges. The company proposes a ten-year contract, which provides for the installation of 250-watt incandescent lamps to replace the present arc lamps. The new charge would be $38,886 as against the present schedule aggregating $49,300.

Carlisle, Pa. — An electric power plant, 30x94 ft., will be erected by C. H. Masland & Sons, Amber and Westmoreland streets, Philadelphia, in connection with their proposed carpet manufacturing plant on the former fair grounds at Carlisle. Bids for the building are now being asked.

Catasauqua, Pa.—The Town Council is having surveys made of the present street lighting system to devise plans for extensions and improvements. It is planned to install a modern system of lighting system, covering a total of about 43,275 cp. throughout the city. John A. Wise, President of the Eastern Pennsylvania Securities Co., is co-operating with the city in connection with the work.

Hershey, Pa. — An electric power plant, 13x140 ft., will be erected by the Hershey Chocolate Co. in connection with the proposed addition to its local plant to cost about $500,000.

Philadelphia, Pa.—The Hospital for Women, 4035 Parrish street, has filed plans for alterations and extensions in the power plant at the institution.

Pittsburgh, Pa. — Vetter Manufacturing Co., manufacturer of electrical specialties, has leased a seven-story brick building at 424-8 Second avenue, corner of Cherry Way, for new works.

Shamokin, Pa. — Susquehanna Collieries Co. is planning for extensions and improvements at its various plants to cost about $4,000,000. Considerable electrical and mechanical equipment will be installed for greater efficiency in operation. The company's properties are known as the Richards, Pennsylvania, Scott, Hickory Ridge, Hickory Swamp, Luke Fidler and Cameron Collieries. A new coal breaker will be constructed.

Shenandoah, Pa.—The City Council has had plans prepared for the erection of a new one-story electric pumping plant for municipal service to cost about $30,000.

Wilkes-Barre, Pa.—Acheson Bread Co., Main street, will build an addition to its boiler plant to cost about $10,000. Frank H. McCafferty is manager.

York Haven, Pa. — York Haven Water & Power Co., will soon commence the construction of a new transmission line to connect with the system of the Reading Power Co., at Annville, Lebanon County. Surveys for the line have been completed. The Reading company will extend its present line from Lebanon to Annville, to make the connection. The two power companies have also arranged for a tie in with other power companies operating at Philadelphia, Pottsville and Allentown. The York Haven company plans to connect with neighboring lines as well with its Middletown system.

Baltimore, Md.—Cambridge Iron & Metal Co., 2032 Aliceanna street, will install 50-hp. in motors.

Charleston, W. Va.—A new electric power plant, 40x60 ft., for works operation will be erected by the Virginia Rubber Co. in connection with its proposed new rubber manufacturing plant. The company was recently incorporated with a capital of $1,200,000. A. A. Lilly is president, and Houston G. Young, vice-president.

Wheeling, W. Va.—West Virginia Traction & Electric Co. has closed a contract with the Elkins Coal & Coke Co. for furnishing electric power for operation at its properties in Monongalia and Preston counties. The company plans for the complete electrification of its plants in every department of operation.

Lockhart, S. C.—Lockhart Power Co. is planning for the erection of a new hydroelectric power plant on Broad river. The structure will be 36x100 ft. reinforced concrete. Enslie Nicholson, president.

Orangeburg, S. C.—The City Council is planning for extensions in the local electric power plant to increase the present capacity. The work is estimated to cost about $70,000. E. Hawes is city engineer.

Hayesville, N. C.—Public Service Co. recently incorporated with a capital of $125,000, has acquired a local hydroelectric power plant to be used as its initial station. It is planned to build an addition to increase the present capacity, and to locate another hydroelectric plant on a water development on Shooting Creek. A six-mile transmission system will be constructed, with local distributing lines to furnish electric light and power throughout this vicinity. G. H. Haigler and W. J. Winchester head the company.

Pensacola, Fla.—A series of about 20 electrically operated centrifugal pumps will be installed by the Bruce Dry Dock Co., in connection with its proposed dry dock and ship repair plant. The plant is estimated to cost $450,000.

NORTH CENTRAL STATES.

Cleveland, Ohio—L. A. Sommer, 2934 East 55th street, Cleveland, will let contracts for a $75,000 power house. The building will be brick, steel and reinforced concrete construction, steam heating, plumbing, fireproof interior finish, motors, generators, pumps and boilers, and electric lighting.

New Concord, Ohio — $35,000 in bonds have been voted to purchase water and light plant.

DATES AHEAD.

National Council of Lighting Fixture Manufacturers. Midsummer convention, Cleveland, Ohio, Aug. 5 and 6. Secretary-treasurer, Charles H. Hofrichter, 8410 Lake avenue, Cleveland, Ohio.

Michigan Section, N. E. L. A. Annual convention, Ottawa Beach, Mich., Aug. 26-28. Headquarters, Hotel Ottawa. Secretary-treasurer, Herbert Silvester, Monroe, Mich.

Pennsylvania Electric Association. Annual convention, Bedford Springs, Pa., Sept. 3-6. Secretary, H. M. Stine, 211 Locust street, Harrisburg.

Washington State Association of Electrical Contractors and Dealers. Annual convention, Seattle, Sept. 11. Secretary, Forrest E. Smith, 205 Boston Block, Seattle.

Southeastern Section, N. E. L. A. Annual convention, Asheville, N. C., Sept. 17-19. Secretary-treasurer, T. W. Peters, Columbus, Ga.

New England Section, N. E. L. A. Annual convention, New London, Conn., Sept. 22-24. Headquarters, Hotel Griswold. Secretary, Miss O. A. Bursiel, Boston, Mass.

Association of Iron and Steel Electrical Engineers. Annual convention, St. Louis, Mo., Sept. 22-26. Secretary, John F. Kelly, Empire building, Pittsburgh, Pa.

American Electrochemical Society. Fall meeting, Chicago, Sept. 23-26. Headquarters, Congress Hotel. Secretary, Prof. Joseph W. Richards, Lehigh University, Bethlehem, Pa.

International Association of Municipal Electricians. Annual convention, Chicago, Sept. 23-26. Secretary, Clarence R. George, Houston, Tex.

National Association of Electrical Inspectors. Annual meeting, Springfield, Mass., Oct. 13 and 14. Secretary, W. L. Smith, Concord, Mass.

Illuminating Engineering Society. Annual convention, Chicago, Ill., Oct. 20-23. General secretary, Clarence L. Law, 29 West 39th street, New York City.

Hammond, Ind.—Northern Indiana Gas & Electric Co. has petitioned the Public Service Commission for permission to issue notes for $1,067,000 with which it is intended to make extensions and improvements. S. B. Walters, 571 Holmes street.

Indianapolis, Ind.—Nordyke & Marmon Co. has taken out a permit for the erection of an assembly room for motors, one-story, brick and steel construction, 802x100 ft., to cost $90,000. This work is in addition to the proposed factory additions that are to cost $350,000.

Indianapolis, Ind. — Drew Electric & Manufacturing Co., manufacturer of overhead fixtures for electric trolley wire, has purchased a two-acre site at Collamer avenue, and the Nickel Plate Railroad, East Cleveland, Ohio, where it will shortly begin the erection of a plant, machine shop and brass foundry to cost $50,000. James H. Drew is president.

Michigan City, Ind.—Architect W. P. Field, 763 Broad street, Newark, has prepared plans and will let contracts for a $150,000 industrial and power plant to be erected at Michigan City by Smith Bros., North Hamilton street, Poughkeepsie, N. Y. The building will be of brick and concrete construction, steam heating, plumbing, fireproof interior finish, boilers and pumps, electric lighting.

Portland, Ind. — Negotiations are under way with the directors of the Union Traction Co. of Indiana, relative to the purchase of the power plant at Detamore and the water rights of the Cartwright stone quarry. Portland is in need of a better equipped power plant and the Detamore plant will answer that purpose. The consideration is about $20,000.

Ashton, Ill.—At a meeting of the Ashton council the members took up the question of lighting the streets with electricity and a representative of the Illinois Northern Utilities Co. was present at the request of the council to give them the necessary information. The council finally decided to enter into contract with the utilities companies for a period of ten years for 50 lamps of the 100 cp.

Charleston, Ill. — Coles County Telephone & Telegraph Co. will place its cables underground in the business streets.

Chicago, Ill.—Holabird & Roche, 104 South Michigan avenue, have prepared plans and will let contracts for a $60,000 substation for the Commonwealth Edison Co., 72 W. Adams street, Chicago. The building will be brick construction, hot water heat, plumbing, fireproof interior finish, motors, generators and pumps.

Chicago, Ill. — Sears, Roebuck & Co. will erect a large warehouse at the northwest corner of Fillmore street and South Kostner avenue, adjacent to the B. & O. C. T. T. Railway. Plans are being prepared for the erection of a $400,000 paint factory. It will be a five-story structure to be used for the manufacture of paint and will be equipped with the most modern machinery.

Medora, Ill.—An election will be held on August 5 at Medora, to decide if $12,000 shall be issued to provide the village with an adequate lighting system. If the vote is to issue the bonds Medora will be connected with the Greenfield Service from Keokuk power.

Rockford, Ill.—Central Union Telephone Co. and the Rockford Home Telephone Co. have been consolidated by purchase of the latter by the Central Union Co.

Springfield, Ill.—Ira W. Fisk, consulting electrical engineer of New York, will assist in planning the additions and extensions to the electric plant which are to be made when the $400,000 bond issue is voted.

Urbana, Ill.—A street lighting system, ornamental in type, will be installed in the southwest part of the city, adjacent to the campus of the University of Illinois at a cost of $31,600. This is in addition to the installation of ornamental lights on West Green street at a cost of $6000.

Boyne Falls, Mich. — An election will be held to decide the question of issuing bonds to purchase electric pump for water system. Address village clerk.

Beloit, Wis. — City council has granted the street lighting committee permission to redraft plans for proposed ornamental lighting system in the business section. R. E. Wood, city clerk.

Fond du Lac, Wis.—Northern Basket Co. will erect a $75,000 factory, engine, boiler and power house, garage and warehouse.

Manitowoc, Wis.—The city will install electric lighting system on South 8th street. Arthur Zander, city clerk.

South Byron, Wis.—Plans are being prepared for the installation of an electric lighting system in South Byron. Electric energy for operating the system will be obtained from Kilbourne.

Fairmont, Minn. — The municipal electric plant, which has been operated for a number of years has discontinued the manufacture of electricity and is now purchasing its electric current from the Northern States Power Co., Sioux Falls, South Dakota division.

St. Paul, Minn.—Three new warehouses to cost $300,000, $400,000 and $350,000 respectively, a $200,000 paper box factory and a $500,000 candy factory are to be additions to St. Paul industrial activities some time during the ensuing year. Building permits during the first six months of 1919 total $4,318,000, almost equaling the total valuation of buildings actually erected in 1918.

Davenport, Iowa—Property owners on Perry street, between 2nd and 3rd streets, contemplate installation of ornamental lamps. Cost $2500. Hugo Moeller, city clerk.

Davenport, Iowa—H. C. Kahl plans erection of a $1,000,000 office building and theater, to contain theater seating 2500 persons, 234 office suites and 12 store suites. The building will be 150x147½ ft.

Eldridge, Iowa—At a special meeting held, councilmen voted an extension of electric power from Davenport. Approximate cost $6000. Fritz Weise, city clerk.

Mason City, Iowa—Western Electric Telephone Co. has inaugurated an extensive improvement program over the northwestern part of the state in the neighborhood of $200,000. A copper circuit is one of the improvements, to be installed by the company, and will be of the latest type. The company will also make other improvements. Further improvements to be made in Mason City includes the installation of private switchboards in the First National Bank and in the offices of the Northwestern States Portland Cement Co.

Ottumwa, Iowa—In a recent week the new business department of the Ottumwa Railway & Light Co., in conjunction with the local electric dealers, took orders for wiring 18 already built houses and disposed of 31 household appliances.

Chanute, Kans.—The council will secure an engineer to prepare estimates for a municipal light plant. Aug. 5 the question of issuing $75,000 will be submitted to vote. C. G. Wood, city clerk.

Harper, Kans.—Plans are in progress by W. B. Collins, Railway Exchange building, Kansas City, Mo., for waterworks improvements to cost $35,000. The work will include pumping equipment, engine and generator and pipelines.

Hugoton, Kans.—A new electric and water plant is being contemplated.

Manhattan, Kans.—Plans for the new electric light and power plant to be erected opposite the old plant have been drawn and the cost has been estimated at $500,000.

Winfield, Kans.—Bids will be advertised in the near future for improvements to the municipal light and power plant, including a 1000-kw. turbogenerator and auxiliaries at a cost of $45,000.

Lincoln, Neb.—The voters of the city of Lincoln will decide at a special election upon the purchase of the Lincoln Street Car Co. If the city takes over the lines it is the intention to create a new department with an expert on street car business at the head.

Towner, N. D.—At a regular meeting of the city council a committee was appointed to investigate the condition of the lighting service now existing and also to secure advice regarding the cost of installing a more modern lighting plant in connection with the city water system.

Gregory, S. D.—The question of issuing $122,000 municipal light bonds will be submitted to vote. Address city clerk.

Sioux Falls, S. D.—Building permits were issued to the Northern States Power Co. for brick and steel power plant on west side of Weber avenue. $7000.

SOUTH CENTRAL STATES

Louisville, Ky.—Fifty-one new electric light and power customers were secured by the commercial department of the Louisville Gas & Electric Co. during the week ending July 12 with 20 kw. of lighting load and 135 hp. in motors. Contracts were also taken for wiring 13 already built houses. The net connected load gain for the week was 33 customers with 7 kw. of lighting and 20 hp. in motors. Electric energy output for the week was 20.4% greater than for the corresponding week last year.

Mayking, Ky.—Mayking Coal Co. is considering the erection of an electric power plant at its properties for works operation.

Wolf Pit, Ky.—McKinney Steel Co. is planning for the construction of a new electric power plant at its works to cost about $60,000.

Centreville, Tenn.—An election was held to vote $12,000 bonds for the purpose of erecting a light plant for the town.

Ada, Okla.—Election will be held soon to vote $500,000 in bonds for waterworks extensions and storm sewers. Johnson & Benham, consulting engineers, Firestone building, Kansas City, Mo.

Broken Bow, Okla. — Election to vote $100,000 in bonds for waterworks and $30,000 for sanitary sewers, carried.

Enid, Okla.—Five hundred electric fans have been placed on the lines of the Enid Division of the Oklahoma Gas & Electric Co. so far this season. One dealer alone reports the sale of 200 electric fans. The Arctic Ice & Refrigerator Co. is installing 55 hp. additional motors which load is served by the Enid Division.

Hobart, Okla.—V. V. Long, consulting engineer, has been chosen to prepare plans and estimates for a new electric light and water plant. On submission of the plans, an election will be called to vote on the proposition.

Madill, Okla.—Johnson & Benham, Firestone building, Kansas City, Mo., are preparing plans for waterworks improvements to cost $60,000.

Tonkawa, Okla.—Election will be called soon to vote approximately $117,000 in bonds for waterworks and light extensions. Johnson & Benham, Kansas City, Mo., engineers.

Breckenridge, Tex.—J. E. Lewis of Dallas and associates have purchased the electric light and power plant here from Bert Paschall. New machinery will be installed and the capacity of the plant largely increased.

Eastland, Tex.—The electric light and power plant of the Eastland Light & Power Co. is to be enlarged to five times its present capacity in order to meet the growing demand for light and power, due to the remarkable growth of the town since oil was discovered here. The company plans to construct a system of electric power transmission lines through the oil field.

Hearne, Tex.—The capacity of the municipal electric light and water works plants here is to be enlarged by the installation of new machinery and equipment.

Houston, Tex.—Houston Light & Power Co. has arranged for a bond issue of $483,000 for proposed extensions and betterments. The company plans for the installation of a new 10,000-hp. turbogenerator, with auxiliary operating equipment at its plant, and for extensions in its transmission and distributing system. Samuel H. Bertron is general manager.

Kingsbury, Tex. — Arrangements are being made for the installation of a public lighting and water system.

Orange, Tex.—Orange Ice, Light & Water Co. has amended its charter, increasing its capital stock from $60,000 to $100,000. It will enlarge its electric light and power plant.

Waco, Tex.—Election will be held on Aug. 12 to vote on the proposition of a municipal gas and electric plant.

WESTERN STATES.

Ronan, Mont. — Flathead Valley Electric Co. will install several electric light and power plants in the Flathead Valley. Andrew Anderson, Plains, Mont., is president.

Bend, Ore.—Preliminary engineering work for the construction of an 1800 hp. plant on the Tumalo at the Columbia Southern ditch has been started by the Bend Water, Light & Power Co. The estimated cost is $125,000. Power development on the Tumalo was made necessary when plans for building a 5000-hp. plant at Lava Falls were canceled by tying up of all Deschutes water rights for irrigation.

Portland, Ore.—Extension of steam and electric mains planned and now under construction by the Northwestern Electric Co. will involve an expenditure of more than $100,000 according to G. C. Pierce, vice-president and general manager of the company.

Scofield, Ore. (P. O. Burton).—The Standard Box & Lumber Co. will rebuild its plant. The new plant is to be electrically operated.

Toledo, Ore.—The Fisher-Storey sawmill recently destroyed by fire is to be rebuilt on a much larger scale. It will be motor driven, power being supplied by a plant built at the mill.

Grand Mound, Wash. — NePage, McKenney & Co., Armour building, Seattle, have been awarded contract for electric wiring in cottage being erected at school for girls at this place by the State Board of Control at $2957.

Seattle, Wash.—Walter Lassen and R. D. Colman have opened an electric shop in Bremerton, Wash.

Seattle, Wash.—It is proposed in a council bill to issue and sell $1,250,000 utility bonds for the construction and equipment of third unit to the municipal steam plant on Lake Union of approximately 12,500-kw. capacity.

Seattle, Wash.—An eight-bent concrete building 120 by 80 ft. with full basement, will house the new unit of the power plant to be erected at the Lake Union plant of the city. Plans are being prepared by City Archt. Daniel Huntington. Unit for which bonds have been authorized will cost $1,250,000.

Seattle, Wash. — County commissioners have granted a permit to the Pacific Coast Coal Co. for construction of an electric power transmission line from a point near Renton, along the Renton-Newcastle county road.

Tacoma, Wash.—Ground has been broken for construction of a rubber plant for the Western Rubber Co. which when completed will employ 150 persons.

Tacoma, Wash.—The city council has offered the Tacoma Railway & Power Co. $1,500,000 for its street car lines within the city, providing a vote of the people sanctions the purchase. Under the offer the railway company would also agree to finance a loan of $1,000,000 to the city for the purpose of putting the lines in first class condition. In the past the railway and power company has placed a valuation of $6.000.000 on its lines. The action of the council follows a recommendation of a committee of citizens appointed to consider the street railway problem. This committee decided that the lines would be unable to pay expenses under any fare that the people would stand.

Tacoma, Wash.—The City Council has announced a special election to authorize the purchase of the Lake Cushman power site and to issue $300,000 in bonds for construction.

Chico, Cal.—Preliminary steps have been taken toward the construction of a municipal electric system power generating plant. It is planned to erect a power plant in the canyon capable of generating 3000 hp. The construction of two plants will also be considered.

FOREIGN TRADE

[Addresses of firms referred to in these trade opportunities may be obtained by writing to the Bureau of Foreign and Domestic Commerce, Washington, D. C., or its branch and local co-operative offices. Request for each opportunity should be on a separate sheet and the file number given.]

Electrical Material (30,064).—The agency is desired by a man in France for the sale of electrical, sanitary and plumbing material. Correspondence should be in French. References.

Electrical Conductors (30,032).—A street railway company in Spain wishes to receive catalogs of materials such as rails, overhead construction and electrical conductors. Correspondence should be in Spanish.

Electrical Equipment (30,040).—A firm in England desires to act as agent for the sale of engineers' tools and electrical equipment. Quotations should be given f. o. b. American port or c. i. f. English port. Payment, cash against documents. Reference.

Electrical Appliances (30,069).—The purchase and agency is desired by a firm in Belgium for the sale of electrical appliances, such as switches and sockets, wrought iron and steel tubes and fittings, malleable-iron fittings, and gun metal and brass fittings for gas, water, and steam, copper and brass wire, sheets, bar rods, etc. Quotations should be given c. i. f. Antwerp. Correspondence may be in English, but catalogs should be in French if possible. References.

PROPOSALS

Electric Wiring.—Bids will be received by the Sisseton, S. D., Independent School District for the heating, plumbing and electric wiring including electric time program clock and fire alarm system. Frank F. McKenna, clerk.

Electric Light Plant—Bids will be received Aug. 8 for labor and materials required in the construction of an electric light plant for Beresford, S. D. The work is divided into three parts: part 1, brick and tile building; part 2, electric station equipment, consisting of furnishing and erecting two 120-hp. Diesel and semi-Diesel type oil engines, direct connected to two 100-kv-a. generators, also switchboard, constant current transformers, and part 3, pole line, consisting of furnishing and erecting poles, wires, transformers. Address Y. M. Yorker, city auditor.

Pumps—Bids will be opened Sept. 3 for both centrifugal and turbine type pumps to be installed in the pumping station, Kansas City, Kans. Plans and specifications are being prepared for a 50,000,000-gal. capacity pump.

INCORPORATIONS

Brooklyn, N. Y.—Eisenhut Storage Battery Co. Capital, $10,000. To manufacture storage batteries and other electrical products. Incorporators: O. F. and C. Eisenhut, and G. T. Egensteimer, 804 Seneca avenue.

Hadley, N. Y.—Hadley Light & Power Co. Capital, $25,000. To operate a local light and power plant. Incorporators: J. H. Smead, W. Fowler, and J. J. Breen, Hadley.

New York, N. Y.—Portable Electric Current Co. Capital, $2,000,000. To manufacture storage batteries and other electrical specialties. Incorporators: L. B. Kanter, W. A. Blank and C. B. Plante, 761 Lincoln place, Brooklyn.

New York, N. Y.—Mechanical Stokers Corp. Capital, $100,000. To manufacture stokers and other furnace appliances. Incorporators: H. H. Van Aken, M. C. Flanagan and G. B. Sleigh, 31 Nassau street, New York.

New York, N. Y.—Morison Electrical Supply Co. Active capital, $55,000. To manufacture electrical supplies. Incorporators: G. W. Harris, A. H. Abbott, and C. T. Morison, 515 West 187th street.

New York, N. Y.—Victory Engine Co. Capital, $50,000. To manufacture engines, motors, etc. Incorporators: C. O. Assmus, C. H. Atkins, and M. A. Farley, 28 Sterling place, Brooklyn.

Troy, N. Y.—Rensselaer Electrical Supply Co. Capital, $25,000. To manufacture electrical supplies. Incorporators: R. G. Finucane, C. F. W. Kaelber, and A. R. Page, Rochester.

Glenfield (Lewis County), N. Y.—Otter Creek Power Corp. Capital, $35,000. To operate a local power plant. Incorporators: H. S. Lewis, H. D. and G. L. Cornwall, Beaver Falls.

Newark, N. J. — Newark Motor Products Manufacturing Co. Capital, $100,000. To manufacture motors and other electrical products. Incorporators: Otto and H. J. Weber, and Albert J. Farmer.

Philadelphia, Pa.—Railways Electric Equipment Co. Capital, $2,000,000. Incorporated in Delaware to manufacture electric railway equipment and appliances. Incorporators: James F. Bohen, Henry McCarthy and Herbert W. Andrews, all of Philadelphia.

Seattle, Wash. — Seattle Electric Washer Co. has been incorporated by Thomas A. Gaynor et al., for $10,000.

Malone, Wis.—Malone Light & Power Co. has incorporated with a capital of $25,000, and will build an electric plant. John L. Beau, Frank Clark and others are interested.

Personal

Matthew S. Sloan New President of Brooklyn Edison—David C. Rosetahl Joins B & K Manufacturing—Changes

F. M. HAMILTON, superintendent of the department of accident investigation of the Puget Sound Traction Light & Power Co., Seattle, is making a business trip to Philadelphia.

E. J. McILRAITH, formerly superintendent of ways and structures with the Puget Sound Traction Light & Power Co. at Seattle, has been appointed to the position of engineer in charge of maintenance with the Philadelphia Rapid Transit Co.

H. G. BAKER, for the past year connected with the new business department of the Western Colorado Power Co., Salt Lake City, a subsidiary of the Utah Power & Light Co., has resigned to become manager of the Clark Electric Co., with headquarters at Tooele, Utah.

S. L. SHUFFLETON, formerly chief of construction for Stone & Webster in the Seattle district, is now western manager for Stone & Webster at San Francisco. Leslie Coffin, formerly manager for the Puget Sound Traction Light & Power Co., at Bellingham, Washington, and who went to Hog Island for Stone & Webster, is now assistant western manager for Stone & Webster at San Francisco.

H. J. GILLE, sales manager, E. A. Batwell, publicity agent, and Capt. N. W. Brodkett of the legal department of the Puget Sound Traction Light & Power Co., have returned to Seattle from a meeting of the Pacific Coast Committeemen of the National Electric Light Association held at San Francisco for the purpose of arranging for the convention of the association to be held in Los Angeles next May.

MATTHEW S. SLOAN, who is at present operating manager of the New York Edison Company, has been elected president of the Brooklyn Edison Co. following the resignation of N. F. Brady from that office. Mr. Brady continues as chairman of the board and the executive committee. Mr. Sloan has been assistant to the president of the Birmingham Railway, Light & Power Co., and vice-president and general manager of the New Orleans Railway & Light Co.

A. E. KAISER, who for more than twenty-three years has been connected with the Westinghouse Electric & Manufacturing Co., East Pittsburgh, Pa., has been appointed director of production. His experience with the company includes the paint department field and armature machining, winding, assembling, general foreman's offices, rate, central production and storekeeping departments. After spending three years in the latter department he was again called to the office of the works' manager for one year, after which he was appointed assistant director of production in 1912.

PROFESSOR A. P. LITTLE, formerly of the Bureau of Standards, who came to Yale University during the past year in connection with the Signal Corps Training School for officer candidates, has been appointed professor of electrical engineering in the Colorado School of Mines.

F. F. McKINNEY has joined the copy staff of Brooke, Smith & French, Inc., advertising agents of Detroit. During the war he served as an ensign in the navy and since the armistice has been with the advertising department of the Cadillac Motor Car Co. Previous to his enlistment in the navy, Mr. McKinney was engaged in the newspaper business.

F. C. CHAMBERLAIN, for the past six years district engineer of electric operations for the properties of Henry L. Doherty & Co. in the western district, has been appointed general manager of the Richland Public Service Co., Mansfield, Ohio, succeeding R. E. Burger. Prior to his connection with the Doherty organization, Mr. Chamberlain was with the American Gas & Electric Co. at Wheeling, W. Va., and for about four years previous to that time he had been in the New York office.

DAVID C. ROSETAHL, formerly with the National X-Ray Reflector Co., New York City, has become associated with the B & K Manufacturing Co., New Britain, Conn., in the capacity of general sales manager of the portable lamp department. Mr. Rosetahl has been identified with the electrical fixture and portable lamp trade for the past 12 years, having represented such well known concerns as Sampson Bronze Co., J. B. McCoy Co., Sterling Bronze Co., of New York City. While in the employ of the National X-Ray company he acted as sales agent for the entire lower east side of New York City, where he met with great success in the distribution of lighting fixtures, portable lamps and National X-Ray reflectors, and his appointment as general manager of B & K company is a valuable addition to its staff.

STEPHEN C. POHE, who for the past year has been general manager of the Penn Public Service Co., Clearfield, Pa., is now vice-president of the operating companies controlled by the Pennsylvania Electric Co. of New York City, with offices at Clearfield, Somerset and Johnstown, Pa. Mr. Pohe will make his headquarters at Johnstown, where general offices of the companies have been established. He will direct the operating department of the system from that point. Mr. Pohe resigned as manager of the Columbia & Mountour Electric Co. and of the Northumberland Gas & Electric Co. at Bloomsburg, Pa., in 1918, to become general manager of the Penn Public Service Co., from which position he has been advanced. He has been prominently identified with the affairs of the Pennsylvania Electric Association, and was elected president of that organization in 1915.

Obituary.

NEAL KENT, for many years supply salesman for the Manhattan Electrical Supply Co., died recently at his home in Chicago. Mr. Kent was one of the best known and highly esteemed men of the industry in this section, and his sudden death came as a surprise to his many friends in the industry. He is survived by his widow and one daughter.

JOHN C. RODGERS, 75 years old, a prominet contractor of New York City, died on July 24 at his country home at New Rochelle, N. Y. Mr. Rodgers was engaged in the contracting business for forty years. He built portions of Riverside drive and the old subways in New York City, the West Shore Railroad and the Pennsylvania Railroad. He was the sole contractor for the La Chien Canal in Canada, the New York speedway, the Madison avenue bridge in New York City, and the Niagara Falls power tunnel.

LAVERNE W. NOYES, president of the Aermotor Co., Chicago, died on Thursday, July 24, after an illness of many weeks. He was widely known as an inventor and philanthropist. He was born at Genoa, N. Y., Jan. 7, 1849, and was graduated from the Iowa State College with a B. S. degree in 1872. In 1879 he moved to Chicago and patented a wire bookholder, of which he was the sole maker. In 1887 he invented several harvesting machines and later perfected the first steel windmill for the Aeromotor Co., of which he was the head. In 1914 he patented the Auto-Oiled Aeromotor. He designed and built the first steel towers for windmills, and also introduced the first towers for electric transmission. The deceased is survived by an only sister.

JOSEPH WILLIAMS, treasurer of the New York Edison Co., whose home was at 440 Riverside Drive, died on July 23 at Santa Monica, Cal., where he went about July 1 to recover his health, which had been failing for about six months. Mr. Williams was born in New York City sixty-one years ago. In 1873 he entered the employ of Spencer Trask & Co., bankers. In 1890 Mr. Williams was elected assistant treasurer of the Edison Illuminating Co., of which Mr. Trask was president and which was Thomas A. Edison's first venture in electric lighting in New York City. Three years later he became treasurer. When the New York Edison Co. was established in 1901 Mr. Williams was elected assistant treasurer of that company and was elected treasurer in 1910.

For the Readjustment Period—What?

XLVII.

Today's Need — More Business

Today you are in business. Business gets slow. You lose customers. You see the stark, grim wolf of failure creeping 'round your corner, headed for your door. You must do more business.

Will you go and drag customers in? Will you travel 'round and tell your people of your plight and try to get them to patronize you out of pity? What chance do you stand against the punishing advertising of your competitors?

No chance at all—unless—and this is your only salvation—you advertise with them—advertise against them—or go to the wall!

You must race at their pace or you're out of the running.

And just as rocks and rifles enable a man to strike a harder blow than the impact of his fist or the kick of his boot—and at a far greater distance than the length of his arm—so consistent advertising enables a man to persuade more powerfully than by speaking to a few neighbors—enables him to reach untapped sources of patronage at wonderful distances—rather than depend upon precarious transient trade or pitying acquaintances.

Rifles are but perfected stone throwers. And advertising is the modern weapon—the rifle of big business. It is the better way and the only way to bring protection from and to bring down big game!

This little screed, which is copyrighted by the Press Publishing Co., has in it a thought or two of value for the progressive manufacturer or merchant. To meet the rising tide of expense "Doing More Business" is the only effectual safeguard.

C. A. TUPPER *President*
INTERNATIONAL TRADE PRESS, INC., CHICAGO

Financial News

Utility Securities Highly Desirable.

Samuel Crowther, in System Magazine, calls attention to the wisdom of investing present day surpluses in conservative securities. Sound public utility securities meet the requirements which he regards as highly desirable. He says:

"The ability of any individual or corporation to meet adverse conditions is measured by its financial resources that remain unaffected by the shifting conditions. If prices drop, inventory values will be cut, bookkeeping reserves be of almost no use, and any speculative bonds will be worse than useless because their value will vanish at the first storm cloud. The only resource which then can easily be liquidated will be the 'conservative' issues.

"There exists a rare opportunity today to build up a sound reserve. The so-called 'gilt-edged,' long-term, low-interest-bearing bonds are selling at high interest rates. It is unlikely that they can go very much lower. They can hardly be affected by any known business calamity and their value must increase with the shaking down of the years.

"They are the investment for a man who desires to be in business five or ten years from now when the world has resumed more or less normal functioning."

Federation of British Industries After World's Markets.

The Federation of British Industries, which is composed of over 900 of Britain's biggest manufacturers and manufacturing associations, has formulated plans for an overseas organization which contemplates the appointment in every market of the world of a commissioner, assisted where advisable by expert advisers and sub-commissioners. In this connection, the American Chamber of Commerce in London advises that the Federation has issued a map of the world which has been divided into 21 areas. Several of the commissioners for these areas have already been appointed.

Accompanying the map is a valuable analysis of the imports of the various commercial areas in 1913. The figures give the total imports and the amount of imports from the United Kingdom, thus showing clearly where British trade needs stimulating. It is the purpose of the Federation to explore all the possibilities of these markets and to further British trade in all possible ways.

The Oversea Trade Department of the Federation is a separate organization which is divided into eight geographical sections, organized as intelligence centers for the various territories. The purpose of this department is to provide a service run by manufacturers for manufacturers, capable of giving assistance and information of every kind promptly and efficiently to every manufacturer who desires to export his goods or import his raw material.

The American Chamber of Commerce in London says that the Federation of British Industries is a very high class, powerful organization and can be counted on as very likely to accomplish the objects it goes after.

Restoration of Public Utility Credit.

In view of the fact that President Wilson in his recent message to Congress called attention to the need of constructive action in regard to public utilites, and also that the newly organized Federal Electric Railways Commission is investigating the street railway situation with a view to making recommendations, an analysis of the public utility situation has been made by Stone & Webster of New York, Boston and Chicago.

"It is our belief that despite the difficulties of the war period there is a solid basis for optimism in the public utility situation," the analysis states. "The question of restoring public utility credit has become definitely recognized as one of the most important domestic matters to be solved during the coming period of readjustment. This credit must be reestablished on a basis that will insure to this great industry, representing an investment of $12,000,000,000, not only an adequate return on the capital already invested but also sufficient safeguards for the new capital that must continually be attracted so that utilities may serve in the growth of the nation.

"The service rendered in supplying light, power, gas and transportation in our cities and for our manufactories is as fundamental to the industrial and economic life of this country as are our railroads, mines, oil fields, agricultural lands and factories. It is estimated that the urban population served by street railways and interurbans is upwards of 43,000,000 and that they move over 20,000,000,000 passengers annually.

"Yet this great group of public service companies, serving national needs, shouldering all the higher costs of labor, taxes, materials and supplies occasioned by the war, received practically no financial aid from government sources and no assistance in a comprehensive plan for effective and speedy relief in the way of securing higher rates and fares—except as could be worked out by each individual company through the slow method of application to the state commissions, municipal authorities, and referendum vote.

"Capital had to be secured to take care of maturing obligations, amounting in 1918 to over $225,000,000, at interest rates in many instances much higher than the fixed rate of return allowed on the investment by franchises and other regulations, and with the temporary sacrifice in many cases of a large part of the equity value. In normal years the amount of new money required annually by public utilities for extension to plant aggregates from $600,000,000 to $700,000,000. During the period of the war these requirements were cut to approximately $250,000,000 per annum, but this money had to be raised in addition to the maturing obligations.

"For the year 1918 it was estimated that the net operating revenue of the traction companies in the United States approximated $70,000,000, with only a few months of the war labor board awards reflected in expenses. Increases in expenses through these awards amount to over $100,000,000 annually. Since we entered the war in 1917, and up to Feb. 1, 1919, companies operating some 4,900 miles of track, representing approximately one-tenth of the total street railway mileage, have gone into receivers' hands, that about 500 miles of track have been completely abandoned, and that foreclosure sales of twenty-three roads, representing 524 miles of track, have resulted."

Earnings Edmonton Public Utilities Show Improvement.

Edmonton public utilities show a net surplus for May of $2345, compared with a net deficit for the same month last year of $3549. The net surplus for the five months (inclusive of the street railway deficit) amounts to $62,233, against $33,809 for the corresponding period of 1918. Net surpluses for the five months of the respective departments are as follows:

	1919.	1918.
Electric light	$ 66,056	$54,131
Telephone	21,356	13,845
Water works	14,246	10,746
Total	$101,659	$78,724

The street railway deficit is $39,425, as compared with $44,914 last year, leaving, as already stated, a net surplus of $62,233 on the combined utilities, as compared with $33,809 in 1918.

WEEKLY COMPARISON OF CLOSING-BID PRICES OF SECURITIES OF LEADING ELECTRICAL COMPANIES.

Quotations furnished by F. M. Zeiller & Co., Rookery Bldg., Chicago.

Public Utilities.	Div. rate. Per cent.	Bid July 22.	Bid July 29.
Adirondack Electric Power of Glens Falls, common	6	15	14
Adirondack Electric Power of Glens Falls, preferred	6	76	76
American Gas & Electric of New York, common	10+extra	130	130
American Gas & Electric of New York, preferred	6	41	41
American Light & Traction of New York, common	..	258	245
American Light & Traction of New York, preferred	6	98	97
American Power & Light of New York, common	4	65	65
American Power & Light of New York, preferred	6	73	65
American Public Utilities of Grand Rapids, common	..	10	10
American Public Utilities of Grand Rapids, preferred	7	35	32
American Telephone & Telegraph of New York	..	103⅝	103⅛
American Water Works & Elec. of New York, common	..	5	5½
American Water Works & Elec. of New York, particip.	7	11	11
American Water Works & Elec. of New York, first preferred	..	59	60
Appalachian Power, common	..	6	4
Appalachian Power, preferred	7	20	23
Cities Service of New York, common	+extra	441	440
Cities Service of New York, preferred	6	78½	79
Commonwealth Edison of Chicago	8	109½	109⅛
Comm. Power, Railway & Light of Jackson, common	..	27	26
Comm. Power, Railway & Light of Jackson, preferred	6	61	60
Federal Light & Traction of New York, common	..	12	10
Federal Light & Traction of New York, preferred	..	50	50
Illinois Northern Utilities of Dixon	6	70	70
Middle West Utilities of Chicago, common	2+extra	34	34
Middle West Utilities of Chicago, preferred	6	58	58
Northern States Power of Chicago, common	..	69	67½
Northern States Power of Chicago, preferred	ex.div.7	90	91
Pacific Gas & Electric of San Francisco, common	..	68	68½
Pacific Gas & Electric of San Francisco, preferred	6	89	88
Public Service of Northern Illinois, Chicago, common	7	89	89
Public Service of Northern Illinois, Chicago, preferred	6	94	94
Republic Railway & Light of Youngstown, common	4	16	15
Republic Railway & Light of Youngstown, preferred	6	56	54
Standard Gas & Electric of Chicago, common	..	36	35
Standard Gas & Electric of Chicago, preferred	6	46	45½
Tennessee Railway, Light & Power of Chattanooga, common	..	6	6
Tennessee Railway, Light & Power of Chattanooga, preferred	6	20	20
United Light & Railways of Grand Rapids, common	4	47	46
United Light & Railways of Grand Rapids, preferred	6	74	73
Western Power of San Francisco, common	..	22	22
Western Union Telegraph of New York	extra	87	87½
Industries.			
Electric Storage of Philadelphia, common	4	88⅛	91
General Electric of Schenectady	8	167¾	167½
Westinghouse Electric & Mfg. of Pittsburgh, common	7	56⅜	57

Electrical Review

l. 75. No. 6. CHICAGO, AUGUST 9, 1919 Three Dollars a Y

Electrical Review

WITH WHICH IS CONSOLIDATED WESTERN ELECTRICIAN AND ELECTROCRAFT.

VOL. 75—No. 6. CHICAGO, SATURDAY, AUGUST 9, 1919. PAGE 223.

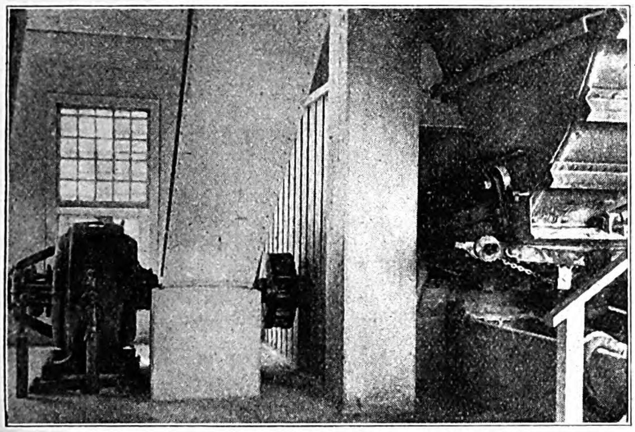


Fig. 1.—60-cycle, 250-hp., 700-r.p.m., 440-volt Driving Williams Mill, in Plant of Southwestern Portland Cement Co.

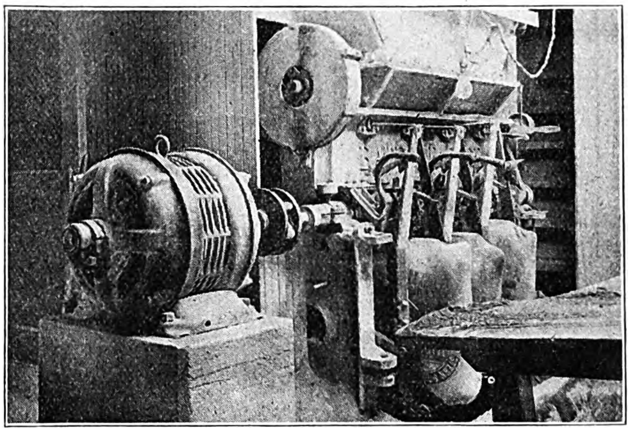


Fig. 2.—15-hp., 1140-r.p.m. Westinghouse Motor Driving Sacking Machine.

Electric Drive in California Cement Mill

Motor-Driven Machinery Proves Successful in Plant of Southwestern Portland Cement Co. at Victorville, Cal. —Central-Station Service Used — Description of Process

APPLICATION of electric drive in the operation of a cement mill, and the advantages to be derived therefrom, are unusually well exemplified in the plant of the Southwestern Portland Cement Co. at Victorville, Calif. This town is in the southwestern part of the state, about 100 miles from Los Angeles on the Santa Fe Railroad, the tracks of which pass by the plant, affording a convenient outlet for the finished product.

This mill has an output of 300,000 bbls. a year of portland cement, and employs approximately 80 people. All of the buildings are of substantial concrete construction built to withstand the severe conditions imposed by the heavy machinery installed.

Water for the wet process system of manufacture, and for use throughout the mill, is raised to a reservoir on a hill back of the plant by a 15-hp. motor-driven triplex pump. Rock and shale are brought to the mill from the quarry which is located 7 miles distant, by a steam locomotive hauling trains of cars that have two compartments or hoppers which are dumped one at a time into the crusher.

Electric current is purchased from the Southern Sierras Power Co., thus relieving the company of the expense and trouble incident to the operation of a power plant. Current is received at 33,000 volts and stepped down to 440 volts, for application to the various motors installed throughout the mill.

Transformers and switching apparatus are of the outdoor type, located immediately adjacent to the mill. The current is taken from here to a 7-panel marble switchboard, built by the Westinghouse Electric & Manufacturing Co., from which it is distributed to the various power and lighting circuits in the mill.

Lime rock is delivered from the hopper cars direct to the crusher, but a reserve pile of crushed stone, amounting to between 3000 and 5000 tons, is maintained sufficient to keep the mill operating for a period of approximately 30 days. This reserve is maintained in the event of any accident, such as a washout, crippling the railroad service from the quarry to the mill.

The crusher and Williams mill are driven by a 250-hp. Westinghouse type CW wound-rotor type motor—as shown in Fig. 1—which break the rock into pieces about the size of a walnut or a little larger. From here the rock is elevated to a storage bin by a bucket elevator, driven by a 30-hp. motor, and thence by belt conveyor to the pulverizing house. Up to this time no water has been put with the rock except what is thrown on at the time it goes into the crusher, which is done with a hose to eliminate whatever dust rises during that process.

During the process of pulverization, water is added again for the purpose of eliminating the dust. After being thoroughly pulverized, the mixture is taken to the slurry tanks where it is kept in motion by air agitation until ready for admission to the kiln.

There are six slurry tanks served in pairs by ele-

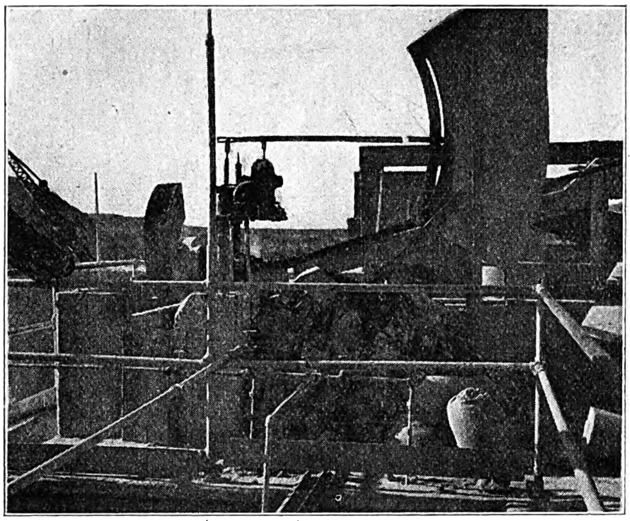


Fig. 3.—¼-hp., 440-volt., 1725-r.p.m. Westinghouse Single-Phase Motor Driving Slurry Feed Control Dipper.

vators operating at a speed of approximately 88 ft. per min., for elevating the mixture from the pulverizing house tanks, and driven by a 7½-hp., constant-speed motor.

After the mixture has been thoroughly agitated it is transferred to the slurry tanks nearest the kiln. From here it flows into a sump and is delivered to the kiln by a motor-operated measuring device illustrated in Fig. 3, which shows the rear of the scale. The dipper is made in the shape of an S, the outlet being in the center. By raising and lowering the dipper in the sump the amount of slurry entering the kiln can be controlled. The dipper is driven by an extended shaft, provided with two universal joints from one of the elevators, and is raised and lowered by a ¼-hp. 1725-r.p.m. motor by means of remote control from the clinker end of the kiln. The large scale is visible to the operator at the clinker end and he can feed the proper amount of mixture to the kiln and watch his fire at the same time.

The rotary kiln is approximately 200 ft. long and 20 ft. diam., lined with fire brick and heated by an oil burner to a temperature of about 2500°, which is measured by a radiation pyrometer. It is driven at a speed of 1 r.p.m. by a 50-hp., type CW, 700-r.p.m.

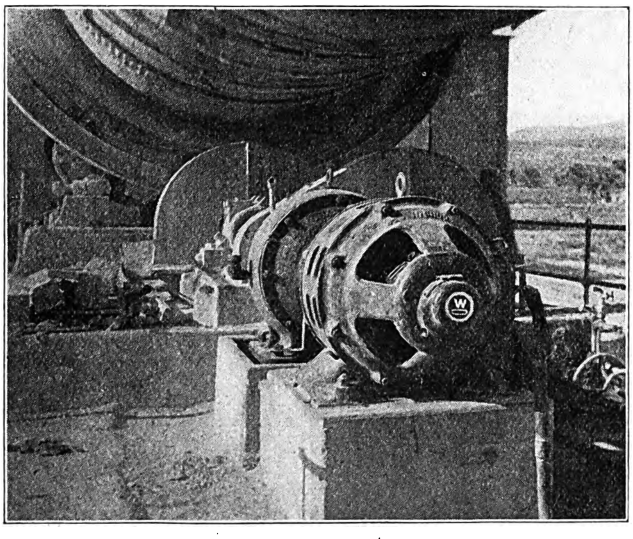


Fig. 4.—50-hp., 440-volt, 60-cycle, 3-phase, 700-r.p.m. Motor Driving Rotary Kiln Through Foote 14 to 1 Reducer; Speed, 1 r.p.m.; Double Reduction, 48 to 1.

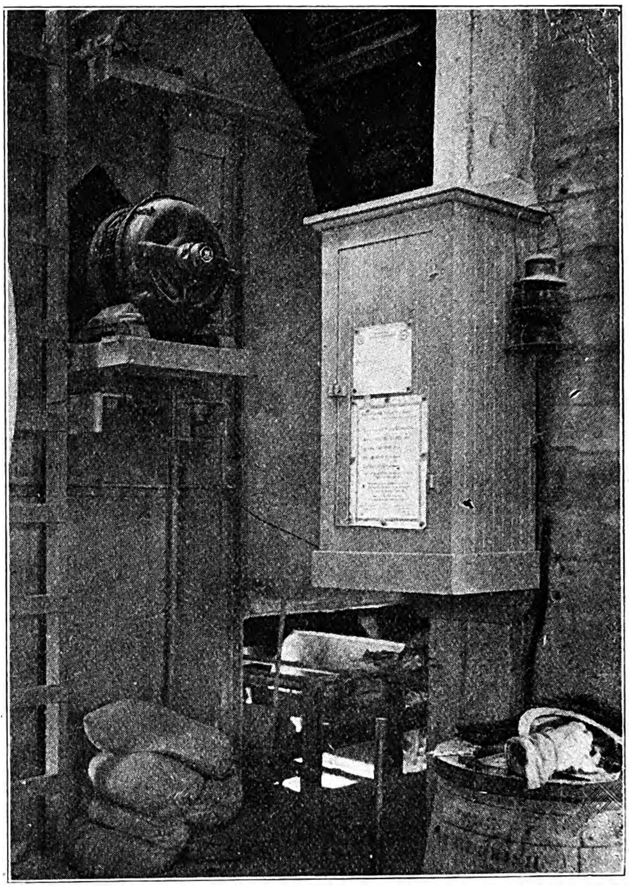


Fig. 5.—7½-hp., 680-r.p.m., 440-volt, 60-cycle Motor Driving Clinker Elevator.

motor through Foote reduction gears, as shown in Fig. 4. The kiln is elevated at the raw end so that, as it rotates, the mixture will travel toward the clinker end. Upon coming from the kiln the clinker falls about 20 ft. into a pit to allow it to cool somewhat. It is then elevated by the clinker elevator which is driven by the 7½-hp., 680-r.p.m. motor, shown in Fig. 5, to an automatic scale and dumped into the storage bin. From the storage bin the clinker is transferred by means of a locomotive crane, with a clamshell bucket, to a bin from which it is fed into the finish mill. The locomotive crane is also used for mixing the clinker, as it will vary somewhat in quality. After being ground and analyzed by the chemical department, it is ready for the packing house, to which it is carried on a belt conveyor over a weighing machine, which automatically records the number of barrels that pass.

From the storage bins, the cement is taken to the

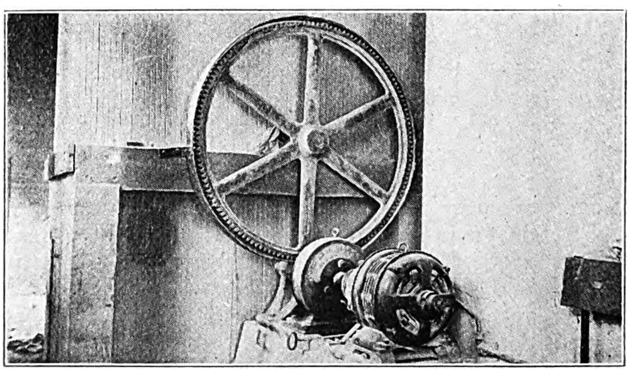


Fig. 6.—7½-hp., 10-pole, 680-r.p.m. Westinghouse Motor Driving Sack Cleaner Through Foote Reducer.

sacking machines, shown in Fig. 2, driven by a 15-hp. motor. A sack cleaner driven by a 7½-hp., 680-r.p.m. motor, through a Foote reduction gear, is shown in Fig. 6. A 15-hp. motor-driven blower, for collecting dust from the sacking and sack cleaning machines, is also used.

The motors are of the 440-volt, 60-cycle, 3-phase, induction type, and were furnished by the Westinghouse Electric & Manufacturing Co., of East Pittsburgh.

This plant was designed and built by L. D. Gilbert, and has been in operation over 3 years, during which time no shutdowns have been experienced due to any trouble with the electrical equipment. It is a model plant from every standpoint and is practically dustless.

UNIQUE NATIONAL ADVERTISING EXHIBIT PLANNED AT NEW ORLEANS.

Successful National Advertising Campaigns, Industrial Relations Campaign and the Neosho Co-operative Advertising Plan to Be Featured.

Information of a most valuable character will be available to those who visit the National Advertising Exhibit, to be held as a part of the 15th annual convention of the Associated Advertising Clubs of the World, at New Orleans, La., Sept. 21 to 25, says a recent bulletin from the advertising association. It is believed that this exhibit will prove of interest to electrical manufacturers, jobbers and utility companies that do extensive advertising.

In addition to the fact that this year's advertising exhibit will take a new form, embracing complete showings of several actual advertising campaigns, it is also announced that at stated hours those who planned and executed the campaigns shown will be on hand to explain them and to answer any questions which are not answered to the complete satisfaction of the visitor by the exhibits themselves.

Several campaigns are to be shown; there will be national, semi-national, territorial and local campaigns. Advertisements from publications and from all other mediums used, as well as "follow-up" matter employed in the campaigns will be shown and explained, and Joseph S. Potsdamer, of Philadelphia, chairman of the exhibit committee, has declared that it will be such an exhibit and explained in such interesting detail, as to bring notebooks from the pockets of those who see it.

In addition to these campaigns, two other features of importance are being planned. One of them, following the chief theme of the convention, will show campaigns which have been used by manufacturers, merchandising establishments and other employers, in gaining the co-operation of their employes. This section will be supplemental to the plan to have a labor leader and a man equally representative of capital present what they believe to be the terms upon which capital and labor can agree so as to insure increased production and thereby insure continued prosperity. Samuel Gompers, president of the American Federation of Labor, has accepted a place on the program.

The other feature of importance will be a complete exhibit showing how the Advertising Club of Neosho has built up the business of Neosho through a plan of co-operative advertising and by co-operation among the merchants, to insure that all of the advertising done is so truthful as to insure that the customer who comes to Neosho will desire to make Neosho his regular trading point.

CIVIL-SERVICE EXAMINATION FOR ELECTRICAL ENGINEER, SIGNAL CORPS.

Examinations for Electrical Engineer, $2400 to $3600 a Year, and Assistant Electrical Engineer, $1800 to $2400 a Year, to Be Held Sept. 16.

The United States Civil Service Commission, Washington, D. C., announces open competitive examinations for the positions listed above, for men only. Vacancies in the Signal Service at Large at the salaries indicated, and in positions requiring similar qualifications will be filled from these examinations. Certification to fill the higher-salaried positions will be made from those attaining the highest average percentages in the examinations.

The duties of these positions comprise the development and design of electrical equipment and especially Signal Corps storage batteries, or the administration of commercial telephone systems and installation of Government-owned systems.

Competitors will not be required to report for examination at any place, but will be rated on the following subjects: (1) education, training, and experience; (2) publications, reports, or thesis (to be filed with application). Under the first subject competitors will be rated upon the sworn statements in their applications and upon corroborative evidence.

For the position of electrical engineer, applicants must have graduated with a B. S. degree, preferably in electrical engineering, from a college or university of recognized standing, and also have received the E. E. degree after having completed the required courses of resident or nonresident work; and, in addition, have had at least two years' experience devoted in major portion to work involving one or more of the following subjects: Testing of electrical instruments or apparatus; research concerning radio apparatus; calibration and standardization of electrical meters and apparatus; teaching or theoretical and analytical research in physics, electrical engineering, telephony, or telegraphy; direction or management of electrical or physical laboratories; acceptable consulting engineering practice in telephony, telegraphy, radio, or electrical engineering other than power plant.

For the position of assistant electrical engineer, applicants must have received at least 59 credit hours for resident study in a college or university of recognized standing; and have had at least two years' experience devoted to the testing, standardization, and calibration of electrical instruments or apparatus; teaching in physics or electrical engineering; as laboratory assistant in physical or electrical laboratory; or in analytical electrical research or radio production or inside plant telephonic consulting engineering.

Under subject two, applicants must submit with their applications any publication or report prepared by them showing their fitness for the position for which they apply; or, in lieu thereof, they should prepare and submit with their applications a technical thesis on the design and development of some piece of apparatus for the Signal Corps.

Applicants will be admitted to these examinations regardless of their age; and regardless of their residence and domicile.

Further particulars regarding this examination are given on Circular 394 issued by the commission. All applications with statements as to training, experience, etc., and with reports, thesis, photographs, etc., must tomer who comes to Neosho, Mo., desire to make it his regular trading point.

Practice in Making Electric Utility Appraisals

Practical Methods Used in the Inventory of Land, Buildings and Outside Plant—Systematic Planning of the Inventory—Forms Used in Gathering Field Data

By CHARLES W. McKAY

THE previous articles in this series have confined themselves to a discussion of the general problems involved in electric utility appraisement. The present article, and those immediately succeeding, will deal with the practical problems involved in taking the actual inventory of an electric utility company's property.

From the article in the issue of the ELECTRICAL REVIEW for June 28, 1919, it will be remembered that the Direct Construction Cost is divided into two general divisions: Cost of Inventoriable Property and Incidental Construction Expense. The Cost of Inventoriable Property is again subdivided according to the major classifications of an electric utility company's physical property. These major classifications are:

1. Land.
2. Buildings.
3. Pole lines.
4. Conduit system.
5. Aerial wire and cable.
6. Underground wire and cable.
7. Transformers.
8. Central-station equipment.
9. Tools.
10. Supplies, etc.

Before taking up a discussion of the detailed methods to be employed in the actual inventory of the items represented by these major classifications it may be well to briefly discuss the general *modus operandi* of taking and recording field data.

The reader will doubtless appreciate that the volume of data involved in the appraisement of even the smallest electric utility plant is so great as to necessitate the utmost care not only in acquiring the data, but, also, in so recording them as to be subsequently intelligible. Otherwise the completed inventory would only present a hopelessly confused mass of well-nigh useless data.

Making Rapid and Accurate Utility Appraisals.

UTILITY rates are nowadays usually set after a valuation of the utility company's property has been made, this being to set at rest charges often loosely made that the company is earning big returns on watered capitalization. Even in emergency rate cases, where there is no time to make a complete valuation of the plant, provision is commonly made for a later revision of the rates when a subsequent valuation shows them to be too high or too low. In general, it may therefore be said that valuation is a quite usual concomitant of utility rate cases, and, because of the present exceptional importance of these cases, valuation of utility properties is a very timely topic for the utility manager.

In this article Mr. McKay discloses many valuable facts and makes important suggestions for carrying on an appraisal of electric utility properties, all based on his many years' experience as an appraisal engineer. The ideas and forms he suggests will be found to save much time and money in making the inventory and to increase its reliability decidedly.

This article is the fourth of a series of twelve on valuation and rates. In the first article, in the issue of May 17, Mr. McKay gave a general introductory discussion of modern utility regulation; his second article in the June 7 issue, included definitions of the principal terms used; his third article in the June 28 issue discussed reproduction cost as the basis of appraisement. The next article will consider appraisement, or valuation, of the inventory discussed in the present article. Mr. McKay will gladly throw additional light on any of these matters, if inquiries are addressed to him in care of the editor of the ELECTRICAL REVIEW.

There are certain preliminary steps which must be observed in the appraisement of any electric utility property to make it systematic and economical. These steps may be summarized as follows:

1. Determination of the purpose of the appraisal.
2. A general survey of the property by the engineer in charge of the appraisal.
3. A careful investigation of the utility company's records.
4. A review of the appraisal requirements of the public service commission, under whose jurisdiction the company operates.
5. A careful determination of the various types of construction used by the company whose property is under appraisement and the subsequent preparation of suitable field forms to record the inventory data.
6. Selection of employes for performing the task of inventory.

Determination of the Purpose of Appraisal.—Electric utility appraisals are used for various purposes and to avoid unnecessary refinement of detail in preparing the appraisal it is most necessary that the appraisal engineer shall make a careful study of the ultimate uses of the appraisal. The various uses to which electric utility valuations are put may be summarized as follows:

1. For presentation before a regulatory body in rate cases.
2. For determining fair value as a basis of subsequent financing.
3. For use as a basis for tax adjustment.
4. For accounting purposes.

Our present problem is confined largely to item 1—the preparation of an appraisal for presentation before regulatory bodies in connection with rate cases. It is well, however, for the appraisal engineer to make every effort to so prepare the appraisal that it may be used for accounting, tax adjustment, financing, and other purposes.

Survey of Conditions.—Knowing the use to which the appraisal is to be put, the engineer in charge is equipped to prosecute the actual work of appraisement. To do so intelligently he must first make a general inspection of the property to be appraised, noting the geographical layout of the plant and determining, in so far as possible, the construction history of its component parts.

It is most important that this preliminary survey be made with the utmost care. A study of the geographical layout of the plant—especially if the property is a large one—will subsequently enable the appraisal engineer to so plan his work as to effect many economies in the cost of appraisement.

Investigation of the Company's Records.—After completing the preliminary survey the appraisal engineer should carefully review the company's records and map files. If the records are reasonably accurate, they may often be used as an aid to the field work. Maps of the plant, if accurate, may be used as a guide for the field engineers. The use of such maps frequently obviates many days work in the field in preparing ground layouts.

In reviewing the company's records the appraisal engineer should also determine to what extent these records may be used as a basis for building up the unit costs. *Reproduction* unit costs based upon *actual* costs afford the most conclusive evidence for presentation before state commissions.

Review of Commission Requirements.—If the appraisal is to be used in connection with a rate case —and we assume that it is in our present discussion— it is most important that the appraisal engineer shall thoroughly familiarize himself with the commission instructions referring to the presentation of inventories and cost data. The requirements of various state commissions vary widely and in view of the fact that the readers of the ELECTRICAL REVIEW are scattered all over the United States, it is deemed advisable to confine the present discussion to general, common-sense methods of inventory and appraisement. It is thought, however, that the appraisal methods presented in this series are flexible enough to facilitate their ready adaptation to the peculiar requirements of any commission.

In undertaking a specific appraisal problem it is most important that the engineer in charge shall carefully review the instructions of the local commission —otherwise he might subsequently be confronted with the embarrassing problem of entirely revamping his data to meet the commission's requirements.

Preparation of Field Forms.—The problem of preparing suitable forms for recording and summarizing the inventory data is a difficult one and its importance cannot be exaggerated. This whole subject will be discussed in detail in a subsequent portion of this installment. For the present suffice it to say that time expended in the preparation of suitable forms is well spent and should result in a minimum cost of appraisement and a maximum usefulness of the completed valuation.

Selection of Appraisers.—Many electric utility companies adopt the practice of employing a skilled appraisal engineer—and possibly one or two of his assistants—to supervise the preparation of the inventory and appraisal and to co-operate with counsel in the task of presenting the rate case before the state commission. These companies prefer to furnish the necessary help, in the way of field inspectors and office men themselves—the thought being that a sufficient number of men can be spared from the operating forces to undertake this work without impairing the operating efficiency and thus minimizing the cost of appraisement.

The adoption of this policy is questionable, but where it is adopted the task of selecting the men should be left entirely to the appraisal engineer.

In this connection it is interesting to note that the best operating employes often make the poorest appraisers. The engineer in charge of the appraisal is obviously best qualified to pick the men for his own peculiar needs.

FORMS FOR RECORDING THE INVENTORY DATA.

Having completed this general discussion of the steps preliminary to the actual task of taking the inventory, we are now ready to consider ways and means of recording the inventory data. The various plant classifications will be discussed in the order enumerated in the foregoing recapitulation—the first item being land.

Land.—It is most important that the land, owned by an electric utility company, be completely described so as to avoid subsequent embarrassment when the case is presented before the state commission. It is best to base such a description upon the records in the tax assessor's office. Usually such records are readily accessible to the appraisal engineer if he will but take the trouble to state clearly the use to which the information is to be put. Another source for obtaining authoritative information is the office of the commissioner of deeds or county recorder.

The following is an illustration of the form in which land inventories are prepared:

LAND OCCUPIED BY POWER HOUSE OF BLANK ELECTRIC LIGHT COMPANY.

Location: Southeast corner of 8th and Cedar Streets—City of ...., State of ....

Description: Lot No. 3, block No. 13, and that portion of lot No. 2, block No. 13, lying westerly of the easterly line of lot No. 3; Roberts and Randalls subdivision of the westerly addition to the city of ...., ...

Leaseholds and right-of-way are often considered as subdivisions of the land item. To illustrate: A certain company may have a 99-year lease on the parcel of land upon which its central station is erected. In many states a leasehold of this nature may be considered as one of the fixed assets of the company and therefore should be included in the appraisal.

Again, many electric utility companies have certain right-of-way privileges over private property covering the right to occupy such property for purposes of placing poles, underground conduits, etc. Such right-of-way may be frequently included in the appraisal and the value assigned to it will be entirely dependent upon the exigencies of the case in question.

In this connection it should be remembered that the present article is confined specifically to ways and means of recording and summarizing the inventory. We are therefore concerned only with the description of land and the various other major items of physical property—the question of values will be discussed in a subsequent article.

Leaseholds may be described in a manner similar to that suggested for describing the land proper. Right-of-way for pole lines is usually described only by stating the number of poles involved. For instance, if a certain company has 500 poles upon private right-of-way, the inventory right-of-way item will be listed thus:—Right-of-way for 1000 poles @ (unit cost per item of right-of-way) ....

Buildings.—Many of the state public utility commissions have taken the stand that electric utility appraisers are not qualified to testify as to the value of buildings and that this phase of the appraisal problem should be relegated to building contractors or architects. Be that as it may, it is always well for the appraisal engineer to make his own careful inventory of the buildings and subsequently to appraise this inventory—even if it is merely used as a check upon the architect's valuation.

The inventory of buildings should include the following items:

1. Character of building—whether fireproof, slow-burning, non-fireproof, etc.
2. Over-all dimensions—length, breadth and height.
3. Detail of construction of building:
   - (a) Detailed description of foundation.
   - (b) Detailed description of walls.
   - (c) Detailed description of floors.
   - (d) Detailed description of roof.
   - (e) Detailed description of interior finish —if any.
   - (f) Any further general information that will assist in the appraisement of the building.

The description of a building as included in the appraisal should take somewhat the following form:

POWER HOUSE OF BLANK ELECTRIC LIGHT COMPANY.

Fireproof, brick and concrete building, located at the northwest corner of Third Street and Fourth Avenue.

Main building, 100 ft. long by 75 ft. wide by 30 ft. to peak of roof (25 ft. to wall plate).

Addition at north end, 25 ft. by 25 ft. by 15 ft. to wall plate supporting flat roof.

Detailed description: (Give detailed description of foundations, walls, floors, roof, etc., as suggested in the foregoing instructions).

Pole Lines.—The inventory of the outside plant of an electric utility company is obviously the most difficult problem confronting the appraisal engineer,

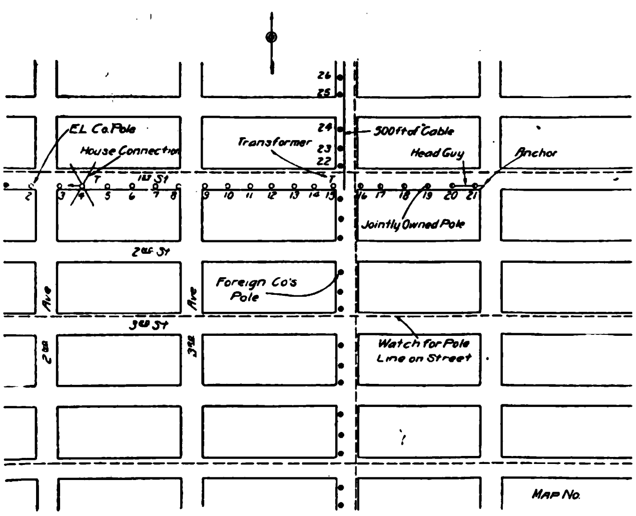


Fig. 1.—Map for Use in Inventory of Aerial Plant.

not that the items themselves are especially complex, but due to the fact that the various pole lines, primary and secondary circuits, underground conduit systems, etc., are scattered over a wide area. It is customary in electric utility appraisal work to undertake this phase of the problem first—weather conditions permitting. The inventory of the land, buildings, central-station equipment, and minor items may be taken at odd times when the weather is unfavorable for outside work.

It is customary to take the inventory of poles, anchors, guys, wire circuits and cables simultaneously. The appraisal engineer should first procure a map of suitable scale—say 400 or 600 ft. to the inch. Upon this map should be indicated the various primary and secondary circuit leads—the map will then serve as a guide for the field inspectors. If the plant to be inventoried is a large one the map should be suitably divided so that all of the inventory gangs will be assigned approximately equal portions.

Various pole leads may be indicated on these maps by a light pencil line and subsequently the field inspectors should show the actual pole locations as found in the field.

Such a map is illustrated in Fig. 1. The light dotted lines indicate the pole leads and the small circles the actual pole locations as found in the field. Guys between the poles are shown by a thin straight line and the anchors by arrows. Poles bearing transformers are indicated by the letter *T*. House connections are indicated by straight lines radiating from the poles.

A map of this character must be used in conjunction with a properly designed form for recording the field data. Such a form is illustrated in Fig. 2.

The following instructions should be helpful in understanding the use of the field form (Fig. 2) and the field map (Fig. 1):

1. Spot poles on the field map, Fig. 1, locating each pole as accurately as possible in relation to street and alley intersections. Poles belonging exclusively to the electric light company should be indicated by a hollow circle. Poles belonging exclusively to foreign companies (such as telephone companies) should be indicated by a filled-in circle. Poles belonging jointly to electric light and foreign companies should be indicated by a circle half filled-in. Spot only those poles belonging to foreign companies upon which there are wires or cables of the electric light company.

In some cases it may be found that the electric light company has in its possession maps giving the above information either in the code just referred to or in some other suitable code for distinguishing between the ownership of poles. In such cases these maps may be used by the field inspectors—providing they are carefully checked in the field and corrections made where the information given on the map is found to be inaccurate.

Before leaving any block make certain that the number of poles shown in the block is correct.

2. Number the poles consecutively as they are spotted (or checked), beginning the series with "1" on each map.

3. Use a separate line on the data sheet for each pole spotted on the map—whether the pole is owned by the electric light company or by a foreign company. Place the pole number in the corresponding ownership column on the data sheet. List only the wire, or equipment, belonging to the electric light company—ignoring all equipment owned by foreign companies.

4. In the column marked "Kind," indicate the material of the pole—using the letter "C" for cedar, "Ch" for chestnut, etc.

5. In the column marked "Setting," use the letter "D" for dirt setting, "R" for rock, "P" for pavement and "C" for pole set in concrete (concrete reinforcement).

6. In the column marked "Tree Trimming," use the letter "L" for light trimming, "H" for heavy trimming, "M" for medium trimming, and "C" for trees cut down.

7. Anchors should be divided into two general classifications, log anchors and patent anchors. Each of these classifications should be subdivided into heavy, medium and light anchors as indicated on the data sheet (Fig. 2). The distinction between heavy, medium and light anchors should be decided by the appraisal engineer before the field work is started and definite instructions should be issued to the field forces.

8. Under the column marked "Cable," give the gauge of the cable and the number of conductors.

The cable measurements (lengths) should be shown upon the map (Fig. 1) as indicated.

9. Under the columns marked "Condition," use the letter "E" for excellent, "G" for good, "F" for fair and "P" for poor. (This phase of the subject will be discussed more specifically in a subsequent installment on Depreciation.)

10. The field inspector should place his name, and the date on which the sheet was filled out, upon each inventory sheet. When several field sheets are used in connection with one field map these sheets should bear consecutive numbers.

11. Where a given pole line extends beyond the limit of the map mark the last pole with a cross inside of a circuit; colored chalk may be used for this purpose. Such a designation will indicate to the field inspector who happens to have the map of the adjoining section that this pole has already been taken—thereby eliminating duplications in the inventory.

12. Transformers should be marked on the map with a "T" opposite the pole on which they are located. In the column of the data sheet headed "Transformers" the size and make of the transformers should be noted.

A set of instructions similar to the foregoing should be issued by the appraisal engineer at the beginning of every large appraisal task. If this is done, and the work of the field inspectors carefully supervised at frequent intervals, the accuracy of the inventory is assured and the possibility of embarrassing mistakes will be obviated.

This method of using a map in conjunction with the inventory sheet has another advantage—it facilitates the ready checking of the inventory by the commission engineer. The advantages of the adoption of this system—or some equally good system—can hardly be exaggerated. Each step of the inventory work is readily identified and even if errors should creep into the work they can easily be corrected.

It is thought from the foregoing rather broad discussion of the method of taking the inventory of poles, anchors, guys, wires, cable and transformers, that the reader will gain a general idea of the method usually adopted in work of this nature. A detailed discussion of this phase of the subject would exceed the space allotted to one article. However, if any questions should arise the author will be very glad to answer them.

Underground Conduits and Cables.—Even more care should be adopted in the inventory of the underground than in the aerial system. This is for the reason that underground systems are very expensive and an error of a few feet in the inventory may result in an appraisal error of several hundred dollars or more.

Another reason for exercising care in making an inventory of the underground plant is that subsurface distribution systems are usually so complicated that it is necessary to employ higher grade men than is the case in the recording of aerial inventories. Care in laying out the work will effect a saving of time on the part of the field inspectors and therefore a saving in expense. In this connection it is interesting to note that one experienced in the inventory of underground distribution systems can record accurately the data for from 50 to 75 manholes a day, whereas a novice in this type of appraisal work could not possibly cover over 15 to 25.

As in the case of the inventory of the aerial system, the combination map and record-sheet scheme is best adapted for insuring speed and accuracy.

APPRAISAL OF BLANK ELECTRIC LIGHT CO.

FIELD FORM FOR POLES, CROSSARMS, WIRE, CABLE, ETC.

Sheet No 1	Name	Date
Field Work	A.J.W.	7-25-19
Ap'v'd By	C.W.M.	7-28-19
Compiled By	XYZ	7-29-19

Map No 1

Location: On	Location: Between		Pole No	Poles: Full Ownership	Joint Ownership	Owned by Others	Priv. Right of Way	Kind	Length (Ft)	Diam. Top (In)	Stepped	Trussed	Hub Guard	Setting	Tree Trimming	Painted		Condition
			1															
			2															
			3															
1st St.	2nd Ave	3rd Ave	4	✓	X	X	X	C	35	7	✓	X	✓	C	L	✓	X	G

Pole No	Guying: Log Anchor Light (No)	Log Anchor Medium (No)	Log Anchor Heavy (No)	Patent Anchor Light (No)	Patent Anchor Medium (No)	Patent Anchor Heavy (No)	Head Guy (No)	Tree Guy (No)	Building Guy (No)	Stub and Guy (No)	Push Pole		Condition
1													
2													
3													
4	X	1	X	X	X	X	X	X	X	X	X	X	G

Pole No	Crossarms: Single	Single: Standard (No)	Single (No)	Single: Condition	Double	Double: Standard (No)	Double	Double: Condition	House Connection: Number of	House Connection: Condition
1										
2										
3										
4	X	2	X	F	X	X	X	X	4	G

Pole No	Line Wire, Number of Wires: #10 T.B.W.P. Copper	No 8 Ditto	No 6 Ditto	No 4 Ditto	No 2 Ditto	Condition	Cables: Diameter	No of Conductors	Gauge of Cable	Condition	Transformers: Number of	Size Kw	Make	Type
1														
2														
3														
4	4	X	X	X	3	F	X	X	X	X	1	10	GE MB	

Note: Complete Record of Pole No 4 (See Fig No 1) Given for Illustrative Purposes
Check (✓) Signifies that Item Falls in Column Checked
Cross (X) Signifies Nothing to Record, but Item has not been Overlooked

Fig. 2.—Sample Field Sheet for Recording Aerial Plant Data.

The appraisal engineer should provide himself with a map showing the location of all the manholes. If such a map is not available, a skeleton map should be made and the manhole locations noted thereon. Information as to the position of the manholes, at least approximately, may usually be had by consultation with some of the older employes of the company whose property is under appraisement. The data, as thus obtained, may subsequently be checked by the field inspectors.

Fortunately, however, most companies maintain reasonably accurate records of their underground systems and these records frequently show not only the location of the manholes, but also information as to the numbers of ducts, locations and sizes of lateral leads and sometimes data relative to the size and gauge of the underground cables.

A typical underground map is shown in Fig. 3. while Fig. 4 illustrates a form of field sheet for recording the data. One of these sheets, obviously, should be made out for each manhole.

To illustrate the correlation of the field map and data sheet—as they are used in the appraisement of an underground system—the various steps necessary to the proper recording of the data for one manhole will be described in detail. Assume that the field inspector has completed his inventory of manholes 1, 2, 3 and 4. Using a 100 ft. steel tape the inspector and his assistant will carefully measure the distance between the center of the cover of manhole No. 4 and the center of the cover of manhole No. 5. It is most important that such measurements shall be accurate, as errors may amount to from one up to several hundred dollars a lineal foot. The best way to insure accuracy is to use surveyor's pins; counting the pins and reading the last measurement on the tape, it is a comparatively simple matter to obtain accurate measurements.

While en route from manhole No. 4 to No. 5 the inspector will note the character of the pavement, or pavements, between the two manholes.

Arriving at manhole No. 5, the inspector will note

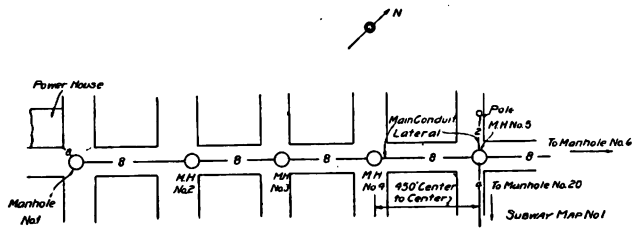


Fig. 3.—Typical Map for Subway Plant Inventory.

the manhole number and geographical location in the spaces provided therefor on the data sheet. The distance between manhole centers, 450 ft. in this case, will also be recorded in the proper place upon the data sheet. Assuming that the manhole covers are located centrally, with respect to the manholes themselves, the method of determining the actual conduit (trench) length will be apparent—deduct the distance between center of manhole cover and manhole wall, in each manhole, from the total center-to-center measurement.

After the cover for manhole No. 5 has been removed, the inspector will leave his assistant on guard on the surface while he descends into the manhole to obtain the necessary data. In this connection it is most important that municipal regulations as to protecting street openings shall be carefully observed. For instance, some cities require a man outside of the manhole to wave a red flag while the manhole is open.

Manholes are usually dirty and to insure the protection of the inventory records it is good practice for the assistant to note the data on the field sheets as it is called out by the inspector in the hole.

The following data should be obtained and noted in the spaces provided therefor:

1. Material of manhole—brick or concrete.
2. Measurements of manhole—length, width, distance from roof to floor and distance from street level to floor.
3. Diameter of cover casting.
4. Distance from center of cover to walls where the ducts enter the manhole—this for the purpose of obtaining actual duct lengths as referred to in a foregoing paragraph.
5. Number of ducts on each wall face, internal diameter of ducts and material of which they are made.
6. Where more than one duct enters a manhole wall the formation of the ducts should be shown on the spaces provided therefor in the manhole diagram. To illustrate: An 8-duct subway may consist of two 4-duct tiles placed one on top of the other, or it may consist of two parallel 4-duct tiles. It is important that the formation of the ducts should be noted, as this has a material bearing upon the cost per trench foot. It requires a wider trench to lay two 4-duct tile horizontally than to place one on top of the other. (It will be noted that the manhole diagram shows the four walls of the manhole folded back in the plane of the manhole floor. This is the simplest and most satisfactory method of diagrammatically picturing the inside of a manhole.)
7. The enveloping material of each subway entering the manhole should be noted. Electric light subway systems are sometimes surrounded by a complete concrete envelope. In other types of construction the ducts are laid on a concrete base and are roofed with concrete while the sides are left unprotected.
8. Care should be observed in noting all branch conduits leaving the manhole. Subsequently these branches should be located and measured.
9. The size of cable—whether 2-conductor, 3-conductor, 6-conductor, etc.—should be noted. The cable diameter should be determined. This for the reason that standard cables of a certain diameter contain a given number of pairs of a given gauge. Knowing the diameter, therefore, it is a comparatively simple task to compute the size and gauge of cable.
19. The amount of manhole slack cable should be determined and the center-to-center measurement (450 ft.) should be increased to allow for the slack.

It will be noted that Fig. 4 calls for some additional data—the nature and method of determining these data will be obvious. A set of instructions similar to the foregoing should be provided to the field inspectors in every large electric utility appraisal.

We have now briefly covered the subject of the inventory of all of the major items of the physical property of an electric utility company—with the exception of central-station equipment, tools, and supplies. In other words, we have covered the more complex and the more difficult—from the standpoint of the inventory—portion of the appraisal. The inventory of the central-station equipment is, of course, most important, but it is concentrated in a comparatively small area, is easily identified and, therefore, easily appraised.

The next article in this series will deal with the *appraisement* of the land, buildings and outside plant. In other words, we will proceed to appraise the inventory we have just completed. The inventory and appraisal of the central-station equipment, tools and supplies may best be treated in one article as it is often possible to make the inventory and appraisement simultaneously. In other words, experienced appraisers can frequently set down the prices opposite the item as they are listed in the inventory, although of course this does not apply to the larger items of

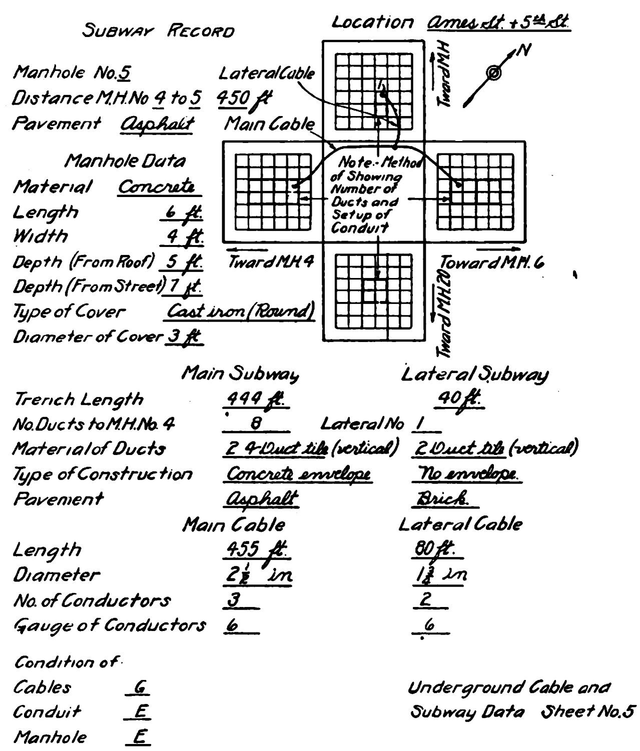


Fig. 4.—Sample Field Sheet for Recording Underground Cable and Subway Data.

central-station equipment, such as engines, turbines and generators.

The author will be very glad to answer any questions regarding this article, or the preceding ones, if addressed in care of the editor of the ELECTRICAL REVIEW.

Central-Station Rates in Theory and Practice

Fifth Article—Apportioning the Demand Charges According to Consumers' Maximum Demands—Assumptions as to Coincidence with Peak Load of Station and as to the Actual Demand

By H. E. EISENMENGER

This is the fifth article of a series appearing weekly throughout practically this entire volume. A general outline was published in the July 5 issue and the first article appeared in the issue of July 12. The first few articles discussed costs in general and showed that the cost of electric service comprises three elements—energy, demand and consumer's costs. Several of the recent articles have treated of various features of the demand costs, which will be continued in a few more installments. After the cost analysis has been completed, the discussion of rates, which depend largely on cost, will be taken up.

PART I—THE COST OF ELECTRIC SERVICE—Continued.

II-A. THE THREE ELEMENTS OF COST.

B. APPORTIONMENT OF THE DEMAND COST BETWEEN THE CUSTOMERS.

3. *Central Station's Peak Extending Over a Certain Period of Time.*[1]

SECTION 30. The exact method of determining the demand cost, as mentioned in the last issue, and as set forth in detail in Insert VI, can of course be used in practice only for larger groups of consumers (for instance, for the power consumers where we can separate the load curves for light and power). An application to individual consumers is entirely out of the question, unless we have to deal with consumers of exceptional magnitude, for instance, a railway company supplied with traction power. For smaller individual consumers the method would be far too complicated.

31. Even if we are satisfied with the consumer's peak responsibility as exclusive basis for the demand—assuming for the moment that this scheme would be commercially feasible—we would discover at the first attempt that it is impossible to determine the time of the central station's peak load exactly to the second or even to the minute. The maximum of the central station's load will extend over a period of perhaps 10 or 20 minutes, or more, at practically constant load, and this peak may even be repeated on several days, during the year. The changes of the central-station load within these peak periods will be so small that the eye cannot detect them on the chart, whereas the load of the consumer during these periods may vary between zero and 100%.

32.. But even if it were possible to discern a certain moment of time of one or a few seconds' duration during which the load of the central station is larger than at any other moment of time and disregarding the statements of Sections 28 and 29, we would still have to consider the loads in the neighboring moments of time because they influence the necessary size of the plant on account of the overload capacity of the equipment.[2]

33. For these two reasons we have to extend the theoretical moment at which the peak-load responsibility takes place over a certain length of time, 2 minutes, or 10 minutes, or 30 minutes, etc. Just how long this period should be chosen depends on the shape of the highest portion of the load curve of the central station (short and steep or round and flat). This taking into account of the "near-peak load" is at the same time an approach to the fulfillment of the postulates of the exact theory as set forth in Insert VI. (Compare also Sections 28 and 29.)

34. During the assumed duration of the central station's peak load the load on the central station will be practically constant. But the load of the respective individual consumer or group of consumers during that interval may vary within wide limits, in fact from 0 to 100%. The question arises, then, which one of the loads of the consumer is to be taken as peak responsibility. Evidently we have to assume some kind of average of the consumer's loads during the interval.

35. If the central station's equipment would not have any time element involved in its overload capacity we might simply take the arithmetical average of the consumer's loads, that is, the number of kilowatt-hours consumed by him during the central station's peak-load interval, divided by the duration of that interval (in hours, or fractions of an hour).

36. But as stated above, the overload capacity of a large portion of the equipment (generators, transformers, cables and other electrical apparatus) depends on the temperature rise of the equipment,

[1]As the peak responsibility is generally not made the basis for the demand cost in practice, the principles deduced in this and the following sections are not practically applicable to the peak responsibility, but they are reflected in the practical methods of determining the basis for the consumers' demand cost (maximum demand, see later Section 38 et seq.).

[2]The load which electrical machinery, cables and other apparatus is able to carry is in general determined by the temperature rise, that is, by the heating effect of the current being generated in, or passing through, the respective equipment. We can therefore put a heavier load than normal (24-hour load or "continuous rating") on electrical equipment without doing any damage, provided that the overload does not last longer than until the maximum permissible temperature is reached. The heavier the overload, the shorter is the period during which it may be applied without damage. For instance, electrical machinery will generally be able to carry a momentary overload of 50% of the continuous rating, but it will stand only about 125% of the continuous rating for half an hour without overheating. Now, it is clear that if we have loaded the equipment, for instance for 29 minutes, with 125% it will no longer be able to safely withstand immediately afterwards an overload of, let us say, 15% as long as it would otherwise.

that is, on the combination of the heating effect of the current passing through, or generated in, the equipment and the cooling effect of convection, radiation, etc. This fact suggests the choice of another average for the value of the consumer's peak responsibility such as would be furnished by the readings of an instrument constructed to register the maximum temperature rise of an element which is heated by a conductor connected in series with the consumer's load. (Wright demand meter, see later Insert XVI.) The instrument would thus reproduce to a certain degree the heating effect developed in the electrical machinery.

It must not be left out of consideration, however, that the heating and cooling effect of such an instrument may be—and generally is—different from the corresponding effect on the electrical machinery, not only in size but also in its variation with time, although they follow similar laws.[3] Also the heating curves of the various parts of the electrical equipment are different from one another.

The question which one of the two averages to choose is further complicated by the fact that the temperature rise determines the overload capacity for a certain portion only of the central station's equipment, whereas the permissible overload of other parts of the equipment is determined by other factors without any time elements entering.[4]

37. Neither of the two averages will, therefore, give an entirely correct solution and we can hardly say that one solution comes much nearer the theoretically true value than the other. We have, moreover, moved so far from the exact theoretical conditions of the problem by the previous simplifying assumptions[5] that these nicer distinctions and details of the influence of the duration of the loads and overloads on the demand cost are entirely obliterated and swallowed in the inaccuracy introduced by these approximations. For all these reasons we cannot say that we ought to give the preference to either method of averaging the instantaneous demands during the peak-load period.

4. The Consumer's Maximum Demand and Substitutes Therefor.

38. Even allowing all the approximations for the computation of the consumer's demand cost which have been made so far (see footnote[5] to preceding section), conditions would still be too complicated for practical application to the individual consumers, except to those of the very largest size. In order to compute the demand cost of every consumer on the basis of his peak responsibility it would be necessary to know every consumer's peak responsibility. We would have to place a curve-drawing wattmeter or ammeter (which are very expensive instruments) on every consumer's premises. At the end of the year we would have to find out from a similar instrument in the central station just at what date and what hour the peak load of the central station has occurred and then determine from every individual consumer's chart how large his average peak responsibility has been during the period of the central station's peak load. All this is obviously a commercial impossibility, on account of the high cost not only of the necessary instruments but also of the handling of their record charts. For this reason we have to apply a further approximation to determine the consumer's share of the demand cost, as follows.

39. We do not determine the consumer's kilowatt demand at the time of the central station's peak load, but rather his demand at the time of his own peak load, that is, his "maximum demand" in kilowatts (or watts) regardless of the time when it occurs, the assumption being that the consumer's maximum demand is proportional to his peak responsibility. This is rather a bold assumption, inasmuch as it seems to amount to nothing less than that the shapes of all the load curves of all the consumers are similar amongst each other and thereby also to the central station's load curve. But, as will be shown later (Section 42), the error introduced by this assumption can be materially reduced by classifying the consumers into groups of such character that the curves of all customers within each group are liable to be similar to each other (compare also Section 9); the choice of the consumer's maximum demand instead of his peak responsibility becomes then entirely justifiable.

40. A consumer's maximum demand is much more easily and cheaply determined than his peak responsibility. We can use comparatively inexpensive instruments for that purpose, the so-called maximum-demand meters or demand indicators. These instruments indicate only the maximum demand during any chosen period, just as a maximum thermometer records the maximum temperature during any chosen period. And just as a maximum thermometer is very much cheaper than a curve-drawing thermometer, so a maximum-demand indicator is much cheaper than a curve-drawing wattmeter, not to speak of the cost of the handling of the charts.

Or we can use another type of instrument, the so-called demand limiter, which automatically limits the amount of the maximum demand of the consumer by interrupting his current and making his lights flicker as soon as he exceeds the given amount of demand. He can, therefore, never cause a greater demand cost than the adjustment of the instrument will permit.

With a corresponding sacrifice of accuracy we can even go so far as to abandon all such instruments. We can simply estimate the maximum demand to be expected from the size and character of the installation. This will be discussed more fully when we come to the systems of charging, that is of making the rates or prices (Part II of this series of articles).

41. It has been shown above that where the consumer's peak responsibility is made the basis of the demand cost we have to take the consumer's demands over a certain period of time and then take an average of all these instantaneous demands. Similarly, we have in this case also to take not the instantaneous demand of a given moment but the average of all the instantaneous demands during a certain period of time when the demands are at and near their maximum, including the elements of time shortly before and after the real maximum demand occurs. The average may again be the arithmetical mean or the heating equivalent, as has been explained in Section 36. The instruments employed to determine this maximum demand will be described later in Insert XVI.

[3] See "Rates and Rate Making," P. M. Lincoln, Transactions A. I. E. E., 1915, page 2279.

[4] Thus the boilers and prime movers (this term means the non-electrical machinery driving the dynamos) respond to overloads by a reduction in efficiency and an increase of wear and tear; the distribution lines do not allow of any overload at all, as this would result in an excessive drop of voltage which should be avoided even for the shortest period of time.

[5] Mentioned in the second footnote of Section 17; also, the further assumption that the demand cost is proportional to the peak responsibility is an approximation. In addition to these the assumption to be made later for practical application that the consumer's maximum demand is proportional to his peak responsibility.

Insert VI—Appendix to Section 28—Continued.

1. Curve "h."

Given curve "*B*," that is, the load curve of the central station, it must be transformed in such a way that the ordinates are arranged from left to right in the order of their lengths, to get the curve "*h*."

The construction of this curve is as follows (see Fig. I[1]). We have to cut up, as it were, the whole area under the curve *B* into vertical strips of very small (infinitesimal) width *dt* and then rearrange these strips in the order of their magnitude from left to right. One of these strips is shown shaded in Fig. I.

From the highest maximum of *B*, that is from the point B_{m1}, a horizontal line is drawn towards the axis of ordinates; it intersects the latter at the point *H*. This point evidently is the starting point of the *h*-curve. Considering now some other ordinate h_1, there will generally exist at least two points u_1 and u_2 on curve *B* which correspond to this ordinate. If now we select all those of the above-mentioned vertical strips which are higher than h_1, in order words, which correspond to ordinates larger than h_1, and arrange them side by side beginning from the axis of ordinates in order of their magnitude, these strips will take up a space of the width $= u_1u_2$. The curve *h* will therefore contain a point with the ordinate h_1 and the abscissa $u_0U = u_1u_2$. In the same manner any number of points of the curve *h* can be found. If the respective parallel to the axis of the abscissae intersects the load curve of the central station in more than two points—for instance, in v_1, v_2, v_3, v_4, then v_0V must of course be made equal to the sum of $v_1v_2 + v_3v_4$. It will be noticed that the *h*-curve has several breaks, at W_1, W_2 and W_3. Every maximum (other than the peak load B_{m1}) and every minimum of the *B*-curve causes such a break, as is easily understood from the construction of the *h*-curve. Usually the *B*-curve extends over a complete cycle, which means the end ordinate (point B_z) has the same height as the initial ordinate (point *B*). If this is not the case, as has been assumed for the sake of getting a general case in Fig. I, the end ordinate at B_z or the initial ordinate at *B*, both, will also cause such a break.

In Fig. H, which starts from an assumed *h*-curve, this curve is so chosen that it does not contain any such breaks, but the method of the subsequent construction is exactly the same where such breaks occur. (Also see Fig. L.)

2. Curve "a."

According to the definition (see Fig. F) *a* is the instantaneous demand of the respective customer at the moment when the total demand on the central station equals *h*. Fig. I shows, however, that usually there is more than one value of instantaneous demand of the customer corresponding to a certain given amount of load of the central station, since that given amount of central-station load will generally occur more often than once. Thus, for instance, in Fig I when constructing the point *U* of the *h*-curve which has the ordinate h_1 we found that there are two points in the central station's load curve *B* which have that same ordinate h_1; consequently, there will be also two ordinates (generally of different lengths) of the customer's load curve *b* corresponding to that ordinate h_1 of the *h*-curve. They are r'_1r_1 and r'_2r_2. The question arises which one of these two ordinates should be chosen. Resuming the above-mentioned method of cutting up the area into vertical differential strips it is clear that the strip attributed to point *U* actually is composed of two parallel strips side by side, each one having a width *dt*/2, one of which owes its existence to r'_1u_1, the other one to r'_2u_2. It is evident from this that the ordinates of the *a*-curve must be equal to the arithmetical mean of the different ordinates of *b* belonging to the respective point of the curve *h*.

Thus $U'a_u = (r'_1r_1 + r'_2r_2)/2$.

Every one of the breaks of the *h*-curve mentioned above (W_1, W_2, and W_3 in Fig. I) is connected with a sudden drop (or rise) in the ordinate of the *a*-curve. Thus, for instance, for the abscissa OW'_1 the *a*-curve takes a sudden jump downwards from a_1 to a_2. The reason for this is that at this abscissa the ordinates of the second peak (B_{m2}) of the *B*-curve enter into the *h*-curve and consequently the ordinate of the *a*-curve is no longer the arithmetical mean of *two* ordinates of the *b*-curve, situated on either side of the peak B_{m1}, but it suddenly becomes the arithmetical mean of *four* ordinates of the *b*-curve, one on either side of B_{m1} and one on either side of B_{m2}.

3. Curve "q."

Whereas the ordinates of the two curves "*h*" and "*a*" dealt with heretofore are given in units of kilowatts, the term of $q = a/h$ is an abstract number and a certain length must be chosen as unity. It has been mentioned before that the maximum demand of the central station (*OH* in Figs. H and I) should be chosen as unity.

The construction of curve $q = a/h$ is obvious and hardly needs any explanation. It is shown in Fig. J for a certain abscissa Op_1. H_1 and A_1 are the points on the curves *h* and *a*, respectively, belonging to the abscissa Op_1. *O'* is chosen somewhere on the axis of abscissae in a convenient position. H'_1 is found as the intersection of the extension of line $O'H_1$ with a horizontal line drawn from the starting point *H* of curve *h* (compare Fig. I). Q'_1 is found as the intersection of $p'_1H'_1$ and $O'A_1$; a horizontal line from Q'_1 furnishes in its intersection with p_1H_1 the required point Q_1 of the curve of *q*.

$$\frac{p'_1Q'_1}{p'_1H'_1} = \frac{p_1A_1}{p_1H_1}$$

and, since $p'_1H'_1 = OH$ has been assumed as unity,

$$p'_1Q'_1 = \frac{p_1A_1}{p_1H_1} = \frac{a}{h} \text{ or } p_1Q_1 = \frac{a}{h} = q.*$$

Where possible, the location of O^1 should be chosen so that $p'_1H'_1$ coincides with the axis of ordinates, which saves a little labor.

Every break in the *h*-curve mentioned above with consequent sudden drop or rise of the *a*-curve corresponds to a sudden drop or rise in the *q*-curve (see Fig. L).

4. Curve "f".

According to the definition, the ordinates of the *f*-curve for a given abscissa *Om'* (see Fig. H) are represented by the

[1]To avoid misunderstandings it should be kept in mind that Fig. I deals with the construction of the *h*-curve and the *a*-curve from a given *B*-curve and *b*-curve, whereas Fig. H deals with the construction of the *q*, *f* and *g*-curves, beginning with an assumed *h*-curve which is not identical with the *h*-curve arrived at in Fig. I. Fig. L (see later), being an example from practice, will then show how the different operations tie together if carried out consistently on the same set of curves.

*An additional feature of the construction of the curve *q* is the following: $q = a/h$, differentiate with respect to the time *t* (the abscissa):

$$\frac{dq}{dt} = \frac{h\frac{da}{dt} - a\frac{dh}{dt}}{h^2}$$

From this we see that q reaches a maximum (or minimum) if:

$$\frac{\frac{dh}{dt}}{\frac{da}{dt}} = \frac{h}{a},$$

in other words, if the tangents of such points of the two curves *h* and *a* as have the same abscissa intersect each other on the axis of abscissa (for instance, abscissae Om_1 or Om_2 in Fig. H). By means of this principle it is easy to predict with a fair amount of precision the position of the maxima and minima of the curve *q*.

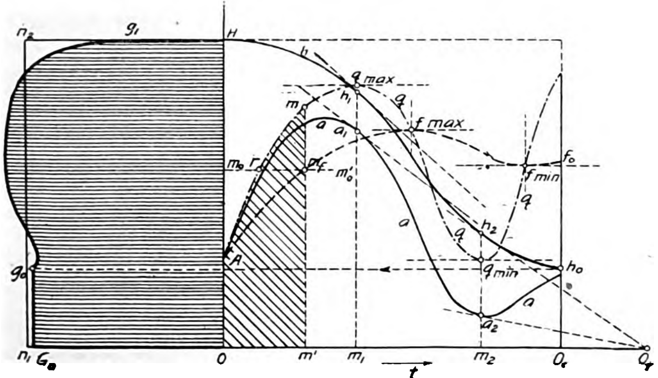


Fig. H.

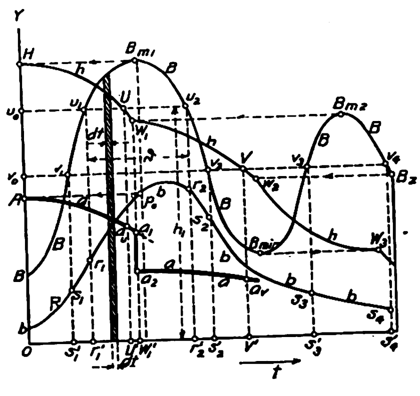


Fig. I.

height of a rectangle erected over the base Om' and enclosing the same area as the surface enclosed by the curve q, the ordinate over the point m' and the two axes of co-ordinates. This last named area is shown shaded diagonally. If we desire therefore to find that point m_f of curve f which belongs to a certain abscissa Om' we have to select a horizontal line $m_0m'_0$ at such a height that the two three-cornered figures Am_0r and mm_fr have the same area. The use of a planimeter will generally not be necessary and a person with fairly good

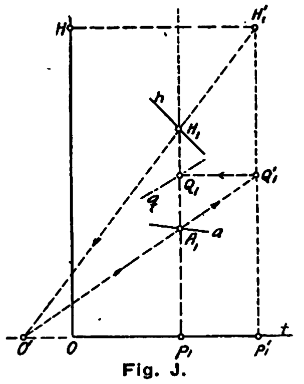


Fig. J.

eye-measure will be able to locate these horizontal lines accurately enough by the eye.

A few additional characteristics as explained hereafter of the curve of f will facilitate an exact and rapid construction of that curve.

Maxima and Minima.—Since the ordinate of every point of f is the arithmetical mean of all preceding ordinates of the curve q, it is evident that f will have either a maximum or a minimum every time it intersects curve q. Thus, for instance, in the left part of the f-curve in Fig. H the ordinates of q are larger throughout than those of f, therefore with increasing abscissae the arithmetical mean of the ordinates of q will grow, that is, curve f will rise. As soon as q falls below f, that is, to the right of the intersection point f_{max} of the two curves, every addition of a new ordinate of q will decrease the average and f will assume a falling tendency until the next intersection point f_{min} is reached, etc.

Direction of tangents of curves.—Expressing the definition of f mathematically we get

$$f=\frac{\int_0^t qdt}{t}$$

where f is the ordinate of the curve of the same name and t is the abscissa. From this we get $ft=\int_0^t qdt$ and differentiating

$$fdt + tdf = qdt$$

$$\text{or } \frac{df}{dt}=\frac{q-f}{t} \quad\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (2)$$

this means with reference to Fig. K that $t_fm_ft_f$ (the tangent to the curve of f) is parallel to m_0mt_0 where m_0 is again (as in Fig. H) the horizontal projection on the axis of ordinates of the selected point m_f and m is the point on curve q with the same abscissa as m_f; we thus get easily and quickly the direction of the tangent of every point of curve f. From the definition of f it follows that the curve of f will start from the same point A of the axis of ordinates as the curve of q. (Figs. G, H and K.) For this point A ($t=0$, $q=f$) equation (2) changes into

$$\frac{df}{dt}=\frac{0}{0}=\frac{dq}{dt}-\frac{df}{dt} \quad\ldots\ldots\ldots\ldots\ldots\ldots (2^*)$$

Now $\left(\frac{dq}{dt}\right)_{t=0}=\tan\phi_0$ (see Fig. K) and $\left(\frac{df}{dt}\right)_{t=0}=\tan\psi_0$.

Substituting this in equation (2*)

$$\tan\psi_0 = \tan\phi_0 - \tan\psi_0$$

$$\tan\psi_0 = 1/2 \tan\phi_0.$$

This equation allows us to rapidly and easily find the angle at which f rises from its starting point A on the axis of ordinates.

Every sudden drop or rise of the q-curve as mentioned before causes a sudden change in the direction of the f-curve, but in practice these changes in direction, especially for large abscissae, will be imperceptible (Fig. L).

5. *Curve "g."*

The construction of the curve of g is so simple that it hardly needs any explanation. Select a point on curve h (Fig. H), draw a horizontal line from the same to the left beyond the axis of ordinates and on that line from its intersection with the axis of ordinates step off that ordinate of the f-curve which belongs to the same abscissa as the originally selected point of h. Repeating this for a number of points we arrive at the curve of "g."

After we have thus reached, from left to right, the point which corresponds to the lowest value O_0h_0 of the h-curve (at the extreme right of the latter) the ordinates of the g-curve are constant and equal to the terminating value O_0f_0 of the f-curve. The g-curve, beginning from the point T_0, will therefore change into a straight line parallel to the axis of abscissae OH of the g-curve, that is, to the axis of ordinates of the rest of the curves. (That this must be so is easily understod if we go back to Fig. G.)

Summary.

This whole procedure of establishing the equivalent demand is not a very simple one, but it is more simple than it appears at first sight. It must also be considered that the problem itself, as has been shown above, is an inherently intricate one and involves a great many factors.

We see that the consumer's demand cost is an intricate function of the *entire* load curve of the central station *and* of the *entire* load curve of the respective consumer, not only of certain parts of those curves. The equivalent demand and consequently the demand cost, is represented by the shaded area of curve "g," Fig. H, and instead of being simply proportional to the peak responsibility it is a true integral extending over all elements of time over which the load curves extend[2]. As will be demonstrated in the following, however, at those times when the central station's load is low the influence of the consumer's load is small and ultimately even becomes practically negligible compared with the influence of the consumer's load at or near the central station's peak load time. Yet all these infinitesimal influences of the various differentials of time are of the same *order* of magnitude.

It is obvious that the f-curve (which represents by its ordinates the respective areas under the q-curve) has the tendency of approaching more and more a horizontal straight line as the abscissa increases, that is, as the instantaneous load h of the central station decreases. (Supposing, for instance, that the f-curve stands at $0.1 \times OH = 0.1$† at the end of the first hour and that $q=0.3$ throughout the following hour; then at the end of that hour, f will have risen to $(0.1+0.3)/2=0.2$, or by 0.1, or by 100%. If, however, the f-curve stands at 0.1 as above, not at the end of the first hour but at the end of the 23rd hour, and q is again $=0.3$ throughout the following hour, then at the end of that hour f will be only $(23 \times 0.1 + 0.3)/24 = 0.1125$, or it will have risen only by 0.0125, or by 12.5%.)

This means that the values of the consumer's load for small central-station loads (large abscissae of h-curve),

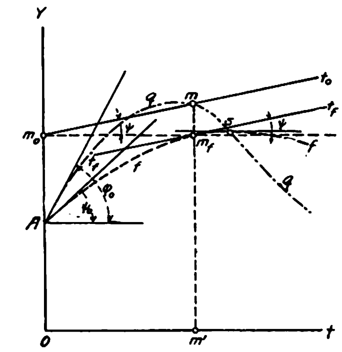


Fig. K.

where the f-curve is already steadied, will not be able to affect the equivalent demand and the demand charges as much as the consumer's load at those particles of time, when the central station's load is near its peak. The consumer's loads near the central station's peak load have a greater influence than where the central station's load is small, so much so that in the generality of cases at all moments when the central station's load is not near peak load the amount of the consumer's load need not be considered. Nevertheless, as will be shown by an example from practice a little later (Fig. L), *the equivalent demand may be very far off from the peak responsibility.*

Theoretically the load curve would have to be taken over

[2] This integral is, of course, not identical with the integral which gives the energy consumed $\int_0^t b\, dt$ (Fig. I) and it is of a much more complex nature. Further investigations (which are omitted here) show that it is a double integral.

†It should be remembered that OH has been chosen as unity.

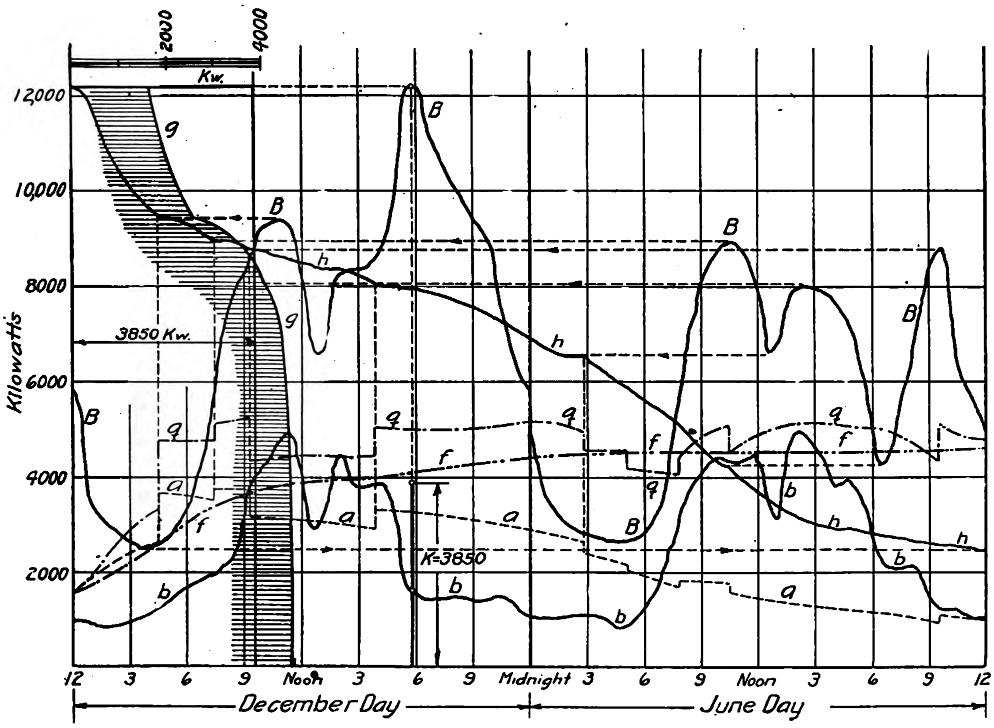


Fig. L.

the whole year. But in practice this is neither possible nor necessary. In ordinary cases it will be sufficient to take one typical day around the winter and one around the summer solstice.

Fig. L is an example from practice showing the curves of a large central station which was the first one to employ this method devised by the author. The diagram has the purpose of determining how the aggregate peak load for light and power should be apportioned between the power consumers and the lighting consumers, in other words, how large the aggregate equivalent demand of each one of these two groups is. Fig. L shows the total lighting and power curve B and the power load curve alone b. A December day and a June day were selected as representative of the extreme seasons of the year. We see plainly how every peak and every valley of the B-curve causes a break in the direction of the h-curve, as explained before, and a sudden jump up or down in the q-curve. The resulting breaks in the direction of the f-curve are so small that they are hardly discernible in the left-hand part of the curve and disappear entirely to the eye after the first quarter of the total abscissa. We see from this practical example also how the f-curve as well as the g-curve[3] become practically level, beginning about the second half of the respective total abscissa.

The peak load of the central station occurs shortly before 6 p. m. in December and amounts to about 12,200 kw.; the peak responsibility of the power load is only about 1600 kw. The equivalent demand, however, in consequence of the great power demand at other hours is not less than 3850 kw. or nearly 2½ times as high as the peak responsibility. The balance of 12,200 — 3850 = 8350 kw. is charged to lighting.

Note.[4]

A glance at Figs. A(a) to A(g) shows that in each case customer B has used 600 kw. continuously during the hours between 2 o'clock and 6 o'clock. If the equivalent demand for B is figured by the same method as given above (see page 185) but on the basis of Figs. A(a) to A(d), the results will be the same as before in Fig. A. On Fig. A(e), however, we get the following result from the equivalent demands:

Customer A.... $\frac{1}{3} \times 400 + \frac{1}{5} \times 200 + \frac{1}{3} \times 400 = 306\frac{2}{3}$ kw.
Customer B.... $\frac{2}{3} \times 400 + \frac{4}{5} \times 200 + \frac{2}{3} \times 400 = 693\frac{1}{3}$ kw.

1000 kw

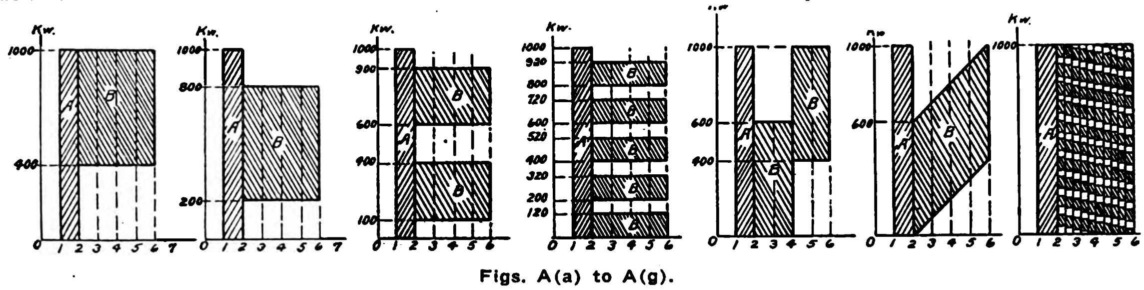
This is very different from the result given on the basis of Fig. A or Figs. A(a) to A(d). If A and B were to deal directly and independently with each other about the use of the central station (for instance, in case they are joint owners of the central station) A might contend that the distribution of the demand charges should be made according to Fig. A(e), whereas B would probably claim that the load curves should be drawn as in Fig. A and not as in Fig. A(e). Who is right, A or B?

The 1000-kw. central station might be imagined in this case to consist of five units of 200 kw. each (it does not matter for the purposes of this deduction whether these five units are actually in physical existence as such or not). According to Fig. A, customer B would use none but the first three of these units (counting from the bottom up in the drawing). If Fig. A(a) is made the basis of the computation, he would be using only the three uppermost units, etc. In Fig. A(e) customer B would use the three lowest units for the first two hours and the three uppermost units for the last two hours.

Let it now be supposed that this latter assumption [Fig. A(e)] be permissible; then evidently there is no reason why the total time between 2 and 6 o'clock should be divided into only two periods of that kind. With the same right, four subdivisions of time might be assumed, of one hour's length each, or eight, etc.; in fact, there is no upper limit to the number of subdivisions of that period. We can, therefore, assume an infinite number of very small periods and suppose that during each one of these periods B is drawing his 600 kw. from another part of the central station. This may

[3]In order to save space in the drawing, the ordinates of the g-curve have been stepped off to the right of the main axis of ordinates instead of to the left as on the other illustrations. The g-curve is emphasized by shading.

[4]Referring to first paragraph in the second column of page 185 of the last issue.



Figs. A(a) to A(g).

result for instance in Fig. A(f). If Fig. A(e) is permissible as a basis of computation, moreover, we are certainly at liberty to assume the subdivision of the demand of *B* also in the manner indicated in Figs. A(c) and A(d). This subdivision in vertical direction can also be carried out to finer and finer degrees, and can be combined with the manner of subdivisions shown in Figs. A(e) and A(f); this will result in a distribution of the demand about as shown in Fig. A(g). If these combined subdivisions are carried out to sizes of infinitesimal order this obviously means that the demand charge be distributed proportionately to the number of kw.-hr. used, independently of the shape of the load curve. This evidently is absurd; therefore, the basic assumption of the whole conclusion must be wrong. This initial assumption has been that the distribution according to Fig. A(e) is permissible and we arrive, therefore, at the conclusion that the distribution according to Fig. A(e) is wrong. With two customers only the distributions of the load curve of the type of Figs. A, A(a) to A(d) are the only ones which are correct, but not A(e) and A(f), and it is easy to see that they all have the same result as to the equivalent demand charge. An analogous deduction shows that with three or more customers the load curve of every single customer must be drawn in the customary way in order to obtain correct results; that is, with the axis of abscissae as a basis from which to step off all ordinates of every single load curve, as in Fig. A.

(To be continued.)

FISCAL YEAR'S FOREIGN TRADE EXCEEDS TEN BILLION DOLLARS.

All Records Broken as to Exports and Imports—Excess of Former in Last Five Years Exceeds That of the Preceding 125 Years.

An excellent indication of the growth of American business in the last few years is given in the following figures on our extraordinary foreign commerce of the last fiscal year.

United States commerce in the fiscal year which ended June 30 broke the record in many particulars. Both imports and exports were the largest in the history of our foreign trade, and the grand total for the first time crossed the $10,000,000,000 line; the "favorable trade balance" exceeded that of any earlier year, and the closing month, June, wound up the spectacular record with a total trade of $1,211,282,450, an average of nearly $50,000,000 a day in the 26 business days of the month. The value of the merchandise forming the foreign commerce of the United States in the fiscal year 1919 was one-half as large as that forming the entire international trade of the world in the year preceding the war.

The exact record of this remarkable year in our trade was, according to a statement by the National City bank of New York: Imports, $3,096,000,000, against the former high record of $2,945,655,000 in 1918; exports, $7,226,320,000, against the former high record of $6,290,048,000 in 1917; the grand total, $10,322,460,000, against the former high record of $8,949,404,000 in 1917. The excess of exports over imports or "favorable trade balance," was $4,129,000,000, against $3,630,639,000 in the former high record year of 1917. The favorable trade balance in the five years since the beginning of the war is greater than in the 125 years preceding the war. The gold imports in the last five years aggregated $1,823,000,000, and the gold exports $785,000,000, making the net importation of gold in the five years $1,038,000,000. The excess of exports of merchandise in the same five-year period was $13,963,000,000, this difference between net exports of merchandise and net imports of gold being largely offset by the Government's credits of $10,000,000,000 to our European allies.

LARGE PORTION OF CITIZENS INTERESTED IN UTILITIES.

Recent Statement Shows One-third of Illinois People Financially Affected by Utilities.

At a recent meeting of utility managers and operators held in Springfield, Ill., to lay plans for a closer co-ordination of effort in placing the after-the-war problems of utilities before the public the statement was made that 33⅓% of all citizens of Illinois, directly or indirectly have a financial interest in the public utilities of the state. The conference was held under the auspices of the Illinois Committee on Public Utility Information which has been created by the various associations of the combined utility industry of the state.

Speakers at the meeting declared that the ramifications of the industry are such that fully one-third of all citizens now have a financial interest, either as wage earners, security holders or through collateral industries dependent upon the utilities. Of the total of all citizens of the state, 193,700 are directly in the employ of the electric, gas, telephone, water, street and interurban railways or railroads and 153,600 others are employed in industries dependent upon the public utilities. These 347,300 wage earners, with their families, represent 1,736,500 persons dependent for their living upon the industry, or 17% of the entire population. In addition there are 230,000 security holders, who with their families total 1,150,000 persons, who are indirectly affected.

INVENTION CLAIMED TO INCREASE CONDUCTIVITY OF ALUMINUM.

Electrical men will be interested in the following submitted by United States Consul Philip Holland, of Basel, Switzerland, and published in *Commerce Reports* for Aug. 2:

"A new invention called conducting aluminum M. 277, which is said to be creating a profound impression, has been made by Dr. Georges Giulini, the most famous expert in the aluminum trade. This new metal is produced by putting the ordinary aluminum through a special patented process, by which it acquires the same mechanical qualities and capacities as bronze, copper, and brass without changing its specific weight.

"It is said that the price of the new metal can be kept within very low limits; so that, even at the prewar prices of other metals, it will be able, by reason of its smaller specific weight, to compete with copper and brass very favorably. The fact that the new metal is a conductor will make it especially in demand in the electrical trade. The inventor anticipates also a good market for it among the builders of motor cars, aeroplanes, ships, and railway carriages. Leading men, to whom the invention is already known, are said to be much impressed with its possibilities."

ELECTRIC UTILITIES IN JAPAN INCREASING.

It is stated that there are 715 electrical utility undertakings in Japan, including 625 power plants, 42 electric railways, and 48 companies operating both power plants and tramways. This is an increase of 40 companies over last year and evidences the growing popularity of electricity in that country.

Wireless Telephone Transmitter for Seaplanes

Light-Weight but Powerful Set Developed for Use by Navy's Flying Boats During the War

MARKED progress in the perfection of airplane wireless telegraph and telephone apparatus is a direct result of exhaustive researches in radio communication which have been conducted during the past two years. Light-weight transmitters having a sending range of 150 miles or more have been developed. Spark apparatus has been employed to a considerable extent in airplane communication, but transmitters utilizing the vacuum-tube oscillator have the advantage of permitting either speech transmission or telegraphic signals by damped or undamped oscillations, at the will of the operator.

Practical wireless telephone apparatus of the vacuum-tube type is disclosed in the following description of the Marconi type S.E. 1100 set—a comparatively high-power bulb transmitter—developed by the Marconi Wireless Telegraph Co. of America.

The set was designed primarily for the large flying boats, the H-16 class, of the United States Navy, and has fully satisfied every test to which it has been put. In one of the earlier tests in flight over Chesapeake Bay, telegraph signals radiated from a trailing antenna on an H-16 boat were heard distinctly in Washington, D. C., over a distance of 120 nautical miles. Subsequent tests with the set used as a wireless telephone permitted the accurate transmission of speech over a distance of 150 miles. The transmitter radiates at two wave lengths, 1600 and 600 meters. For the former wave length a trailing wire antenna of 0.0004 mfd. capacity is employed; for the latter, an emergency aerial of 0.00026 mfd.

The transmitter is supplied with two three-electrode tubes of the pliotron type. One tube is employed as an oscillator for the production of radio-frequency currents and the other as a modulator and amplifier of the voice currents communicated to it by the microphone.

The fundamental circuits of the set are shown in Fig. 1, the actual circuit in Fig. 2, a front view of the transmitter in Fig. 3, a rear view in Fig. 4, another rear view in Fig. 5, and a wiring diagram showing the function of the change-over switches in Fig. 6.

For best understanding of the operation of the apparatus, it should first be appreciated that if grid and plate circuits of a vacuum tube include radio-frequency circuits coupled inductively, conductively or electrostatically, alternating currents of any desired frequency may be generated. This is the first requisite; other problems, such as rapid change of wave length, satisfactory modulation and the elimination of disturbing capacities between circuits, arise in the practical set and are of equal importance. They were satisfactorily solved only after diligent research.

In order to set valve circuits into a state of radio-frequency oscillation, it is necessary that the connections be so made that the grid end of the grid inductance will be alternately negative and positive as the plate end of the plate inductance is positive and negative. When the grid and plate radio-frequency circuits are coupled with the proper phase relation, any variation of voltage in either the grid or plate circuits will cause minute disturbances in the oscillation circuits, setting them into oscillation at whatever frequency they happen to be adjusted to. For example, a slight variation of voltage in the plate circuit by any means whatsoever will cause its resonant circuit to oscillate at radio frequency, and the resultant currents will act upon the grid circuit, setting it into oscillation at the same frequency. The resulting radio-frequency fluctuations of the grid potential will act upon the plate at the right time to keep the plate resonance circuit in a state of oscillation, and this state of affairs will continue so long as the proper supply of voltage and filament current is maintained, but not otherwise.

The tube is able to generate alternating currents because of its amplifying properties. The energy delivered to the grid circuit in accordance with the actions just outlined will gradually increase in value until a maximum is reached, which is the maximum output the valve is capable of delivering, as may be discerned from the well-known characteristic curve.

Referring to Fig. 1, it will be observed that the plate and grid circuits of the tube contain the coils *L-1* and *L-2*, in inductive relation, each connected through the condensers *C-3* and *C-4* to the negative side of the filament. The grid oscillating circuit comprises the coil *L-2*, the condenser *C-2* and a protective condenser *C-4*. The plate oscillating circuit includes the condenser *C-3*, a part of the coil *L-1* and the series condenser *C-5*. The antenna and earth connections tapped off from the coil *L-1* take the place of the con-

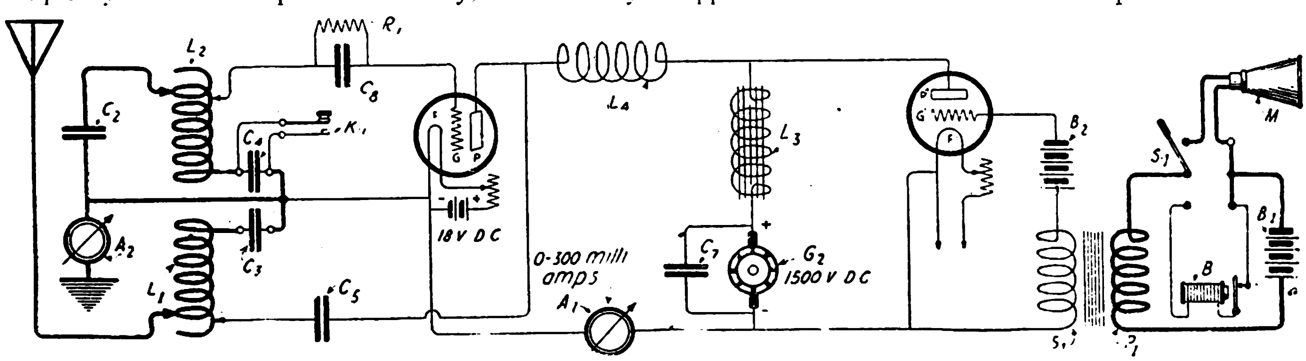


Fig. 1.—Fundamental Circuits of the Wireless Telephone Transmitter for Seaplanes.

denser C-2 in the grid oscillating circuit. C-2 is called the balancing condenser. In series with the grid is another condenser C-8 shunted by a leak resistance R-1, which maintains the grid at a negative potential.

The system further includes a three-electrode tube F', G', P', which amplifies the output of the microphone circuit and simultaneously modulates the output currents of the oscillating bulb.

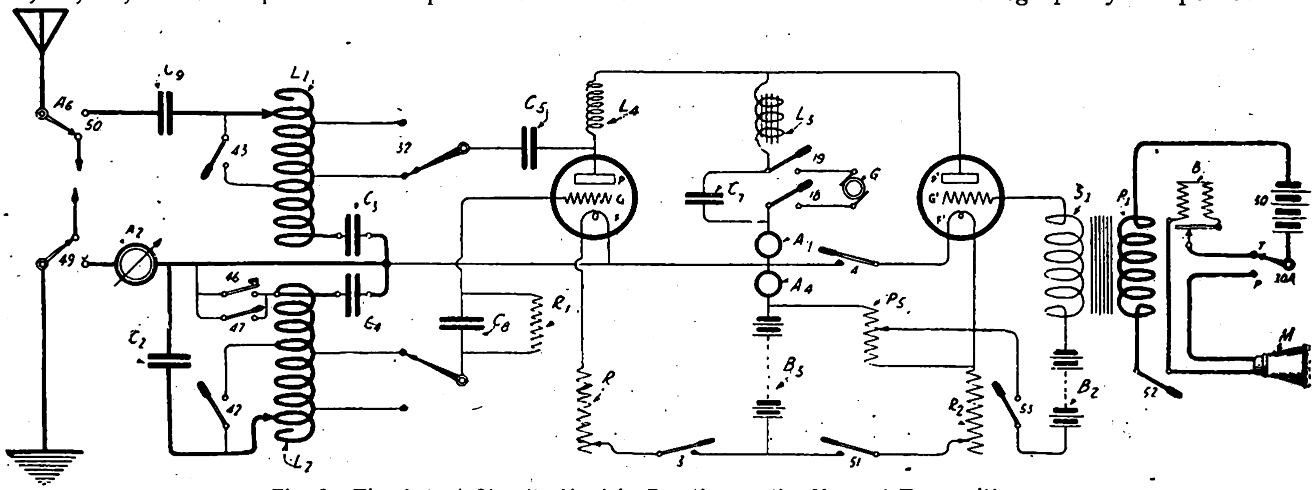


Fig. 2.—The Actual Circuits Used in Practice on the Marconi Transmitter.

It will be noted that the plate circuit is fed by a 1500-volt direct-current generator G-2, the positive terminal of which connects to the plate P of the oscillating tube through the audio-frequency inductance or transformer L-3 and the radio-frequency inductance L-4. The negative side of the generator connects through the milammeter A-1 to the negative side of the filament F. The condenser C-5 is the protective condenser which is generally employed in tube oscillating circuits when the source to the plate circuit is connected in shunt to the plate and to the filament, as is the case in this circuit. The modulating circuit shown to the right of the drawing permits either voice transmission or telegraphy by damped oscillations.

For telephony, the microphone M is placed in series with the telephone induction coil P-1, S-1 and the battery B-1, by means of the switch S-1. The coil S-1 is connected to the grid and filament of the modulating tube and includes in its circuit the battery B-2 through which the grid is held at a suitable negative potential for maximum magnification. The filament and plate of the modulating tube are shunted across the plate circuit of the oscillating tube. The audio-frequency choke coil L-1 may be said to act as a one-to-one transformer. The radio-frequency choke L-4 prevents the radio-frequency currents developed by the oscillator from flowing back to the plate-circuit generator G. C-7 is protective condenser for the plate-circuit generator.

When the transmitter M is spoken into, speech currents of variable frequencies generated by the microphone are impressed upon the grid circuit of the modulating tube and, through the medium of the autotransformer L-3, alternating currents are superposed upon the plate circuit of the oscillator. This in turn varies the amplitude of the oscillator currents at speech frequencies, and accordingly the amplitude of the radio-frequency oscillations flowing in the antenna circuit. It is essential that the key K-1 of Fig. 1 be closed for the production of undamped oscillations, for when it is open the tube stops oscillating. Manipulation of this key permits telegraphic signaling by the undamped oscillations produced by the tube.

When it is desired to telegraph by damped oscillations, the change-over switch S-1 is thrown from the microphone to the buzzer B which is energized by the battery B-1. The interrupted currents fed by the buzzer through the primary P-1 of the induction coil produce alternating currents of higher voltages in the coil S-1, which in turn are magnified by the modulating tube, the latter varying the radio-frequency currents in the oscillator tube at the frequency of the buzzer. In this way, the antenna radiates damped oscillations in groups, the frequency of the groups varying as the number of interruptions of the buzzer.

A more detailed circuit of the Marconi aircraft set appears in Fig. 2. This diagram not only embraces the fundamental connections of Fig. 1, but includes all necessary switches for the three different signaling

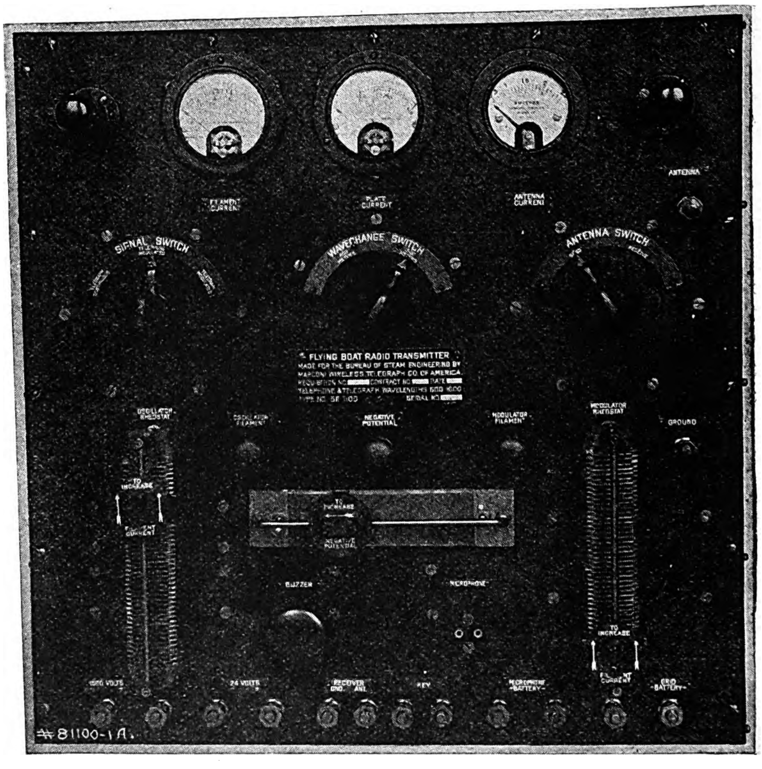


Fig. 3.—Front View of Marconi Wireless Set Used in Seaplanes.

functions on the 600 and 1600-meter wave. It includes, moreover, a detailed wiring diagram of the filament circuits.

The filament circuit divides at the positive terminal of the 24-volt storage battery *B-3*, one branch going through the rheostat *R-1* to the filament *F* of the oscillating valve, and the other going through the rheostat *R-2* to the filament *F'* of the modulating valve. The negative sides of the two filaments are connected together and to ground. In addition there is provided a potentiometer *P-5* connected across the battery *B-3* with a tap leading to the negative potential battery *B-2* and on through the secondary of the microphone transformer *S-1* to the grid *G'*.

The object of the potentiometer in Fig. 2 is to compensate for any loss of negative potential in the grid circuit *G'*, which may be occasioned by the lowering of the voltage of the filament battery *B-1*.

The switches for shifting the connections from one system of signaling to the other are enclosed in drums, as may be noticed in the left-hand part of Fig. 5. The inside and outside rows of jaws on each set are represented by the upper and lower group of dots in Fig. 6. In that figure the left-hand pair constitute the wave-length changing switch, the middle pair the sending and receiving switch and the right-hand pair the signal switch. The first, second and third positions of each switch are indicated by the letters *X*, *Y* and *Z*, these letters being placed between the two points which the blades of the switch short-circuit in that position.

Regarding the action of the oscillating valve itself it should be noted: When the grid is negative in respect to the filament, no current passes between the grid and filament; but when it is positive, considerable current passes which constitutes a loss in the circuit; but if the grid is held at a constant negative potential this energy loss is reduced and a more effective transmitter is obtained. The grid potential may be held at a negative value by the insertion of a grid battery but it can be done in just as effective a way by inserting a condenser in the grid circuit which rectifies the grid currents and holds the grid at a negative potential.

If the leak were not provided, the potential of the grid would rise to such a high negative value that all action would be stopped. A leak of proper value definitely limits the maximum negative potential of the grid and therefore does away with the necessity for a special grid battery.

The numbers on the separate single-pole switches in Fig. 6 correspond with those shown in Fig. 2. The outside row of studs on the wave-length changing switch perform the following functions: In the 600-meter position (*X* at *32* in Fig. 2) the first tap on the upper section of the loading coil *L-1* is connected to the plate series condenser *C-5*, and at *43* short-circuits the end portion of the same coil. In the 1600-meter position *Y*, it connects at *32* the second tap of the coil to the condenser and opens the short-circuit.

The inside row of studs on the wave-length changing switch performs the same functions for the coil *L-2*, which is the lower portion of the long single coil mounted in the middle of the rear of the panel in Fig. 4. In the schematic diagram, Fig. 6, the blade marked *35* is shown connecting to the first tap of the lower portion of the coil in the 600-meter position,

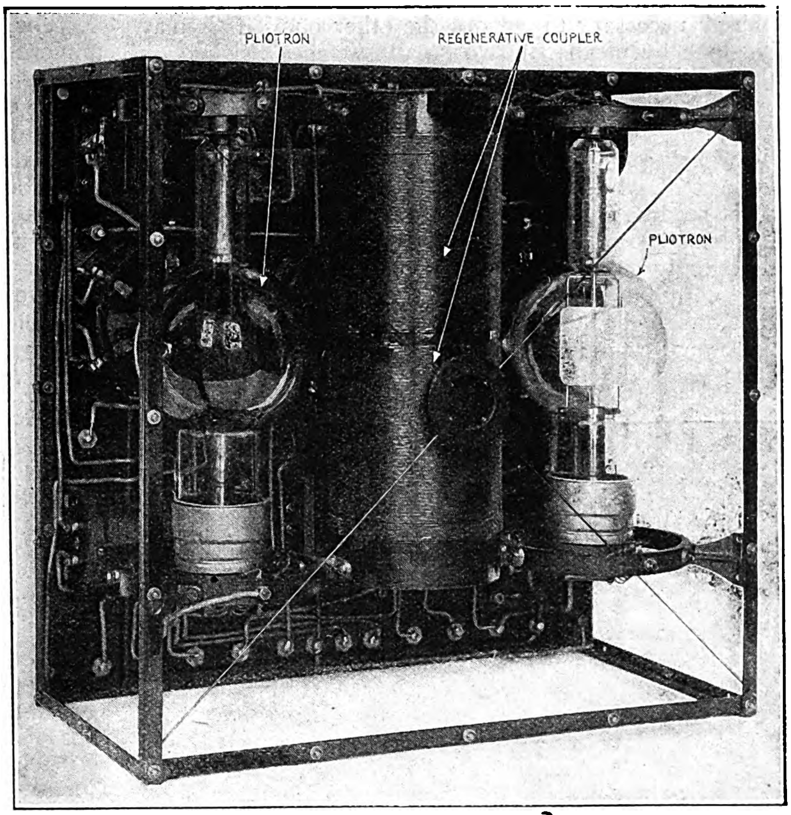


Fig. 4.—Rear View of the Transmitting Set With Pliotrons in Place.

and to the second tap in the 1600-meter position to the grid condenser *C-8* with its leak resistance *R-1*.

The outside portion of the switch marked "send-receive" (in the right-hand position of Fig. 3 and also in the upper central position of Fig. 6) serves to connect the antenna *A-6* to the transmitter in the "send" position (*X*) and to the receiver in the "receive" position (*Y*). In the "send" position the circuit of the antenna at *50* is through the series condenser *C-9* to the top of the loading coil *L-1* and to the ground. The latter is connected at *49* through the antenna ammeter *A-2* to the main ground bus of the set, which is the frame.

The inside portion of the "send-receive" switch, in the lower part of Fig. 6, is idle in the receive position *Y*, but in the "send" position *X* at *21*, it completes the 1500-volt direct-current supply current to the plates *P* and *P-1* of the pliotrons. At *52* it connects the primary of the microphone transformer *P-1* to the microphone terminals *28* and to the buzzer *B*. These connections are opened in the "receive" position.

There are three positions for the signal switch. The first *X* is for continuous wave telegraphy. In this position the connections made in the second and third positions are opened. The second position *Y* is for telephony; the inside portion of the switch (the upper part in Fig. 6) connects the microphone to the microphone battery, and at *51* the outside portion (in the lower part of Fig. 6) completes the filament circuit for the modulating valve and short-circuits the key at *47*. In the third position, the switch connects at *30-A* the buzzer to the microphone battery and at *51* keeps the filament of the modulating valve lighted, removing the short-circuit from the key.

Space and weight considerations demand the fewest possible measuring instruments. A direct-current ammeter *A-4* is connected in series with two filaments and reads the total current taken by both of them. The instrument's scale registers from zero to 10 amperes; to read the current in either filament it is merely necessary to cut out the other one. This may be done by means of two small switches marked on the set "oscillator filament" and "modulator filament."

The principal indicator for checking up the proper operating conditions of the set is the plate current drawn by each of the valves from the dynamotor, the voltage of which, as already mentioned, is 1500 volts. This reading is obtained from the plate-current ammeter *A-1* of Fig. 2, connected in the ground leg of the supply circuit. This instrument reads from zero to 300 milliamperes and measures the total plate current taken by the oscillator and modulator. The maximum voltage developed by the dynamotor is 1600 volts and the vacuum tube generally will cease to operate when it falls below 1100 volts. The generating tube will oscillate over a wide range of plate voltage if the filament current is kept below a certain critical value. The filaments of the pliotrons are designed to operate on 18 volts.

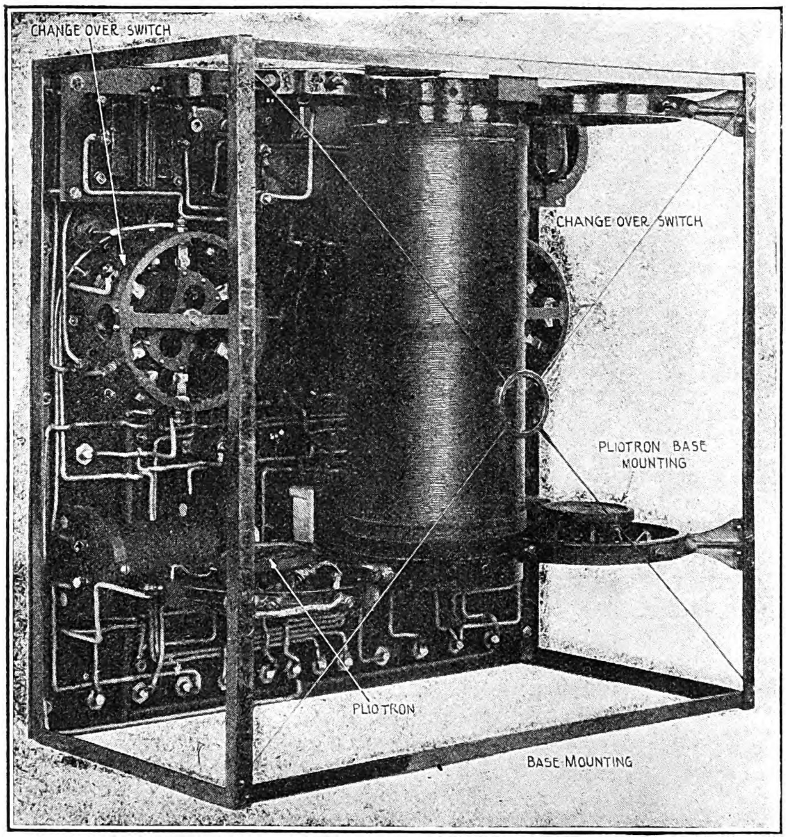


Fig. 5.—Rear View of the Set After Pliotrons Have Been Removed.

The entire set is wired with No. 12 B. & S. gauge bare soft copper wire with empire cloth tubing slipped over it as insulation. No terminal lugs are used; the ends of the wires are bent in the shape of an eye which fits the stud terminal and is passed around it in a direction that tends to make the wire grip the stud when the nut is tightened.

Owing to the vibration of the airplane every possible precaution has been taken to prevent the fastenings working loose. Special steel lock washers are used throughout the set. The general scheme of construction is such that the main supports and fastenings will bend before they break, wood or any material which splits or fractures having been eliminated. The steel wire cross braces shown in the rear views make the structure an extremely light and a surprisingly rigid unit.

The primary source of energy is two 12-volt, 50-ampere-hour storage batteries of the Willard lead type similar to those used in automobile starters. The filaments of the two pliotrons are operated through a rheostat directly from the 24-volt storage battery. Since the tubes require a plate potential of 1500 volts direct current, a small dynamotor, driven by the 24-volt storage battery, is supplied. The armature has two windings in the same slots, one connected to the 24-volt commutator at one end, and the other to the 1500-volt commutator at the opposite end. It is a two-pole machine excited from the 24-volt source. The armature, which runs on ball bearings at 5000 r.p.m. and draws about 30 amperes on its full load at 450 watts, weighs approximately 30 lb.

In addition to the 24-volt storage battery, three other batteries are required; two for the transmitter and one for the receiver. These three sets are known as the microphone battery, grid battery and receiver battery. The voltage of the first is 5; of the second 60, and of the third 40. The 60 and 40-volt sets consist of 20-volt units connected in series.

To insure against breakage, the best position for the pliotrons is vertical with the large neck at the bottom. This brings the plate-terminal cap at the top and the filament and grid-terminal cap at the bottom. In each of the two Dilecto rings shown at the top of Fig. 4, three spiral springs placed 120° apart support a spring cap which fits over the plate-terminal cap of the pliotrons. The springs are held by small machine screws which pass through the insulating ring. One of these serves as a terminal, being connected by a pigtail to the spring tap. In each of the two bottom Dilecto rings, three spiral springs placed 120° apart, support a special jack block made to take the filament and grid terminals. This block is made in two halves, upper and lower, held together by screws; clamping these spring jacks between them, three posts, which project from the bottom of the jack block, take the ends of the three supporting springs and are electrically connected by a copper pigtail to the screweyes that hold the other end of the spring to the Dilecto ring. The two filament terminals of the tube and the grid terminal are brought out to the three screws in the Dilecto ring. Thus, each pliotron is supported to the rigid frame of the set by six springs which are set so that when the tube is in place the top springs pull down and the bottom springs pull up.

The mechanical period of vibration of the vacuum tubes in this spring mounting is considerably below that of any vibration that will occur in the seaplane itself. Sudden shocks in any but a horizontal direction are not transmitted through these springs with sufficient violence to injure the tubes.

The antenna reel group for this set consists of the reel mechanism, a removable drum with antenna wire and spare drums with complete antennae on them. The wire from the reel runs through a take-off pulley and passes through the lead-in insulator in the side of the hull of the boat. It then passes through either a strut pulley or wing pulley, depending upon the type of the boat.

A cast aluminum plate, clamped to one of the main struts in the hull of the boat, carries a shaft on which the drum turns. On this same shaft, next to the attachment plate, there is a brake drum of cast aluminum and around this drum a cast-iron brake band. The band is sprung over the drum and prevents it from turning except when a cam which is attached to the brake lever springs it open. A pin on the brake drum engages holes in the main drum, when the latter is put on the shaft. The crank by which the main drum is turned has a square hub on which the drum sets. It is slipped onto the shaft and latches in place. The latch is released by a latch handle just behind the arm of the crank. To remove the drum, to put a new one in place, the operator grasps the arm of the crank, and in so doing also grasps the latch handle and releases the latch. He then pulls the crank and drum off together. One drum may then be slipped off the hub of the crank and a new one put on, and the two slipped back onto the shaft.

The drum is a pressed-steel spool, black japanned, and will hold about 600 ft. of the standard antenna wire. It has a square hole at its center which fits the hub of the crank. The antenna wire has a ball at the reel end and this ball is dropped through a hole in the drum face. The other end of the wire is attached to a swivel, and this in turn is attached to the "fish" or weight.

The lead-in insulator is a molded Electrose fitting, with a metal tube running through it, and a wide flare at either end, so that the wire cannot catch on the ends of the tube even if it enters at right angles. The insulator is held by locknuts in a hole in the side of the hull. The antenna connection from the set is brought to this insulator. When the antenna is out, the ball on the reel end of the wire rests against the inside flare of the insulator. The wire is thus entirely disconnected from the reel, and the reel is dead. When it becomes necessary to reel up, the ball is grasped and of course brings the wire with it. The ball is passed through the take-off pulley and dropped through the hole in the drum face, and the crank is turned. The brake mechanism is arranged so that the cam may be left holding the brake off during the reeling-up process.

The maximum antenna current is 2.5 amperes, with the antenna supplied with the set. This has been found to satisfy all ordinary distance requirements.

Comprehensive instructions are supplied with each set, enabling the operator to obtain the best adjustment for the three signaling positions with the greatest ease.

SQUARE DEAL TO UTILITIES, THEIR EMPLOYES AND PUBLIC.

In a recent interview on high prices and the general business outlook, Britton I. Budd, president of the Metropolitan Elevated Railway Co. and head of the Chicago Elevated Railways, said:

"We hear a good deal of talk about prices again becoming 'normal' Such talk results from a lack of understanding of what constitutes a 'normal' price of a commodity or a 'normal' wage of labor. If by 'normal' is meant the prices and wages of, say, 1914, I do not believe we shall ever again see such prices and wages, and we should at once begin squarely to face the facts. In my judgment the tendency is toward higher prices and wages.

"As I view it, a 'normal' price is a price based upon the cost of production, so that what was a fair price for a commodity in 1914 is not a fair price in 1919. The same is true of wages for 'normal' wages in 1919 must be based upon what it costs the worker to live according to American standards and allow a reasonable margin for the inevitable rainy day.

"We are entering upon a new era. The future must bring a square deal for labor, a square deal for the public and a square deal for the public service companies, which are now being starved to death for lack of nourishment."

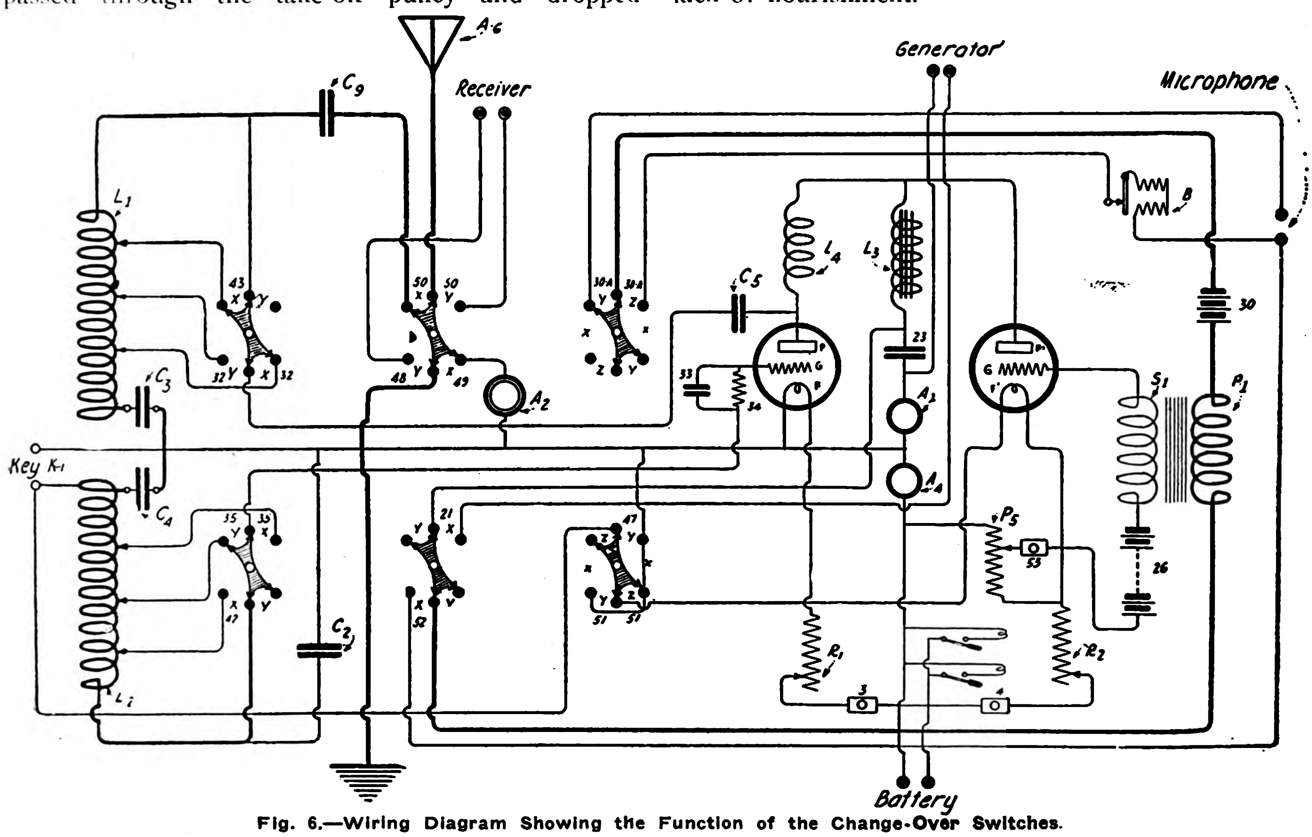


Fig. 6.—Wiring Diagram Showing the Function of the Change-Over Switches.

Editorial Comment

Another Step in Co-operation

ANOTHER big improvement in the conditions in the electrical industry was made recently when the manufacturers of outlet boxes, covers and similar supplies adopted a standard system of numbering their products for catalog purposes. In doing this these companies have evidenced their progressiveness and willingness to co-operate with the rest of the industry and it therefore behooves all others interested in these fittings to familiarize themselves with the new numbers as quickly as possible and use them exclusively when ordering or referring to them. There is no doubt but that the proper use of the new numbers will effect a considerable saving and be much more convenient to all concerned and at the same time enable architects and others not connected with the electrical industry directly to become more familiar with such fittings and their uses.

The most striking feature, however, is that this action marks another step in the advance of the electric industry along co-operative lines. It represents another case of one branch of the industry expressing a desire to assist the others and accepting their suggestions. There are, of course, other factors in our business that need to be adjusted, some perhaps more important than this, but as long as we proceed in this manner, working together for each other's benefit and avoiding individual strife we need not worry but that in a short time we will succeed in eliminating these other difficulties.

Value of Good Street Lighting

IT HAS come to be quite common to say that good street lighting is the best policeman, it having been found that where there is ample light there is less crime and fewer accidents than where the illumination is sparse.

The recent lamentable race riots in Chicago brought home to the writer of this editorial, while on militia duty for over a week, the value of good street lighting and, inversely, the objections inherent in inadequate lighting. Things go on in the dark that would not occur nor could they persist in the light. It was during the dark hours of Chicago's race riots that the most serious and most numerous crimes were committed. And it was where the darkness was densest that the worst was done. The well lighted streets were the streets where disturbances were least looked for and where they could be most easily handled.

It was in the dark alleys that the incendiaries traveled the paths of destruction. It was in the shadows and the densest masses of gloom that the snipers did their deadly work. These things are expected and proved by experience. The difference between the dark and the light street was such that in most cases, for similar conditions, double the number of militia or police were required in the dark or inadequately lighted terraine that sufficed where the streets were well lighted.

What has been said—that ample street lighting is far superior to insufficient lighting on the score of safety and law and order—is quite self-evident. But what was found true in the time of riot is also true in normal times. The well lighted neighborhood needs less policing than the neighborhood where the lighting is deficient. The investment in street lighting is a good investment when balanced against the police payroll.

And there are many other items on the credit side of the street-lighting cost—items difficult to valuate because less tangible but none the less real—chiefly all that goes with safety and law and order. Moreover, there is the increased value to the property owner of having his residence or place of business on a bright and cheerful street instead of on a dark, gloomy and dangerous one. And to the city at large good street lighting accounts for much of the difference between attractive and repulsive streets. Finally, at small cost, it may save a city's reputation from being suddenly besmirched with a stain that its authorities and the great mass of its law-abiding citizens would gladly have avoided, regardless of expense.

The Field for Static Condensers

POWER-FACTOR correction is one of the measures offering the greatest opportunity for the central stations in the way of economies of fuel, of equipment and lines. With the war came the urgent need for improving the power-factor because doing so meant increased capacity available for useful service. While the urgency of utilizing equipment to the best advantage, that is, by reducing needless and preventable wattless current, has somewhat abated, the benefits of power-factor improvement remain. Power-factor improvement and correction are, therefore, coming in for considerable attention on the part of operating companies.

Better power-factor can be obtained by the judicious choice of motors and proper loading in many industrial plants. However, it is necessary to go further than this if the lagging wattless current is to be reduced to a desirable amount. This means that synchronous motors, synchronous converters and static condensers are finding increasing application in industrial load centers.

The field for the synchronous converter for power-factor control is rather limited, as is well known, and the synchronous motor and the static condenser only are available for general application. It is only of comparatively recent date that the static condenser has found favor, it having come into commercial usage in this country only quite recently. It has been employed in Europe, however, for a somewhat longer period and with satisfactory results.

The chief objection to the static condenser is that for a given frequency and applied voltage the power-factor, hence the leading current, is a fixed quantity. This means, of course, that the static condenser will improve low power-factor but cannot correct it by varying the wattless current component. This shortcoming of the static condenser eliminates it from consideration in certain classes of service, but really is not a very serious drawback in other instances. For example, if the average power-factor of an industrial load center is 65% and the installation of a static condenser enables the average power-factor to be raised to 90%, the fact that adjustable gradations cannot be readily obtained is really immaterial. It is a case of power-factor betterment as contrasted with power-factor control or voltage regulation. For the former the static condenser may be the solution; for the latter the synchronous condenser is the solution.

Experience seems to show that for installations up to about 1000 kv-a. where power-factor betterment is sought, the static condenser may be preferable to the synchronous condenser. Power-factor betterment is obtained without human attendance or supervision; once the condenser is installed it can be forgotten so far as concerns operation. The efficiency of the static condenser is higher than that of the synchronous condenser and the cost more and more in favor of the former.

There is no doubt but that the static condenser meets a certain condition admirably. This condition is quite general but the suitability of the static condenser is not generally appreciated to the same extent as is its unsuitability for certain purposes. For power-factor betterment up to, say, 1000 kv-a. in localities remote from personal supervision the static condenser is deserving of most careful consideration.

Return of the Wires

TELEGRAPH and telephone wire systems of this country have been released from Government operation, the change having taken place at midnight of July 31. From this time we predict gradual but noticeable improvement in both these classes of service. During the year of Government control, due to unavoidable conditions growing out of the war, both equipment and trained personnel were greatly depleted. Now that the men are steadily coming back from service overseas and equipment tied up for war service is being released, we believe there will be steady improvement in service to at least the standards formerly prevailing.

The two big telegraph companies, the Western Union Telegraph Co. and the Postal Telegraph-Cable Co., both have announced to the public through their presidents return of their properties to the management of the owners, and the latter company states its rates will be reduced 20% to the point where they were before the Government assumed control.

In the telephone industry, as represented by the Bell System, the announcement of the change and all that was involved during the past year was made substantially as follows:

"A year ago today we were at war. Labor and materials needed for both telephone operation and construction were turned to military uses. Some materials were so vital to the carrying on of the war that even the work of providing telephone facilities for the Government was retarded and no part of them could be spared for commercial telephone purposes. No less vital was the Government need for those skilled to create, maintain and operate the vast intercommunication system necessary in modern warfare and in the conduct of the vastly increased Government services. Thousands of telephone men were already at the battlefront. Thousands more were under arms, and still telephone experts and skilled operators went into the service of the Government and contributory industries by the tens of thousands. The reserves of plant and equipment were drawn upon until they were entirely used up, and the experienced staff was gradually depleted. To find others to take the places of those who had gone was difficult, to train them takes time. During the year came victory and the armistice; and instantly the business world sprang into intense activity. The demands for telephone service passed all former records. To replace the exhausted reserves which had been carried for just such purposes and to replace the skilled forces to meet this unprecedented emergency, there began a rush for construction, for readjustment, for high-pressure repairs, for feverish extensions. All these must be continued with increasing effort. * * * There are no people in any public or private endeavor who are working more tirelessly or strenuously for the common good than those of the telephone companies. Service has always been given. More of it must be given, and it must be improved. That improvement in some cases will take months. Eventually service must win the race with demand."

Before the war's demands crippled the telephone service, as well stated above, the telephone organization was satisfactorily and efficient managed. We believe the change that has now taken place will soon show a very decided and comprehensive improvement. A little patience is required on the part of all the public while the present conditions are being remedied.

Current Events

Outlet Box Numbering Standardized—Meeting a Transportation Emergency—Michigan Convention Dates Changed

OUTLET BOX MANUFACTURERS ADOPT STANDARD NUMBERING SYSTEM.

New Method Offers Many Advantages to Jobbers and Contractors in Ordering.

As further evidence of their progressiveness the group of the Associated Manufacturers of Electrical Supplies manufacturing outlet boxes recently adopted a standardized system of numbering for outlet boxes and covers. This action is the result of a suggestion made some time ago by the Electrical Supply Jobbers' Association. At that time, due to war conditions, it was not possible to make these changes. Now, however, a method of making these changes has been decided upon and new catalogs will shortly be on the market bearing the new standardized catalog numbers. Hereafter the trade will have but one number to consider as substitute numbers and cross-indexing will be eliminated. A catalog number will mean a certain definite box and this number will apply to this same box made by every manufacturer.

The method adopted is very simple and clear, there being no key to remember and no puzzles to clear up. As an evidence of this, the numbers have been so worked out that the first two numerals of the cover for a certain size and shape of box, will be the same as the first two numbers of the box itself. The box number will consist entirely of numerals. The cover will be designated by the insertion of the letter "C" after the first two numerals. The flush plate will be designated by the insertion of the letter "R" after the first two numerals.

A few of the reasons for the standardization of box numbers and the advantages to be derived from it, follow:

1.—There are at present approximately 1500 different numbers used in designation of boxes and covers of various manufacturers. There are, however, less than 200 distinct types.

2.—Each manufacturer now has his own system of numbering, although the use and general type of almost any box or cover is identical with that of several manufacturers.

3.—Both contractors and jobbers, in placing orders, rarely, if ever, take the trouble to look up and use the numbers of the manufacturer with whom the order will be placed. This necessitates the editing of orders by either the jobber or manufacturer and necessarily results in numerous errors. On orders received from contractors, the jobber will often substitute the numbers of such boxes as he may have in stock, for those specified on the order, if shipment is to be made from stock, or, in case direct factory shipment is to be made, forward the order as received to the manufacturer with whom he may be placing his box orders at that particular time. This is invariably done unless the purchaser insists upon the particular make of boxes specified.

4.—The types and styles of boxes and covers have become so standardized as to be almost on the same basis as sizes of conduits. There is, therefore, no more reason why different numbers should be used to designate the same box as manufactured by different manufacturers than that different numbers should be used to designate the sizes of conduits.

5.—With the various box manufacturers using separate numbering systems, it is now necessary for the device manufacturer to use as much space in listing the boxes or covers with which their receptacles, switches, attachment plugs, etc., may be used as to list the articles themselves. This is also applicable inversely; about as much space is used in the catalogs of the box manufacturers in listing the devices as in listing the boxes and covers themselves. Then, again, it is the almost universal custom of the various box manufacturers to list the corresponding numbers of competing manufacturers. To do this requires additional space.

6.—For the box manufacturers to furnish the device manufacturers with the necessary data for a proper listing involves an enormous amount of detailed research work for the design, engineering and drafting departments of each. Also voluminous correspondence and consequently errors are frequent. Both labor and errors will therefore be reduced to a minimum by a standardization of numbers.

7.—If the various manufacturers adopt a standard set of numbers it will effect a considerable economy in catalog costs, and, in addition, reduce the volume of jobbers' catalogs. Separate sheets are now issued by the National Electrical Supply Jobbers' Association, to show the lines of the several manufacturers. By the adoption of a standard set of numbers, these could be consolidated and one set of sheets used to show the lines of all manufacturers. This would reduce the volume of the association catalog by from 100 to 200 pages. The same would apply to the data sheets issued by the National Association of Electrical Contractors and Dealers.

8.—The reduction in the volume of sheets would be particularly appreciated by jobbers' salesmen, as it would considerably reduce the weight of the catalogs which they have to carry.

9.—A jobber, in getting out a new catalog, would feel no hesitancy in listing a standard set of numbers, cuts, etc., for they could be so listed and his orders placed with any manufacturer. At the present time jobbers are frequently carrying the listing of one manufacturer's line and furnishing boxes of some other manufacturer.

10.—Separate numbering systems, as now used, give recognition to substitutes, which, at best, is a bad practice and not to be encouraged. For if encouraged in one line, as at present in the outlet box line, leeway is allowed for substitution in all lines.

11.—The adoption of a standard numbering system would prove educational to all in the electrical business, for contractors, salesmen, wiremen, clerks, etc., would soon become familiar with any system adopted and know that an XYZ box was a box of a particular type and for a certain use. With many different numbers, as is now the case, this is impossible.

12.—While some advantage might now accrue to the various manufacturers through familiarity of portions of the trade with their own "pet" numbers, the adoption of a standard set of numbers would prove reciprocal, and each manufacturer would benefit in about the same proportion.

13.—The adoption of a standard set of numbers would in no way interfere with the various manufacturers playing up the strong points of their own lines, such as finish, detailed construction, materials used in manufacture, etc. As a matter of fact, these features could be emphasized more than is now possible. In ordering, a contractor, if he wanted some particular make of box, could specify by giving the name or brand and then list the standard numbers desired. As indicated in a previous paragraph, this would reduce substitution to a minimum, eliminate frequent errors, etc. If no particular brand was specified, jobber would, of course, understand that no preference existed, and could ship from his stock or place the order for direct shipment with his preference of manufacturers.

CHICAGO CENTRAL STATION MEETS TRANSPORTATION EMERGENCY.

Commonwealth Edison and Other Companies Find Electric Truck Useful in Recent Tie-up—Terms of Settlement.

The recent four-day strike of the elevated and street car men in Chicago resulted in a complete tie-up of the transportation facilities of this city and was rendered even more confusing inasmuch as it was entirely unexpected both by the public and the companies. In this emergency the officials of the various industries had to act promptly if a great industrial shutdown was to be avoided. This was done however in the vast majority of cases with the result that aside from a little confusion and annoyance practically all concerns carried on business as usual.

Prominent among the Chicago companies whose prompt efforts in transporting its employes to and from their work was particularly noticeable, was the Commonwealth Edison Co. As soon as the news of the strike became known, which was not until early Tuesday morning, the officials of that company began making their arrangements, and in a few hours had 11 automobiles on duty transferring its station operators and other station employes to the stations and to their homes.

During that same day arrangements were completed for taking care of the company's other employes. Ten routes were laid out covering practically all of the city except those parts that could be reached by train service and 30 electric trucks were assigned to these routes. Those employes who did not live near the railroads were given passes that entitled them to ride on the trucks. The trucks were fitted up with benches and seats to make them more comfortable and to permit as many as possible to be carried at one time. The average number of passengers carried on one truck was about 30 but as many as 50 were loaded onto some of them.

As the "loop" section of the city on this day was badly congested the trucks were started from points outside of this district. This congestion was considerably relieved on the second day, however, and after the first evening the passengers were carried directly to the main office of the company located at 72 West Adams street. Each truck was started at a certain time in the morning from a given point where the various employes living in that neighborhood congregated. Other employes were picked up at various points en route. In the evening the trucks were loaded at the Edison building and carried home.

The operation of the electric trucks in this emergency is especially noteworthy. Although the usage to which they were subjected was particularly severe no serious difficulties were encountered. Of course the excessive mileage they were forced to cover necessitated numerous boosting charges, but a little extra attention given to this phase of their operation eliminated any difficulty in this respect. In addition the passengers were carried much more comfortably than on the improvised gasoline buses and due to the congestion which necessitated frequent stopping, the speed was also equal to that of the gasoline vehicles.

Employes of Commonwealth Edison Co., Chicago, Use Company's Electric Vehicles for Transportation During Recent Traction Strike.

Many other large Chicago concerns, notably the department stores, used their electric trucks to good advantage during this time. No bad results were noticed from the hard usage.

At this time it might also be of interest to state briefly the terms by which the strike was concluded. The strike was called at a meeting on Monday night which was controlled by a radical element of the unions and at which a compromise offer suggested by Governor Lowden was rejected. Friday, however, a vote of the entire membership was taken which resulted in its acceptance.

The compromise offer provides for a maximum wage scale of 65 to 67 cents an hour on the basis of an 8-hour day, with time and a half for overtime. The increased expense to the traction companies will be met by an increase in fares authorized by the Public Utilities Commission of Illinois. This order permits the Chicago Surface Lines to increase its fares 2 cents, making the fare 7 cents, and the Chicago Elevated Railroads a like amount making its fare within the city limits 8 cents.

GOVERNMENT ASKED TO REDUCE ITS USE OF CABLES.

Public Ownership of Commercial Wireless Opposed by Foreign Communications Committee of National Foreign Trades Council.

The National Foreign Trade Council's committee on foreign communications, at a recent meeting, declared strongly in favor of the establishment and maintenance of adequate systems of transoceanic communications under private enterprise and for the speediest possible release of Government control of such private commercial systems as have not already been returned to their owners. At the same time the committee took measures looking to the early establishment of additional means of communication across the Pacific so as to bring to an end as promptly as possible the present intolerable conditions in transpacific cable and wireless communication.

The committee went on record as definitely opposed to Government ownership, control or operation of commercial systems or cable or wireless in time of peace; but pending the return to private operation of such commercial systems as are still under Government control, the committee favors the continuance of the Naval Radio stations in commercial service, in order to afford as much relief as possible from present conditions, especially across the Pacific.

One case reported to the committee was of the receipt of a cable from China that was 12 days old. Another case showed a delay of one month in closing a single transaction, owing to the necessity of repeating a message, mutilated as well as delayed in transmission. It was brought to the attention of the committee that there is a tendency in different Government departments to use cable or wireless at times for communications more or less routine in character and that such traffic increases the delay in transmission of commercial messages that are essential to the transaction of important international business.

The committee is calling this situation to the attention of the President and to the heads of various Government departments with the request that the volume of Government business which now takes precedence over all commercial business shall be reduced as far as practicable, and that Government messages which are not urgent should be transmitted without the right of precedence over commercial business. The committee will also ask the Government to call the attention of other governments to this situation and urges that they take similar measures in the interest of international commerce.

DATE OF MICHIGAN CENTRAL-STATION MEN'S CONVENTION CHANGED.

Program of Meeting to Be Held at Ottawa Beach, Aug. 26, 27 and 28.

The dates originally set for the next convention of the Michigan Section of the National Electric Light Association, Aug. 19 to 21, have been postponed to the corresponding days of the following week, Tuesday to Thursday, Aug. 26 to 28. This change was made necessary by the large number of members and guests desiring to attend the meeting. The Hotel Ottawa, at Ottawa Beach, Mich., where the convention is to be held, could not accommodate so large a number along with its regular summer guests until the last week in August. Reservations should be directly with the manager of the Hotel Ottawa and as soon as possible.

An interesting program covering all phases of central-station business has been arranged as follows:

The convention will open on Tuesday morning with an address to be delivered by the president of the section, Thomas Chandler, of Sault Ste. Marie. This will be followed by an address on the "New Public Utilities Bill" by James V. Oxtoby, Detroit. Two papers will then be read, one by John Swanson, Consumers Power Co., Jackson, on "More Favorable Policies Toward Consumers," and R. A. Gordon, of the Houghton County Electric Light Co., on the "Central Station and the Contractor-Dealer."

In the afternoon J. F. Mayo, of the Consumers Power Co., and H. H. Magdsick, of the National Lamp Works of General Electric Co., Cleveland, will read papers on commercial and industrial lighting, respectively.

A special session has been arranged for the evening of this day at which Harry Burton, of the Consumers Power Co., will deliver an address on safety and resuscitation, and W. A. Durgin, of Chicago, will present a lecture and demonstration on industrial illumination. Both of the talks will be suitably illustrated and in addition a moving picture, "Queen of the Waves," showing the progress of electricity in navigation, will be shown through the courtesy of the General Electric Co.

The speakers for Wednesday are as follows: A. H. Touscany, Detroit Edison Co., on "Appliance Sales in Detroit Edison Co.'s Suburban District"; H. H. Koelbel, Consumers Power Co., "Electrical Merchandising"; E. J. Copeland, Kelvinator Corporation, Detroit, "Domestic Refrigeration"; R. F. Hetton, Detroit Edison Co., "Electric Ranges, Their Sale and Operation."

In the evening a special entertainment program has been arranged at which F. G. R. Gordon, Haverhill, Mass., will speak on "Municipal Ownership."

On Thursday, J. H. Lobben, Detroit Edison Co., and J. A. Cavanaugh, Benton Harbor, will read interesting papers.

Herbert Silvester, Monroe, Mich., is secretary of the association.

ACTIVITIES OF NATIONAL LAMP WORKS ENGINEERS.

S. E. Doane, chief engineer of the National Lamp Works, of General Electric Co., Nela Park, Cleveland, Ohio, presented a paper before the sales managers of the Association of Edison Illuminating Companies at Association Island on Aug. 4, on the subject, "The Incandescent Lamp from the Manufacturer's Standpoint."

G. S. Merrill, assistant chief engineer, National Lamp Works, has been appointed chairman of the Illumination Committee of the Ohio Electric Light Association.

E. J. Edwards, electrical engineer of the National Lamp Works, was in Buffalo the week of July 28 to conduct an investigation of air and steam transmission at the plant of the Puritan Refilled Lamp Division.

H. H. Magdsick, of the Engineering Department, National Lamp Works, will present a paper on "Practical Phases of Industrial Lighting" at the convention of the Michigan Section, National Electric Light Association, at Ottawa Beach, Aug. 26 to 28.

Commercial Practice

Central Stations Show Big Load Increases—Appliance Sales Improve in South — Pittsburgh Company Reduces Rates

NORTHERN ILLINOIS COMPANY'S LOAD GROWING RAPIDLY.

Public Service Co. of Northern Illinois Also Actively Conducting Appliance and House-Wiring Campaigns.

According to present indications there is no doubt but that the year 1919 will be a notable one in the power development of the Public Service Co. of Northern Illinois. At the beginning of this year it was estimated that the probable increase in power load during the entire year would be 17,000 hp. According to the *Public Service Lumen,* the house-organ of the company, the increase during the first six months of the year has been 14,937 hp., or roughly about 2200 hp. less than the total allotment, with six months still to go. The increase from May 31 to July 5 was over 4500 hp.

The large expansion of many plants in the booming industrial districts surrounding Chicago and extending north to Waukegan and south beyond Joliet as far as Kankakee to a considerable extent, is accountable for the increase noted. But that is by no means the sole cause. Many new customers—new plants beginning operations and other hitherto unprovided with electric power—have created a demand which works into large figures. As compared with the corresponding period of 1918, the increase is over 100%. For 1917 the figures were 9806 hp. The following table is an analysis of the six months' record of 1919. It includes, as seen, the load created by electric ranges:

TOTAL CONTRACTED POWER BUSINESS.

Jan. 1, to July 5, 1919.

Div.	Customers.	H.P.	1919 Allotment.
A	43	4,080.8	3,000
C	93	636.7	2,000
D	121	2,266.7	3,000
E	30	143.6	500
F	43	4,312.7	3,000
J	64	2,166.9	3,000
K	31	262.5	1,000
L	25	134.5	250
O	17	106.6	100
R	10	139.1	150
S	21	181.8	1,000
	498	14,331.9	17,000
Ranges	62	605.5	
Total	560	14,937.4	

Among the late contracts made is one for 790 hp. additional made by the Elgin, Joliet & Eastern Railroad for use in its shops at Joliet; one with the Vitanola Talking Machine Co. at Cicero for 700 hp., one with the Coonley Manufacturing Co., also at Cicero, for 250 hp., and one with the Parrett Tractor Co., at Chicago Heights, for 380 hp. The Construction Materials Co., at Waukegan, engaged in construction work, contracted for 600 hp., and in Cicero the same concern became the user of 50 hp. The Arcady Farms Milling Co., at Riverdale contracted for 500 hp. to operate its large mills. At Chicago Heights the Calumet Steel Co. made a contract for 100 hp. and at Waukegan the Cyclone Fence Co. signed for 137 hp. additional. The Mueller Construction Co. at Cicero contracted for 50 hp., the Superior Chemical Co. at Joliet for 73 hp. additional, the Towns Elevator Co. at Evanston for 70 hp., the Macey Construction Co. at Clearing for 50 hp., the Magazine Circulation Co., Chicago Heights, for 60 hp., and E. J. Butler & Co., at Riverdale, for 70 hp.

The electric range figures are especially interesting. These appliances present so strong a case of their own that the favor with which they are received by the public is steadily increasing. In a comparatively short period 48 new range customers were added. In the week ending July 5, ranges disposed of represented a demand of 25 hp. No attempt is made to push this device in territory where the company supplies gas but considerable success has been achieved in the sale of electric ranges in the resort districts served by the company.

The increase of new business in house-wiring is also impressive. Up to July 1 the total number of houses equipped so far in the year was 969. An increase of more than 200% is represented in these figures compared with the same period of 1918. Division "J" leads the procession with 287 houses connected up. Division "C" comes next with a score of 165. Division "A" is third, its total in the report being 147 houses. Division "D" is fourth with 132 houses. Of the whole number of houses wired the owners of one-third declined to take advantage of the easy installment privilege and paid for the improvement in cash. In all the towns in the territory a close co-operation between the company and local contractors was secured and the latter's business was benefited by the company's liberal advertising. The contractors' work is not included in the above figures. In the period referred to they wired in all parts of the territory a total of 470 houses.

In addition household electrical appliances are moving out in much larger volume than last year. The record for the first six months of 1919, in fact, is in its way as notable as that made in the contracted power business of the company. The greatest demand is for labor saving appliances—irons, washers and vacuum cleaners. Throughout the smaller towns where no office is maintained, 50,000 circular letters were sent recently to customers offering an electric iron or an electric toaster on a 10-day free trial, payment for either appliance, if the user elected to keep it, to be made in small installments monthly. The response to this offer has been excellent.

The company's Sales Department is also co-operating with the Edison Electric Appliance Co., of Chicago, in the latter's campaign among the educational institutions throughout the country to encourage the use of electrical appliances in the home. Various circular letters have been sent out to the instructors of the Domestic Science Departments of the schools in the territory served by the company and its sales force is taking every advantage of this opportunity.

GREATER DEMAND FOR ELECTRIC APPLIANCES IN SOUTH PREDICTED.

Increasing Scarcity of Colored Help Results in Greater Use of Electric Labor-Saving Devices.

Largely increased sales of labor-saving electric household appliances are predicted through the South, where the domestic labor situation has taken on more of the aspects familiar in the North. Conditions in Louisville, for example, have changed radically in the last three or four years, according to Robert Montgomery, manager of the Commercial Department of the Louisville Gas & Electric Co., Louisville, Ky. "When I first came to Louisville," says Mr. Montgomery, "negro servants were so plentiful and could be employed at such low prices that it did not pay the housewife to do much of the hard work, but today you find servants difficult to obtain and they are now demanding prices such as paid for labor of this kind in Chicago. It is a condition entirely new to the Southern people, who have never before experienced difficulty in securing cheap domestic help."

In line with the increased use of electrical household appliances, the Booker T. Washington community center at Louisville is teaching negro women how to use these devices. A circular describing the course of instruction at this institution says: "The world keeps moving forward all the time. We must all keep up with the times. If we do not we lose in comfort, convenience, time and money. The man or woman who studies and learns to use the new way of doing things and the new inventions is the one who gets ahead in the world, makes the most money and has the largest amount of leisure."

DUQUESNE LIGHT CO. REDUCES RATES FOR RESIDENCE SERVICE.

Lower Rates of Pittsburgh Company Expected to Stimulate House-Wiring Campaign.

A reduction in the rates for residence service amounting to approximately 20% was put into effect July 1 by the Duquesne Light Co. of Pittsburgh. The new rate provides for a charge of 8 cents net per kw-hr. for the first 30 hours' use of maximum demand in any month. The next 60 hours of demand will be charged for at the rate of 6 cents per kw-hr. and all current consumed in excess of this amount in any month will be charged for at the rate of 3 cents per kw-hr.

The maximum demand for such service will be determined by the number of lamp outlets on the following schedule: The first 10 lamp outlets are rated at 300 watts; the next 20 lamp outlets are rated at 20 watts each; lamp outlets in excess of 30 are rated at 10 watts each. Every lamp socket excepting those contained in portable and floor lamps is counted as a lamp outlet, as well as all baseboard, floor and similar outlets. The service charge residential rate schedule remains unchanged.

In order to apply this new rate, it was necessary to take a census of the lamp outlets for every residential installation now on this schedule, approximately 65,000. For this purpose a staff of 60 census men was organized and began work on June 23. It is anticipated that this census will be completed within 90 days.

Reductions were also made at the same time in the wholesale power rates for the company but these were much smaller than those made in its residential service. These changes will effect the energy charges only.

Coincident with the house-wiring campaign being conducted by the company, these liberal reductions in its residence rates should bring about an enormous addition to its residence consumers. In the early part of this year the Wiring Department of the company, under the supervision of Howard H. Wood, started a campaign to secure the wiring contracts for 2000 old houses by July 1. This campaign was very successful, 2065 contracts being secured in Allegheny county and 325 in Beaver county during this period. With the impetus afforded by the reduced rates, the campaign period has been extended and a new mark of 5000 house-wiring contracts for the year ending Dec. 31, 1919, has been set and according to all indications will be reached with a good margin to spare.

SOUTHERN CALIFORNIA EDISON CO. SHOWS BIG LOAD INCREASE.

Prospects Also Particularly Good According to Reports from District Offices.

According to the reports from the various district offices of the Southern California Edison Co., Los Angeles, Cal., the present year promises to be a notable one in the annals of that company. During the past month many of these districts have secured considerable increases in their power loads and the prospects for the future development along these lines is also particularly good.

The Oxnard district during May and June signed up more than 300 hp. while the Whittier district during the latter month added 224 hp. to its lines. The San Bernardino district recently completed the installation of 500 hp. additional, for the Fontana Land Co. for pumping purposes and Pomona just completed the installation of 100 hp., replacing a steam plant. The station output for June at Lancaster was 804,000 kw-hr. Thus far this year this district has added 388 hp. to its lines and still has 182 hp. yet to be connected. The Ventura district reports that the power business for June more than doubled that of the same month in 1918.

Since April 1, 1919, 377 shares of the company's stock have been sold to the employes of the Los Angeles office and 190 shares disposed of through this office to the public.

CRIPPLE CREEK SHORT LINE TO BE ELECTRIFIED.

Electrification Expected to Effect 20% Saving in Operating Expenses—Central-Station Service to Be Used.

Work on the electrification of the Cripple Creek Short Line railroad, which operates between Colorado Springs and the gold mining camps in that section, is expected to begin early in September. Electric power for the operation of the road, according to a recent announcement, will be purchased from two central-station companies, one of which is to be the Arkansas Valley Railway, Light & Power Co. By electric operation the railroad expects to reduce its operating expenses 20%.

Contracting-Construction

New Chicago License Ordinance—Considerations in Selecting an Electrical Contractor—Iowa Contractors to Meet

NEW CHICAGO ORDINANCE COVERING LICENSING OF ELECTRICAL CONTRACTORS.

Principal Features of License Law to Become Effective Sept. 1.

The new ordinance governing the licensing of electrical contractors, fixture hangers, maintenance and sign men in Chicago, which was briefly outlined in a previous issue, has been passed and will go into effect Sept. 1, 1919. The changes in the new ordinance are substantially as follows:

Any person or corporation making application for permits must first file with the Commissioner of Gas and Electricity an application containing an affidavit stating that the work to be done under such permits will be under the supervision of a person who is not less than 21 years of age, who has a thorough knowledge of electrical construction and who has had not less than four years of practical experience in installing or maintaining electrical wires and apparatus in the class mentioned in the application for license and who shall also have regularly passed the examination as provided for hereinafter. The application shall be made upon a form prepared and approved by a Board of Examiners, to be appointed by the Mayor for the purpose of inquiring into and ascertaining the qualifications of the applicant and of the supervising electrician, as provided herein. Such application shall contain the name and signature of the person under whose supervision the work is to be done, together with two indorsements from responsible citizens, made under oath, that such person possesses the qualifications above designated. Upon filling such application in proper form and upon the deposit of an amount equal to the license fee for the class of license being applied for, and upon the supervising electrician successfully passing the examination provided for, the deposit will be transferred to the City Collector, which deposit the City Collector shall receive as the license fee for the said applicant, and the Commissioner of Gas and Electricity shall issue, or cause to be issued, the license applied for, which license shall entitle the licensee to obtain permits to do such work as shall be within the classification covered by such license. The license fee for the first year for a general electrical contractor shall be $200 with a renewal fee of $50 for each year. The license fee for the first year for electrical construction only shall be $100 with a renewal fee of $25 for each year. The license fee for the first year for a fixture license, including such persons or corporations doing fixture work only, shall be $100, with a renewal fee of $25 for each year. The license fee for the first year for a sign license, including such persons or corporations doing sign work only, shall be $25, with a renewal fee of $10 for each year. The license fee for the first year for a maintenance license, including such persons or corporations doing maintenance work in buildings owned or controlled by such persons or corporations, shall be $25, with a renewal fee of $10 for each year. The above classification of licenses and the fees pertaining thereto shall not immediately apply to those certificates of registration in existence but shall apply at the expiration of the period for which they are issued, at which time a renewal fee in accordance with the above classification must be paid before the renewal is made.

Prior to the issuance of a license for general electrical contractor, electrical construction, fixture license and sign license, the applicant shall file with the City Collector of the City of Chicago an indemnifying bond with good and sufficient sureties in the penal sum of $5000, such bond being payable to the Commissioner of Gas and Electricity of the City of Chicago, for the use of those with whom the applicant shall thereafter contract to do work, to indemnify for damages sustained on account of failure to perform the work contracted for, in accordance with the provisions and requirements of the City of Chicago, relating to the installing, operating or maintaining of electrical wires or apparatus. The filing of the above mentioned bond shall be required previous to the issuance of any original license or the renewal of any Certificate of Registration in existence at the time of passage of the ordinance.

For the purpose of ascertaining the qualifications of the applicant and of the supervising electrician, the Mayor shall appoint an Examining Board of five members to consist of the following: Commissioner of Gas and Electricity, chairman; one member to be selected from the Board of Underwriters of the City of Chicago, one member to be a general electrical contractor regularly engaged in the contracting business in the City of Chicago, one member to be a journeyman fixture hanger who has had at least five years of practical experience, and one member shall be a journeyman electrician who has also had at least five years of practical experience. Such members shall hold office for a period of one year or until their successors are duly appointed. It is also provided that the Examining Board shall have power to adopt the necessary rules and regulations for the licensing of electricians and for the examination of supervising electricians and such examinations shall be conducted by the oral and written method and the judgment of the board as to whether or not an applicant or supervising electrician is qualified and has sufficient experience and knowledge for the particular class of license applied for shall be final.

Where a Certificate of Registration is in existence at the time of passage of this ordinance a renewal of such Certificate shall only be made within the classification previously placed on such Certificate by the Commissioner of Gas and Electricity, and for the purpose of transferring to or renewing a Certificate of Registration in any other class, as provided for herein, the Supervising Electrician must submit to and properly pass an examination such as will determine his experience and qualifications to act as Supervising Electrician in the particular class of business to which he desires to transfer.

The ordinance also provides that all licenses issued are transferable, but such transfers cannot be made until transferee has complied with all its terms. The supervising electrician may also be replaced at any time, providing the new man shall comply with the terms. No fee is to be charged for such transfers.

The Board of Examiners will meet as often as it deems necessary and must act on all applications within 45 days from the date of filing. Applications must be filed 15 days before the time set for the examination. The Board of Examiners also may recommend the revocation or suspension of a license for any violations. A license may be suspended by the Commissioner of Gas and Electricity for a period not to exceed 30 days and may be revoked by the Mayor.

The ordinance also provides for the following payment of fees:

Wiring only for lighting circuits (not including fixtures, sockets or receptacles). For the inspection of each complete branch lighting circuit of 660 watts or less a sliding charge is made ranging from $1 for the first circuit to 40 cents for each circuit over 25. For the inspection of each complete branch lighting circuit of larger capacity than 660 watts the charge shall be in proportion to the wattage of such circuit. For the inspection of additional outlets on existing circuits: 20 cents for each outlet on which a socket, receptacle or fixture will be attached.

Electrical fixtures, sockets and receptacles (not including the circuit feeding same). For the inspection of fixtures, sockets or receptacles for lamps of nominal 50 watts capacity the charges range from 50 cents for from 1 to 15 lamps to 25 cents for each group of 25 or less in quantities above 200. For lamps of larger or smaller capacity the charge shall be in proportion to the wattage of the lamp. For the inspection of both circuit wiring and fixtures, sockets or receptacles: The aggregate sum of the fees as shown above for wiring and for electrical fixtures.

For the inspection of each electrical horsepower of 746 watts used for mechanical or other purposes than above mentioned, the sum of $1 for each horsepower from 1 to 5 hp., inclusive for each of the next succeeding 5 hp., 75 cents; for each of the next succeeding 5 hp., 65 cents; for each of the next succeeding 10 hp., 55 cents; for each of the next succeeding 25 hp., 50 cents; for each of the next succeeding 200 hp., 25 cents; for each of the next succeeding 250 hp., 10 cents; and for each additional horsepower, 5 cents.

Inspections of electric lights, other than electric signs as herein defined, placed on a public street or alley for the purpose of illuminating the same, temporary installations for show window exhibitions, conventions and the like, underground or overhead wires and apparatus, and all other inspections not specifically provided for herein, shall be charged for according to the time required for such inspections at the rate of $1 per hour. Reinspection shall also be charged for at this rate.

The fee for all signs projecting at right angles or obliquely from the building against which same are placed, whether such signs are vertical or horizontal, and not being flat signs as hereinafter described, shall be computed at the rate of 15 cents per annum per square foot of sign surface on each illuminated side of such sign. The fee for all signs placed against a building running parallel thereto and not projecting obliquely or at right angles therefrom shall be computed on a sliding scale, based on lamps of 50 watts capacity, varying from 10 cents each for the first 25 lamps to 4 cents for each additional lamp above 300.

IMPORTANT CONSIDERATIONS IN SELECTING AN ELECTRICAL CONTRACTOR.

Interesting Pamphlet on This Subject Being Distributed by Louis Kalischer, Inc., Brooklyn.

"Important Considerations in Selecting an Electrical Contractor" is the title of a pamphlet recently published by Louis Kalischer, Inc., 1225 Myrtle avenue, Brooklyn, N. Y. This pamphlet, which is intended for distribution among manufacturers and users of industrial apparatus, brings out very clearly the importance of properly selecting a competent electrical contractor to install the electrical equipment for an industrial enterprise.

"The electrical equipment of an industrial plant," the article states, "is conceded to be of vital importance to its successful commercial operation.

"The maximum result of an efficient design in manufacturing is based on continuity of service, and it is within the range of possibility that the best and most carefully thought out plans to accomplish this may be seriously affected by improper or inadequate consideration of the electrical equipment.

"Changes in manufacture to accomplish higher efficiency may be met at times without great effort or expense, but this does not always apply to the electrical equipment, therefore, greater care must be exercised in the original layout. Furthermore, the entire electrical equipment of a plant is installed at the inception of the building project and is considered a building or one-time operation. In selecting an electrical contractor to undertake the work, it is important that the results of previous experiences in the same or similar lines of business should be taken advantage of, as an inefficient design of a plant constitutes a continuous loss.

The article then relates the experience of Louis Kalischer, Inc., and describes the facilities of this company which enable it to meet these requirements satisfactorily. In addition to a competent, practical engineering force this company has also put into effect an up-to-date follow-up system by which a check is kept on material and apparatus deliveries from manufacturers and eliminates to a considerable extent the difficulties often encountered by poor deliveries. "Service Plus Satisfaction to the Customer" it explains, has always been the keynote of the business.

This company is now erecting a new building at 288 Livingstone street, Brooklyn, where it will conduct a modern electrical retail store and carry a complete stock of all electrical devices of standard merit.

IOWA CONTRACTORS MAKING PLANS FOR ANNUAL CONVENTION.

The Iowa State Association of Electrical Contractors and Dealers plans to hold its next annual convention in Sioux City, Iowa. The exact date of the meeting has not been definitely determined as yet but indications are that it will be held during the last week of September. F. Bernick, Jr., Oskaloosa, Iowa, is secretary of the association.

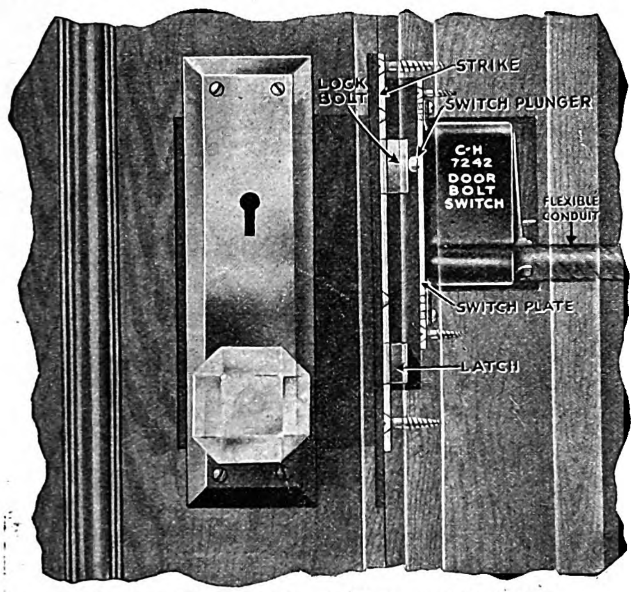
New Appliances

Door-Bolt Switch for Hotels — Cutter Outdoor Line and Disconnect Switches — Volt-Ammeter for Automobile Use

New Door-Bolt Switch for Hotel Guest Rooms.

To prevent the wasteful use of electric light in their guest rooms, hotels and clubs often display in each room a sign reading, "Please turn out the lights when leaving the room." The new C-H door-bolt switch, which has been developed by the Wiring Device Department of the Cutler-Hammer Manufacturing Co., Milwaukee, Wis., accomplished what the sign aims to do. When the occupant of a room leaves and locks the door from the corridor side, this switch is operated by the lock bolt, the lights within the room are cut off, and the wall switch made inoperative. When the door is unlocked the wall switch may be used to control the lights. This new door-bolt switch, although similar in shape to the well-known C-H door switches, is operated by the lock bolt of a two-bolt lock, such as is generally used in hotels. The new switch is mortised in the lock side of the door jamb in back of either a flat or box strike, and is connected in series with the regular wall switch that controls the lights within the room. As it is customary to install the regular wall switch conveniently near the door, very little additional wiring is necessary for the installation of the door-bolt switch.

The accompanying illustration shows the details of this new device and how the movement of the lock bolt will push against the switch plunger and thus open the switch. In this phantom view the switch is shown mounted in the door jamb with wood screws. The switches can also be mounted on the strike by using spacers and machine screws, the latter furnished with the strike, two holes being tapped in the switch plate for the screws. Being purely a mechanical device, the life of this switch should be as long or longer than the ordinary wall switch. Since it works with the locking of the door, the reader will readily appreciate that its regular use is practically automatic and that it will be instrumental in the saving of much lighting current to the hotel manager.



Phantom View of New C-H Door-Bolt Switch.

New Line of Outdoor Load and Disconnect Switches.

This is the age of urban and interurban electric power distribution. Not only do many city employed people live far out in the country and require city conveniences, but the farmer is fast becoming a convert to the use of electric power and light. Many manufacturers are moving out also to obtain the advantages of cheaper sites, lower taxes, lower insurance rates, more stable labor, etc., and the factories are especially good electric power customers.

Then, too, the small rural towns and communities can be served with a profit to the public utility if the cost of the substation for stepping down transmission voltages can be kept reasonably low and not require continual care by an operator. During the past ten years this business has been rapidly expanding because of the development of outdoor protective and switching equipment. There still remains much to be desired in the way of reliability for outdoor equipment. The utility man will therefore be especially interested in the following announcement:

The George Cutter Co., South Bend, Ind., is placing on the market the first items of a line of high-tension transmission equipment which will be sold under the trade name of "Clear Break Equipment."

The first of these items is an outdoor, air-break switch which is designed for rupturing load current under the most severe conditions. This switch is designated the type "T" switch and will be furnished regularly in 150-200-ampere capacities and for rated voltages of 22,000, 33,000, 44,000, 55,000 and 66,000. Developments now under way will take care of voltages of 90,000 to 150,000 and higher, if desired.

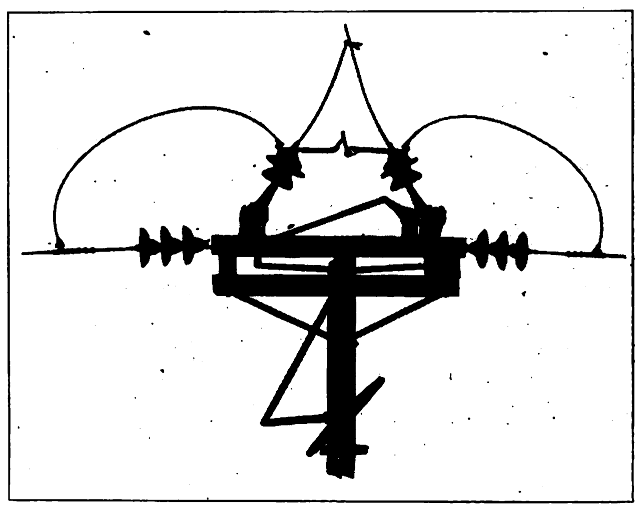


Fig. 1.—Cutter Type "T" 33,000-Volt Switch in Closed Position.

These switches will be furnished hand-operated, automatic or non-automatic overload release, also motor-operated, automatic or non-automatic overload release. Inasmuch as standard series and shunt-trip mechanisms will be used in connection with standard circuit-closing relays, time-element devices are readily applicable. The switches may be obtained in one, two or three-pole arrangement and are readily mounted on wooden poles or steel towers.

Regularly the 22,000 and 33,000-volt switches are designed for mounting on a framing arranged on one pole. The 44,000 to 66,000-volt switches, which are considerably heavier and with wider phase spac-

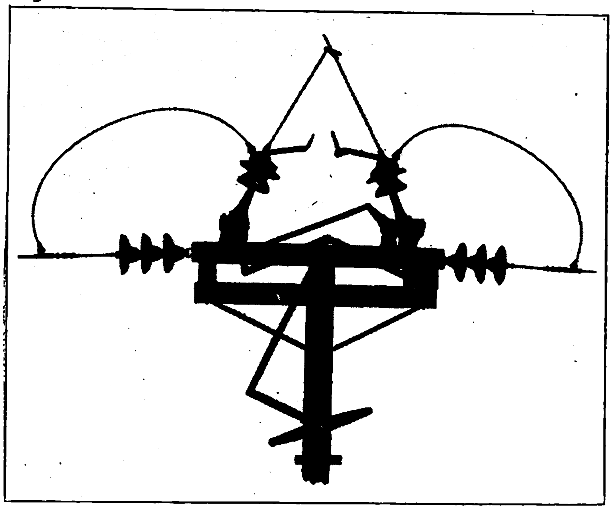


Fig. 2.—Same Switch Partly Opened with Auxiliary Contacts Ready to Open.

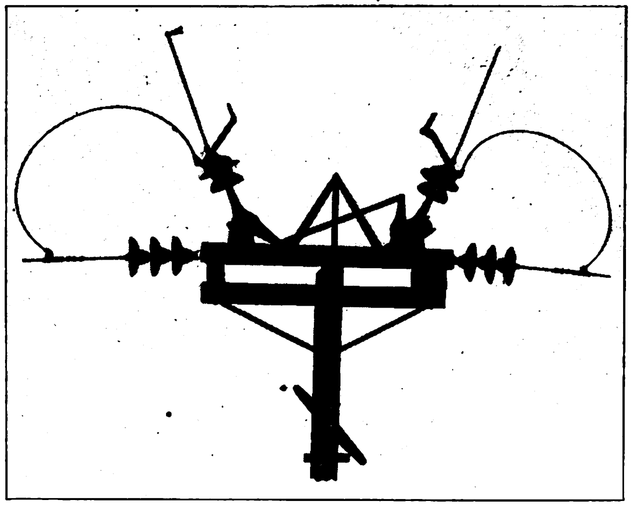


Fig. 3.—Same Switch Entirely Opened, Showing Wide Separation of Contacts.

ings, are arranged for mounting on two wooden poles. The construction, however, is such that they are readily adapted to suit almost any condition.

The second item to be announced at this time is a line of switches known as the type "D," which are designed for disconnect purposes only but are arranged to operate all legs of the switch simultaneously from a ground lever which may be readily locked in either the open or closed position.

The especially novel feature in connection with the type "D" line of switches is the fact that only a pole and the strain insulators for dead-ending are required for mounting the switch. The switch framework, consisting of 3 by 4-inch angles, furnishes the necessary double arming for dead-ending the lines on each side.

These switches are furnished with insulators rated at 22, 33, 44, 55 and 66 kilovolts and all give a little more than 2 ft. of clear separation between live parts when switches are in the open position. No auxiliary contacts are provided on the type "D" line of switches to prevent blistering of the main contacts in case of opening with line current.

A very noteworthy feature of both the types "D" and "T" switches is what is known as the spring type of contact for the main current-carrying capacity. These contacts are identical for all of the type "T" and "D" switches rated from 22 to 66 kilovolts and consist of a multiplicity of parallel spring wires, each seating in a "V" notch in the other member of the contact and arranged to be bent back when in the closed position so as to exert a pressure against the notch. This insures a constant large carrying capacity by each one of these wires, which under tests of 10 to 12 times their rating have shown no injurious results. This contact was designed to meet the great demand for a contact which would stand up and continue to give satisfactory service under ice conditions and would also not weld electrically and prevent opening. Good seating is insured by a wiping action.

The type "T" switch is provided with an auxiliary or arcing contact (not a horn), which ruptures the line current at its tip when opening. The arc is thus drawn at a point well above the grounded framework and is drawn in a vertical plane parallel to the phases. This prevents shortening of phase spacing in opening and this, in connection with the quick, long break given, insures prompt interruption of the current.

The 22,000 and 33,000-volt type "T" switches have a phase spacing of 6 ft. and in opening stretch the arc to 6-ft. length. The 44, 55 and 66-kilovolt type "T" switches have a phase spacing of 8 ft. and in opening stretch the arc to 8-ft. length. The 90 to 150-kilovolt type "T" switches will be furnished regularly with phase spacings of from 12 to 15 ft. and will stretch the arc in opening from 14 to 18 ft.

On all of the type "T" and "D" switches for voltages from 22,000 to 66,000, standard pin-type insulators with ¾-in. separable thimbles are used and the insulator caps are held on by especially formed rings in the groove under which setscrews in the cap are engaged, forcing the cap down rigidly onto the top petticoat of

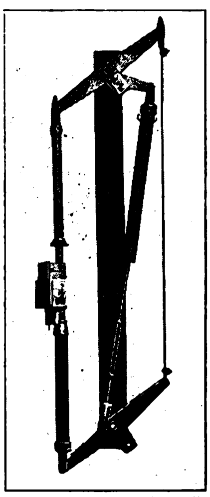


Fig. 4.—Hand-Operated, Automatic Overload Release and Special Operating Mechanism.

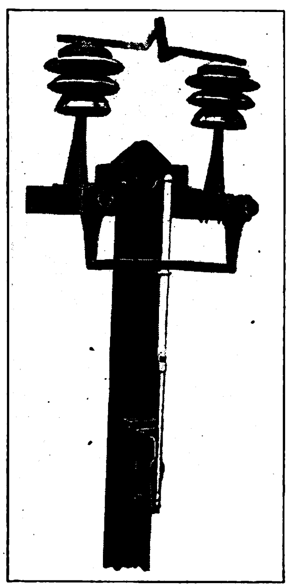


Fig. 5.—Cutter Type "D" 44,000-Volt Disconnected Switch in Closed Position.

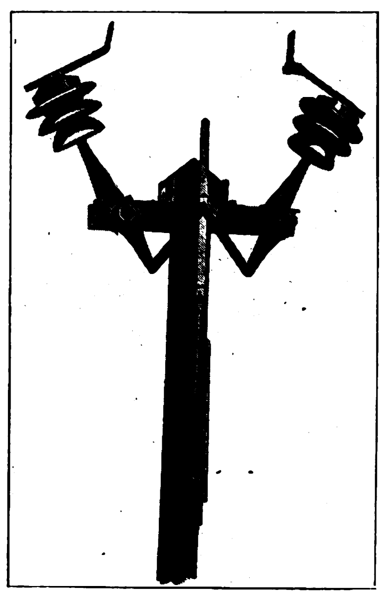


Fig. 6.—Same Switch in Wide Open Position.

the insulator. The setscrews exert no direct pressure against the porcelain. Type "T" switches for voltages above 66,000 will be equipped with built-up post-type insulators.

Any of the type "T" switches can be furnished with outboard insulators mounted on an extension of the channel-iron support and with rigid pantograph-type line connector between the rotating and the stationary insulators. This latter arrangement is for use where switches are units of power and substations and line spans thus terminated.

Fig. 1 shows one leg of a type "T" 33,000-volt switch in closed position with the upper operating mechanism for hand operation. The ground lever is not shown. Fig. 2 shows the same switch partially opened until the main contacts are disengaged sufficiently to prevent re-establishing of the arc and the auxiliary contacts, at their tips, just at the point of separation. Fig. 3 shows the same switch in the wide open position and the long break between auxiliary contacts. The action of the No. 0 copper-clad flexible line connectors is readily seen from these three cuts.

Fig. 4 is a hand-operated, automatic overload release and operating mechanism for mounting in place of the regular ground hand lever. This mechanism is equipped with trip coils for operating from the secondaries of current transformers or may be furnished with mechanical trip from series of trip coils mounted on top of outboard insulators or any other suitable adjacent insulators.

Solid steel wire is used to connect the two ends of the upper operating lever on the switch Fig. 1 with the corresponding two clevis ends on the top lever of this automatic device, which is placed directly below at the foot of pole. The lower lever arm of this automatic device is locked in its present position by means of a latch and bolted on the arm, which are not shown. In case of overload either one or two strip coils, placed in the housing, midway up on the left, will trip a catch, which is also in this housing, and allow a heavy coil spring in the pipe housing on the right side to rotate the upper lever through 90°, the lower lever arm remaining fixed until released by the operator and brought back to again engage the trip catch. The switch can then be closed again, if desired, but cannot be held closed in case the overload condition still exists.

Fig. 5 shows one leg of the type "D" switch for 44,000-volt service with ground operating lever and push rod shortened to show in the picture. This view shows switch in the closed position. Fig. 6 shows the same switch in the open position.

The type "D" switch is furnished without the regular flexible line connector except when ordered. As the angle of rotation is small, the use of solid hard-drawn copper wire bolted rigidly to the switch arm and the line wire, with loop for flexibility, is ample.

It will be noted that holes are provided in the ends of the cross angles for terminating line wires through strain insulators. The stringer angles on the type "D" switch are extended on each side of the pole so as to give a 3 ft. 8-in. phase spacing on the 22,000 and 33,000-volt switches and 6 ft. on the 44,000 to 66,000-volt switches. A double angle brace is provided for each stringer angle, giving ample rigidity of construction.

This equipment was designed by an engineer who has spent years in the study of outdoor substation equipment with a view to eliminating troubles being encountered, and these troubles as summarized may be stated as follows:

Failures are due generally to:

1. Striking between phases when opening.
2. Striking to ground when opening.
3. Contacts burning and welding so they cannot open.
4. Contacts freezing from ice so they cannot open nor flow.
5. Mechanical shock or blow to insulators, causing breakage and failure of same.
6. Insulators often under torsion, causing separation of units and failure.
7. Dependence on horns to carry arc upward and stretch to rupturing length.

It is the belief of the engineering department of the George Cutter Co. that to a large extent the difficulties and failures enumerated above have been eliminated. This is borne out by the fact that several of the type "T" switches have been giving excellent satisfaction for more than five years. A number of improvements have been added to the original design which add materially to the merits of the design and to the serviceability. Further, at the National Electric Light Association convention held at Atlantic City, N. J., May 19-22, where samples of this equipment were exhibited, engineers were unanimous in their high praise.

New Automobile Type Volt-Ammeter for Testing Lighting and Starting Systems.

Troubles in the lighting and starting systems of gasoline automobiles are not very frequent, but when they occur they are very vexatious and hard to locate. To facilitate the location of trouble it is essential to have a convenient and dependable measuring instrument for determining current and voltage.

An instrument of this type especially designed for this service has recently been placed on the market by the Roller-Smith Co., 233 Broadway, New York City. It is known as the "Handy" auto type volt-ammeter. The illustration herewith shows at a glance the appropriateness of this name, since the instrument has dimensions of only 4 by 5 by 2 in. and its weight is only 20 oz. The instrument is of the permanent magnet and moving-coil type, giving dead-beat indications and providing uniform divisions of the scale. The instrument most commonly used for this purpose has six ranges, of which three are for voltage and three for current measurement. The former include a scale of 0-75 millivolts, which is useful in making tests of commutators; a scale of 0-3 volts for testing voltages of individual dry cells or storage cells; a scale 0-30 for testing battery voltages of lighting and starting batteries of any of the usual combinations up to 12-cell batteries. The current scales are 0-3, 0-30 and 0-300, the first being used for testing current taken by lamps, ignition circuits, etc., the second for testing generator output, charging current, etc.; and the last for testing the starting current. For use as an ammeter, the instrument is provided with three shunts which are all mounted on base with suitable terminals for convenient connection to the instrument and the circuit being tested. These instruments are also made in several other ranges. A special leather carrying case for the instrument, shunt and the connecting leads can be provided at a small additional expense. These instruments are especially suitable for use in garages and service stations.

"Handy" Volt-ammeter for Automobile Testing.

Trade Activities

New Agency for Green Engineering Co. — Jewell Instrument Sales Organization — Many Electric Furnaces Sold

The Sierra Electric Co., San Francisco, Cal., has been appointed Pacific Coast distributer for the Chicago Solder Co., maker of Kester self-fluxing wire solder. Both acid-core and rosin-core solder will be carried in stock.

Boyle Engineering Co., Cincinnati, Ohio, announces that it is now occupying its new building at 2023 Reading road. This company handles all kinds of electrical equipment for automobiles, and represents 18 electrical organizations.

The Electric Appliance Co., Seattle, Wash., has moved from 118 Spring street to 1214 Third avenue, where a large store room has been fitted up for handling general electrical appliances. The company is now specializing in washing and ironing machines.

The Central Electric Co., Chicago, Ill., has issued price list 39-A, which applies to the company's general catalog No. 39 and is unique in the fact that it carries, along with the prices in that catalog, addenda pages listing new or redesigned devices that have not been previously included.

The Electric Products Co., manufacturer of Wotton battery-charging motor-generators and rheostats, vehicle motors, controllers and switchboards, Cleveland, Ohio, has just opened a branch office in Detroit, Mich., at 2306 Dime Bank building. E. H. Bridge has been placed in charge as district manager.

Surf Manufacturing Co., Milwaukee, Wis., manufacturer of electric washing machines, has acquired 14,000 sq. ft. of the building at 109-113 Clinton street. The new company, which has recently completed its organization, is capitalized for $100,000, and expects to build more than 5000 machines during the coming year. It is said that the product of the company employs an entirely new principle of mechanical washing. The officers of the company are as follows: O. F. Fischedick, president; J. Hoffman, vice-president; A. Schmidt, secretary, and A. W. Kerhan, treasurer.

Cutler-Hammer Manufacturing Co., Milwaukee, Wis., is furnishing to dealers who handle C-H electric irons and other C-H electrical appliances a new four-page two-color folder which has for its title "The Aristocrat of the Laundry," illustrative and descriptive of the C-H electric iron. These irons are made in four sizes, 3, 6, 7½ and 9 lb., three of which are illustrated in the folder. The cords of all C-H irons are equipped with the C-H 7050 switch, which is being advertised in the national and trade media as well as by direct mail. Space is provided on page 4 of the folder for the dealer's imprint.

International High-Speed Steel Co. announces the removal of its New York City office to 294-6 Lafayette street—129-31 Crosby street. The general business of the company will hereafter be conducted from its works at Rockaway, N. J.

Simplex Electric Heating Co., 85 Sidney street, Cambridge, Mass., is sending out two new and attractive display cards, 9¼ by 11 in., printed in colors, one featuring the Simplex electric iron and the other the No. 27 domestic range. These are being sent to the leading distributers of Simplex products with the request that they order for themselves and their customers the quantity which they can use to advantage.

The American Steam Conveyor Corp., Chicago, Ill., has just announced the appointment of H. S. Valentine as sales engineer in charge of Philadelphia territory. An office has been established in the North American building, Philadelphia. Mr. Valentine is an experienced mechanical engineer and was connected with the Link-Belt Co., Philadelphia, for five and one-half years, with the Brown Hoisting Machine Co., and Yale & Towne Manufacturing Co. for six years, and with the Badenhausen Co. for one year.

Novo Engine Co., Lansing, Mich., has issued an instruction book and repair list for Novo engines (No. 819); this is a valuable reference book for those employing this type of engine. A detailed description of the principles of operation as well as instructions for installation and operation are given, accompanying which are many diagrams to clarify the text. The company has also issued Bulletin No. 18 entitled "Novo Reliable Power" containing a detailed description of the Novo engine. It points out the salient features of this engine and the advantages of the vertical design. Illustrations of various types of engines are included.

Allis-Chalmers Manufacturing Co., Milwaukee, Wis., has issued Catalog No. 107, illustrating and describing its ore concentrating machinery and equipment. This includes crushers, rolls and ball granulators, sizing and classifying apparatus, concentrators, elevating, conveying and transmission machinery, power-generating and electrical equipment, pumps, etc. The catalog contains 112 pages, printed on a very fine grade of paper and the back inside cover gives a list of the district offices, foreign district offices, Canadian representatives and foreign sales agencies. Page 112 gives an alphabetical list of Allis-Chalmers' principal products. The cover is in four colors and shows a typical concentrating mill.

Blaw-Knox Co., Pittsburgh, Pa., announces the appointment of K. C. Murray as an engineer-salesman in the Knox department. Mr. Murray is a graduate of the Pennsylvania State College and was for many years connected with the Carnegie Steel Co., both at the Edgar Thompson Works, Bessemer, Pa., and in the sales department. He will, for the most part, devote his activities to the steel plants in the Pittsburgh district.

Green Engineering Co., East Chicago, Ind., manufacturer of Green chain-grate stokers and related products, announces that the firm of Bull & Livensparger has been appointed as its sales representative in Chicago and northern Illinois. They have taken charge of the company's Chicago office, 14 East Jackson boulevard, and are prepared to handle all inquiries respecting Green chain-grate stokers, Sealflex arches, steam-jet ash conveyors, cast-iron ash tanks and allied products and replacements for the same. E. H. Bull has been connected with the company as an engineer for the past seven years. D. A. Livensparger has been a member of its sales force for the past nine years.

Jewell Electrical Instrument Co., Chicago, during the past two years has been pursuing a policy of concentrated sales work with representatives in the larger cities and electrical manufacturing centers in the United States, with the result that today it has a sales organization, the personnel of which is second to none. Frederick Rall, 19 Park Place, New York City, covers the state of New York, New York City and adjacent territory, George E. Linton, the Boston territory with offices at 10 High street, Boston Mass., & Benjamin B. Baseler 1716 Sansom street, Philadelphia, Pa., the territory of Philadelphia and Eastern Pennsylvania, Western Pennsylvania is covered by the Superior Engineering Co. located at Jenkins Arcade, Pittsburgh. H. L. Porter, 1202 Illuminating building, Cleveland, Ohio, covers Cleveland and Northern Ohio. Missouri is covered by C. B. Fall Co. with offices in the Railway Exchange building, St. Louis, Mo. Minnesota territory is covered by W. F. Uhl, with offices at 505 First National Bank building, Minneapolis, Minn. More Electric Co., covers the state of Colorado, its offices being located in the Gas & Electric building, Denver, Colo. L. Brandenberger, Walker Bank building, at Salt Lake City, covers the state of Utah. Nixon-Kimmel Co., Lincoln and Main street, Spokane, covers Spokane and Eastern Washington. Burton R. Stare Co., covers Western Washington and Oregon and has offices at 325 Yesler Way, Seattle, Wash. C. F. Henderson, Call building, San Francisco, covers territory of San Francisco and northern California. O. E. Thomas Co., 625 Washington building, covers Southern California, including Los Angeles, its offices being located in Los Angeles. With the exception of Filer-Smith Machine Co., in Winnipeg, who covers Winnipeg and Western Canada and the Tokiwa Co., of Tokyo, Japan, in the Orient, all foreign representation and export business is handled by the Frank E. Watts, Inc., 50 Church street, New York City.

The Electric Furnace Co., Alliance, Ohio, has just shipped to the Dayton Engineering Laboratories, Dayton, Ohio, an electric furnace for melting and refining aluminum in the Delco plant. This furnace has a hearth capacity of 500 lb. and a melting rate of 200 lb. of aluminum per hour. It is equipped with a double charging door in the front and rear, and otherwise is similar to the standard Baily electric furnace of 105-kw. electrical capacity, and 1500-lb. hearth capacity, that is used for melting brass.

The Electric Storage Battery Co., with general offices Allegheny avenue and 19th street, Philadelphia, Pa., is distributing a new booklet, Form 881-R, devoted to its "Ironclad-Exide Battery." This booklet has been revised and brought up to date. It gives a general description of these batteries with illustrations, reviews their development, and also contains a brief history of the company, which maintains "Exide" depots in Boston, New York, Philadelphia, Cleveland, Washington, Rochester, Chicago, Detroit, St. Louis, Kansas City, Denver, Atlanta, Minneapolis and San Francisco. A corps of inspectors are constantly traveling through the country coaching users of its batteries.

Roller-Smith Co., 233 Broadway, New York City, announces that it has made an agency arrangement with L. B. Gottschall, 211 North St. Paul street, Dallas, Tex. Mr. Gottschall will handle the Roller-Smith company's lines of instruments, meters and circuit breakers in the state of Texas with the exception of a small portion in the western part of the state. He has had an extensive experience in the sale and installation of electrical apparatus in his locality and his technical ability and wide acquaintance with the trade place him in an excellent position to handle the company's rather complex lines. The company is also distributing Bulletins No. 73 and 74, describing "Standard" type circuit breakers. The undervoltage, overload and combined overload and under-voltage types are furnished for both alternating and direct current, the underload type being furnish for direct current only.

Westinghouse Electric & Manufacturing Co., East Pittsburgh, Pa., has issued Circular No. 7375 describing the Westinghouse achievements in field of electrical precipitation. The process applies to copper, lead or zinc smelters, blast furnaces, chemical, acid and cement plants for the recovery of valuable material otherwise wasted. Water can be precipitated from oil, dust removed from ventilating systems, etc. It is also applicable to operations such as round houses which by their smoke or fumes are a nuisance to the surrounding territory. The necessary apparatus for the precipitation process such as motor-generators, transformers, rectifiers, motors, switchboard and accessories are shown installed, and are described in detail in this circular. While there are several mechanical and chemical methods for collecting or suppressing dust in furnace and kiln operation, they are in general limited in application by conditions of temperature, acid, and similar qualities of the product to be handled. Electrical precipitation has few limitations of this sort and is generally applicable for collecting suspended solid and liquid particles of every description, whether acid, alkaline, or from gases of widely varying temperature.

Cutler-Hammer Manufacturing Co., Milwaukee, Wis., has prepared for further publicity on the C-H Seventy Fifty switch eight two-color stickers which will be used on the outgoing mail from the company's home and eight district offices. These will be furnished to dealers, contractors, jobbers and central stations, for use on letters, envelopes, folders, packages and similar material. Four of the stickers have been prepared especially for the jobber and others who do not come in direct contact with the consumers, while the other four are especially for the dealer. They direct the customer to bring their appliances cords to the dealers to have them equipped with C-H Seventy-Fifty switches, thus following the trend of all the national and direct advertising being done on this switch of convenience and safety.

Wallace & Tiernan Co., Inc., New York, has the distinction of having its liquid chlorine apparatus for treating water used in hundreds of cities throughout the United States. It is estimated that the company's apparatus makes 3,000,000,000 gal. of water fit for consumption daily, an amount that to flow over Niagara Falls would require 44½ minutes. The average cost of the chlorination by this system is said to be less than 50 ct. per 1,000,000 gal. The company has recently issued another edition of its booklet, "Protecting the Water Supply of Greater New York." This describes how the W. & T. apparatus was adopted after a competitive test for purifying New York City's water supply, and contains also much general information on the metropolitan problem. Copies of the booklet will be mailed free upon request.

Morse Chain Co., Ithaca, N. Y., is distributing publication No. 14 revised as of June, 1919, illustrating and describing the Morse silent chain and showing a few of the many large power drives of 100 hp. up to 5000 hp. A table of data to be used in the preliminary design of Morse silent-chain drives is included. The bulletin contains full and complete data necessary for filling out the blank inquiry page and securing estimates and details of the Morse chain drive. The application of this chain for transmitting large powers has come to be recognized, not only as good mechanical practice where the specifications favor such a drive, but as highly desirable on account of its great efficiency, quiet operation, low upkeep cost and long life in many places where belts or gears could be used. The marked popularity of the Morse silent chain for the larger powers is not confined to any particular field, but is well distributed over every industry.

Edwards & Johnston, Indianapolis, Ind., is the name of a recently organized firm which will devote its services to investigations, research, engineering, accounting, supervision, management, financing, appraisals and rate cases, of electric light and power plants, gas, water, heating and telephone plants, and electric street, urban and interurban railway properties. C. A. Edwards, senior member of the partnership, was until recently and for nearly six years a member of the Indiana Public Service Commission, and formerly a banker and successful merchant. He will have personal charge of all cases before state commissions and the Interstate Commerce Commission. J. K. Johnston, the other member of the partnership, is a telephone engineer of Indianapolis. Both members of the new organization have made splendid reputations in their lines of endeavor and are especially well known in Indiana and Ohio.

The Electric Furnace Co., Alliance, Ohio, has just installed a battery of two Baily Electric furnaces at the Capital Brass Works, Detroit Mich. These furnaces are the standard 105-kw. tilting type with hearth capacities of 1500 lb. each. They will be used for melting yellow brass scrap and borings in the foundry. The Buick Motor Co., Flint, Mich., has just purchased a second Baily electric furnace for melting phosphor bronze. The furnace is of the tilting type, rated at 1500 lb. hearth capacity, and an electrical capacity of 105 kw. The Akron Bronze & Aluminum Co., Akron, Ohio, has installed a 50-kw. rectangular tilting type Baily electric furnace in its jobbing foundry. This furnace has a hearth capacity of 300 to 500 lb. and will be used for a wide variety of compositions. Heats will range from 100 to 500 lb. and will include gun metal, phosphor bronze, red and yellow brass.

Electric Storage Battery Co., Philadelphia, Pa., is distributing a new publication on the subject of the "Ironclad-Exide" battery as used on industrial trucks and mine locomotives, pointing out their importance and efficiency in the transfer of material. The industrial truck and the mine locomotive are illustrations of modern methods of haulage, and there are few up-to-date manufacturing establishments or mines that could not employ one or more of these units. They do the work of many laborers and speed up the haulage so that not only greater quantities of goods are moved but a large economy in labor is secured. The applications of electrically propelled trucks and tractors, which are found in manufacturing establishments throughout the country and used in railway and wharf haulage and mines, on which the "Ironclad-Exide" battery is extensively used, are shown. Copies of this interesting booklet may be secured from any of the sales offices of the company or by direct request to its general offices at Philadelphia.

Current News

Weekly Record of Construction Activities—Conventions

EASTERN STATES.

Liberty, Me.—Liberty Light & Power Co. has incorporated with a capital of $5000 to generate and distribute electricity for light, heat and power service in Liberty. H. W. Maitherson is president and J. P. Sanford, clerk and treasurer, both of Liberty.

Laconia, N. H.—Scott & Williams have recently broken ground for the construction of the proposed 1-story boiler plant at their works, and favorable progress is being made. The structure is estimated to cost $20,000. Lockwood, Greene & Co., 60 Federal street, Boston, Mass., are engineers for the company.

Woonsocket, R. I.—Barnard Worsted Co., 92 South Main street, has awarded a contract for the construction of a new boiler plant at its works, to be erected in connection with a new dye plant. The work is estimated to cost $14,000.

New Britain, Conn.—Considerable electric equipment, including motors, and other electrical machinery, will be required by the Hart & Hutchinson Co., Corbin avenue, in connection with the construction of a large 1-story plant, about 77 by 340 ft., estimated to cost $65,000, contract for which was recently awarded. The company manufactures steel lockers and kindred equipment.

Brooklyn, N. Y.—Announcement has been made that John H. Delaney, transit construction commissioner, has authorized the New York Consolidated Railroad Co. to contract for the construction of 100 additional steel cars for operation on the subway and elevated lines of the Brooklyn Rapid Transit System. The new rolling stock will cost about $1,628,000, or approximately $12,049 for each car body and $2117 for each motor, deliveries to be made within 14 months.

Brooklyn, N. Y.—A. Arnesen, Inc., operating an electrical contracting establishment at 312 Court street, has filed notice with the Secretary of State of a change in its corporate name to Arnesen Electrical, Inc.

Brooklyn, N. Y.—In connection with the proposed issuance of receivers' certificates for $20,000,000 by the Brooklyn Rapid Transit Co., recently authorized by Federal Judge Mayer, it is understood that a total of $5,000,000 of this issue will be used for improvements in the surface lines of the company's system.

Brooklyn, N. Y.—United States Government, Bureau of Yards & Docks, has awarded a contract to B. Diamond, 12 Bergen street, for the erection of a new extension to the substation at the local naval station.

Geneva, N. Y.—Plans have been arranged by the City Council for the immediate installation of a new electrically operated pumping unit at the municipal water works plant, to have a capacity of 4,000,000 gals. per day. The new unit will replace the two 2,000,000-gal. capacity pumps now in operation at the works. The superintendent of public works is in charge.

Lyons, N. Y.—Empire Gas & Electric Co. has filed with the Public Service Commission, Second District, a new tariff under which it proposes to establish new seasonal service power rates to all consumers within the service area having a connected 5 hp. or over and operating four months or less during the year. The company will require a guarantee of $1.00 per month per horsepower, the rates being as follows: $1.00 per month per horsepower connected, minimum 5 hp., plus 6 cents per kilowatt-hour for the first 120 kilowatt-hours' use of each horsepower connected, plus 3 cents per kilowatt-hour for all current consumed in excess of this amount. It is proposed also to arrange a seasonal charge of 50 cents per kilowatt capacity of transformer installed, to cover the cost of setting and removing transformers.

New York, N. Y.—Announcement has been made by the American Flying Club, 11 East 38th street, that plans are now in process of formation for the establishment of a chain of radio stations across the continent, in order to allow for communication of airplanes at 30-minute intervals.

New York, N. Y.—A resolution has been adopted by the Public Service Commission, Second District, calling for an investigation of the numerous complaints made by business firms as regards inefficient service recently given by the New York Telephone Co. A series of public hearings will be held commencing Aug. 8. It is understood that in connection with the inquiry, the question of rates will also be gone into.

New York, N. Y.—Effective Aug. 1, the New York Railways Co. and the Brooklyn Rapid Transit Co. have placed into operation a charge of two cents for transfers, recently authorized by Public Service Commissioner Nixon.

New York, N. Y.—Interborough Rapid Transit Co., 165 Broadway, has had plans prepared for alterations and improvements in its 1-story car repair plant at 1530-42 Lexington avenue. The work is estimated to cost about $50,000.

New York, N. Y.—New York Edison Co., 130 East 15th street, has awarded a contract for alterations in its 3-story power plant at 123 East 83rd street.

New York, N. Y.—Westinghouse Lamp Co. has recently completed negotiations for the disposal of its group of 5-story factory buildings at 510-32 West 23rd street, held at $400,000. The property is located between 10th and 11th avenues.

Niagara Falls, N. Y.—Niagara Falls Power Co. has filed application with the Public Service Commission for approval of its first and consolidated mortgage, dated July 1, to secure an issue of bonds not exceeding $75,000,000.

Atlantic City, N. J.—In connection with an ordinance recently passed by the City Commission transferring rights of the Atlantic Coast Telephone Co. to the Delaware & Atlantic Telegraph & Telephone Co., and the sale of the former company's property in Atlantic City for a consideration of about $60,000, approval has been granted by the Board of Public Utility Commissioners.

Brunswick, N. J.—Plans have been prepared by Acting Supervising Architect James A. Wetmore, Treasury Department, Washington, D. C., for the installation of new heating equipment, boiler, etc., at the local post-office building.

Hackensack, N. J.—Hackensack Water Co. has been granted permission by the Board of Public Utility Commissioners to place into effect a surcharge of 17.5% applicable to all schedules of rates existing under an order made by the Board in April, 1917.

Lambertville, N. J.—Lambertville Public Service Co. has recently completed plans for the installation of a quantity of new machinery at its local power plant, to facilitate operations. Harold R. Wilbur is manager.

Newark, N. J.—Final contracts have been awarded by the Seton Leather Co. for the construction of the proposed new tannery addition to its plant, with 1-story boiler house, estimated to cost $55,000 and $10,000, respectively. The Essex Construction Co., 87 Academy street, is the contractor.

Newark, N. J.—Krich Light Co., 70 Springfield avenue, has completed negotiations for the purchase of a 5-story brick building at 306 Market street, near Alling street, for a new establishment. The company manufactures electrical fixtures and supplies.

Newark, N. J.—Louis Sacks, operating a foundry on Wilson avenue, near Avenue L, has had plans prepared for the construction of a 1-story brick boiler plant at the works, to facilitate operations. The structure is estimated to cost $5000.

New Hope, N. J.—New Hope Electric Light Co. is understood to be considering plans for alterations and improvements and the installation of a quantity of new equipment at its power plant to facilitate operations.

Perth Amboy, N. J.—Plans are under consideration by the lighting committee of the Board of Aldermen for the installation of new electric machinery at the municipal light and power plant.

Trenton, N. J.—Board of Public Utility Commissioners has granted permission to the Eastern Telephone & Telegraph Co., operating in Camden, Gloucester and Cape May counties, to increase its rates for service.

Trenton, N. J.—Board of Public Utility Commissioners has authorized the sale of the property of the Vulcan Electric Light & Power Co. to the Cape May Court House Light & Water Co. for a consideration of about $35,072, and the issuance of stock to the amount of $24,200 by the Cape May company.

Allentown, Pa.—Lehigh Electric Co., 15-17 North Sixth street, is making alterations and improvements in its establishment, to increase the present capacity.

Catasauqua, Pa. — Lehigh Valley Light & Power Co. is planning for the immediate installation of new lighting units throughout the municipality.

Crafton, Pa.—Duquesne Light Co., Pittsburgh, has completed arrangements for the erection of a 2-story local substation on Noble street, about 24 by 83 ft., with 1-story rear wing, 42 by 40 ft., estimated to cost $45,000.

Gettysburg, Pa.—Plans are under consideration by the Town Council for the construction of a new electric light plant, to be used for municipal service.

Harrisburg, Pa. — Bell Telephone Co. has completed the removal of its offices from 208 Walnut street to larger quarters at 206 North Third street. W. H. Fetter is manager.

Harrisburg, Pa.—Bell Telephone Co. has been granted permission by the Public Service Commission to file the present rates as those to be effective after the return to private ownership by the Government of the wires, with the stipulation that a hearing should be held on Sept. 17, and notice given by advertisement for three weeks "showing in a general way the amount of such increases."

Harrisburg, Pa.—Governor Sproul of Pennsylvania has recently granted approval to the telephone merger bill passed by the Legislature. The measure provides that subject to approval by the Public Service Commission, corporation accepting the provisions of the act "may buy and own all or any part of the capital stock of any other like corporation, and may acquire, enjoy all the franchises, corporate property, rights, and credits then possessed, owned, held or exercised by said last mentioned vendor corporation" including telephone lines. The bill provides procedures for mergers.

Philadelphia, Pa. — Announcement has recently been made by the Philadelphia Storage Battery Co. of the perfection of a new storage battery guaranteed to perform substantially 100% service for a period of two years instead of 12 months. It is understood that the new battery will be placed on sale during the present month. Edward Davis is president.

DATES AHEAD.

Michigan Section, N. E. L. A. Annual convention, Ottawa Beach, Mich., Aug. 26-28. Headquarters, Hotel Ottawa. Secretary - treasurer, Herbert Silvester, Monroe, Mich.

Pennsylvania Electric Association Annual convention, Bedford Springs, Pa., Sept. 3-6. Secretary, H. M. Stine, 211 Locust street, Harrisburg.

Washington State Association of Electrical Contractors and Dealers. Annual convention, Seattle, Sept. 11. Secretary, Forrest E. Smith, 205 Boston Block, Seattle.

Southeastern Section, N. E. L. A Annual convention, Asheville, N. C., Sept. 17-19. Secretary-treasurer, T W. Peters, Columbus, Ga.

New England Section, N. E. L. A. Annual convention, New London, Conn., Sept. 22-24. Headquarters, Hotel Griswold. Secretary, Miss O. A. Bursiel, Boston, Mass.

Association of Iron and Steel Electrical Engineers. Annual convention, St. Louis, Mo., Sept. 22-26. Secretary, John F. Kelly, Empire building, Pittsburgh, Pa.

American Electrochemical Society Fall meeting, Chicago, Sept. 23-26 Headquarters, Congress Hotel. Secretary, Prof. Joseph W. Richards, Lehigh University, Bethlehem, Pa.

International Association of Municipal Electricians. Annual convention, Chicago, Sept. 23-26. Secretary, Clarence R. George, Houston, Tex.

National Association of Electrical Inspectors. Annual meeting, Springfield, Mass., Oct. 13 and 14. Secretary, W. L. Smith, Concord, Mass.

Illuminating Engineering Society. Annual convention, Chicago, Ill., Oct. 20-23. General secretary, Clarence L. Law, 29 West 39th street, New York City.

Philadelphia, Pa.—Liggett & Myers Tobacco Co. has completed arrangements for the installation of new boiler equipment at its plant at Third and Ontario streets.

Philadelphia, Pa.—Plans have been completed by the A. Schoenhut Co., Adams and Sepviva streets, for the erection of a boiler plant in connection with the construction of a sawmill to be located at Venango and Amber streets. Ballinger & Perrot, 17th and Arch streets, are architects for the company.

Philadelphia, Pa.—Schimmel Electric Supply Co., 318 Market street, has acquired the building at 232-34 Market street, about 38 by 168 ft., for a new establishment. The property was held at $135,000.

Philadelphia, Pa.—The Bureau of Water is making rapid progress on improvements in the engine and pumping equipment at the Torresdale station, to increase the capacity to about 180,000,000 gals. daily. It is understood that plans are being arranged by the department for the installation of four new pumping units for the Queen Lane station, to increase the capacity from 40,000,000 gals. to from 120,000,000 to 140,000,000 per day. Consideration is also being given to the construction of additions to the filtration plant at this latter station.

Pittsburgh, Pa.—City Council has recently authorized the disposal of the municipal pumping station located in River avenue, in the Northside district, for a consideration of about $125,000.

Reading, Pa.—Philadelphia & Reading Railway has awarded a contract to the Robert E. Lamb Co., 845 North 19th street, Philadelphia, for the construction of a 1-story brick, steel and concrete power plant, about 30 by 50 ft.

Clarksburg, W. Va.—Weston Electric Light, Power & Water Co. is considering plans for the installation of a quantity of new equipment at its plant, including electric motors, to be used for air compressor or blower, for low water centrifugal pumps, etc., new head indicating gauges, and other equipment.

Kenova, W. Va.—Ohio Valley Electric Railway Co. will expend $50,000 in improving plant at Kenova and $75,000 in improvements in Russel, Ky. Address general manager.

Logan, W. Va.—Guyan Machine Shops desire prices on 100-hp., three-phase, 60-cycle, 800 r.p.m., 2300-volt motor with flexible coupling or pulley, and 15-hp. and 20-hp. three-phase, 60-cycle hoist motors.

Piedmont, W. Va.—Plans are under consideration by the Baltimore & Ohio railroad for the complete electrification of its system over the 17-mile grade district, to facilitate operations.

Federalsburg, Md.—Eastern Shore Gas & Electric Co. is making rapid progress on the rebuilding of its line between Federalsburg and East New Market, changing it from a single-phase to a three-phase system, to provide for increased capacity. It is understood that the company is arranging plans for the erection of a new outdoor substation on property recently acquired.

Security, Md.—Breakage, caused by a stroke of lightning on July 28, caused the suspension of operations at the large local power plant, placing out of service the entire Hagerstown & Frederick railway system which supplies power and light throughout western Maryland, northern West Virginia, and the southern part of Franklin county, Pa. An auxiliary local plant was placed into service, and work on repairs is progressing rapidly.

Dover, Del.—Central Power Co., of Chicago, a Delaware incorporation, has filed notice with the Secretary of State of an increase in its capitalization from $1,750,000. to $3,000,000.

Dover, Del.—Keokuk Water Power Lighting Co. Capital, $400,000. To operate electric light and power utilities at Keokuk, Ia. Local incorporators: L. A. Irwin, M. L. Rogers and W. H. Singer.

Wilmington, Del.—Announcement has been made by the Electric Specialty Co., 849 Tatnall street, that a new branch establishment will be inaugurated at 827 Market street.

Bakersville, N. C.—Bakersville Milling, Light & Power Co. is considering plans for the erection of an electric plant, estimated to cost $10,000. R. T. Teague is manager.

Charlotte, N. C.—Southern Power Co. is understood to be considering plans for the construction of a new electric substation at Marshville to furnish electric power to the city, which has recently voted the issuance of bonds for $300,000, for the construction of a municipal electric system.

Hayesville, N. C.—Public Service Co. has incorporated with a capital of $125,000; incorporators are G. H. Haigler, W. J. Winchester and others. Purchased and will enlarge electric plant, develop water power on Shooting Creek, and other streams, supply city with electricity, also drill well for water supply, erect flour mill, ice and cold-storage, creamery, etc.

Gaffney, S. C.—Plans are under consideration by the Board of Public Works for the installation of a street-lighting system of the "white way" type.

Elberton, Ga.—An election will be held Aug. 27 to vote on $15,000 bonds for the extension of the light, water and sewer systems. Address the mayor.

NORTH CENTRAL STATES.

Columbus, O.—Increases in the demand for electric current from the municipal light plant will necessitate improvements and additional equipment which will cost $39,497 and to take care of these demands Superintendent Lewis Rowe has recommended to Service Director Geo. A. Borden that council authorize a bond issue of $40,000.

New Concord, O.—Bonds to the amount of $35,000 have been voted to purchase a water works and electric light plant.

Chicago, Ill.—Byllesby Engineering & Management Co. has been incorporated under Delaware laws with a capital of $10,000,000 as an affiliated organization to H. M. Byllesby & Co., Inc., Chicago.

Marquette, Mich.—Architect Thos. W. Orbison, Appleton, Wis., has prepared plans for $150,000 light and power plant to be erected by City Commission of Marquette; the building will be brick and steel, reinforced-concrete construction, including steam heating, plumbing, brick interior finish. The specifications include electrical equipment. Contracts will be let by city clerk.

South Haven, Mich. — The City Council is planning ways and means to secure additional electric power. Address city clerk.

Atlantic, Ia. — Architects D. S. Fisher & Co., Davenport, have prepared plans and will let contracts for $26,000 power plant addition to be erected by the city. The building will be brick construction, 15 by 18 ft. in dimensions, including steam heating, plumbing, fireproof interior finish. Generators, pumps, motors, etc., will be purchased for electric lighting. Address city clerk, Atlantic.

Stout, Ia.—A meeting was held to organize a company for the purpose of building an electric line from Dike to Stout and from Stout to Fern. Address village clerk.

Storm Lake, Ia.—On Aug. 11 the citizens will vote on a proposition to issue $100,000 in bonds for the erection of a municipal electric light, heat and power plant. It is believed the proposition will be carried.

Terrill, Ia.—On Aug. 18 the people of Terrill will hold a special election for the purpose of voting on the proposition of issuing $6000 in bonds for electric lights and the granting of a franchise to Charles Larson, of Spencer, to furnish power for the town.

Traer, Ia.—Municipal light bonds for $50,000 have been authorized.

Wapello, Ia.—Bids will soon be advertised for the installation of a new pumping plant in the lower end of the No. 13 drainage district. Charles Young, engineer.

Kirksville, Mo.—The local light and power plant was damaged by fire; loss $15,000.

SOUTH CENTRAL STATES.

Frankfort, Ky.—Kentucky & West Virginia Power Co., recently incorporated with a capital of $6,000,000, has acquired the system of the Kentucky River Power Co. at Hazard, aggregating in value about $1,000,000; the $1,000,000 plant of the Rug River Electric Co. at Sprigg, W. Va., and the power station of the Logan County Light & Power Co. at Logan, W. Va., valued at $500,000. It is understood that additional power properties will also be developed by the new organization. R. E. Breed, president of the American Gas & Electric Co., Philadelphia, Pa., is interested in the company.

Louisville, Ky.—Wm. C. Krauth Electrical Co., 113 West Market street, will construct brick addition and install machinery. Wm. C Krauth, president.

Owensboro, Ky.—Kentucky Electric Lamp Co. has awarded a contract for the construction of a 3-story brick and concrete plant, about 60 by 200 ft., for the manufacture of electric lamps. The structure is estimated to cost $20,000. It is proposed to increase the present capacity of the company from 3000 to 8850 lamps daily. Ray Burlew is secretary.

Wolfpitt, Ky.—McKinney Steel Co. will expend $60,000 in building power house for which considerable electric equipment will be purchased. Address general manager.

Centerville, Tenn.—City Council is arranging plans for the construction of a new municipal electric light plant. Bonds to the amount of $15,000 have been voted to cover the cost of the proposed work.

Knoxville, Tenn.—The Knoxville Gas Co. will remodel plant, for which $12,000 will be expended. The remodeling and installation of new machinery will be started at once and the work will be completed in about six weeks.

Nashville, Tenn.—Plans are being arranged by the City Council for extensive improvements and alterations in the municipal electric light plant. The work is estimated to cost $48,000.

Birmingham, Ala.—In connection with the recent issue of notes for $6,000,000, the Sloss-Sheffield Steel Co. set aside an appropriation of $1,250,000 for the electrifying of its mines in the Birmingham coal and iron district.

DeRidder, La.—City officials planning for the issuance of bonds of $100,000 to provide for the installation of a municipal electric light system and waterworks plant.

Frederick, Okla.—City will install lamps; $40,000 bonds. Address mayor.

Bryan, Tex.—The City Commission has ordered an election here for Aug. 26 to vote on issuing $75,000 bonds, the proceeds to be used in purchasing the electric light and power plant from H. T. Lawler & Sons. If the plant is purchased it will be enlarged and otherwise improved.

Dallas, Tex.—Dallas Power & Light Co. has increased its capital stock from $1,000,000 to $2,500,000. It plans important extensions to its power transmission system.

Dallas, Tex.—It is stated by J. F. Strickland, president of the Texas Electric Railway Co. and the Dallas Railway Co., that the interests which he represents will begin the construction of an interurban electric railway out of Dallas on or before Nov. 1. In an agreement entered into between the Texas Electric Railway Co. and the City Commission it is provided that the line shall be completed within 18 months from the time the work is started and that the road must be at least 30 miles in length. Mr. Strickland said that the proposed road may be built either to Terrell, Greenville or Denton. This is the first of three interurban lines arranged for when the street-railway franchises in Dallas were granted.

Fort Worth, Tex.—The local telephone company is engaged in the installation of additional facilities for the purpose of improving the local and long-distance service that will require the expenditure of about $50,000. The improvements will include underground cable extensions, the installation of switchboards, etc.

Houston, Tex.—Houston Light & Power Co. will install a 10,000-hp. turbine-generator and extend its transmission system.

WESTERN STATES.

Grand Junction, Colo.—A movement has been started at Collbran for the installation of a hydroelectric plant to supply light and power to practically every section of the Plateau Valley.

Boise, Ida.—Idaho Power Co. plans erecting a transmission line to connect its eastern and western systems in southern Idaho, and it is proposed to build a line from Shoshone Falls to American Falls to connect at the latter place with the Utah Power & Light Co.'s system. The Idaho company has completed a 4000-hp. unit at lower Salmon Falls, south of Twin Falls, and it is now proposed to build a 6000-hp. hydroelectric plant at Thousand Springs on Snake river, to reinforce its system of power production.

Ogden, Utah.—An electric line may be built from Ogden, along 21st street, to the district west of the city. John S. Lewis is president of the company.

Bellingham, Wash.—At a meeting of the Kullshan Civic Improvement Club plans for extending the electric light line to the vicinity of Lake Padden were discussed.

Portland, Ore.—Construction of a $3,000,000 radio station to be located at the mouth of the Columbia river is being considered by the Federal Government.

Scofield, Ore.—A large mill is being built on the ground where fire recently destroyed 5,000,000 ft. of lumber, the sawmill, planing mill, power house and electric lighting plant. The Standard Lumber Co. is owner.

Santa Monica, Cal.—The arc lamp lighting throughout the Palisades section of the city is to be replaced soon by ornamental post lights in many of the streets. Specifications are at the office of the superintendent of public works.

Oakdale, Cal.—Calaveras Copper Co. has in preparation plans for a reservoir and power plant to supply electricity to the plant at its mines in Copperopolis.

MEXICO.

Monterey, Mexico.—According to announcement made by the Department of Communications and Public Works of the Mexican government, it has just entered into a contract with the Mexican Tramways Co., Ltd., for the resumption of construction of the interurban electric line that is to run between the City of Mexico and Puebla, about 130 miles. The construction of this line was started about 12 years ago but before much progress had been made the revolutionary activities caused a suspension of the work. Later the lines of the company were taken over by the Mexican government, and, if they have been turned back to their owners, it is only recently that this was done. The company is composed of Canadian and English banking interests and was headed by the late Dr. F. S. Pearson of New York, who lost his life in the sinking of the *Lusitania*. The same interests own the great hydroelectric plant at Necaxa which generates about 100,000 hp. of electricity. This power is transmitted to the City of Mexico, 96 miles, to El Oro, 54 miles, and to other points. The proposed interurban electric line to Puebla will traverse a route that passes close to the foot of Mt. Popocatepetl and Ixtaccihuatl volcanoes.

Tampico, Mexico.—The Mexican government has granted a concession to the National Norwegian Co. for the construction of an interurban electric railway between Tampico and Tuxpam, about 120 miles, with branch lines to several smaller towns in the oil-producing territory. The route of the proposed main line will closely follow the Tampico-Tuxpam intercoastal canal. The National Norwegian Co. is composed of large banking interests of Copenhagen. It was organized under the laws of Mexico only a few months ago for the purpose of operating in the oil fields of the Gulf Coast region. From the very beginning it met with marked success in developing large production of crude petroleum. It has established its principal office in Tampico.

PROPOSALS

Cable.—Bids will be received by the commissioner of gas and electricity at his office, Room 614, City Hall, Chicago, Aug. 11, for furnishing and delivering to the city of Chicago, in accordance with specifications on file in the office of the commissioner and in the following approximate quantities: No. 19 B. & S. gauge paper-insulated, lead-covered, fire-alarm cable; 79,200 ft. of 15-pair, 72,800 ft. of 30-pair, No. 16 B. & S. gauge rubber-insulated, lead-covered, fire-alarm cable; 5000 ft. two-conductor and 5000 ft. four-conductor cable. Address William G. Keith, commissioner of gas and electricity.

Copper Wire.—The Department of Purchases and Supplies, New Municipal Courts building, Detroit, Mich., will receive bids until 10:30 a. m., Aug. 14, for furnishing the Board of Fire Commissioners with 50 miles of No. 10 B. & S. gauge, triple-braid weatherproof hard-drawn copper wire.

Electric Work.—Until 7:30 p. m., Aug. 12, bids will be received by Arthur Davenport, secretary of Dorranceton Borough, Wilkes-Barre, Pa., for the erection of a town hall and installation of heating, plumbing and electric work. E. E. Joralemon, architect, 547 Franklin street, Buffalo, N. Y.

Electric Work.—Until 3:15 p. m., Aug. 16, bids will be received by the Board of Education, Sussacunna, N. J., for general construction, plumbing, and electric work for the proposed alteration and additions to Port Morris school building. Rasmussen & Wayland, architects, 1133 Broadway, New York City.

Power Transmission Lines.—The Hackensack Improvement Commission, Hackensack, N. J., will receive bids until 8 p. m., Aug. 18, for construction and equipment of disposal works, flotation basins, power house, power transmission lines, air lines, ejectors, etc. Lemuel Lozier, engineer of commission, Room 3, Bank building, Main and Mercer streets.

FOREIGN TRADE

[Addresses of firms referred to in these trade opportunities may be obtained by writing to the Bureau of Foreign and Domestic Commerce, Washington, D. C., or its branch and local co-operative offices. Request for each opportunity should be on a separate sheet and the file number given.]

Motors (30,106).—A man from Finland who is in this country for a short time desires to purchase shoes, raw hide, sole leather, leather goods, concrete-mixing and other building machinery, and gasoline and electric motors. Reference.

INCORPORATIONS

Wilmington, Del.—American Conduit Manufacturing Corp. has incorporated with a capital of $540,000, to manufacture electrical conduits, etc. Incorporators: C. L. Rimlinger, P. D. Drew, and H. E. Knox, Wilmington.

Belleview, Fla.—Belleview Utilities Co. has incorporated with a capital of $25,000, to operate a local light and power plant. Incorporators: F. E. Martin, president; John L. Carney, vice-president; and Edward S. French, secretary-treasurer.

Hartford, Conn.—Perry Electric Co. has incorporated with a capital stock of $20,000. George W. Perry, Ernest C. Perry and S. J. Perry are incorporators.

Boone, Ia.—Napioer Electric Co. has incorporated with a capital stock of $10,000. S. A. Walker is president and W. A. Gillette is secretary.

Hazard, Ky.—Kentucky & West Virginia Power Co. has incorporated with a capital of $6,000,000. The incorporators are Bailey P. Wooten, H. T. Taylor and J. G. Green.

Montclair, N. J.—Filtration Engineers, Inc., has incorporated with a capital of $80,000, to manufacture engines, etc. Incorporators: F. W. Young, Verona; G. H. Caffey, Brooklyn, N. Y., and H. E. Kinner, Yonkers.

New York, N. Y.—Alpha Laboratories has incorporated with a capital of $60,000, to manufacture incandescent lamps, etc. Incorporators: J. H. Mandidge, W. A. Bell, and W. T. Davis, Ogdensburg.

New York, N. Y.—Emzee Electrical Conduit & Manufacturing Co. has incorporated with a capital of $5000, to manufacture conduits and kindred equipment. Incorporators: M. E. Meredith, T. Ganer, and P. Simon.

New York, N. Y.—Motorite Corp. has incorporated with a capital of $100,000, to manufacture motors, machinery, etc. Incorporators: C. E. Taoru, S. A. H. Dayton, and M. F. Mills, 211 West 82d street.

New York, N. Y.—Paragon Incandescent Lamp Works has incorporated with a capital of $60,000, to manufacture electric lamps, etc. Incorporators: F. Alexander, N. Favian, and L. T. Levy, 110 Morningside drive.

Asheboro, N. C.—Electric Equipment Co. has incorporated with a capital of $5000 by Leo Barker, Carl Kivett, of Asheboro, and H. T. Long, of Charlotte.

Bakersville, N. C.—Bakersville Milling, Light & Power Co. has incorporated with a capital of $25,000. J. C. McBee is one of the incorporators.

Dalmatia, Pa.—Dalmatia Light Co. has incorporated with a nominal capital of $5000 to operate a local plant. F. Brosious is the principal incorporator.

Nashville, Tenn.—Gibson Light & Power Co. has incorporated with a capital of $6000. E. H. Lessenberry is the principal incorporator.

Personal

H. D. Larrabee Becomes General Manager of Eastern Connecticut Power Company—Promotions and Other Changes

EARLE W. VINNEDGE, who recently was released from military service, has joined the staff of the Worthington Pump & Machinery Co., Cincinnati office, in the capacity of sales engineer.

H. F. CAMERON, of the Lake Charles Railway, Light & Power Co., has been appointed vice-president and general manager of the Texas Gas & Electric Co., and will have his headquarters in Houston, Tex.

L. A. WALLON recently returned to Seattle from Chicago, where he was drafted by Stone & Webster on the indexing system for the appraisal of the Chicago surface lines, and is again on his job as assistant engineer of the Puget Sound Traction Light & Power Co. at Seattle.

FRED BATES JOHNSON, Indianapolis, Ind., has been named a member of the Indiana Public Service Commission by Governor Goodrich. Mr. Johnson was formerly a newspaper man and served for a time in the army. He succeeds Charles A. Edwards of Huntington.

ORVILLE R. TOMAN is again with the Continental Gas & Electric Corp., Omaha, Nebr., as superintendent of construction of overhead lines and substations. Mr. Toman served two years with the Signal Corps and was in France with the 109th Signal Battalion, specializing in radiotelegraphy and radiotelephony.

J. F. OWENS, vice-president and general manager of the Oklahoma Gas & Electric Co., has been made president of the new War Camp Community Club, which has just been organized in Oklahoma City. The organization is for the purpose of providing entertainment, suitable welcomes and employment for returned soldiers.

A. W. HOUSTON has resigned his position as vice-president and general manager of the Texas Gas & Electric Co., to accept a similar position with the Southern Utilities Co. Mr. Houston will have his headquarters in Palatka, Fla., and will have supervision of plants of the Southern Utilities Co. in the states of Florida and Georgia.

G. E. CARLSON, formerly of the F. E. Newbery Electric Co., Chicago, has been appointed manager of the Chicago office of the Hatfield Electric Co., electrical contractors and engineers, located in the Insurance Exchange building, 175 West Jackson boulevard. Mr. Carlson has had a very broad experience in electrical work and is well known in the electrical contracting fraternity.

MATTHEW S. SLOAN, operating manager of the New York Edison Co., New York, was recently elected president of the Brooklyn Edison Co., to succeed N. F. Brady, resigned. Mr. Brady will continue as chairman of the Board of Directors and the Executive Committee. Mr. Sloan was for a period of 4 years vice-president and general manager of the New Orleans Railway & Light Co.

F. N. COOLEY has been promoted from assistant sales manager to sales manager of the Seattle office of the Western Electric Co. Mr. Cooley first became associated with the company in 1912 as lamp salesman at San Francisco. Two years later he became supply specialist at Seattle, a little later becoming assistant manager there.

WILLIAM A. BAEHR, a well-known consulting engineer of Chicago, through the purchase of the Southern Illinois Light & Power Co., Hillsboro, Ill., has been elected president of that company. Mr. Baehr takes up the duties of J. J. Frey, of St. Louis, formerly president of the company. Mr. Frey, however, is retained as vice-president and a member of the Board of Directors.

ARTHUR G. GEHRIG, structural engineer, Western Electric Co., Chicago, has been appointed associate professor in civil engineering, in charge of structural engineering at the University of Nebraska. He has been previously employed by the American Bridge Co. on erection work, including the Municipal Bridge at St. Louis, and the Balboa shops, emergency dams and Navy coaling stations at the Panama canal.

THOMAS O. MORGAN, until recently head of the service department of the New York office of the American Steam Conveyor Corp., has been promoted to the position of sales engineer. He will handle Long Island and Connecticut territory. Mr. Morgan's sound experience in service work has been a splendid training for his new responsibilities and his customers are assured of receiving authoritative advice on correct ash-disposal engineering.

CHARLES S. RUFFNER, vice-president of the Union Electric Light & Power Co., St. Louis, Mo., has been elected a vice-president of the North American Co., which owns the Union company and whose common stock ownership in the United Railways is controlled by that company. Mr. Ruffner recently relinquished a part of his duties in the management of the Union company to Louis H. Egan, who has been made a vice-president, and has removed to New York where he will reside.

HAROLD D. LARRABEE has been appointed general manager of the Eastern Connecticut Power Co., with headquarters at Norwich, Conn. He is well known in the New England public utility field. He was graduated from the Massachusetts Institute of Technology in 1902 and for the last 10 years has been general manager of the Barre & Montpelier Light & Power Co., of Vermont, one of the properties under the management of Charles H. Tenney & Co., of Boston. The Barre & Montpelier Traction Co. was also under Mr. Larrabee's management during his term of service in the Green Mountain State. At Norwich Mr. Larrabee will have general charge of a 22,000-kw. generating plant interconnected by transmission tie line with the system of the New England Power Co., and supplying the principal municipalities of southeastern Connecticut with electrical energy.

W. GORDON COPELAND has resigned from his position as acting chief inspector of the Commonwealth Edison Co., Chicago, to become associated with Wm. A. Baehr, consulting engineers, 122 South Michigan avenue, Chicago. Mr. Copeland entered the Construction Department of the Commonwealth Edison Co. in 1910 but was soon transferred to the Distribution Engineering Department, in which department he worked in various capacities until 1917. At that time he entered the Coast Artillery of the Army and served as a 1st lieutenant until the close of the war, being on active duty in France at that time. On his return to the Edison company he was made acting chief inspector in the place of Capt. Arthur P. Good, who is still in Government service. Mr. Copeland is a graduate of Cornell University and has made a host of friends in the industry in Chicago.

ARTHUR B. REYNDERS, who since March, 1912, has served as director of production for the Westinghouse Electric & Manufacturing Co., East Pittsburgh, Pa., is now works manager of the East Springfield works. Mr. Reynders was graduated from the University of Tennessee as a civil engineer in 1895 and as an electrical engineer the following year. In June, 1899, he was first employed by the Westinghouse company as a draftsman on switchboards and switchboard apparatus. Three years later he became engineer on circuit breakers, switches and relays and in 1904 was appointed acting assistant chief draftsman. In February, 1906, Mr. Reynders was appointed general engineer on insulator work, and in November, 1909, became assistant to manager of engineering. In March, 1912, he became director of production. The East Springfield works will manufacture small power motors and automobile starting, lighting and ignition equipment. Mr. Reynders is now supervising the installation of machinery.

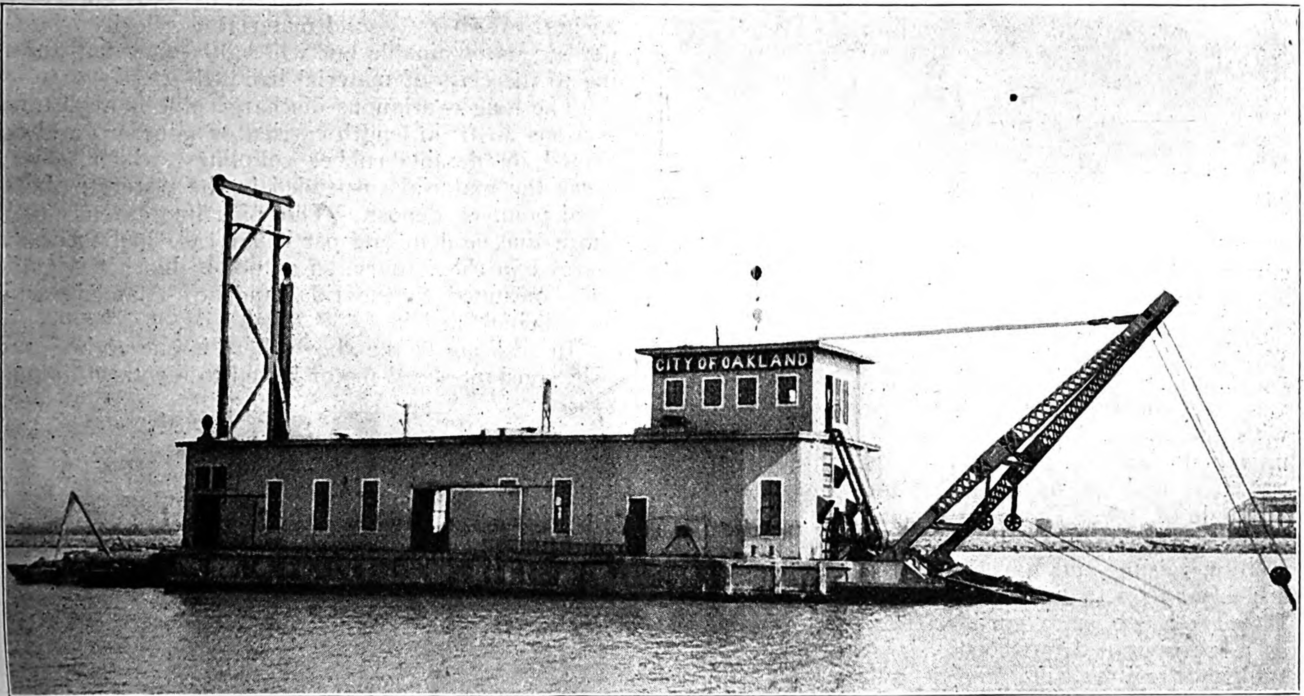
Electrical Review

Vol. 75. No. 7 CHICAGO, AUGUST 16, 1919 Three Dollars a Year

Electrical Review

WITH WHICH IS CONSOLIDATED WESTERN ELECTRICIAN AND ELECTROCRAFT.

VOL. 75—No. 7. CHICAGO, SATURDAY, AUGUST 16, 1919. PAGE 263.



Electrically Operated Dredge Owned and Operated by City of Oakland, Cal.

Features of Electrically Operated Hydraulic Dredge

Description of Dredge Owned and Operated by City of Oakland, Cal.—Advantages of Electric Drive and Savings Effected — Central-Station Service Is Used

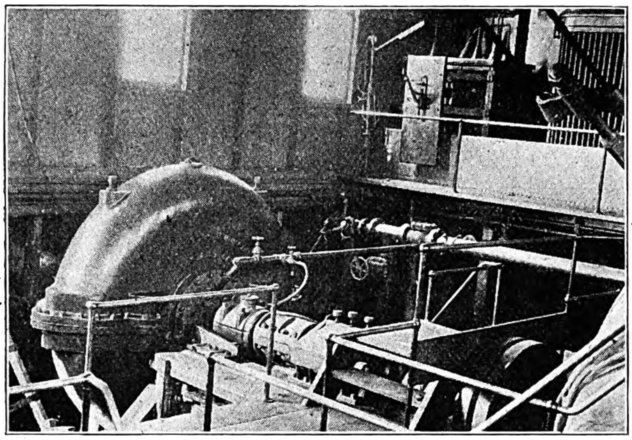
By CHARLES W. GEIGER

ALTHOUGH not an entirely new field for electrical engineering or the application of electric apparatus, there are only a very few motor-operated hydraulic suction dredges in existence at the present time. For this reason a description of the 20-in. dredge, owned and operated by the City of Oakland, Cal., and the successful results obtained are worthy of mention and consideration by the electrical industry.

The operation of a hydraulic suction dredge is a simple process whereby solid material, heavier than water, such as sand and gravel, is raised and transported from its place through pipes by virtue of the velocity of a current of water in the pipes. The dredge itself is similar to a houseboat in appearance and floats on the water. For this reason it is essential that the dredging machinery be as light and compact as possible while from the nature of the work it must be very powerful, rugged and able to withstand heavy overloads and severe usage.

The electric motor affords a compact, easily controlled and highly efficient substitute for steam drive in such work. In addition it permits the use of an exterior source of power which effects a great reduction in the weight of the dredge. Central-station service is of course especially valuable for such work due to the fact that it is often carried on over a large area and on account of the nature of the load. Moreover, such service is much cheaper in the majority of cases. In this particular case a saving of approximately 50% has been effected in several instances and naturally the city officials of Oakland recommend such service and the electrically operated dredge very highly.

The equipment of a hydraulic suction dredge consists of a centrifugal suction pump, the spuds, the



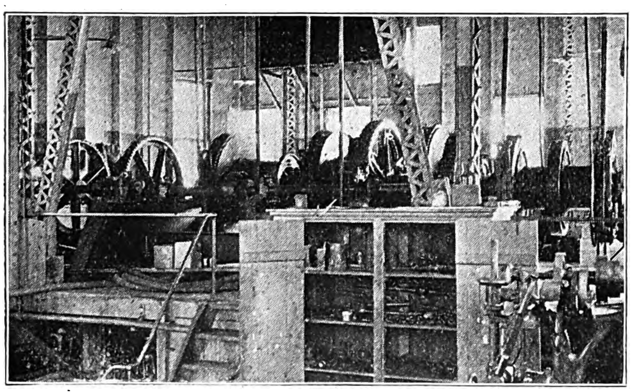
Interior of Oakland Dredge, Showing Pumps and Power Transformers.

cutter and several auxiliaries. On this dredge all this apparatus is operated by electric motors.

The cutting machinery is driven by a 150-hp. variable-speed motor. The motor is operated at 600 r.p.m. and is located in the hold of the dredge forward, on the fore and aft center line, and connected with the cutter by double reduction gearing and a universal coupling. The cutter shaft is operated at 15 r.p.m. and the normal position in operation is at an angle of 45°. The control consists of a reversible drum controller with suitable starting resistance.

For raising and lowering the spuds, cutter head and head lines, a five drum winch is used, belt connected to a 600 r.p.m. variable-speed motor, controlled by a reversible drum controller with a rheostat of sufficient resistance to permit of a 75% speed reduction.

The spuds, which are two heavily weighted iron-shod timbers 65 ft. in length, are at the stern of the dredge and are supported by a steel gallows 60 ft. in height. They serve to brace the dredge as the cutter moves forward into the bed of the stream and can be raised or lowered alternately by a controlling winch, which permits the dredge to swing in an arc. The cutter can be used to open up a channel about 180 ft. in width and cut away the bed of the stream to a depth of 30 to 40 ft. The main suction pipe, which extends along a steel ladder at end of which is the cutter, catches and conveys the dirt and water directly behind the cutter, drawing both off as it is cut away. The suction pump is of the centrifugal type, with a single runner 20-in. suction and discharge operating at 360 r.p.m. It is located athwartships and connected directly by a leather link coupling to a 750-hp., 3-phase, 60-cycle, 2-speed induction motor. Although rated at 750 hp., this motor is able to withstand heavy overloads and often operates at 900 hp. without trouble. The control apparatus consists of a drum controller and an iron-grid heavy-duty starting rheostat, which handles the secondary current of the motor only, the primary current being controlled by means of an automatic oil switch.

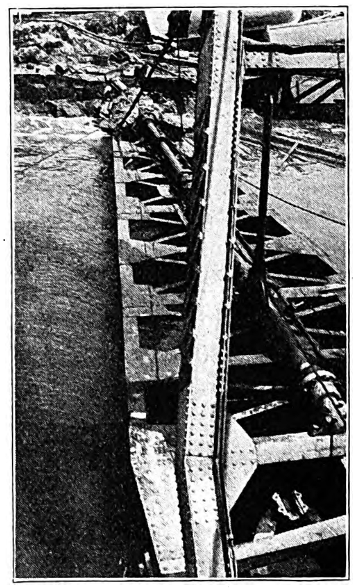


Five-Drum Winch Used for Operating Spuds, Cutter Head and Headlines.

The water and silt from the cutter are carried back over the stern of the dredge through a 20-in. pipe line connection at the rate of 3500 cu. yd. per 24 hrs. With 15% solid material, a velocity of 12 ft. per sec. is obtainable but will vary somewhat according to the class of material handled.

The long continuous discharge pipe is made up of sections 40 ft. in length carried on pontoons and connected by flexible rubber couplings, which serve to carry the material suspended in the water to the desired point of deposit. This pipe line extends to the shore line, and in one particular case had to be submerged in the estuary, so as not to block navigation, and continued to the tide lands of Alameda which were being filled in.

In addition to the above there is one 20-hp., 2200-volt, constant-speed motor belted to a rotary air pump



Cutter Head of Oakland Dredge.

for priming the main suction pump and a 6-in. single-stage centrifugal general service pump.

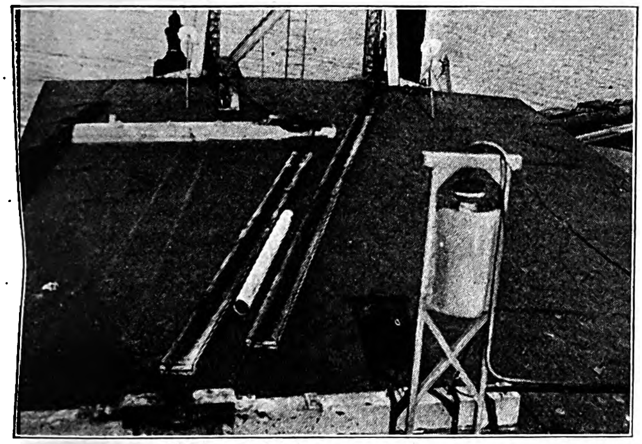
The switchboard consists of one main service panel and three feeder panels. The starting compensators for the constant-speed motors are placed in the stern of the dredge. Power is supplied by the Pacific Gas & Electric Co. over a short transmission line from its station A, in the immediate vicinity at a tension of 11,000 volts stepped down to 2300 volts by means of three 250-kv-a. transformers located on board the stern end of the dredge above the main deck. In addition, a 10-kw. transformer is provided to furnish a 110-volt supply for the lighting of the dredge and the floodlights. Shore connections are made by a 1200-ft., 3-conductor flexible armored cable which permits of considerable range of operation without shifting. The cable is carried on a special reel on a houseboat in the rear of the dredger and is run from the shore to the houseboat on poles placed 200 ft. apart.

Due to the fact that the dredge is usually operated about 20 hrs. a day, special attention has been given to the lighting. The interior of the dredge is adequately lighted with 100 and 150-watt units and in addition several floodlights have been installed on the decks to illuminate the surrounding water surface and the shore. Several of these floodlights are of special construction and all are portable.

Saving Made in Filling in Oakland Auditorium Site.

An illustration of some of this particular dredge's work was the discharge of material through 7500 ft. of pipe line to fill the site where the Oakland Civic Auditorium now stands and which was once a marsh. The average cost of operation of the dredge at the time of making this fill was about $5500 per month. This cost was made up of the following items; labor, $3000, power $2000, incidentals $50. The dredge was operated on an average of 20 hrs. per day and 20 days per month. The work was done at a cost of about 5 cents per cu. yd. The competitive bids made by outside dredging companies, all of whom used steam power, ran from 10½ to 12 cents per cu. yd.

The cost of operating the electric dredge at the present time under average conditions for a long period is about $10,000 per month. This includes



Flood Lights on Oakland Dredge. Light in Foreground is of Special Design.

$950 per month for the motor-boat tender, pipe worn out, and repairs to the equipment. At the present time the dredge averages 20 hrs. of operation every day the year around. The cost per unit fluctuates from 5 cents in mud to 12 cents per cu. yd. for hard pan. According to the Oakland harbor engineer, this dredger is doing work under unfavorable conditions at half the cost of the steam dredgers operated by private contractors. Under the same conditions these contractors would charge from 18 to 24 cents for the work which the city dredger is now doing.

The crew consists of the chief engineer, leverman and eight men on board. Two or three additional men attend to the extending of the pipe on land. This also represents a saving over the number of men required to operate a steam dredge.

ITALY TO ESTABLISH INDUSTRIAL LABORATORIES.

Experiment Stations and Laboratory Schools for Various Industries, Including Electrotechnical, to Be Established.

Appreciating the importance of applying scientific methods in its industrial development, if it is to solve successfully the great problems of reconstruction and to meet competition from other nations whose industries are more highly organized, Italy has decided to devote special attention to the question of industrial experiment stations and of technical education. The necessity for such action is made more urgent by the adoption, in many industries, of an 8-hour day. If the working day is shortened to 8 hours, increased efficiency in manufacturing methods must be brought about if production is to be maintained.

In this connection the Italian Government, together with the manufacturers, is preparing to establish experiment stations for the principal lines of industry. In addition to studying new processes and making new applications of old methods, these stations will supply the industries with a trained personnel. Preparatory meetings at which the manufacturers were represented have recently been held at the office of the Undersecretary of Labor.

Up to the present there have been only four such stations—two at Milan, for paper and fats, respectively, and two at Naples, for leather and ceramics. Another is being added to Reggio Calabria for essential oils and perfumes. At the recent conferences it was decided to establish the following new stations: At Rovigno, for the sugar industry, in connection with the existing school of beet culture; at Milan, for the development of the refrigerating industry; a third, probably at Rome to study the distillation of gases and their byproducts and, in general, all the processes of combustion. One section of this last-named station will devote itself to the question of the utilization of national fuels and lignite, which, it is said, is suitable for the production of gas. Later on consideration will be given to the creation of stations, on the initiative of the manufacturers, for the electrotechnical and phototechnical industries and for dyestuffs.

By a decree of December, 1918, provision was made for the establishment of laboratory schools in order that the standard of vocational education might be raised. At first there will be 20 of these schools, of which two will be at Milan, one for mechanics and the other for carpenters. In addition to a Government subsidy of 25,000 lire ($4825 at normal exchange) each, the laboratory schools will receive appropriations from the local authorities and the obligatory support of the manufacturers. In accordance with an agreement recently reached by the Undersecretaries of Labor and of Arms and Munitions there will be assigned to these schools war material amounting to about 25,000,000 lire ($4,825,000). The schools established by the Ministry of War during the war at Turin, Milan, Genoa, Modena, Florence, Rome, Naples, and Palermo will be transformed into laboratory schools. Provision will also be made for the ordinary industrial schools, 150 of which are royal schools and 400 of which are subsidized. In all these schools short courses of study, both practical and theoretical, will be instituted.

ELECTRIC POWER USED IN BURMAH OIL FIELDS.

Drilling and pumping wells by electric power has been introduced by the Burmah Oil Co. in its operations in the Yenangyoung field in Burmah. Considerable saving in the cost of getting the petroleum to the refineries is one of the chief advantages of the plan, as reported by John T. Cargill, chairman of the board of the company.

Central-Station Rates in Theory and Practice

Sixth Article—How Diversity of Demand Affects the Demand Cost — Diversity-Factor Defined — Other Features Affecting Demand Cost — Mean and Weighted Averages

By H. E. EISENMENGER

This is the sixth article of this series, which will continue to appear weekly throughout practically the entire current volume. A general outline of the entire series will be found in the issue of July 5, 1919. In the early articles of the series, the first of which appeared July 12, costs of service were discussed in general and with special reference to electric service. It was shown that analysis of the costs of rendering this service is necessary before rates for the service can be set or even intelligently discussed. The present article concludes the consideration of the second element of cost—demand cost—and the next one will take up the third element—consumer cost.

PART I—THE COST OF ELECTRIC SERVICE—Continued.

II-A. The Three Elements of Cost.

B. APPORTIONMENT OF THE DEMAND COST BETWEEN THE CUSTOMERS.

5. *The Diversity-Factor.*

SECTION 42. If the load curves of all customers would have the same shape amongst each other, the central station would have to have a load curve of the same shape (disregarding losses and home consumption of the central station) and the peak load of each customer would occur at the time of the central station's peak load. Then the sum of the customers' peak loads would be equal to the central station's peak load and the error introduced by replacing the peak responsibility with the consumer's maximum demand would be nil.

Actually, however, the shapes of the various consumers' load curves are different from one another. We can now classify the consumers into various groups or classes in such a manner that the curves within each class are liable to have similar shapes. For instance, we might group the lighting customers in one class and the power customers in another one. Lighting consumers will draw almost all their current during the evening, whereas most power consumers will consume practically all their current during the regular working hours, that is, mostly in daytime during week days. Then we may subdivide each one of these classes. For instance, the lighting consumers might be subdivided into stores, offices, factories, restaurants, theaters, churches, residences, street lighting and others. If necessary the subdivision may be carried further, for instance, the stores may be subdivided according to what is sold therein, etc. Various central stations have different practices in this respect. Likewise, the power consumers may be divided into a number of classes.

The error will then not be so very great that is introduced by the assumption that all the customers of the same class have the same shape of load curve. Gross deviations from the average load curve will occur only in individual cases and need not be given individual attention. In fact, they cannot be given individual attention.

It is not difficult to picture to ourself how the peaks of various classes occur at various times. The stores will, for instance, have their peak-load time of the year at 5 p. m. or soon afterwards, around Christmas time when the days are shortest. Shortly after that hour the rush hours for the street railway will set in when the people are returning from work to their homes. When they arrive at home their residences will be lit up and we have a peak of the residence load which may last until 9 or 10 o'clock. The theaters will have their peaks beginning at about 8 p. m. The peak of summer amusement parks comes, of course, in the summer evenings after sunset. Similar diversities occur between the peaks of the various classes of power load. Where we have an irrigation load for agricultural purposes the peak of that load will even come in the daytime of summer.

43. We might now from actual measurements in a number of representative cases, or by guesswork, obtain the load curve of every class or group of customers and from this we can obtain the ratio of the group's peak responsibility to the group's maximum demand. Then we would have to multiply by that ratio the known cost per kilowatt of peak responsibility to get the cost per kilowatt of that group's maximum demand. This first step would be only another way of basing the demand cost of the class or group on the peak responsibility of the group. Suppose, for instance, the group's load curve shows a peak four times the amount of its peak responsibility, then the cost per kilowatt demand of the group's peak load would be one-fourth of the cost per kilowatt of peak responsibility. If it costs, let us say, $4 of fixed charges per month to keep 1 kilowatt in readiness at the central station, then we must figure only $1 per month as fixed cost per kilowatt of maximum demand of that class of customers. Since the group's maximum demand can, of course, never be smaller than the group's peak responsibility, this correction to the kilowatt cost of the group's maximum demand will never be an increase of unit demand cost, but generally a reduction.

44. This fact, that the peaks of various classes or groups of consumers do not occur at the same time, is called *diversity* of these classes. To make it quite clear what this means we can look at it in another

way. Taking a simple case, let us suppose we have two classes of consumers only, *A* and *B*, each using 1000 kw. throughout the day, but raising their respective demand to 3000 kw. each for one hour during the day. Now, if these two peaks of 3000 kw. coincide, we would need a plant with a capacity of 6000 kw. to satisfy the aggregate demand. If, however, the peaks occur one after the other a plant of 4000 kw. will be large enough; 1000 kw. for one class and 3000 for the other. We can use a portion of the capacity of the plant twice, so to speak, first for *A* and then for *B* (or vice versa) on account of the diversity which exists between the two demands. If we had *A* alone, that class would have to be charged with the demand cost of 3000 kw. as the plant would have to have the capacity of 3000 kw. and the same would apply if we had *B* alone. As it is, with both classes on the lines and with the diversity between them as stated, we have to provide 4000 kw. for the two, and each one will be charged as an average with the demand cost of 2000 kw. only[1], because, as explained above, on account of the diversity we are able to use a part of the capacity of the first plant for one class of consumers and then for the other one.

45. The degree of diversity is measured by the so-called *diversity-factor,* that is, the ratio of the sum of the maximum demands of the various classes divided by the sum of their peak responsibilities; in other words, the diversity-factor is the weighted average[2] of the ratios $\frac{\text{maximum demand}}{\text{peak responsibility}}$ the meaning of which ratios (or, to be exact, of their reciprocate) has been explained in Section 43. As the sum of the peak responsibilities is equal to the peak load, we arrive at the definition of the diversity-factor as being the ratio of the sum of the maximum demands to the peak load[3]. In our example the sum of the maximum demands is $3000 + 3000 = 6000$ kw. and the actual demand (or the sum of the peak responsibilities) is 4000 kw., so that the diversity-factor is $6000/4000 = 1.5$. Obviously the diversity-factor can never be smaller than unity.

The diversity-factor is of great importance in central-station economics. It indicates, so to speak, how many times the capacity of the plant can be used.[4]

46. We have a diversity not only between the various groups or classes of load which in their aggregate build up the central station's load, but also between the consumers of the same class amongst one another. If the consumers of every class would actually have the same load curve, as presupposed so far (Section 42), there would exist no diversity amongst them; in other words, the diversity-factor amongst them would be unity. As a matter of fact, however, there are differences in the load curves and consequently there is a diversity between the consumers of the same class; therefore, the diversity-factor between these consumers will be greater than unity.

An example will make this clear. Measurements have shown[5] in a certain city block of apartments containing 189 residential consumers that the individual maximum demands in these installations, if added up on paper, gave the sum of 68.5 kw. But the actual maximum output of the transformer supplying these 189 installations (and no other load besides them) was only 20 kw. The reason for the difference between these two figures is, of course, that the maxima in the various installations did not occur at the same time. Customer *A* might be entertaining one night in his residence with all his lights ablaze while *B* might that same night happen to use very little light; perhaps he is attending *A*'s party and all the lights in his residence are shut off. *C*'s demand may be a maximum one hour later than *D*'s demand, etc. The diversity-factor in this example would be $68.5/20 = 3.4$. If the demand cost of every kilowatt of transformer's maximum demand would be, for instance, $3.40 per month, there would be a cost of only $1 chargeable to every kilowatt of the consumer's maximum demand. (Of course, owing to the diversity between the various transformers of the system, the cost of the kilowatt of transformer's maximum demand will again be lower than the cost of the kilowatt of central station's peak load. Assuming for illustration that the diversity-factor between the various transformers of that station equals 2, then the demand cost per kilowatt of central station's peak load would be $2 \times \$3.40 = \$6.80$ per month, as against $1 per kilowatt of the maximum demand of the class of consumers in question.)

47. We have so far discussed only two examples of diversity-factor: among the residence consumers to the transformers and among the transformers to the central station. Evidently we can take any group of consumers (or loads) and speak of a diversity-factor among the constituents of that group to the total group. The constituents may again be subdivided into smaller groups. We may, for instance, choose the following successive divisions: Central station, substation, feeder, transformer, consumer, lamp, and then we might distinguish a diversity-factor among the elements of any one of these divisions to any other higher division, as follows:

Among substations to central station

{ Among feeders to substations;
among feeders to central station.

{ Among transformers to feeder;
among transformers to substation;
among transformers to central station.

{ Among consumers to transformer;
among consumers to feeder;
among consumers to substation;
among consumers to central station.

{ Among lamps to consumer;
among lamps to transformer;
among lamps to feeder;
among lamps to substation;
among lamps to central station.

In every one of these cases[6] we can again distinguish between the *individual* diversity-factor and the *average* diversity-factor. For instance, choosing the diversity-factor among the consumers of the same transformer, we can distinguish a diversity-factor of an individual transformer, or an average diversity-factor of all transformers on the same feeder, or of all transformers on the same substation, etc. (always

[1]Compare also Insert VI.

[2]Readers who are not familiar with the term "weighted average" will find an explanation in Insert VII.

[3]A more complete and general definition of the term "diversity-factor" will be given later (Section 49).

[4]In our above example we have for instance a plant of 4000 kw., whose capacity is distributed in such a manner that
at *A*'s peak-load time: 3000 kw. are used by *A*
+ 1000 kw. by *B* = 4000 kw.;
at *B*'s peak-load time: 1000 kw. are used by *A*
+ 3000 kw. by *B* = 4000 kw.

Assuming from the first one of these two conditions a subdivision of the plant's capacity in such a manner that 3000 kw. are set aside for *A*, and 1000 for *B*, we must conclude that 2000 kw. of *A*'s 3000 can be used over again for *B* at the time of *B*'s peak load and, as these 2000 kw. are one-half of the total plant capacity, this capacity can be used 1½ times. This way of looking at the meaning of the diversity-factor becomes still clearer if we assume more than two (for instance three) customers with the described load curves and the individual peaks occurring one after the other.

[5]Insull, "Central-Station Generation." Transactions A. I. E. E., 1912, page 246.

[6]Except in case of the diversity-factors taken directly to the central station.

meaning the diversity-factor among the consumers to the transformer).

48. Given a certain classification into divisions, for instance as chosen above in Section 47, we can distinguish a diversity-factor among the members of one group either to the next higher group (for instance, consumers to transformers) or to any other group above that (for instance, consumers to feeders or to substations). These latter diversity-factors may be designated as being "combined" from the "elementary" diversity-factors. The combined diversity-factor is the product of the weighted averages[7] of the constituent elementary diversity-factors.

If we take, for instance, the diversity-factor among consumers to a certain feeder as the combined diversity-factor, and choosing the diversity-factor among consumers to transformers, and among transformers to feeder, as the elementary constituents, then we have the following relations:

(a) Individual diversity-factor among the consumers connected to one certain transformer =

$$\frac{\text{sum of maximum demands of all consumers connected to transformer}}{\text{maximum demand of the respective transformer}}$$

(b) Weighted average over the whole feeder of the diversity-factors among the consumers to the transformers $= \dfrac{\text{sum of the numerators in (a)}}{\text{sum of the denominators in (a)}} =$

$$\frac{\text{sum of maximum demands of all consumers connected to feeder}}{\text{sum of maximum demands of all transformers connected to feeder.}}$$

(c) Diversity-factor among the transformers connected to one feeder=

$$\frac{\text{sum of maximum demands of all transformers connected to feeder}}{\text{maximum demand of the feeder}}$$

(d) Diversity-factor among the consumers connected to a certain feeder =

$$\frac{\text{sum of maximum demands of all consumers connected to feeder}}{\text{maximum demand of that feeder}}$$

By multiplying the fraction under (b) with that under (c), the denominator of (b) cancels against the numerator of (c) and we get the fraction under (d); this means:

The weighted average over the whole feeder of the diversity-factors among the consumers to the transformers $\times$ diversity-factor among the transformers connected to one feeder = diversity-factor among the consumers connected to one certain feeder (combined diversity-factor). This is in accordance with the aforesaid contention.

49. Now we can proceed to the general definition of the term "diversity-factor" as standardized by the American Institute of Electrical Engineers. This definition will now be understood more readily than if we had started the explanation of diversity with that definition. "Diversity-factor is the ratio of the sum of the maximum power demands of the subdivisions of any system or parts of a system to the maximum demand of the whole system or of the part of the system under consideration, measured at the point of supply."[8]

In shorter, though less precise, words we can say that the diversity-factor is the ratio between the sum of the maximum demands and the sum of the peak responsibilities or the average ratio between maximum demand and peak responsibility. It determines, therefore, the ratio by which the demand cost must be reduced from peak responsibility to maximum demand and this is the reason for the importance of the diversity-factor.

Statements about the numerical values of diversity-factors will be found in "Diversity-Factor," by H. B. Gear (Transactions A. I. E. E., 1910, page 375) and in a lecture by Professor Ryan (ELECTRICAL REVIEW, April 3, 1915, page 638).

We can also speak of the diversity-factor between groups of consumers which are not yet connected to the same system of supply. We may, for instance, have a number of neighboring towns, each served from its own central station. If we now scrap these generating systems and connect all those towns to one common station, this latter source of power will not have to be quite as large as the previous independent ones taken together, because the peak loads in the different towns will occur at more or less different times.

6. Variations of the Demand Cost per Kilowatt Maximum Demand Between Consumers.

50. It can be seen from the above that the demand cost, if reduced to the maximum demand of the consumer, varies in a large degree, owing to the diversity of the load curves.

There are other variations in the demand cost per kilowatt between the customers, due to other reasons, for instance the following:

51. The installations of small customers, that is, in general of the residential consumers, are generally scattered more widely apart than the large consumers' installations which are crowded together in the factory and business districts. The small installations require, therefore, a greater length of distribution lines, not only per installation but even more so per kilowatt installed. The transformers are greater in number and smaller in size for a given total capacity. The residences are generally located on the outskirts of the cities, away from the center of gravity of the system of power supply and consequently the transmission lines will have to be both longer and of larger section, etc. All this means greater investment and consequently greater cost of service due to increased interest and other capital charges.

52. Another element which affects the demand cost is the following: Electric light requires a high degree of constancy of voltage since 1% of voltage fluctuation causes more than 3½% fluctuation of the light, so that small fluctuations of the voltage may prove very annoying to the eye. We may easily notice this in some street cars, especially in interurban service, where the voltage regulation is adapted to the modest needs of the motor service only and not with a view to the exacting needs of lighting. Motor service, as just stated, is not as sensitive to fluctuations of the voltage. If it were not for the lighting service our distribution lines in the cities would contain much less copper and they would consequently be much cheaper. We are justified in saying that the capital charges for the extra copper necessary to reduce the necessary fluctuations from the power-service requirements to the narrower limits required by the lighting service should be charged as cost to the lighting consumers only and not to the power consumers.

This and other minor variations in the demand cost between consumers are generally disregarded when it comes to the computation of the cost and of the rates,

[7] Reference is here made again to Insert VII for those readers who are not familiar with the term "weighted average" (see footnote to Section 45).

[8] Transactions A. I. E. E., 1914, page 1797.

but it is well once to get a clear conception that they do exist.

53. In passing, we can return to the kilowatt-hour cost and mention that we have under this heading also variations in the energy cost between customers. (To explain these it has been necessary to first explain what the load curve is and the load-factor and the diversity-factor. Therefore, these variations in the energy cost could not be discussed in their proper place in Section 12 when we were dealing with the energy cost and the other classes of variations of this cost.)

If the load-factor of the customers and their diversity-factor is low, the transformers will run at low load during a large part of the time. Now the efficiency of a transformer decreases if the load on the transformer decreases below full load. Moreover, instantaneous copper losses in the transmission and distribution lines are proportional to the square of the power consumed (at given power-factor[9]); this means that the aggregate losses of energy for a given amount of energy transmitted during a given time are larger if the power is great during a part of the time and small during the rest, than if the energy is transmitted at a uniform rate. In addition to this the power-factor decreases at low transformer loads which increases the average current and therefore further increases the copper losses.

For all these reasons the energy cost will be higher with a poor load-factor and a poor diversity-factor than if these factors are good. But this increase in the energy cost is usually disregarded; taking it into account would make matters too complicated.

We will also see that there are variations in the third part of the cost, the consumer cost or customer cost, which part we are to discuss in the next installment.

Insert VII—Appendix to Footnote of Section 45.

Mean and Weighted Average.

Where we have to deal with averages of fractions or ratios, we have to distinguish between the "mean" average and the "weighted" average. The *mean* average is formed in the same way as the average of all other values, that is, by adding the values and dividing the sum by the number of values which are to be averaged. For instance, the mean average of $\frac{1}{2}$ and $\frac{1}{4}$ is $\frac{1/2 + 1/4}{2} = \frac{3}{8} = 0.375$. The *weighted* average is the sum of the numerators divided by the sum of the denominators. The weighted average of $\frac{1}{2}$ and $\frac{1}{4}$ is therefore $\frac{2}{6} = 0.333..$, but the weighted average of $\frac{50}{100}$ and $\frac{1}{4}$ is $\frac{51}{104} = 0.4093$; of $\frac{1}{2}$ and $\frac{25}{100}$ the weighted average would be $= 0.2549$.

The weighted average applies to such cases where the fractions are ratios and the numerators as well as the denominators are the results of physical measurements or countings or other observations. It is clear that before taking the weighted average, the fractions must *not* be reduced by the elimination of common factors. The larger are the values of both numerator and denominator of a certain individual ratio resulting from a certain observation the greater is the relative importance or weight of the respective ratio if we are concerned with the "weighted average," hence that name. With the mean average every fraction or ratio has the same "weight" as every other one.

An example will make this clear. Supposing, for instance, we would be interested in the average density of population in two neighboring towns—a city and its suburb—the city *A* having a million inhabitants on an area of 50 square miles and the suburb *B* having 10,000 inhabitants on 2 square miles. *A* has therefore a density of 20,000 inhabitants per square mile and *B* 5000. It would be obviously incorrect to say that the average density of population in the two cities is the average of these latter two values, *i. e.,* 12,500 inhabitants per square mile (mean average). The lower density of *B* will have much less weight in influencing the average density because *B* is so small in comparison with *A*. The correct value for the average density is the aggregate population of the two cities divided by their aggregate area, that is the weighted average, $\frac{\text{sum of numerators}}{\text{sum of denominators}}$ or $\frac{1,000,000 + 20,000}{50 + 2}$ $= 19,615$ inhabitants per square mile.

(*To be continued.*)

[9]The non-technical reader will find an explanation of the term power-factor in Insert X.

IMPORTANT FACTORS GOVERNING SOUTH AMERICAN ELECTRICAL TRADE.

Valuable Information Contained in Pamphlet Being Distributed by Guaranty Trust Co.

Considerable valuable information regarding the opportunities for the sale of electrical material in South America is contained in a pamphlet being distributed by the Guaranty Trust Co. of New York City. According to this information two factors play a dominant part in dictating the purchase of the materials used by railway, street railway, light and power, and other public service companies in this country.

The first of these is that South America does not itself produce any of this material and, consequently, it must be imported. The second factor is that nearly all such companies are financed by foreign capital and the almost irresistible tendency is for them to purchase their material in the country from which the capital comes. This second factor is declared to be the key to the entire situation and some pains are taken in the article to explain the policy and viewpoint of European peoples, as compared with our own, in respect of the persistence of nationality in corporations established abroad.

Each country of South America is taken up alphabetically and its general economic features considered briefly. There follows then a list, by groups, of the important companies in that country which use electrical supplies. The information in regard to these companies includes ownership, capitalization, extent of business, conditions of operation, etc. It is calculated to furnish the essential facts for those interested in extending their markets in those countries or in establishing new ones.

PLANS PREPARED FOR TUNNEL UNDER MT. BLANC.

Electric Railway of 50 Miles Proposed, of Which Tunnel Will Include 10 Miles.

A special cable dispatch, dated Aug. 3, from Rome, Italy, to the *Chicago Tribune,* states that negotiations are being concluded between a representative of a French syndicate and the Italian Government for the construction of a tunnel through Mount Blanc, which will be one of the greatest projects to pass through the Alps. Studies for the project have been going on for about fifteen years. It is now proposed to build an electric railway from Chamonix in Savoy to Amsta in the province of Turin, a length of 50 miles, whereof 10 will be under Mount Blanc. The new railway will join two of the most celebrated valleys with magnificent scenery and perhaps the most renowned among all picturesque cities of the Alps.

Factors Affecting Heat Absorption of Boilers

How Heat is Transmitted—Effects of Scale and Soot and the Importance of Removing or Preventing Them—Tests that Prove Advantages of Mechanical Soot Blowers

By ROBERT JUNE
Mechanical Engineer.

HEAT is transmitted to the water within a boiler by three processes,—radiation, convection and conduction. Radiation originates in the fuel bed, and hot furnace walls, convection in the hot traveling gases, and conduction is a function of the metal of the boiler. The generally accepted theory of the part each of these processes plays is illustrated in Fig. 1. In this illustration it is also shown that the heat has to penetrate five layers of interfering substances, namely, a film of dry, stagnant gas, a layer of soot, the metal of the tube, a layer of scale and a film of dry steam.

With the exact or relative values of radiation and convection, we are not here concerned, except to observe that on account of the limitations of refractory materials, there is no great hope of increasing furnace temperatures in this way in the immediate future, and that if we are to increase boiler capacity, it will have to be through agencies other than by convection. Inasmuch as we can greatly increase the amount of the boiler surface exposed to radiation, this is the principal line along which we are to look for improvement in boiler and furnace design.

Hardly less important, however, is the necessity for devising means of dispersing the dry gas and steam films on either side of the tube. These films are extremely poor conductors of heat. It has been found, as a result of experiments by Professor Nicholson, and the United States Geological Survey, that by establishing a powerful scrubbing action between the gases and the boiler plate, the non-conducting film of gas can be torn off as rapidly as it is formed, thus bringing new portions of the hot gases into contact with the tube, and thereby greatly increasing the rate of transmission. Similarly, the faster the circulation of the water, the greater will be the scrubbing action, tending to remove the bubbles of steam from the wet surface, and the more rapid will be the transfer of heat from the tube to the water. By filling up the tube of a Cornish boiler with an internal water vessel, leaving an annular space of only one inch around the latter, Professor Nicholson found that it was possible to drive the boiler to 800% of normal rating, with a flow of gases of 330 ft. per sec. This flow, which is 8 to 10 times the average, was maintained by a fan, utilizing about 4½% of the total power generated.

These factors in heat transmission have been mentioned because they presage certain important improvements sure to come in boiler and furnace design, and it is the duty of prospective boiler purchasers to be informed of them, to discuss them with the boiler manufacturers, and to lend every encouragement to the latter in their work of devising cheaper means of steam production.

Importance of Preventing or Removing Scale Formation.

Coming now to practical questions of every-day operation, it is found that the formation of scale is a factor of design only in a limited degree, being chiefly dependent upon the rate of driving and the nature of the scale forming ingredients in the feed water. That the formation of scale should be absolutely prevented by purifying the feed water, or that it should be removed as rapidly as it forms, by scale cutters, or "tube cleaners," as they are called, is one of the most elemental facts in efficient boiler room operation.

The loss in conductivity, due to the presence of scale, has never been reduced to a rule or formula, depending upon the thickness, or the degree of hardness and thickness or the chemical composition of the scale. The percentage of loss, therefore, can only be determined in each case by actual tests.

The following table shows the results of a number of tests of loss due to scale, made at the University of Illinois. It will be seen that the results are so varied as to prevent any detailed conclusions but they do point unmistakably to the very great loss caused by scale, running from 2% to 19%, and they also point to the previously stated very great necessity of absolutely preventing soot formation, or, failing this, its removal as soon as formed.

Influence of Scale on Heat Transmission.

Test No.	Thickness of scale.	Character of scale.	Decrease in conductivity due to scale, per cent.
1	.0	Hard, dense	9.1
2	.02	Hard	2.02
3	.033	Soft	4.3
4	.033	Very hard	3.5
5	.038	Medium	4.03
6	.04	Soft, porous	6.82
7	.04	Hard, dense	3.07
8	.042	Very soft	9.54
9	.047	Hard	2.75
10	.065	Medium	2.39
11	.07	Soft	2.38
12	.07	Hard	4.43
13	.085	Soft, porous	19.0
14	.089	Very soft	4.95
15	.11	Hard, porous	16.73
16	.13	Hard, dense	6.75

Dangers of Soot Accumulation.

Soot, as has been stated before in previous articles, is the most troublesome source of preventable waste in the boiler plant. With the exception of scale, all other losses are of such a character that when once located they may be practically eliminated for all time by the single application of corrective measures. This holds true of losses caused by air leakage in the setting, losses due to radiation, excess of air through the furnace, etc. But there is no means of preventing the formation of soot. Its deposit on the fire surfaces of the boiler is an ever continuous process.

It is a matter of frequent surprise, not only to the layman, but to many men experienced in boiler room practice to learn that soot is the second best heat insulator known. Its lack of the property of conduction is so great that it has been proven to be more than five times as effective as fine asbestos in prevent-

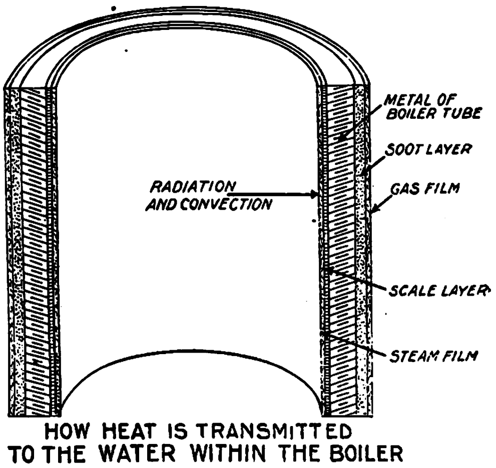


Fig. 1—How Heat Is Transmitted to the Water Within a Boiler.

ing heat transference; that is, more heat would reach a boiler through a 1-in. wrapping of asbestos than through a 1/5-in. coating of soot. To emphasize the importance of soot removal two tables, which appeared in a previous article by the author are reproduced herewith, together with a description of soot as found in the boiler plant.

The first of these tables, from Kent's Mechanical Engineers' Pocketbook, is as follows:

Comparative Resistance to Heat.

Thickness of each substance............................ 1 in.
Temperatures applied to each............................ 310° F.
Temperature increase of water in each case........... 10° F.

	Substances.	No. of pounds of water heated.
1.	Loose wool	8.1
2.	Loose lampblack (soot)	9.8
3.	Hair felt	10.3
4.	Carded cotton wool	10.4
5.	Fine asbestos	49.0

A perfectly clean boiler tube, ⅛-in. thick will transmit 40 times as much heat as will a tube covered with a one-inch thickness of soot.

The loss in the heat conductivity of boiler plants due to soot deposits may be noted in the following table:

Thickness of soot.	Per cent of loss.
1/32 in.	9.5
1/16 in.	26.2
1/8 in.	45.3
3/16 in.	69.0

Fortunately, soot does not collect on all surfaces of a boiler in the same proportion. Some portions may be fairly clean, while others are thickly coated, but this does not lessen the fact that there is a considerable loss of fuel and heat wherever even a portion of the tubes are coated.

Composition of Soot.

The principal constituent of "pure soot," or lamp black, is carbon. Mixed and associated with this carbon, are various tar products and acids. In color, soot varies from black, to gray, grayish white, grayish green, grayish blue, brown and reddish brown.

Soot as found in steam boilers varies considerably in appearance and composition, depending upon the grade of coal burned, condition of combustion, and the part of the furnace from which the sample is taken. Nearest the fire, the deposits formed consist largely of ash. Analysis of samples of soot taken from the first pass of a boiler show, in addition to "pure soot," the presence of silica, alumina, iron oxide, various alkalis and sulphur dioxide.

In all but the coolest portion of the setting, soot is usually gritty in texture. The grains may be as large as medium sand, or as fine as cigar ash. These particles are in a plastic state when they leave the furnace, and striking the lower portion of the boiler, they adhere to the tubes. If this deposit is not removed frequently, it quickly increases in amount and changes in character. The carbon burns out in part and the mass cements together. The repeated reduction in heating surfaces, increases the temperature of the flue gases, so that the process of cementation is continuous and constantly increasing in intensity. An extremely hard clinker-like formation results and in a short time the space between the tubes in portions of the boiler will become entirely blocked, thus materially reducing its capacity. In this condition, mining operations alone will remove the deposits.

Another bad feature of these deposits is that if they are allowed to remain, the corrosive action of the various constituents of the soot is very apt to cause leaky tubes. Under the influence of heat, a ferrous carbonate is formed. The excess of air that is always present, brings free oxygen into contact with the ferrous carbonate, and the reaction produces ferric acid. Carbonic acid, particularly in the presence of free oxygen, acts very rapidly on the metal of the

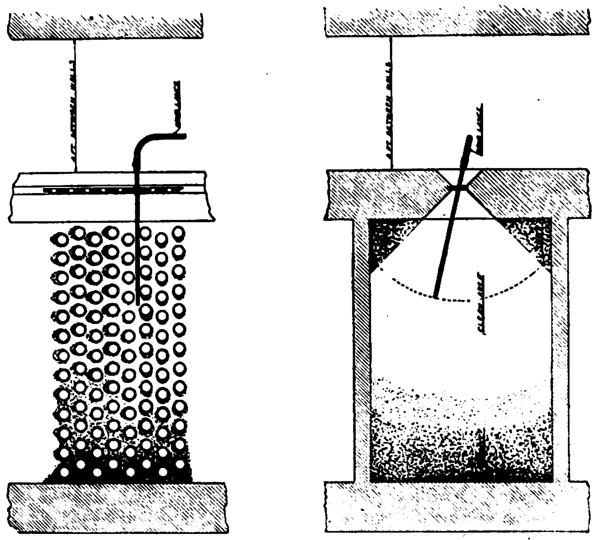


Fig. 2.—Why Hand Hose Is Ineffective.

boiler. Another source of corrosion is the sulphur dioxide in the soot, which changes first to sulphurous acid, and then to sulphuric.

Only the boiler-insurance companies know exactly how many boilers are condemned annually as unfit for operation on account of such action, years before their natural period of service would terminate. That the number is very high however, is generally admitted, for such cases are being constantly brought to light.

Hand Cleaning Not Effective.

It is a mistake to think that soot can be suitably removed by the hand-hose method using steam, through a rubber hose and nozzle. The use of this system arose in the sheer necessity for removing some of the deposits from the tubes. It is admittedly an inefficient and expensive process, as well as being an extremely disagreeable, and, to a certain extent, dangerous one.

Two men are required in this process, one close up to the boiler setting, frequently on a ladder, and the other, at the steam valve. The time employed is usually from 20 to 30 minutes. The nozzle is inserted, the spray of steam goes into the boiler, but whether it reaches all of the soot-covered parts of that section can not be determined. For example, there is a section near the cleaning door which cannot be reached at all. In addition a large supply of steam is used and an immense amount of cold air is let into the furnace. When the hose is moved to the next location, some of the soot will be blown back.

Effects of Soot on Boiler Efficiency.

When the velocity of the gases over boiler surfaces is doubled and there is a corresponding increase in combustion rate and load, if the surface is maintained clean of soot coatings and ash deposits, two times as much heat is absorbed by each square foot of surface. The temperature of the waste gases is but little or no higher than of the gases formerly discharged from the boilers when they were operated at low loads, with a sluggish flow of gases, and soot-coated tube surfaces.

In both marine and locomotive boilers 10 lb. of evaporation per square foot of heating surface is common practice, higher than this being often obtained. There is, therefore, no real reason why stationary boilers may not be driven at these ratings. The principal requirements are scrupulously clean tubes, inside and outside, the latter requiring efficient mechanical soot cleaners.

Boilers must be cleaned more frequently when forced than when operated at rating, and the maintenance of both boiler and setting must be considered, and while this may appear to be against the use of

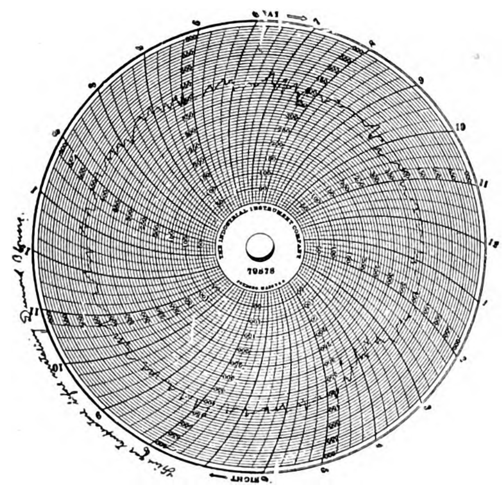


Fig. 3.—Flue Temperatures Before Installing Mechanical Soot Blowers.

high ratings, it is not as serious as it may seem. Boiler repairs and tube replacements under forced conditions are no more necessary than at lower ratings, provided the boilers are kept clean. If the boilers are to conduct heat as rapidly as possible to the water within the tubes, the steam is to be kept up when the soot piles up, more coal will have to be piled in.

The Five Essentials in Preventing Soot Waste.

The five essentials in preventing soot waste are:

1.—Frequency in cleaning. In order to minimize the cumulative effects of increasing deposits tubes should be cleaned three to six times a day.

2.—Thoroughness in cleaning. In order to maintain high furnace and boiler efficiency, and prevent

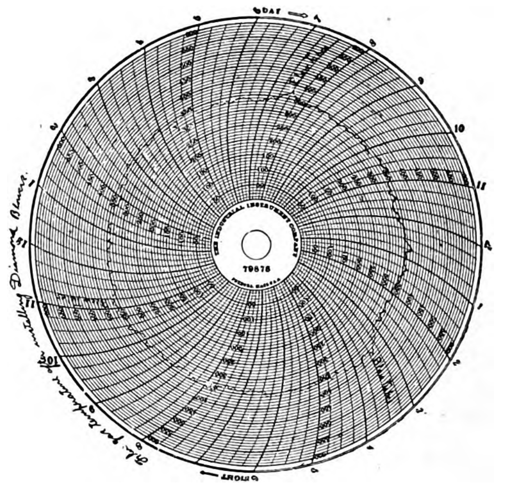


Fig. 4.—Flue Temperatures After Installing Mechanical Soot Blowers.

the destructive corrosive effects of soot accumulation.

3.—Availability of system. The soot-cleaner system should be instantly available, automatic in action, capable of rapid operation.

4.—Durability of system. The blower units should be so designed and constructed that they will withstand the stress of hard service, when placed in the hottest portions of the boiler, without the necessity for frequent repair or replacement.

5.—Economy of operation. The soot-removing system should require less steam and labor than hand-blowing; it should be installed so as to prevent the entrance of cold air into the furnace during operation; and, it should pay for itself from an investment standpoint.

The following figures from one of the largest electric plants in the country for a new and perfectly clean 1000-hp. horizontal water-tube boiler operated at 150% rating indicate the bad results of permitting soot accumulation:

Uptake temperatures for 1st day were an average of 550°.

Uptake temperatures for 2nd day were an average of 575°.

Uptake temperatures for 3rd day were an average of 600°.

Uptake temperatures for 4th day were an average of 625°.

Uptake temperatures for 5th day were an average of 650°.

These boilers were not cleaned and the figures given are good indication of the rapidity with which soot insulates the tube surface and cuts down economy as the time increases during which a boiler has been in service. An increase of 100° in flue gas temperatures in four days represents an increase in coal consumption of approximately 5%.

Tests Prove Soot Blower Savings.

The following data regarding soot-blower tests indicate the results to be expected by the use of soot blowers. The first of these tests was made at the plant of the General Electric Co., Schenectady, N. Y., and indicates a 6% saving in fuel. The data was obtained from tests by A. L. Rohrer, electrical superintendent of the General Electric Co., in which he states:

"Replying to your inquiry concerning the trial installation of Diamond Soot Blowers, made in our power station here, I beg to say that perhaps I cannot do better than to give you some data obtained by several tests, each of which cover a period of two weeks. During tests both boilers had tubes blown twice in 24 hours, and in each case the same boiler was used for the hand-blown test. The data given is the average obtained during runs:

Before Using Soot Blower.				After Using.			
	Temperature				Temperature		
Time. A. M.	Stack.	Sup. steam.	Load meter.	Time, P. M.	Stack.	Sup. steam.	Load meter.
10:15	550	500	4.2	2:30	485	495	4.2
10:30	550	502	4.0	2:45	485	506	4.0
10:45	555	498	4.0	3:00	482	504	4.3
11:00	557	498	4.1	3:15	483	505	4.2

	Test results Before.	After.
Load meter	4.075	4.175
Per cent rating	101.88%	104.38%
Steam pressure gage	199.5 lbs.	200.75 lbs.
Superheated steam temperature	499.5 F.	502.5 F.
Stack temperature	553 F.	483.75 F.

From Oct. 8 to Nov. 4, 1916, the General Electric Co. ran a comparative test of mechanical soot blowers

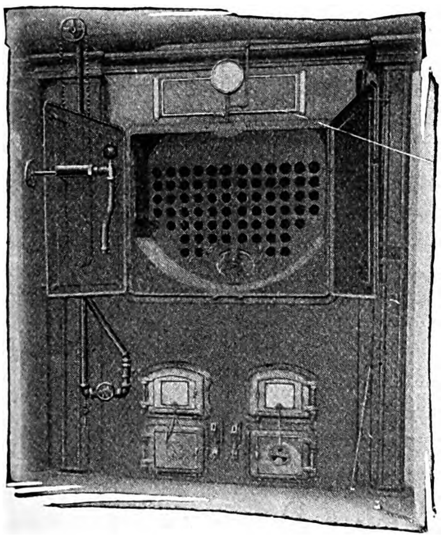


Fig. 5.—Mechanical Soot Blower in Return Tubular Boiler.

and the hand hose method on two 500-hp. boilers, set in the same battery, and identical in design, stokers, general equipment, and operating conditions. The results were as follows:

Average production of two boilers, 26 days—10,500,000 lb. steam.

Boiler No. 5, hand hose, at $0.17 per thousand	$1,785
Boiler No. 7, Diamond equipment, at $0.16 per thousand	1,680
Saving, 26 days	105
Estimated saving, 300-day year	1,260

	Hand hose method.		Soot blowers.	
Time of tests.	Flue temp.	Per cent rating.	Flue temp.	Per cent rating.
Two weeks ending Oct. 7	586	128	553	140
Two weeks ending Oct. 20	635	133	563	141
Two weeks ending Nov. 4	630	126	560	154

The results of another soot-blower installation are contained in the data furnished by A. J. Fisher, chief engineer, on two 500-hp. boilers at the company's plant of the Miami Electric Light & Power Co.

Decrease in coal consumption since Jan. 1, when soot blowers were installed, 217.5 tons, or 6.5%. Increase in output for same period 294,682 kw-hr. or 25%. This represents a saving in coal alone for this period, Jan. 1 to Sept. 30, of $1196.25 over the same period of the preceding year.

From the tests made by J. A. Switzer, professor of Hydraulic Engineering, University of Tennessee, at the plant of Brookside Mills, Knoxville, Tenn., for the owners, the following data was obtained:

From the results of the test at boiler plant No. 1, made with a view of determining the saving effected by the installation of mechanical soot blowers, it appears that the saving brought about amounts to 7%. This represents a saving of one ton of coal during the 10 hours' period. Had the test covered a 24-hour period, so as to include the coal burned for heating the mill during the night, as well as for the hours of running, before and after the 10 hours' test period, the saving would amount to approximately 1¼ tons of coal. Accordingly it is perfectly safe to state that the soot blowers will completely pay for the cost of installation in somewhat less than six months' time. In view of the service which the soot blowers are rendering at this boiler plant, Professor Switzer strongly recommended that blowers be installed in boiler plant No. 2 of the company. In reference to the last, he stated that it was his belief that the soot blower would show a saving certainly not less than 10%.

From the tests made on two 822-hp. boilers using fuel oil at the plant of the Pacific Gas & Electric Co., San Francisco, it is shown that the soot blowing caused the temperature of the stack gases to fall from 553° F. to 483.75° F., making a difference of 69.25° F., or 13.05%. Also the temperature of the superheated steam was raised from 499.5° F. to 502.5° F., a raise of 3°, or 0.6%. The direct effect of the use of soot blowers, therefore, is a saving of 3.9%.

It will be observed that in every test the boiler equipped with mechanical soot blowers gave higher rating with lower flue gas temperatures and shows a higher efficiency in heat transference.

WINDMILLS USED ON DENMARK FARMS TO GENERATE ELECTRICITY.

During the coal famine caused by the war many attempts were made to improve the working of the windmills geared to dynamos to generate electricity. About 250 installations on farms and small estates have proved fairly satisfactory. Many experiments in this connection were carried out by the late Mr. P. la Cour, and a trial mill designed by him is still being used for observation purposes. During about one-third of the year there was either complete absence or excess of wind, and the force available was very variable. It was nevertheless found possible to save fuel for steam or gas-driven power producers. The cost per kilowatt from peat gas fired plants is approximately the same as from a windmill-driven installation. Attempts were made to design special three-phase dynamos capable of maintaining constant voltage independent of the speed of the mill, special attention being also paid to automatic adjustment of the sails in order to reduce the cost of attendance. A mechanical contrivance effects a turning movement of the sails so that during very high winds these occupy a position parallel to the direction of the wind, thus avoiding damage to the mill. Attention has also been paid to gearing and bearings to minimize losses in transmission from the sails to the dynamo.

Editorial Comment

Electric Drive on Hydraulic Dredges

HYDRAULIC dredges offer a large field for the application of electric drive and one that has only been barely touched up to the present time. On this account the description of the dredge operated by the City of Oakland, Cal., and the savings which it effects, as shown in the article by C. W. Geiger in this issue, should be of considerable interest to electrical men.

Undoubtedly this particular dredge in its operations is especially well adapted to the use of electric power but there are many others in various sections of the country which are operating under similar conditions and many more where a substantial saving could be made by the installation of motor drive.

Keeping After the Soot

SOOT is the arch enemy that interferes with the transfer of heat from the furnace gases to the contents of the boiler. By careful firing and combustion approaching the ideal, soot can be reduced, but not eliminated. Only those most closely concerned appreciate the amount of soot deposited upon heating surfaces of boilers and surfaces in close proximity during a day, a week or any other period of time, and in doing so acts as an almost perfect heat insulator.

But if the formation of soot cannot be prevented, it does not necessarily have to form a heat-insulating covering upon the heating surfaces. Prevention is better than cure, and soot should be removed with sufficient frequency from the boiler heating surfaces to prevent it from seriously interfering with heat transfer. The mechanical soot blower possesses the very real advantages that soot can be blown whenever conditions are thought to warrant, and without stopping steam making or taking a boiler or fire out of active service.

The mechanical soot blower would seem a necessity in these days when striving for economical boiler rooms. It is undoubtedly a necessity in the larger units with their high capacities and high rates of combustion. The mechanical soot blower is no longer an adjunct but a necessity in the large boiler room of today.

Carnegie and Haeckel

TWO famous men, both men of remarkable talents and drastic limitations, both in a peculiar sense the products and exponents of the later eighteenth century, both of a venerable age, have passed away within a few hours of each other. Carnegie, the Scottish-American ironmaster, and Haeckel, the German scientist, have passed out into the Great Unknown.

Carnegie, better than almost any other man, represented the industrial development which came with and followed the age of invention that began about 1870. Every new process in mining and smelting of iron or in the making and forging of steel paid Carnegie a profit. He did much, perhaps more than any other one man, to introduce efficiency into the steel industry, hence it was he who may be said to have been the sponsor of electricity in the steel industry. Incidentally, Carnegie was one of the first three men able to read the Morse code by sound.

As Carnegie typifies the later nineteenth century in industry, so Haeckel typifies it in science. Haeckel was a disciple of Darwin, only he was possessed of a dogmatism never seen in the gentle English student. To him, evolution was more of a deity than a truth, and he clung to the notion that there was no mystery but that would be explained in time with a fuller understanding of evolution. Haeckel was a militant missionary of science, unconsciously reflecting, perhaps, the influence of the militaristic society in which he lived and which he accepted with an almost childlike faith.

Both these men were of abounding talents, of kindly personality, both tireless workers. Both were keen investigators, daring in their divers ways and both were many-sided, brilliantly so. Both have served the world. To consider two such men together, their characteristics or their achievements, can only remind one of the infinite variety of the world.

Public Utility Dilemma

ALMOST every day comes to this office details of another municipally owned and operated light plant that has failed. Meanwhile the agitation for municipal ownership goes on, with its optimism, its falsehoods, prevarication, wrong theories and Utopian dreams.

High costs of fuel, of labor and supplies, loss of revenue and inability to do this and that are the reasons that so many of the municipal plants are going under. Meanwhile, privately owned and operated systems must keep going for the reason that they cannot quit. Their position is in many instances not an enviable one, for they must wait until relief comes in the form of higher rates of revenue or lower rates of expenditure, the former dependent upon public opinion, the latter upon world conditions.

The public and the politicians that allow the municipal plants to close down and cease functioning, are the same public and politicians that turn a deaf ear and refuse relief to the privately-owned plant that must keep on generating and distributing service. Is this fair play? And is it wisdom?

Psychology and Car Fares

WHILE the troubles of the traction companies were being aired before the Federal Electric Railway Commission in Washington, Secretary of War Baker, one-time mayor of Cleveland, expressed it as his opinion that the five-cent fare for street car rides in cities was a "psychological necessity," higher rates probably reducing the profitable short haul business. Mr. Baker admitted higher fares might be an emergency measure, "But if fares are raised," he said, "they ought to be raised by the people who are to pay for the increase. Otherwise it will be resented."

He who pays the piper calls the tune. Higher car fares should be granted, when granted, by those that will have to pay the higher fare. Higher fares ordered by commissions far-removed from the locality concerned will not meet with public sanction, but will tend, instead, to breed opposition and resentment. The company needing more revenue and seeking to obtain it by increasing its fares will do well to place the matter fairly and squarely before its patrons. This is the one and only way in which higher fares can be obtained without bringing with them ill-feeling.

Demand Cost and Diversity-Factor in Public Utility Service

FOR quite a few years it has been known that a high diversity-factor is an important means of reducing the cost of rendering central-station service. This means that serving many classes of customers with diversified demands spreads out or levels off the peak load and by thus reducing the necessary capacity of the central station decreases its fixed charges. The consequent reduction of the demand cost is thus closely dependent on the diversity-factor. Diversity of demands makes the reduction of the plant's generating capacity offset the cost of the distribution system and this, combined with the much higher efficiency and lower unit cost of large generating units accounts for the superior economy of the central station as compared with the isolated plant.

In the sixth of the present series of articles on "Central-Station Rates in Theory and Practice," by Mr. H. E. Eisenmenger, which appears in this issue, the author brings out very clearly the relation between diversity-factor and demand cost in central-station service and applies it in detail in several cases. The principles he brings out are applicable to all kinds of public utility service, although up to the present at least they have been applied to only a very limited extent outside of electricity supply service.

Failure to recognize the heavy additional cost of meeting the peak loads (rush-hour traffic) of street-car service is one of the reasons for the sad plight of so many traction companies at this time. The capital tied up in the great number of extra cars, heavy feeders and generating plant needed to handle the rush traffic of only a few hours each work day is idle the rest of the time. Consequently the fixed charges are greatly in excess of what they would be if the traffic curve were leveled of its peaks, which means more diversified service should be developed. On lines in industrial communities this may be difficult at first sight, yet spreading out of the peak load should not be difficult if effort is made to secure the co-operation of the industrial plant managers in spreading out the time of starting and quitting work. The supreme folly of this matter is the practice followed in quite a few industrial communities, up to quite recently of giving lower fares to workmen during the rush hours than at other hours of the day. We are not ready perhaps to accept higher fares during the rush hours than at other times, but this is the logical method of reducing the rush-hour traffic as well as apportioning the higher charges of this traffic among the passengers responsible therefor. At the very least the lower rush-hour fares should be abolished where they still are required and every effort made to spread out the traffic as much as possible.

Telephone service has its rush-hour traffic also, this requiring a much more expensive plant equipment than if the traffic were more evenly spread out. Telephone companies have not felt free to exact higher rates for peak-load service and it is doubtful whether they ever will. About the only effort made to develop use of otherwise practically idle equipment is the practice of offering lower long-distance rates during the night hours. Greater diversity of service is possible of development, however.

Water and gas supply companies have the same problem also, but seldom, if ever, attempt to reduce maximum demands by means of the rate schedule. Yet large reservoirs and gas holders are needed to meet the peak-load demands. There is no branch of public utility service that can not profit from consideration of the manner in which the central stations have met the problem by developing higher diversity-factors. Mr. Eisenmenger's articles therefore contain much of interest to other utilities and the managers of central stations are not the only ones that will find in them food for profitable thought.

Unification to Benefit Pacific Coast

INTERCONNECTION of generating systems received great impetus during the war on account of the saving of fuel and the availability of generating capacity obtainable thereby. When the emergency ceased the need for the remedy also abated, at least so far as the need was less prominently acute. However, interconnection was found so beneficial in many instances that it has come to be a permanent measure instead of a war measure. And interconnection of different systems by different companies has in many cases come to be the unification into one company, as under some conditions it should be in the best interests of the public, the utility and the territory served.

It is in California that interconnection of systems made great progress both before and during the war. Distances were great, settlements were widely scattered, and water powers were numerous with varied stream flow, different pondage capacity and availability for utilization. By interconnecting sources of energy, stream flow could be utilized to the full, diversity could be taken advantage of efficiently, water power could be made to replace steam wherever possible and power available where not needed could be transmitted to markets where there was a shortage.

A number of important interconnections were made in California during the war, thereby saving oil and utilizing water power, but the war came to an end before ambitious plans could come to their full fruition. However, the benefits indicated were such that the movement has continued. The latest movement in this direction is the purchase of the Northern California Power Co. by the Pacific Gas and Electric Co. For some years the interests of these two large companies have been closely interwoven and during the war at the direction of the Power Administrator of California the two systems interconnected, the Northern California Power Co. thus becoming the central link in a chain of high-tension lines that reach from the mountains of Oregon to the Bay of San Francisco. It has already been prophesied that it will not be many years before a chain of interconnected transmission systems link up Oregon with the Mexican border. The acquisition of the Northern California Power Co. by the Pacific Gas and Electric Co., and the attention now being given to the adoption of 220 kilovolts as a commercial voltage lead one to expect that things will move apace during the next few years.

The unification of two large utilities, serving vast territories and harnessing many small water powers is pregnant with possibilities for California. The Northern California Power Co.'s property with its 525 miles of high-tension line, 1611 miles of low-tension lines, its six hydroelectric generating stations aggregating 50,000 horsepower on Battle and Crow Creeks respectively and its power site on the Pitt River representing potentially 90,000 horsepower will now enable the Pacific Gas and Electric Co. to expand to meet the ever-growing demands for power, develop latent power resources for utilization in the near future, and use existing water flow to best advantage. The unification of these two Californian utilities is of importance to the electrical industry as a whole and it is of greatest moment to the Pacific coast.

The Pacific Coast needs more industries, and industry consumes electric power. Interconnection spells fuel economy, conservation of water power and industrial development.

Industrial Unrest

INDUSTRIAL unrest is universal. From coast to coast, in almost every industry in the country has come discontent or smoldering discontent is on the verge of springing into flame.

Police, firemen, railroadmen, and others in positions of public trust have gone on strike or threatened to strike for shorter hours, higher rates of remuneration, or better working conditions, or from sympathy. While we clamor for a lower cost of living, labor is insisting upon conditions that not only precludes lowering the cost of living but must necessarily increase it. Unless something is done and done soon, this country will face an extremely acute and hazardous situation. We are heading at high speed toward a calamity.

It is natural that the World War that turned the world upside down, should be followed by upheavals and readjustments. It was inevitable. But the tendency of these upheavals, these movements, is for labor to prosecute its own interests without taking into consideration the interests of others. Labor today is passing through a much exalted opinion of itself and its value to the world, and it is this latter that, after all, is the criterion of worth. If labor would serve its own best interests and those of the country as a whole—and the need for patriotism is with us still—labor would do well to tackle the urgent and complex problem of lowering the cost of living instead of making things worse by insisting upon higher wages, wages in many instances out of all proportion to intrinsic worth. To do the former would strike at the root of the problem; doing the latter is no solution, not even a palliative to the most pressing problem this country faces today.

No country can continue to progress healthily unless its progress is founded upon a firm basis. Inflated prices and labor costs and an excessively exalted opinion of labor for itself and its value to the community do not work for this condition. The value of labor itself depends not upon itself alone but upon those using and utilizing its labor.

We need more give and take, closer harmony, co-operation and mutual appreciation of moral obligations between capital and labor, the curtailment of the profiteer to a point where he ceases to be a menace to our national life, that all can start again, energetically, the work of peace, and bring about increased production, better distribution and fair play all round. For it is these three, increased production, better distribution and fair play, and these alone, that will bring about lower cost of living and industrial rest.

Current Events

Program for Illuminating Engineers' Meeting—New Code Committees—Chicago's Electrical Show—Convention Plans

BROAD PROGRAM FOR ILLUMINATING ENGINEERING SOCIETY CONVENTION.

Topics of Interest to All Branches of Lighting Industry to Be Included in Program of Chicago Convention.

A tentative list of subjects to be included in the program of the 1919 convention of the Illuminating Engineering Society at Chicago, Oct. 21 to 24, inclusive, has been announced by the Papers Committee, of which George H. Stickney, Harrison, N. J., is chairman. A "high spot" at the beginning of the program will be the report of the Committee on Progress which will review not only the normal progress of the year, but the lighting developments during the war, including, if possible, some of the new things which heretofore have not been openly discussed. Searchlights, their development and application during the war, will be another interesting feature.

A paper on "Viaduct Lighting" will describe an installation made without poles or posts and involving an unusual and interesting method of distributing light over the roadway with provisions for reducing glare; this paper is to be accompanied by illustrations and curves. The gas-lighting industry will be represented with a paper on gas street lighting, its present status and recent developments. Recent developments in equipment and applications of electric street lighting will also be discussed.

A paper which will not be printed in advance is one on prospective lighting applications. This will be a "ginger" talk, pointing out the extensive and as yet undeveloped field for the wider application of artificial lighting.

For the industrial man there will be several papers. One entitled "Industrial Lighting" will give data and descriptions of good lighting installations recently put in under the advice of experts of important central stations; figures on burning hours, etc., will be included. What the manufacturer says he is doing in regard to good industrial lighting will be brought out in a paper entitled "Industrial Lighting Survey."

The recent movement for lighting codes for various states has been recognized by placing on the program a symposium on the application of industrial lighting codes. State experts will give their experience in applying and enforcing these codes. Results of insurance companies' inspections will also be brought out; the importance of insuring industrial safety by means of regulations of lighting will center much interest on this topic.

A message from the merchandiser to the illuminating engineer will be included in a paper entitled "Illuminating Engineering and Merchandising." This paper will tell how to encourage better lighting practice among dealers of lighting equipment. A paper on "Hospital Lighting" will bring out what illuminating engineers believe is good practice as exemplified by modern installations.

There is also enough of the technical in the program to make it well balanced. "Tests of Lighting Units" will bring out facts about photometric and illumination tests of typical units for interior lighting. "Diffusion of Light" will discuss a study of glare and diffusion in their relation to practical lighting installations. "Distribution of Light in Rooms" is an analysis of natural and artificial lighting with regard to wall finish, window openings, shading, etc. A paper on the "Reflecting Power of Paint" will contain data from careful tests of different colored paints. "Photometry" is the title of a paper which will bring out some ingenious methods of making difficult measurements.

From the foregoing condensed summary of the principal topics, it is evident that the program will not neglect any of the chief lines of lighting activity, commercial and practical as well as academic and theoretical. For this reason it is hoped that the convention will attract many men from every branch of illumination science and art.

MUNICIPAL ELECTRICIANS TO HOLD INTERESTING CONVENTION.

Four-Day Meeting Being Planned in Chicago Sept. 23-26—Exhibits and Entertainment Not to Be Neglected.

Arrangements are rapidly being perfected for the 24th annual convention of the International Association of Municipal Electricians which will be held at the Auditorium Hotel, Chicago, Sept. 23-26, inclusive. The technical program cannot yet be announced, but it can be stated that it will include reports, papers and addresses on timely topics of unusual interest. An exhibit by manufacturers of electrical apparatus and supplies used by municipal electrical departments will be a feature supplementing the program. An entertainment program is being worked out that will provide relaxation between the sessions and pleasant diversion for the ladies during the technical sessions. Clarence R. George, Houston, Texas, is secretary of the association, and William S. Boyd, 175 West Jackson boulevard, Chicago, is secretary of the local committee on arrangements.

COMMITTEES APPOINTED TO REVISE NATIONAL ELECTRICAL CODE.

Persons Interested in Code Revisions Invited to Communicate with Subcommittee Chairmen.

The following special committees have been appointed by the chairman of the Electrical Committee of the National Fire Protection Association to consider various questions in anticipation of the 1920 Code. All persons interested in any of these questions are invited to communicate with the chairman of the technical subcommittees as given below.

These subcommittees grouped under the standing committees through which they will report are as follows:

1.—Standing Committee on Cars and Railways: M. Schreiber, chairman, American Electric Railway Association, Newark, N. J.; R. C. Bird, Ralph Sweetland. In the revision of rules on carhouse wiring and car wiring for more than 600 volts the American Electric Railway Engineering Association has appointed two committees to co-operate with the standing committee.

2.—Standing Committee on Devices and Materials: A. R. Small, chairman, 207 East Ohio street, Chicago; H. O. Lacount, H. R. Sargent.

Technical Subcommittees:

(a). Wires and Cords: Stranding, identification, types, etc. B. H. Glover, chairman, 207 East Ohio street, Chicago; G. E. Bruen, V. H. Tousley, G. S. Lawler, H. A. Morss, W. S. Clark, W. F. Field.

(b). Cabinets and Cutout Boxes: A. O. Boniface, chairman, 207 East Ohio street, Chicago; E. C. Horton, L. L. Johnson and representative of American Society of Mechanical Engineers.

(c). Outlet Boxes and Covers: E. P. Slack, chairman, 25 City Hall Place, New York; F. D. Varnam, L. A. Barley, H. G. Knoderer.

(d). New 10-Amp. Classification of Fuses: A. R. Small, chairman; W. C. Peet, H. R. Sargent.

3.—Standing Committee on Fixtures, Heaters, Signs and Lamps: J. C. Forsyth, chairman, 123 William street, New York; G. E. Bruen, C. H. Lum.

(a). Heaters: J. C. Forsyth, chairman, 123 William street, New York; I. Osgood, R. B. Shepard, H. J. Mauger, Harold Fulwider, Frank Kuhn, C. J. Killam.

(b). Fixtures and Insulating Joints: J. C. Forsyth, chairman; Emil Anderson, K. W. Adkins, A. Waldschmidt, V. H. Tousley, C. H. Hill, H. S. Wynkeep, Louis McCarty and representatives of the National Fixture Manufacturers' Association.

(c). Incandescent Lamps, Gas-Filled, Use of Lamps in Dusty Places: G. E. Bruen, chairman, 123 William street, New York; F. F. Burroughs, R. P. Strong, W. T. Blackwell.

(d). Extensions from Fixture and Other Outlets: G. E. Bruen, chairman, 123 William street, New York; E. H. Joseph, and representative of Outlet Box Manufacturers.

4.—Standing Committee on Generating and Substations: A. M. Schoen, chairman, Southeastern Underwriters' Association, Atlanta, Ga.; W. H. Blood, K. W. Adkins.

The following topics to be treated by this standing committee: *a*, use of switches between generators and transformers; *b*, revision of rule 1-d on fusing of generator sets.

5.—Standing Committee on Grounding: W. H. Blood, chairman, 147 Milk street, Boston, Mass.; C. M. Goddard, H. S. Wynkoop.

(a). Grounding Motor Frames: W. H. Blood, chairman, G. S. Lawler, W. C. Peet.

The standing committee has under consideration the following topics: *a*, Size of ground wires; *b*, voltage limits for grounding; *c*, omission of grounding for short lengths of conduit, metal raceways, etc.; *d*, minor items of Rules 15 and 15A that relate to grounding.

6.—Standing Committee on Industrial Applications: G. S. Lawler, chairman, 31 Milk street, Boston, Mass.; F. Osgood, C. B. Langdon, J. M. Curtin.

(a). Fuse Protection of Motors: E. E. Turkington, chairman, 31 Milk street, Boston, Mass.; J. C. Forsyth, E. McCleary, W. J. Canada and a representative of the Electric Power Club.

(b). Use of Oil Transformers, Autostarters and Motor-Starting Devices: C. B. Langdon, chairman, 266 Pearl street, Hartford, Conn.; F. O. Evertz, F. A. Barron, T. C. Taliaferro and a representative of the Electric Power Club.

(c). Demand Factors in Wiring: Bassett Jones, chairman, 101 Park avenue, New York; C. H. Hill, A. M. Paddon, A. S. Adams, H. B. Gear.

(d). High Potential Wiring: G. S. Lawler, chairman, 31 Milk street, Boston, Mass.; W. S. Boyd, A. E. Silver, D. W. Roper, C. C. Harbinson.

(e). Use of Enclosed Switches: Washington Devereux, chairman, Bullitt building, Philadelphia; Ben W. C. Clark, H. F. Strickland, P. H. Bartlett and representatives of the Associated Manufacturers of Electrical Supplies and of the Electric Power Club.

(f). Fireproof Switchboard Rooms and Running Mains in Hazardous Rooms, etc.: A. M. Paddon, chairman, Gurney building, Syracuse, N. Y.; C. B. Langdon, W. S. Boyd, E. E. Turkington and C. H. Hill.

(g). Housing of Motors in Dust Places, etc.: F. F. Burroughs, chairman, Mutual Fire Prevention Bureau, Oxford, Mich.; H. W. Hadlock, and representatives of the Electric Power Club and of flour and elevator insurance companies.

(h). Revision of Code Rule No. 88: W. C. Peet, chairman, Peet & Powers, 70 East 45th street, New York; H. S. Wynkoop, R. P. Strong.

(i). Electrical Equipment of Lacquer and Varnishing Rooms: A. C. Hutson, chairman, National Board of Fire Underwriters, 76 William street, New York; O. E. Smith, H. S. Wynkoop.

7.—Standing Committee on Outside Wiring, Building Supply and Services: M. G. Lloyd, chairman, Bureau of Standards, Washington, D. C.; C. H. Hill, F. F. Burroughs. This committee has under consideration the following: *a*, transformer vaults; *b*, location of service conduit near combustible material; *c*, supports for service wires on buildings; *d*, enclosed service switches; *e*, revision of Rule 12-d; *f*, sizes of service wires and use of multiple conductor wire for services.

8.—Standing Committee on Signal Systems: W. S. Boyd, chairman, 175 West Jackson boulevard, Chicago; A. M. Paddon, C. W. Mitchell. This committee with the following will act as subcommittee on revision of Rule 85 of the Code: F. A. Raymond, C. C. Johnson, H. S. Warren, Frank Bean, S. L. Burgher.

9.—Standing Committee on Theaters, Moving Picture Establishments, Places of Public Assembly and Garages: Washington Devereux, chairman, Bullitt building, Philadelphia; V. H. Tousley, C. M. Tait.

(a). Theaters and Moving Picture Wiring Standards: Washington Devereux, chairman; F. A. Barron, B. A. Hanson, C. M. Tait, V. H. Tousley, Joseph Honey, J. C. Moulton.

(b). Exit Light Transformers, low voltage: V. H. Tousley, chairman, City Hall, Chicago; F. A. Barron, B. H. Glover.

(c). Elevator Wiring Standards: Washington Devereux, chairman; W. Doane, C. H. Hill, A. Marks, O. P. Cummings, I. N. Haughton, O. F. Shepard.

(d). Film Rewinders: W. A. Lodge, chairman, 207 East Ohio street, Chicago; L. M. Swaab, F. H. Richardson, Lee Johnson, H. N. Speer.

10.—Standing Committee on Wiring Standards and Systems: W. C. Peet, chairman, Peet & Powers, 70 East 45th street, New York City; Dana Pierce, F. Overbaugh, R. P. Strong.

(a). Conduit Work, Sizes of Wires, Distance Between Pull Boxes, etc.: G. M. Sanborn, chairman, Sanborn Electric Co., Indianapolis, Ind.; A. O. Boniface, John Cole, O. E. Smith.

(b). Wattage Limits for Branch Lighting Circuits: I. Osgood, chairman, 55 Kilby street, Boston Mass.; Bassett Jones, Milton Jones, Albin Gustafson.

(c). Farm Lighting Equipments: Dana Pierce, chairman, 25 City Hall Place, New York; B. H. Glover, C. A. Bates, H. L. Bunting, F. F. Burroughs, W. S. Boyd, C. H. Hill, R. W. E. Moore, R. H. Grant, W. Michaelson, J. E. Cross.

(d). Voltage Limit for Low Potential Systems: W. C. Peet, chairman, Peet & Powers, 70 East 45th street, New York City; H. O. Lacount, H. R. Sargent, C. B. Langdon.

(e). Wiring in Places Subject to High Temperatures: H. S. Wynkoop, chairman, Municipal building, New York City; E. McCleary, R. P. Strong.

(f). Interbuilding Connections: H. S. Wynkoop, chairman, Municipal building, New York City; other members to be appointed.

(g). Extension Wiring in Fireproof Buildings: Committee to be appointed.

"LAND OF THE WONDERFUL LAMP" TO BE ELECTRIFIED.

Chicago's Electrical Show, Oct. 11 to 25, Promises to Be Worth Coming Miles to See.

According to all indications Chicago's Electrical Show, which is to be held at the Coliseum Oct. 11 to 25 inclusive, will surpass any ever held by the electrical interests in this city and will be comparable with those held by this or any other industry any place. More than 80% of the available exhibition space has already been allotted and the elaborate decorative and lighting effects have practically been completed.

The setting of the show was designed in accordance with the most modern ideas in attractive mer-

General View of Decorative Effects and Scheme of Illumination. Planned for Chicago Electrical Show, Oct. 11 to 25.

chandise display and at the same time the scene is destined to leave a lasting impression with all who view it. The setting is Chinese, an exemplification of the electrification of the wonderful Aladdin lamp of fable fame, and the typical oriental colors will dominate. It was designed by W. D'Arcy Ryan and J. W. Gosling of the General Electric Co., Schenectady, N. Y., whose work at the San Francisco's world's fair and many other similar affairs are well known.

In the center of the hall a large Chinese pagoda will be erected. This pagoda will be brilliantly decorated and ornamented by 18,000 "Novagem"

Attractive Poster Being Used to Advertise Chicago's Electric Show.

jewels from the "Tower of Jewels" at San Francisco. Surrounding this pagoda other booths will be arranged in typical Chinese fashion and decorated to fit in with the rest of the setting. A white false ceiling will be placed over the whole, terminating at both ends with drops painted to represent Chinese scenes.

The lighting effects have been especially designed to enhance the general decorative scheme. For local lighting hundreds of imported silk and gauze Chinese and Japanese lanterns, equipped with electric lamps will be used. In addition numerous flood lights and projectors will be installed in the balcony. Modern projectors having a total electric consumption of 32 kw. will play on the jeweled pagoda from all angles. The light from others using a total of 28 kw. will be reflected from the white ceiling upon the entire display and several more will be directed upon the scenic drops. Over all a lighting effect similar to an aurora borealis will be created by a 9-kw. searchlight.

The management of the show, however, has gone further than providing an impressive setting. Special pains have also been taken to make the exhibit itself of interest to visitors. For this reason a representation from all classes of electrical manufacturers has been secured which will include all the latest and best electrical devices and applications. It should therefore prove of interest to industrials as well as laymen and manufacturers should send their electricians, plant superintendents and foremen to the show to see the latest devices developed for transmitting and using electricity.

The usual line of well-known electrical appliances and devices will of course be shown in the latest types and models and in addition, apparatus for heat treating, electric furnaces, electric welding, electric ovens, modern lighting equipment, socket devices, electric tools, reflectors, storage batteries, motors, controllers, electric vehicles, transformers, automatic switches, fuses, wiring devices of all kinds and ventilating equipment will also be exhibited.

The time of the show is also particularly favorable. Although Chicago is known as the convention city there are few periods of like length during the year when as many conventions are held as in the two weeks selected for the show. Among the associations to convene in the city during this time are the Illuminating Engineering Society, Illinois Electrical Contractors Association, Illinois Electrical Association, American Association of Railroad Surgeons, National Dairy Show, Grand Lodge of Illinois A. F. and A. M., National Implement and Vehicle Association, Polish National Council of America, and the Railway Fire Protection Association. Special attention will, of course, be given to the electrical conventions held during this time and in addition efforts will be made to have the delegates at the other conventions attend.

E. W. Lloyd, 72 West Adams street, Chicago is manager of the show.

CIVIL-SERVICE EXAMINATION FOR JUNIOR ELECTRICAL ENGINEER.

Applications for $1080 to $1200 Position Will Be Received Until Further Notice.

The United States Civil Service Commission, Washington, D. C., announces an open competitive examination for junior electrical engineer to fill vacancies in the Bureau of Mines, Department of the Interior, for duty at Pittsburgh, Pa., or elsewhere. The salary is $1080 to $1200 a year, with temporary increase of $240 a year granted by Congress if services are satisfactory. On account of the needs of the service, applications will be received until further notice. Applicants must not have reached their thirtieth birthday on the date of making oath to the application.

Competitors will not be required to report for examination at any place but will be rated on the following subjects: Physical ability, 10; education and experience, 90. Graduation from a four years' course in electrical engineering in a college or university of recognized standing, and at least one year's experience in electrical engineering work outside the college are prerequisites for consideration for this position.

Applicants should at once apply for Form 1312, stating the title of the examination desired, to the Civil Service Commission at Washington, D. C., or at one of the district offices.

CHARLES SCHWAB TO ADDRESS MINING AND METALLURGICAL ENGINEERS.

Plans for Annual Convention in Chicago, Sept. 22 to 26, Practically Completed.

Charles Schwab will be a speaker at the banquet of the American Institute of Mining and Metallurgical Engineers to be held in conjunction with its annual convention in Chicago, Sept. 22 to 26 inclusive. Elaborate plans for both the technical and social side of the meeting have been perfected. Engineers who make the trip to Chicago for this meeting are assured of one of the most interesting annual meetings which the Institute has held. In addition to some hundred and fifty papers which have been prepared for the meeting, trips to the zinc smelting districts, the steel works at Gary and the refineries at Whiting and East Chicago are included. A boat trip on the lake together with numerous social events have been arranged for the ladies. The fifth annual exposition of the Chemical Industries will be held in Chicago at the same time as the meeting of the American Institute of Mining and Metallurgical Engineers and members of the Institute are cordially invited to attend.

ELECTRIC VEHICLES TO BE SHOWN AT NEW YORK ELECTRIC SHOW.

The New York Electrical Exposition, which is to be held during the 10 days beginning Sept. 24, at the Grand Central Palace, will have among its exhibits several displays by the leading manufacturers of electric automobiles.

In the commercial car section will be seen different sizes and types of trucks built by the Ward Motor Vehicle Co., the Commercial Truck Co. of America, and the Walker Vehicle Co. Passenger cars will be exhibited by the Baker R & L New York Corporation, and by the Metropolitan Detroit Electric Automobile Co.

Storage-battery manufacturers will be represented by the Electric Storage Battery Co. and the Philadelphia Storage Battery Co.

Another exhibit of particular interest to automobilists will be that of the Bennage Co. This exhibitor will show a new type of electrically heated vulcanizer.

NEW QUARTERS FOR BLIND SCHOOL AT CROCKER-WHEELER WORKS.

The Double Duty Finger Guild of the Crocker-Wheeler Co., Ampere, N. J., an organization for the instruction of the blind that was developed by Dr. Schuyler Skaats Wheeler about two years ago, is arranging to move its headquarters and main workroom now located at North Fifteenth street and Park avenue to a new department in Building No. 70 at the plant. The new quarters will be directly under the restaurant maintained at the works for employes, and a section of this lunch room is to be set aside for the blind workers. This organization, under the direction of Dr. Wheeler, has been highly successful; at the present time about 24 blind workers are engaged in coil work, including taping, insulating, etc., and 10 other blind workers are now being employed in the regular plant with normal workmen after having been instructed at the Guild. Mrs. Ida Hirst Gifford is superintendent of this department.

HOUSEHOLD APPLIANCE CONVENTION HELD IN MINNEAPOLIS.

A convention of the Northwestern Home Appliances Association was held at the Radisson Hotel, Minneapolis, Minn., Aug. 14 to 16. This is an association composed of dealers associated with the Sterling Electric Co. of Minneapolis, the Kelley Hardware Co., of Duluth, and others. Among the manufacturers represented in the association are the United Electric Co., Canton, O., American Ironing Machine Co., Chicago, Pittsburgh Gauge & Supply Co., Pittsburgh, and the Rudd Heater Co.

Commercial Practice

House Shortage Creates Demand for Service — British Plan for Vehicle Business — Successful Washer Campaign

SCARCITY OF HOUSES CREATES DEMAND FOR ELECTRIC SERVICE.

Georgia Railway & Power Co. Reports Great Activity as the Result of Housing Conditions.

The scarcity of houses that is prevalent throughout the country at present, appears to be particularly evident in Atlanta, Ga. As a result, houses that probably might never have been wired for electric service or piped for gas are getting both these days, and the demand on the contract department of the Georgia Railway & Power Co. is greater than it ever has been at this time of the year, according to W. R. Collier, sales and operating manager.

The demand in that city is so great that people are buying and renting homes for their own use which, under normal circumstances, they would not have been willing to consider. In order to make these homes as comfortable as possible they are being improved by the installation of modern conveniences which naturally includes provisions for the use of gas and electricity. In addition, the owners of buildings wishing to take advantage of this demand and realizing the increased value of their property if equipped for such conveniences, are taking steps to have them installed.

Mr. Collier points out further that there is a large number of new houses being erected and all of these are being provided with both gas and electric service which adds to the company's activity.

ELECTRIC VEHICLE BUSINESS IN ENGLAND.

Electrical Development Director Urges Loaning of Vehicles in Order to Encourage Sales.

J. W. Beauchamp, Director of the British Electrical Development Association, writing in the official organ of the Electric Vehicle Committee, urges electric vehicle manufacturers and electric supply undertakings in England to consider the question of letting out vehicles on trial to possible customers. He says it would not be beyond the resources of some of the central-station companies to offer to possible customers the use of an electric truck with a driver for, say, one month, the vehicle and driver to be entirely at the disposal of the customer for his ordinary cartage business and to be charged and garaged by the central station. At the end of the month the cost of the month's cartage service based on figures for electricity, labor, depreciation, etc., which would be exactly comparable with his own costs if he were to buy the vehicle, would be charged.

Mr. Beauchamp thinks that in many cases it would be found that at the end of the month the customer would be very unwilling to part with the vehicle and the trial would bring home to him as nothing else could the advantages and economy to be achieved in the running of an electric for certain classes of cartage and haulage work. Obviously it would be best to attack the user of horse vans at first and to select cases where considerable loads are conveyed over limited distances. The most effective canvassing consists in the loan of a vehicle with an accomplished and obliging driver who will endeavor to get the best out of it and show to the prospect its full possibilities and advantages.

"Lending vehicles out in this way," says the director, "cannot of course be carried out on an extensive scale unless there are considerable numbers available, but if only one general service lorry were employed for a year on such work, being lent to 10 or 12 different persons and particularly to large organizations in the district, such as municipal undertakings, express and freight companies, coal merchants and general cartage contractors, it would probably result in orders much more quickly than ordinary canvassing and publicity efforts."

Although the possibilities of the latter in relation to the electric vehicle business have been by no means fully explored, Mr. Beauchamp comes to the conclusion that the electric vehicle does its own publicity work very well—that is to say, it may be difficult to induce a large organization to purchase the first one, but when that is accomplished the work is done, and the fleet grows without further canvassing.

MAKING THE WASHING MACHINE CAMPAIGN A SUCCESS.

Two Schemes Used by Eastern Montana Light & Power Co. in Recent Campaign.

Perhaps the most prominent of the electrical devices being advertised and sold at present is the electric washing machine. No doubt the great scarcity of household labor and the growing tendency of the modern American husband to lighten his wife's labors are partly responsible for this, but nevertheless, the clever advertising schemes of the manufacturers and the original efforts of local dealers and central stations, have done much to stimulate this demand.

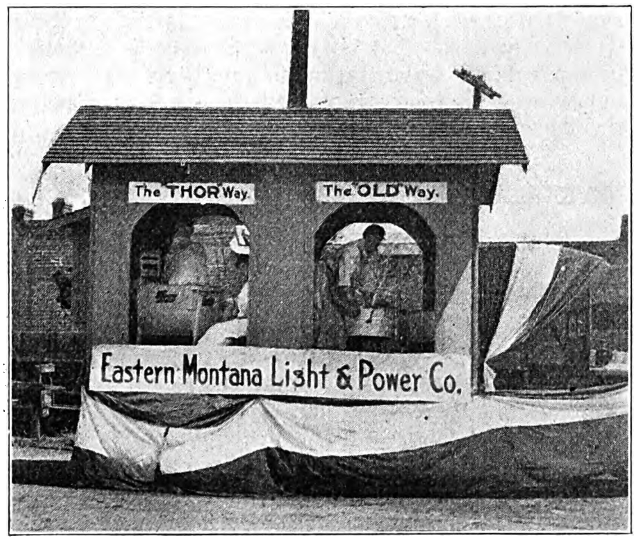
Two such schemes are illustrated herewith. They were used by the Eastern Montana Light and Power Co., Glendive, Mont., of which E. J. Condon of Chicago is president and John M. Culver, sales director, in a recent campaign on Thor electric washers.

In the first scheme, the washer was placed on the roof of the company's building and was illuminated by a number of colored lights placed in the form of an arch above. To add to the effect a number of silk flags were strung from the washer to the arch above which made the effect at night very beautiful. The entire building was also covered with bunting and the show window was attractively decorated with potted ferns and flowers among which smaller electrical appliances were displayed.

The second scheme, which also served to prove the public spiritedness of the company, was a float that took part in a civic parade. On this float a two-room house was built which was suitably decor-

Clever Scheme of Advertising Electric Washers.

ated and arranged so all could see its interior. In one room, called the old way, an old black mammy rubbed over a tub of foaming suds in a vain endeavor to bring the spots out of a soiled garment. In the other room, called "the Thor way," a neatly attired



Central-Station's Float That Won First Prize in Civic Parade.

housewife sat in a rocking chair, reading a magazine, while the electric washer did the work. Needless to say, this float won first prize and also that the campaign proved successful.

LOUISVILLE, KY., CITY HALL GENERATING PLANT ABANDONED.

The City of Louisville, Ky., which for many years has operated an electric generating plant to supply current for the City Hall and annex, has decided to abandon the generation of current and will hereafter purchase its requirements from the Louisville Gas & Electric Co. The business which will be connected by the company soon, amounts to approximately 250 hp.

COMMISSION HOLDS ELECTRIC AND GAS BRANCHES ARE SEPARATE.

New York Commission Also Decides That It Is Time to Consider Situation from Peace Standpoint.

The Public Service Commission of New York, Second District, recently rendered an interesting decision in a complaint against the Central Hudson Gas & Electric Co. Some time ago the commission authorized this company to increase its gas rates from $1.25 to $1.50 per M cu. ft. which resulted in the complaint being filed by residents of Poughkeepsie and Newburgh. Evidence was taken at the critical period of the war and the Commission was reluctant to determine a rate on evidence or conditions at that time. Representatives of the Poughkeepsie complainants desired that the investigation include electrical operations, on the theory that the price of gas should not be increased even if the gas operations should be found unprofitable provided the company as a whole was earning a fair return. Commissioner Irvine declined to receive the evidence on the ground that the two branches of the business must be considered separately and that electric consumers could not be required to make up a loss on the gas business. In a memorandum of the Commission he says doubt was expressed on this point and a case was pending demanding its judicial determination. This case was decided in accordance with the theory expressed by Commissioner Irvine.

The Poughkeepsie complainants were informed that there was no complaint against the company's electric rates, but if one were filed, as provided by the statute, the two matters would be disposed of at the same time. No complaint was filed.

Commissioner Irvine, in reviewing the evidence presented, said:

"An estimate of operating results for 1919 involves too many elements of conjecture to render it of much service. There is nothing to indicate a substantial addition to revenue. It is to be hoped and only hoped that expenses may decrease. It is not probable that the return can exceed 7%. During the war the Commission was inclined when rate adjustments became necessary, to permit increases only far enough to meet operating expenses, taxes and interest on bonds or, in other words, merely to insure solvency. The time has now come when we may properly consider a fair peace time return on the investment. It is necessary to do so if utilities are to be preserved and capital invited in order to make extensions and betterments essential to the rendition of proper service. A return of 7% or less can not be considered an unduly large return. It may be that coal prices and oil prices, and perhaps some other elements of cost, will soon decrease to such an extent as to warrant a lower rate. On the figures before us we cannot hold that the present rate is at the present time unreasonably high and the complaints must, therefore, be dismissed, but the current schedule should not be fixed for a period longer than one year. It is true that the corporation has been paying dividends during the two years under special examination of 8% and that in 1918 the corporate surplus was increased by the amount of $5524. This indicates higher earnings on the electrical side than on the gas side, but, for reasons already stated, the electrical operations are not before the Commission, and therefore no opinion is expressed or even entertained as to the reasonableness of the electric rates."

Operating Practice

Leaky Rock-Filled Dams — Manhole Ladders in Cleveland — Operating Results with Mechanical Soot Blowers

DETECTING AND REMEDYING LEAKY ROCK-FILLED DAMS.

Simple Expedients to Be Followed—Precautions to Be Observed.

By W. F. Snyder.

There are numerous hydroelectric plants and mills, principally in the smaller installations, in which the leakage through rock-filled timber dams assumes such proportions that it materially decreases the amount of power available. The dams of this type of construction are usually sheeted on the upstream side and after a while the sheeting deteriorates and the water passes through in ever increasing volume. Ordinarily this is of no great consequence for it can be resheeted. If, however, the sheeting was not carefully driven to hard pan or solid rock there might be serious undermining of the dam. The action of undermining varies according to the nature of the soil upon which it is built. If it is rock the chances are that the leakage will deteriorate the sheeting. If it is hard pan it will cut through it if the sheeting is not driven deep enough to overcome the pressure.

In gravel or loose soil it is imperative that the sheeting be driven deep enough so as to prevent all leakage, for a small leak will rapidly increase. If in clay, the sheeting driven into it for a moderate depth will very seldom give trouble. Concrete dams should always be on rock or hard pan and if on the latter an extra trench with a double row of sheet piling driven in it will prevent all leakage.

These leakage troubles do not always originate at the dam. Sometimes they are hundreds of feet back and are very hard to locate. If the water is reasonably clear and the pond not too deep, the easiest way to find these leaks is to use a boat to which are fastened ropes on each end and extending across the pond. Two men, one on each shore, move the boat back and forth, shifting position each time by 6 or 8 ft. up or down stream, as the case may be, so that the bottom may be carefully explored. In the boat a storage battery of the automobile type supplies energy to an automobile lamp which is fastened to a pole located inside a tin can so as to direct the light downward and keep it out of the eyes of the operator and enable him to observe the bottom. Care must be taken that the wires to the battery will easily detach themselves for there is danger of the boat being overturned if the light should be drawn into a suck hole suddenly. Sometimes these holes are of such magnitude that they can be observed by the whirlpool action on the water. Any exploring with lamps must be conducted after dark.

If the water is turbid and it is not possible to see very far, a metallic tube resembling a telescope, tapering from 2 to 6 or 8 in. in a length of 6 to 8 ft., tightly closed off at the bottom with plate glass, will enable observations to be made. To this tube the light can be fastened with the rays directed downward as before. It will be necessary to fasten lead or similar weight to the tube so as to make it sink to the proper depth. Great care must be observed so that the tube will not be caught in the suck hole, otherwise it will be gone in an instant.

Another way to explore the bottom is to proceed with a pole to which is fastened a can, the drawing action of which will locate the suck hole. After the suck hole is located, a few 2 by 4-in. timbers or poles can be placed in the shape of a tripod and the telescope attached and then placed over the hole for observation.

The hole being located and the size and nature thereof being determined, the next move is to plug it up. Sometimes throwing rocks in which will be carried down a distance and become lodged suffices. Some may pass through and come out below. A few corked bottles or sealed tin cans forced in above will often reveal the outlet below, after which bags of cinders, sand and stones may be thrown in the hole while someone observes the point of discharge to see if these bags are coming through. If they are not seen to come through it is assumed that they have lodged. It may be well to prove this by trying more cans or bottles and also looking for a decrease in the suction of the hole. If it is determined that the material is lodging, follow up quickly with more bags of cinders and stones until the suction is nearly gone. Then it is well to quickly fill with cinders and manure or just spout fine cinders in the hole. Care must be taken that about 2 ft. is left for a concrete top to seal this so as to avoid further trouble. The concrete should be one part cement to two parts sand, well mixed and slightly wet. This should be spouted into position through a pipe and be permitted to spread over twice as much area as that of the hole so as to be sure that everything is sealed.

Similar methods can also be used when the leak is at the dam proper. There are many leaks such as described which if repaired would result in the delivery of much more power. It is often advisable to engage an expert at hydraulic work to attend to work of this nature for he will usually save money in the long run.

MANHOLE LADDER PROTECTS CABLE SHEATHS.

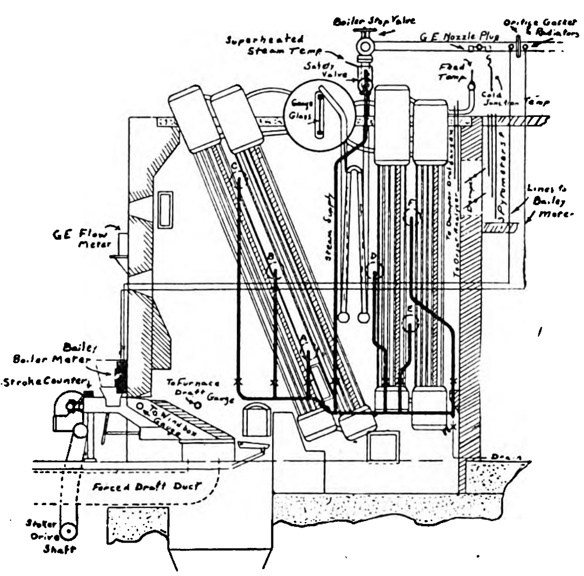
Cleveland Electric Illuminating Co. Uses Ladders in Its Manholes.

Damage is frequently done to underground cables where they pass through the manholes. This damage, which occurs to the lead sheath, is done by the men using the cables as steps to move in and out of the manholes and as they work in the manhole. Even when care is taken a cable sheath may easily be damaged irreparably by a nail in a man's shoe and similar causes.

The use of cement coverings, a sheath of steel banding or asbestos cloth, are methods of protecting the comparatively soft lead cable sheaths, but even with these a careless or hasty man using the cables as steps may do damage. The Cleveland Electric Illuminating Co. is using a galvanized ladder in its manholes by which the men enter and leave the manholes. The company is finding these ladders worth while, since not only do they reduce the likelihood of cable trouble but lessen the chance of accident to the men and loss of time incident to climbing in and out of the manholes over the cables.

OPERATING RESULTS OBTAINED BY USE OF MECHANICAL SOOT BLOWERS.

The economies effected by the use of mechanical soot blowers, due to reduction in quantity of coal required, increased boiler efficiency and increased steaming capacity, have been generally recognized by engineers in recent years. Owing to inherent difficulties, however, there have been very few detailed tests made. The following list of mechanical soot blowers, thought to be the most accurate yet carried out, was made in



a boiler room comprising 14 Bigelow-Hornsby boilers of 625 b-hp. equipped with Diamond soot blowers and fired by Taylor stokers.

The boiler selected for the test consisted of ten groups or units of inclined tubes in the front over the furnace, and ten groups of vertical tubes in the back of these with vertical type Foster superheater in between. Each group or unit of tubes contains 21 3¼-in. steel tubes, a total of 420 tubes. All tubes fit into so-called unit drums. In each of these the ten top drums are connected to the main cross drum. The total heating surface of boiler is 7322 sq. ft. Manufacturer's rating is 625 b-hp. Steam pressure and safety valve setting are similar to that on the B. & W. boilers.

The stoker is of the Taylor seven retort underfeed type, having a grate area of 105 sq. ft. inclined grate. Forced draft was supplied to this stoker by a turbine-driven multivane double inlet fans. In this test the forced draft and stoker driver were separated and stoker was driven by one of the Westinghouse engines recently installed on the boiler room floor for the driving of stokers. Induced draft was obtained by means of fans located at the uptake to the stack.

The soot blowing equipment on this boiler consists of six elements located as shown in Fig. 2. The perforations in the elements A, C D, and F are arranged in five groups of four holes each on one side of the pipe, and five groups of two holes each on the opposite side of the pipe. The elements are set so that the issuing streams of live steam will play all along the tubes. Element B has a set of evenly spaced holes on one side only. This is essentially a baffle blowing element and the stop with which it is equipped prevents the hand wheel from being turned to a position where the jets will play directly on the baffle to the detriment of the latter. Superheated steam is used on this boiler, the supply being taken from the point in the boiler outlet just before the main valve.

The steam flow was obtained by means of two meters, one an integrating recording indicating General Electric meter, already installed and used in tests, the other a newly installed Bailey boiler meter. Weight of coal was obtained from the traveling weigh hoppers and lorry tickets. A revolution counter was placed on the Taylor stoker to count the revolutions of the main power shaft. The thermometer for obtaining superheated steam temperature and that for obtaining feed-water temperature were placed in thermometer wells in their respective pipes at the top of the boiler as in previous tests. The uptake temperature was obtained from three pyrometers inserted into the flue above the damper and inserted at 4, 5 or 6 ft., respectively. The cold junction temperature was obtained by means of an indicating thermometer suspended over the cold junction of the pyrometers, steam pressure was obtained from the steam gauge in regular service on the drum. A steam correcting thermometer for obtaining the superheated steam temperature corrected. The carbon dioxide of flue gas was obtained by means of a sampling tube already installed and used in previous tests in conjunction with a standard Orsat gas analyzer. Draft over the furnace and at the damper was obtained on the indicated gauge. Pressure in the wind box was indicated on the lower gauge and on the recording pressure gauge. In addition to the above, the Bailey meter indicated the draft over the furnace and the air flow through the boiler, the latter being obtained by means of two 1½-in. pipe connections, one to the combustion chamber over the furnace and the other in front of the damper at the same height as the first. The various items indicated above and constituting the testing apparatus on this boiler, are shown in the accompanying sketch.

The test began at 5 a. m., Feb. 3, 1919. The duration of each run was 24 hours. At the beginning of each run the fire was cleaned and the hopper filled. The tail gate was cleaned whenever found necessary by observation of the fire. This varied from about every 2 to 4 hours, depending on the load.

The method was to run a series of tests with the soot blowers attempting to grade the runs from 75% load to about 200% load, each run to extend for 24 hours. This was to be followed immediately without operating the soot blowers, duplicating the loads and conditions of the first series as closely as possible.

The fire-room crew were guided by the steam-flow meter in maintaining the load and also by regulating the opening at the dampers on other boilers. During the test, with soot blowers, the latter were operated every 6 hours. The operation consisted of turning on the steam in the supply header, then in turning on the steam in each element and by means of the chain around the hand wheel turning the element three times in both directions as far as possible. This operation for the boiler occupied 10 and 15 minutes.

On this boiler eight runs in all were made, the first four being with soot blowers and the second four being without soot blowers, attempting to reproduce the conditions of the first four as nearly as possible. In doing this the fire-room crew and the tester were guided by the average conditions attained in the first four runs. Readings were taken every 20 minutes.

The steam utilized by the soot blowers was not registered by the steam flow meters, owing to the fact that the meter connections to the boiler are placed at a point which is not passed by the steam used in the soot blowers. The steam was used along the inside walls and bridgewall to decrease the accumulation and adhesion of clinker. This is a connection in operation during regular operation, and was less so during the test. This steam, also, was not taken into account by the steam flow meter. Readings were taken as follows: Steam flow; air flow; furnace draft gauge; windbox pressure; the speed of the stoker line shaft; the number of revolutions of the stoker power shaft; steam temperature; feed water temperature; flue gas temperature on three pyrometers; cold junction temperature; air temperature; steam pressure, and carbon dioxide in the flue gas. Forced draft was obtained from a blower which was isolated from the other blowers by closing the division damper. It was kept running throughout the entire test, and the draft on the boiler was regulated by means of the control at the boiler.

It has been stated previously that with the present practice of cleaning the boilers with the hand lance, each boiler is cleaned every four or five days. In the tests without soot blowers, in order to reduce this condition, the series was started with the boiler heating surface clean and then left without any cleaning during the series. If the series had been extended for, say, an equal period or longer, and if during that time the regular hand method had been used to clean the boilers on the regular schedule, it is very probable that a still greater rise in flue gas temperature and still greater decrease in combined efficiency would have resulted. This statement is made because it is believed that with the present hand method, owing to the fact that all soot is not removed, there is a gradual accumulation on the heating surface, the longer the boiler remains in service. Therefore, based on the above, it is safe to say that the results obtained were conservative, that a more exact test along the line indicated would show better results.

In addition to the above, may be mentioned the fact that operation of the soot blowers does not require the banking or shutting down of the boiler, while in order to remove the soot by hand method it is necessary to shut down the boiler for two or three hours, during which time the boiler setting cools and must be warmed up again. Here is a loss which is eliminated by the use of soot blowers.

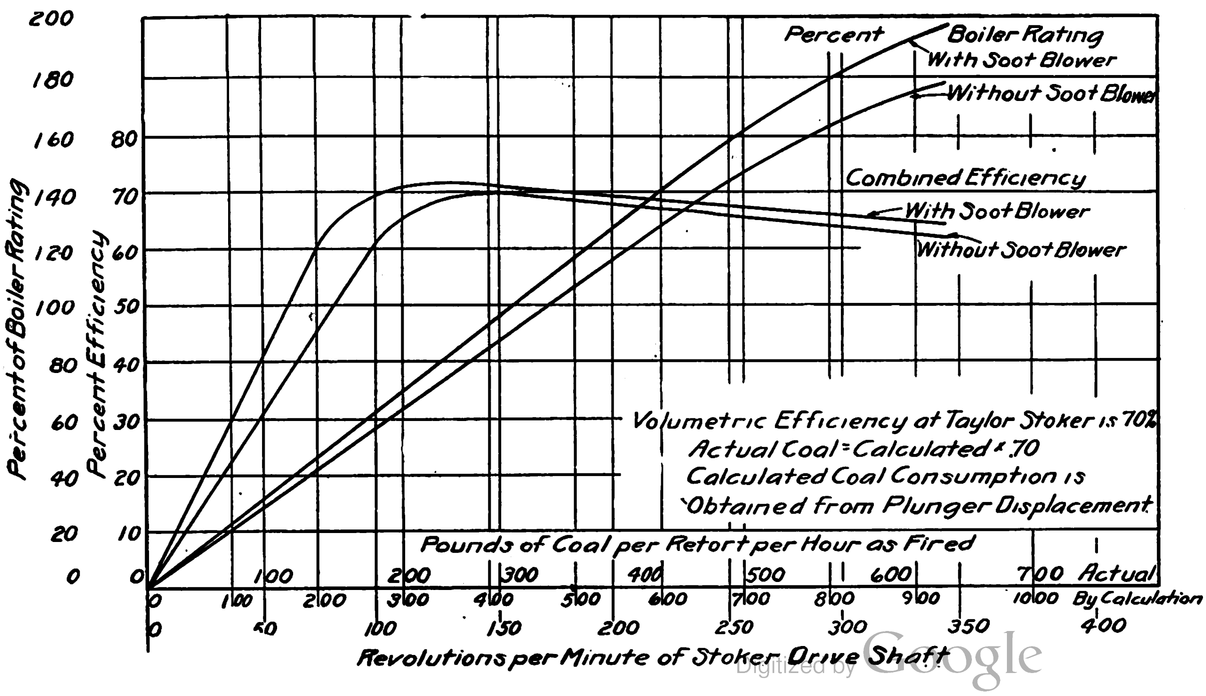
It has been stated that the steam used by the soot blowers was not included in computing boiler efficiency. In other words the boiler was charged with this steam. On the other hand since no steam was used in the tests without soot blowers, the boiler was not charged with steam for this purpose, but it is equivalent that in a long series, as in actual practice, considerable steam would be used for cleaning by hand lance, which would have to be charged to the boiler, therefore further decreasing the combined efficiency.

In conclusion it should be noted that these tests were conducted in a manner calculated to indicate a minimum rather than a maximum improvement by the use of soot blowers. It would have been fairer, on the whole, perhaps, to have refrained from using the soot blowers at all before making the tests without soot blowers, using the hand lance only to clean the boilers at the regular periods of cleaning. Had this been done, the boilers would not have had the advantage of being thoroughly cleaned by mechanical blowers when they entered the hand hose test.

Comparison of Composite Results with and without Diamond Soot Blowers.

Decrease in average uptake temperature with soot blowers	36.1%
Percentage gain in efficiency of boiler, furnace and grate with soot blowers	2.05%
Value of savings of coal per year based on 1918 consumption and prices	$8,559.86

The accompanying table contains a summary of the benefits, exclusive of decreased labor and labor turn-over, of using the soot blowers. It shows that even under the conditions given, the soot blowers would pay for themselves in a comparatively short time.



Contractor-Dealer

How Turnover Effects Profits—Clever Schemes Used to Attract Summer Trade—Dealer's Relations to the Public

THE EFFECTS OF TURNOVER ON PROFITS.

A Discussion of This Important Factor in Merchandising and Methods of Figuring.

By Chester A. Gauss.

Everyone knows that a high rate of turnover is desirable but the reason is often obscure. In fact, the difference between a quick turnover and a slow turnover often amounts to the difference between success and failure.

Turnover may be said to be the time that elapses between the time an article is paid for and the time it is turned over into money again. It is hence, the length of time money is invested in any given lot of merchandise. A good paying business can be built upon small profits just as well as upon large profits. It all depends upon the rate of turnover. Some United Cigar Stores have turned over their stock as often as fifty times a year. A net profit of 1% at such a turnover rate would give a profit of 50% on the capital invested at the end of the year. If the turnover were only 25 times a year and the net profit 1% on sales, the profit for the year on the capital invested would be 25%. To realize the same profit on this turnover as on a turnover 50 times a year, the net profit per sale would have to be increased to 2%.

It is not likely that any electrical contractor or dealer can realize such rapid turnovers but the same principle holds. If a contractor-dealer buys an appliance for $5 and sells it for $15 at the end of the year he has made 200% gross profit on his investment. If he buys $5 worth of electric lamps per month and sells this amount of lamps each month for $7.50, he realizes a gross profit of 50% per month on his investment. This amounts to 50 times 12 or 600% profit for the year on the investment. In other words at these turnovers $5 invested in the appliance first referred to gives a gross profit of $10 at the end of the year while $5 invested in lamps gives a gross profit of $30 at the end of the year.

The profit in any business is, therefore, in the sale of goods and not in the keeping of the merchandise. The more sales that are made in a given time, the more rapidly the stock is turned over and the greater the profit. If an electrical contractor-dealer finds that he cannot sell certain stock at a profit, it is better to sell it at a loss, thus releasing the capital invested in it so that it can be reinvested in stock that will sell quickly and earn money for him.

For the man with small capital, goods that sell quickly should be bought in preference to the slow sellers. It is far easier to show a good profit at the end of the year by doing this than by loading a store up with goods upon which the turnover is slow. Limited capital should always be kept working.

Turnover can only be bettered by proper buying or the increasing of sales. Goods cannot be bought properly unless some record is kept of the sales of each article. To obtain this information, of course, involves a little labor but, since it enables the merchant to sell the same volume on a smaller capital investment, it pays.

One of the easiest ways to obtain data on turnover is to maintain a card index with cards for each article carried. On these cards should be entered the date and quantity of an order of goods when received, as well as the quantity still on hand at that time. When the stock on hand of any item becomes low the merchant can easily count the amount on hand and by referring to the card determine the rate of turnover on the last lot—that is, how long it took to dispose of it. This will enable him to determine the best quantity to order.

When ordering, discounts play as important a part in determining the quantity as does turnover. Suppose that by buying lamps in 100 lots no discount will be obtained and the stock turned over in a month, while if 500 lamps are bought a 10% discount will be obtained. On the basis mentioned, it would take five months to turn over this stock of 500 lamps. If the net profit per lamp is 20% of the cost price when bought in 100 lots, the profit at the end of the year on the money invested will be 12 times 20 or 240%. If the lamps are bought 500 at a time and sold at the same price 10% additional profit will be made on the cost price or a total of 30%. But the 500 lot stock can only be turned over in 5 months or 2 2/5 times a year. The profit for the year on the money invested will be 30 times 2 2/5 or 72%, compared with 240% profit on the invested capital if the lamps are bought in 100 lots. It would, hence, pay the electrical contractor-dealer who is limited in capital to buy in the smaller quantity.

Suppose, however, that the electrical contractor dealer is not limited in capital and that 100 lamps cost him $25. On this basis 500 lamps cost him $112.50. At the end of the year he will make 240% profit on $25 or $60, which is 72% profit, while on $112.50 the gross profit amounts to $81. Since this electrical contractor dealer has unlimited capital it would be well for him to buy in 500 lots and obtain this $21 additional profit on his investment.

Overhead and turnover are closely related although it is not an infrequent occurrence for one to fail to realize the importance of the connection. If, by spending $100 a year in advertising a merchant can double his turnover on an article which he buys in $100 lots and turns over for $150 once every two months it will pay him to do so. Without advertising he would realize 6 times $50 or $300 per year on an investment of $100. If he spends $100 a year in advertising and is thus able to turn over this $100 stock once a month, he will have realized 12 times $50 or $600 per year on his $100 invested in merchandise. From this $600 profit should be deducted the $100 spent for advertising, leaving a net profit of $500 on the investment in place of $300 as would be the case if no advertising were done.

Similarly, if a $20 a week clerk can sell one washer costing $75 and selling at $125 a month while a $25 a week clerk can sell two washers per month, it will pay to fire the $20 a week clerk and hire a $25 a week clerk provided, of course, he is as efficient or more efficient than the cheaper clerk in selling other appliances. Considering four weeks to a month, the higher priced clerk costs only $20 more but in place of selling one washer at $50 profit he has sold two which give a profit of $100.

In figuring turnover one must also take into consideration the effect of any increase or decrease in his turnover upon his overhead expense. If doubling the rate of turnover means that double the sales can be made at the same overhead expense, all the advantages of doubling represent clear profit. If, however, doubling the turnover adds to the overhead expense, this increased overhead must be figured in when determining the desirability of the increased turnover.

Another factor that is too often overlooked in connection with turnover is collections. An article is really not turned over until the selling price is actually paid by a customer. If collections are difficult and if credit, where granted, must be long time credit, it may pay the electrical contractor dealer to sacrifice this credit trade because it takes so long to realize on his investment that, if the same amount were invested in other goods and a strict cash business done, the amount realized at the end of the year may be greater.

Prices and turnover also are closely connected. One can more easily afford to make a small profit on goods that turn over rapidly than to make a small profit on goods that turn over slowly. A profit of 1% on an investment that turns over 12 times a year amounts to the same at the end of the year as 12% on the same amount invested in articles that turn over only once a year.

From this, one can readily see that if a merchant can make his turnover more rapid by sacrificing a little net profit on each sale it may be possible to make more money on the same investment at the end of the year. If an article costing 20 cents is sold at 30 cents, and the stock of 250 worth $50 is turned over once every two months, the gross profit at the end of the year neglecting overhead is 250 times 10 cents times 6 to $150. If sold at 28 cents and turned over once a month the gross profit at the end of the year will be 250 times 8 times 12 or $240 on the investment.

These are but a few factors that affect the profits at the end of the year. Every innovation and every change made in methods, policies, buying, etc., must be viewed from many angles—overhead, net profit per sale, turnover, etc., in order to determine its effect upon the profits on the capital invested.

FEATURING ELECTRICAL HOUSEHOLD SUPPLIES DURING SUMMER WEATHER.

Several Clever Schemes Used by Successful Merchants to Attract Summer Trade.

By W. B. Stoddard.

Although the hot summer weather is nearly over there will still be many days when the thought of cooking becomes a nightmare to the majority of housewives. This is the time to impress upon them the fact that many crisp, dainty and appetizing meals can be prepared without heating up the house by using electricity and electric cooking utensils. E. L. Knight & Co., Portland, Ore., instituted a regular campaign along this line by means of catchy cards in the papers, such as:

What Shall We Have for Breakfast?

Coffee, and toast, and a poached egg, with a dish of fruit. Save time and temper, and serve them in a cool room.

It's regular fun to get breakfast with an Electric Toaster, Percolator and Hot Water Heater. No need to go into the kitchen at all—make them and serve them at the dining room table.

Another advertisement laid stress on the convenience for mid-day or after-theater lunch:

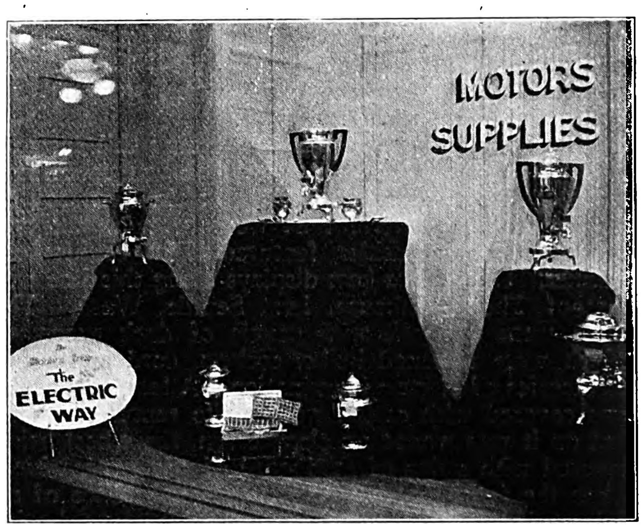
A Tasty Little Midnight Feast.

Whether the weather is hot or cold, a cup of tea, chocolate or coffee is the best thing for that "tired feeling" that is the result of a strenuous day's activity. Crisp toast, too, to go with the salad for a noon-day lunch is always acceptable.

But who wants to make a hot fire to secure these little luxuries? No need to heat the room or yourself. Use an Electric Percolator, Toaster or Grill, and earn the enthusiastic praise of your luncheon companions.

The window that supplemented these cards attracted instant attention. Three tall stands were draped with folds of velvet, and on top of each was an electric percolator. Two lower stands held chafing dishes, and down in front was a waffle-iron with three or four crisp, brown waffles. A large oval card advised: "The Modern Way—the Electric Way." When the idea of a more general use for electric appliances had been thoroughly spread, they sent out to a selected list of patrons a card of invitation:

"You are cordially invited to attend our afternoon tea, Saturday afternoon, from 2 to 5, and learn what delicious lunches can be prepared on electric appliances. Come and enjoy a cup of tea."



An Attractive Window Display of Electric Cooking Appliances.

A little rustic summer house was fitted up at one side of the store and in this sat a young woman before a tea table, on which was a large electric percolator, toaster and grill. Upon these she made coffee, tea, toast and a dressing for the toast. This was served by a maid to all callers, wicker chairs and small tables being disposed about the salesroom so that all could enjoy the lunch at their leisure. "We found," said the manager, "that by putting our guests thoroughly at their ease the best results were secured. By having them seated, too, their gaze had a chance to wander around the store, and, as we took pains to see that all of our appliances were arranged in the most attractive manner possible, many conveniences were seen that caught their fancy. We were not too high-brow to refrain from tagging each piece of merchandise, though in an inconspicuous manner of course, and the result was that they had a chance to learn the price without consulting any of the sales

A Fan Display That Suggests Cooling Breezes.

force, which many seem afraid to do." Little wicker tables were distributed about the room, each with a table lamp with wicker, silk-lined shade, and a vase of flowers. These were set with fragile china and the appropriate electrical appliances, and each table bore an appropriate card.

For the benefit of many, especially men who stopped to look at the window without going inside, there was a small metal wall pocket attached to the bricks at the side of the window, which had printed above it: "Take One of Each." In this pocket, which was divided into compartments, were little booklets on mazda lamps, household appliances, washing machines and house wiring.

The hot weather was long in coming this summer but when it came it set upon us with a vengeance, and the thoughts of all were turning to the best way of keeping cool. Electric fans were brought out and every wideawake dealer featured them in his best manner. One of the best displays along this line was that of The Lighthouse, Inc., Seattle, Wash. The walls were of buff, with panels of dark green, to which were fastened bulbs, sockets, cord and other accessories of electric illumination. A long low bench was covered with cotton wadding to represent snow, and on it was placed an electric fan, the wheel being covered with strips of cardboard of gay hues, which, when the fan revolved, gave it the appearance of an animated rainbow. The floor was also covered with cotton, amid which was an electric fan at rest, so that one could observe its construction.

But it is not only in the drawing room and dining room that electricity comes to one's aid. The laundry will benefit immensely by its use, and especially in the rural districts, where the housewife is usually the laundress as well. The electric washer will prevent many a nervous breakdown. H. R. Basford, San Francisco, brought this fact pertinently before the public through his publicity campaign.

In the window was a scene that showed the contrast very strongly. At one side was the figure of a woman in water-splashed dress and apron, bending over a tub, set on the back of a chair, and at the other an electric washing machine, and near it, in a wicker chair, reading a paper, another woman in neat blue dress. Cards at the base of either figure said: "The Old Way" and "The New Way." Across the base of the window extended a long sign: "Buy an Electric Washing Machine and turn Blue Monday into Sunny Monday." His newspaper advertisement read:

STOP! MR. MAN!

You don't cut wheat with a scythe. You don't write with a quill. You don't read by a tallow candle.

WHY DO YOU EXPECT YOUR WIFE TO USE THE OLD-FASHIONED WASH TUB?

Bring the good wife down to our store and let us demonstrate the Electric Washing Machine. A week's wash done in an hour.

Sold on easy terms if you desire. Pays for itself in a year's time in saving on wear of clothes and laundress' time.

During the recent Home Coming Week celebration they created much amusement, but at the same time drove home very effectively the point they wished to make. During this festival a float was arranged on one end of which was a man, enveloped in a big apron, laboriously scrubbing clothes, while at the other his little daughter was superintending the washing of clothes in an electric washing machine. A big sign on either side of the float observed: "If Father had to do the washing you'd see an Electric Washing Machine in every home inside of a month. Be a good sport and get one for the good wife. Sold on easy terms if desired. Come in and see them demonstrated."

DEALER'S RELATION TO THE PUBLIC IN MERCHANDISING.

Paper Read Before National Association of Electric Contractors and Dealers at Recent Convention.

BY J. R. TOMLINSON

Pierce-Tomlinson Electric Co., Portland, Ore.

The relations of the dealer to the public in merchandising consists of two distinct fundamental factors that must be analyzed and studied separately to determine whether the electrical retail store in its present relation to the public is to continue and develop along lines now existing and the proposed development thereof, or whether it is to change its course into some other channel.

The first of these factors is,—does the present retailer stand on logical, economic ground as a constituent part of the machinery by which electrical goods are to be distributed to the general public? From a theoretical viewpoint the retailer as we know him at present, is surely the proper agency through which the manufacturers' product should flow to reach the consumer, but whether or not he will be so recognized in the future depends upon how he develops as a business man. Now that the world has again resumed something like a normal attitude, manufacturers are turning their thoughts and energies to supplying the needs of the people that will contribute to their comfort and pleasure instead of their destruction and the dealer must, to be recognized as the logical distributor of such goods, be able to convince the manufacturers that he can furnish the business vehicle for such service. Competition is going to be very keen and the manufacturer will seek the outlet through which he can distribute the greatest quantity of his product, therefore it will be incumbent upon the dealer to convince the manufacturer that he is equipped in every essential detail, such as adequate finance, energetic sales policy, efficient delivery service and a liberal repair service. This is the first fundamental to be established. Having satisfied the manufacturer as to the tenability of his position, the second fundamental must be considered—contact with the public.

From the standpoint of economy, is a line of electrical specialty stores prepared to dispense strictly electrical apparatus and supplies, justifiable or shall this business be absorbed by other merchants? Again, due to the fact that the business is of a highly technical nature, it is evident that the public would be much more efficiently and satisfactorily served if a sufficient number of electrical specialty stores judiciously distributed and wisely operated, were to be established.

In any discussion of the relationship of the dealer to the public it would seem that the first consideration should be a clear understanding of just what constitutes the dealer. According to Webster, "The dealer is one who deals in any sense—a trader." However, the more modern classification of dealer in the term "Merchandiser" is preferable. According to Webster, the merchandiser is a person who buys and sells commodities as a business for profit. This distinction is made because it can readily be appreciated that we have too many "dealers" in this country and not enough "merchandisers."

Men and women of this country take the store and the merchandiser too much as a matter of fact, just as they take electric service with scarcely a thought of its wonders and its possibilities. After the house in which he lives, nothing is more important to man in the economy of life than the store from which he draws those things upon which he lives.

Thus the storekeeper or the merchandiser, is one of the greatest factors in the economy of life. Upon his efficiency depends the economical distribution of nearly everything that man produces. He is not alone the most important link in the chain of distribution that reaches from producer to consumer,—he is, practically the whole chain.

In improving the efficiency of the storekeeper, therefore, one serves the manufacturer and other producers by stimulating the consumption of their commodities. And, in like manner, the general public is served by every improvement in service and economical distribution. A merchandiser who loafs on his job not only limits his own livelihood but is an encumbrance to the prosperity of his fellow men.

In order to justify his existence as such, the electrical specialty merchandiser must, in addition to being competent to give expert information to his customer on ordinary, every-day electrical problems, be a competent business executive. All these accomplishments are not essentially to be centered in the one individual where the establishment is large, but in the smaller cities where the proprietor personally supervises the detailed affairs of his business he must necessarily, to be successful, be both executive and experienced mechanic. For this reason some plan should be devised whereby the electrical dealer of the future may receive his preliminary instruction in th art of merchandising. A large percentage of the present dealers are men who have stepped into the business from the ranks of the mechanics without having had any previous preparation for executive or merchandising service. The results of this are well known. This situation should be rectified for the good of the vocation and the public. To establish the fact that he occupies a sound economic position, the dealer must keep absolutely abreast of the times in the realm of merchandising.

In going deeper into the relations of the merchandiser to the public, there is one very important factor to consider, that is the element of human nature. Human nature is largely the same the country over. The desire to possess necessaries and luxuries exists in every man, woman and child. Therefore, whether the merchandiser be located in a large city, or a small town, the first milestone on the road to success is a study of human nature, particularly of the buying characteristics of your community.

Truth in advertising should be an unwavering principle, and advertising matter, systematically placed, should always be clearly and unmistakably worded so that the reader may have no cause to misconstrue the meaning.

The store arrangement and display should be orderly and tidy, the quality of the furnishings depending largely upon the class of trade that is catered to, and the general character of the surroundings, but always neat and clean. Show windows should be washed frequently and the window display should be changed at least every two weeks. If the many excellent and timely suggestions that are received by all dealers through the mails almost daily from the various manufacturers, and trade papers, are preserved for use at appropriate seasons, there would be no excuse for paucity of window-dressing ideas.

Neat tags, bearing retail prices in plain figures, should be appended to each article for sale. This gives the customer a feeling of confidence that he is dealing with a one-price concern.

The sales force should be neatly attired, courteous and accommodating. Most customers have absolutely no knowledge of electrical terms or their meaning, and the manner in which the salesman imparts a little helpful information to such customers usually determines whether or not he has made a future patron. If the information desired is given in a friendly, helpful spirit—well and good, but if with a lordly, smarter-than-thou air—good-bye customer. In fact, in all departments of his business through which he comes in contact with the public, such as his accounting and collections, delivery and repair service, good judgment must be exercised if the best results are to be obtained.

A liberal repair service to remedy or repair defective goods is a good policy. Occasionally, some one will take advantage of such liberality, but in the long run it pays.

One excellent opportunity for widening his clientele is quite generally overlooked by the electrical dealer. That is through membership and active participation in the activities of his local chamber of commerce, or other civic organizations. Most people are appreciative of unselfish efforts that are made in behalf of their home town and if the dealer does his fair share of community work he will find in addition to the personal satisfaction arising from having performed some real duties of our citizenship that there will come a response from his neighbors and townspeople in the form of increased business that will be a surprise to him. In addition, all transactions, whether private or public, should be so conducted as to inspire in the public mind a feeling of absolute confidence and trust.

In conclusion, the measure of the merchant's success will depend upon his ability to qualify on the foregoing necessary conditions, and if he puts industry behind it all he need have no fear for the public's hearty support. In fact, no opportunity exists in the retail line today that seems so favorable for men of the right qualifications.

New Appliances

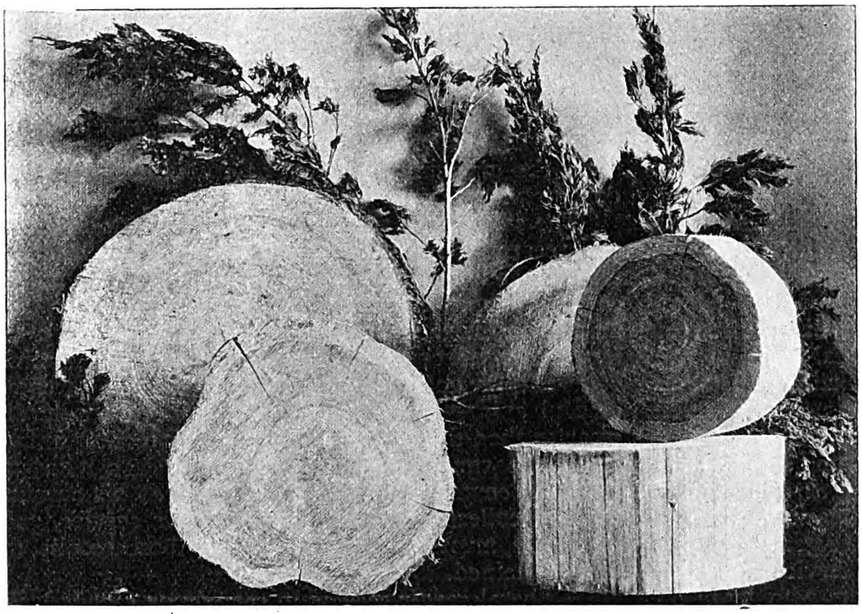
Southern White Cedar for Poles—Special Radio Apparatus for Experimenters — Single-Stage Centrifugal Pumps

Southern White Cedar for Overhead Line Poles.

Cedar has for a great many years been a favored timber for poles of electric light, power, telephone and telegraph companies, the reasons for its choice being its well-known properties of long life, strength and reliability of service. Among the cedars is a species that has not yet been generally employed to any great extent except in certain sections of the country. It is southern white cedar. A Forestry Service bulletin states it is valuable "on account of its long life when in contact with the ground." There are instances of southern white cedar poles having been set for 20 years and still remaining in serviceable condition. One of these lines is at Marion, Ohio.

An experienced timber producer not long ago became a convert to the suitability of southern white cedar for pole purposes and has actively taken up its production and sale for this and other purposes. Willis H. Gilbert, Fisher building, Chicago, has taken over the business of handling "Dixie" brand white cedar. He has had an extended experience in the lumber business since 1880, when he operated pine and hardwood mills at Bay City, Mich. In 1896 he took over some mills at Ashland, Wis., and a few years later also at Washburn, Wis., and Duluth, Minn., producing Norway pine. He became a specialist in this timber and made an enviable reputation for the splendid stock he cut. All timber was produced in his own camps and especially selected to suit requirements as to size, etc.

This practice is being followed by Mr. Gilbert in the southern white cedar business. He produces the timber in his own camps, has it specially selected for the service it is to render, and carefully inspected before shipment. As the result of this practice Mr. Gilbert has not had a single pole rejected this year. The accompanying illustration shows typical sections of southern white cedar, and also some characteristic boughs that Mr. Gilbert had prepared to show the excellent structure of this timber.



Several Typical Cross Sections of Southern White Cedar, Showing Good Structure for Pole Purposes.

Thordarson Apparatus for Amateur Radio Work.

To meet the needs of wireless experimenters who wish to make use of vacuum-tube equipment, the Thordarson Electric Manufacturing Co., 501-515 South Jefferson street, Chicago, has placed on the market special apparatus which is illustrated in the accompanying group cut.

Fig. 1 shows the new Thordarson wireless transformer, whose rating is 1 kilovolt-ampere and 25,000 volts. It is an air-cooled radio transformer of the closed-core, double magnetic circuit type. One of the magnetic circuits is variable to give wide regulation of voltage, capacity and reactance.

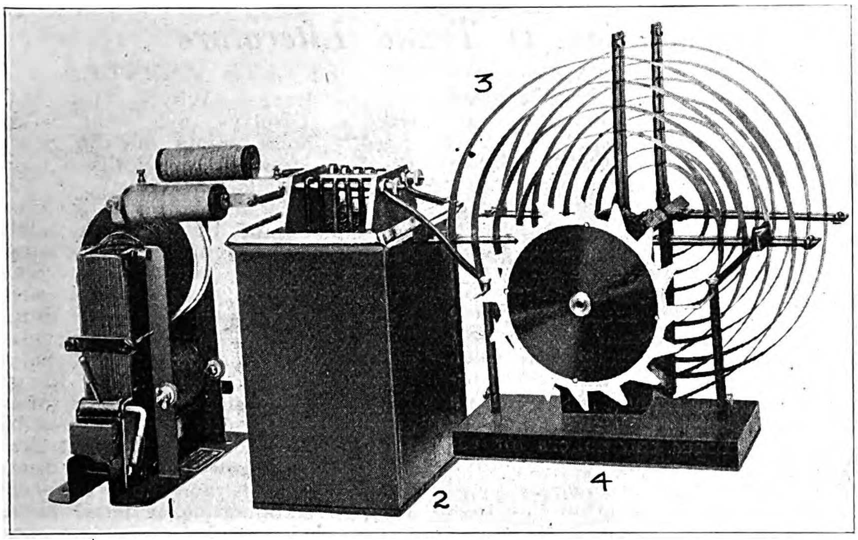
The core is made of high-grade silicon steel with laminations 8 mils thick.

The essential feature of this unit is its magnetic shunt and control which protects the transformer from undue current surges, such as are frequently present. These transformers can be connected directly to the alternating-current source without requiring a choke coil or other impedance. The construction of this transformer includes elimination of all castings, springs and adjustable screws, pressed sheet steel and brass clamps being used in place thereof. Regulation is accomplished by a simple system of levers and accentric cams, which are quiet in operation at all positions. A special mechanical and corona shield for the high-tension coils and a grounding terminal are provided. The coils receive a vacuum impregnating treatment and a special folded layer insulation is used for the high-tension coils. The transformer is entirely oil-proof and waterproof. It is very neatly assembled and makes an attractive unit in the radio set. Exceptionally high efficiency is claimed for this transformer.

In Fig. 2 is shown the special condenser for this equipment, the dielectric of which is phenol fiber, which has withstood potential tests at 48,000 volts before breaking down. It thus permits of an overload of nearly 100% when used with the Type R. 25,-000-volt transformer shown in Fig. 1. The edges of the sheet brass are rolled and the corners rounded, thereby preventing a loss of energy by corona or brush discharge. Between each two sheets of brass on each terminal of the condenser is inserted a third sheet which is corrugated. This arrangement permits the oil to penetrate and circulate, and at the same time prevents heating. There is practically no loss of energy due to heating, corona, or brush discharge, and therefore extremely high efficiency is attained. After assembling, the condenser is immersed in a container of oil, as it is a well-known fact that the greater number of long-distance amateurs use an oil-immersed condenser.

The outstanding feature of this condenser is the arrangement of the 10 terminals. The capacity can be increased from a minimum of 0.0018 mf. to a maximum of 0.009 mf. in single steps of 0.0009 mf. each. This permits very fine adjustment in the closed secondary circuit, and the number of turns on the primary of the oscillation transformer can be increased or decreased by merely decreasing or increasing the capacity of the condenser.

The oscillation transformer is shown in Fig. 3. The primary of this transformer consists of 3¾ turns of 1-in. heavy copper ribbon supported in fiber strips. The secondary consists of 7¾ turns mounted in the same way as the primary. The primary inductance is approximately 4.5 micro-henries. When the maximum turns on the primary are used with the condenser having a capacity of 0.009 mf., the wave meter shows a reading of 385 meters. Using one complete outside turn or an inductance of about 1.2 microhenries and a condenser capacity of 0.009 mf., the wave meter shows a reading of 205 meters. The secondary inductance is approximately 10.9 mi-



Figs. 1 to 4.—Thordarson Radio Transformer, Condenser, Oscillation Transformer and Rotor for Spark Gap.

crohenries. When using a condenser capacity of 0.004 mf. to 0.009 mf., a very select range of short wave lengths can be attained.

Fig. 4 shows a rotor for the rotary spark gap where the latter is to be used. The rotor of electrodes is of ⅛-in. hard aluminum, 8 in. in diameter. The center disk is phenol fiber. Actual test with the rotor of 16 teeth on a motor driven at 1000 r.p.m. to 1500 r.p.m. produces a low note with carrying quality. The same tone was produced with the rotor of 8 teeth and motor driven at 2000 r.p.m. to 3000 r.p.m. The tone can be varied by regulating the speed of the motor, but it is the low note that makes amateurs heard at long distance.

Dayton-Dowd Motor-Driven Single-Stage Centrifugal Pumps.

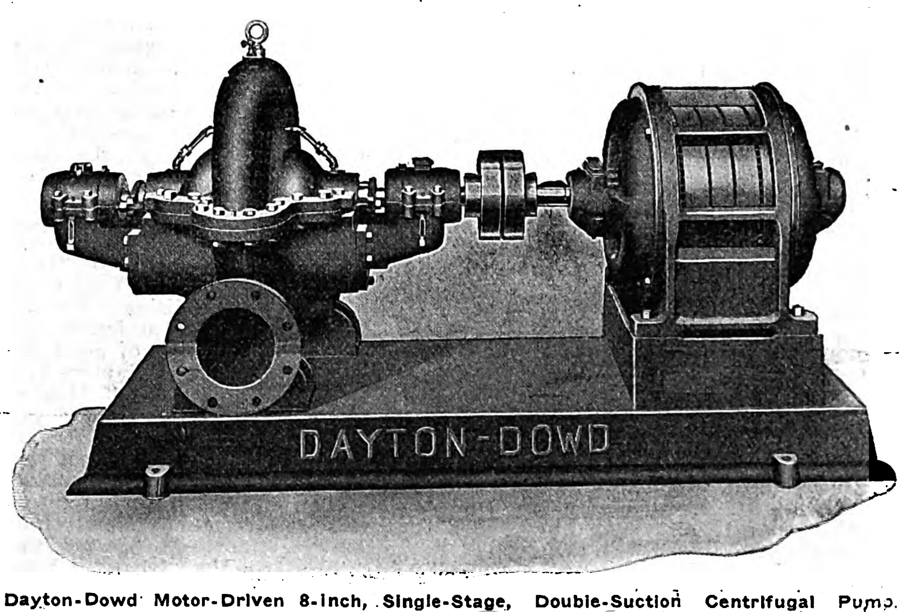
The simplicity of centrifugal pumps and their reliability in operation has won them so much favor that they are coming steadily into more and more extensive use, especially where motor or turbine drive is to be used. A large number of makes of centrifugal pumps are now on the market, and among these is a line that has been developed after many years of experience and has been employed in a great many installations, among the more notable ones being the Hog Island shipyards near Philadelphia, where six 8-in. pumps of this type are used; another case is in the water supply for the Great Lakes Naval Training Station which uses a 10-in. pump.

The pumps referred to are made by the Dayton-Dowd Co., Quincy, Ill. They are known as type CS single-stage double-suction volute centrifugal pumps and are made for either direct connection through an electric motor, steel turbine, oil or other engine, or for being driven by a belt. These pumps are built with special care for ruggedness and simplicity of construction and have excellent efficiency in operating characteristics. The main casing consists of two parts of which the upper half forms a cover and the lower half, with which are cast integral suction and discharge openings, and the feet. The upper half is provided with water seals, vents and an eyebolt for lifting; the lower half is provided with proper drains to permit draining the casing entirely when necessary. Between the two halves is the only joint in the casing; this is provided with a special manila paper gasket that sets between two specially machined surfaces, thus giving a perfectly water tight joint when the heavy flanges are securely bolted together. Although usually made of cast iron, under special conditions the case is furnished of bronze, brass or other material. Special bearings are provided outside of the pump casing so that any water leaking from the stuffing boxes will not enter the bearings or oil reservoir. All bearings are provided with oil rings to lubricate them thoroughly. Special care has been taken in the design and in the finish of the impeller. A special system is used for checking and polishing the interior of the impeller so that it coincides absolutely with the designs. In larger sizes a separate bronze wearing ring is shrunk in place on the impeller hub. There are also provided bronze case-wearing rings of wide section and machined to give a minimum running clearance with the impeller rings, so as to insure against leakage. The stuffing boxes are arranged for five or six rings of packing and a bronze water-seal ring. All of the pumps are provided with a flexible coupling of the pin and rubber bushing type, thus allowing a slight misalignment. In the case of belt-driven pumps an outboard bearing is provided, and in the larger sizes an additional bearing is provided beyond this to release the pump-bearing of the strain from a heavily loaded belt. These pumps are made in sizes from 1¼ in. up to 30 in. and with normal capacities of 30 to 26,000 gal. per min. Each size is made in various speeds and for various heads. Each pump is thoroughly tested to be sure it meets all of the conditions for which it is to be used.

Remarkable Success of Australian-Made Wireless Apparatus.

The wireless operator in the steamer *Karoola* has reported that when his ship was off the northwest coast of Australia he received clear messages from an English low power station in the North Sea which were transmitted on the ordinary short wave-length of 600 meters.

This feat was achieved with the new Expanse type magnifying valve receiver designed and manufactured in Sydney, Australia, by Amalgamated Wireless (Australasia) Limited. These receivers include a modified Fleming valve and were originally designed by the company's managing director, E. T. Fish, for demonstrating the possibility of receiving messages in Australia direct from the Marconi station at Carnarvon in Wales, nearly 12,000 miles away, or practically half way around the globe.



Dayton-Dowd Motor-Driven 8-Inch, Single-Stage, Double-Suction Centrifugal Pump.

Trade Activities

Large Power Plant for Pittsburgh — Successful Roller-Smith Conference — Distribution of Trade Literature

The C. H. E. Williams Co., electrical engineer and contractor, Seattle, Wash., and Vancouver, B. C., installed the electrical equipment in use in the new plant of the Kilbourne & Clark Manufacturing Co., in Seattle, which was described and illustrated in the ELECTRICAL REVIEW of July 19, 1919.

Dwight P. Robinson & Co., Inc., 61 Broadway, New York, has been awarded a contract by the Duquesne Lighting Co. of Pittsburgh, to design and construct a power station at Cheswick, near Pittsburgh, to have an ultimate capacity of 300,000 kw. of which one unit of 60,000 is to be installed initially. The work consists of a new power-station building with the necessary complement of boilers, piping, electrical apparatus, coal handling devices, coal storage, etc. It is anticipated that the work of installing the first unit will require about 12 months.

Wheeler Condenser and Engineering Co., Carteret, N. J., has issued a very clever and interesting little booklet entitled "What Worried Admiral Jellicoe Most." This little publication takes up extracts from Admiral Jellicoe's story of the grand fleet that deal with the big 11-in. guns and condenser tubes. The theme of the booklet is the importance of condenser tubes in a navy, the amount of anxiety caused the British admiral by condenser tube trouble, and the facilities at the disposal of the Wheeler Condenser and Engineering Co. for supplying condenser tubes and research. Tables of condenser tubes weights for tubes of copper and brass are included.

Roller-Smith Company, 233 Broadway, New York City, held a sales conference at its Bethlehem, Pa., works during the week of July 7. The following representatives attended this conference: G. L. Crosby, sales manager, New York; M. Frankel, assistant sales manager, Chicago; C. M. Hunt, New York; C. G. Kahant, export manager, New York; W. G. Merowit, Buffalo; C. H. Nicholson, Detroit; F. C. Perkins, Philadelphia; W. G. Pieksen, St. Louis; F. W. Ryan, Chicago; W. J. Shire, New York; J. E. Wood, Cleveland. In addition to the discussion of sales matters the social side of the conference was a source of much pleasure to all the Roller-Smith men. I. E. Hall, assistant works manager, and W. H. Pugh, superintendent, entertained the men at several functions during the conference. The conference ended in the Roller-Smith Company's New York office at 233 Broadway on July 10, subsequent to which the men who had attended returned to their respective offices. From every point of view the conference afforded much benefit as well as pleasure and the Roller-Smith Company is already making plans for a more elaborate conference at some later date.

Quigley Furnace Specialties Company, New York, has been awarded the contract for furnishing complete powdered-coal equipment for the new sheet mill of the Falcon Steel Company, now being erected at Niles, Ohio. The power-plant boilers will be powdered-coal fired, using the Quigley compressed-air system for transporting and burning the coal. The pulverized coal will be transported from the milling plant through standard 4-inch diameter wrought pipes to furnaces and boilers for various distances aggregating approximately 800 ft. and will be switched from the main distribution line to a storage bin in the power house for use as required for the boilers.

Karry-Lode Industrial Truck Co., Inc., Long Island City, New York, has now available for those interested specification sheets for their models No. 1 and No. 2 storage battery tractors and trucks. The Karry-Lode is an all-steel truck, strength with minimum weight is obtained by eliminating the heavy and unnecessary frame. The all-steel platform is the frame of the truck. In the model No. 2 one-point suspension prevents vibration and deflection of supporting members from affecting the motor and battery. In the specifications the details of capacity, weight, speed light and loaded, mileage per charge, motor, battery, tires, controller and safety devices are all given, together with a dimensioned drawing of the models.

Edison Electric Appliance Co., Inc., Hughes Division, Chicago, Ill., has available for distribution a 48-page book entitled "Hughes Electric Range Sales Service Manual." This book is a valuable treatise on the merchandising of electric ranges. From "The secret of successful electric range merchandising" the book gives a series of eight advertisements, each occupying a full page, in which the idea of cooking electrically is the all-important thing. The next nine pages are devoted to "How Form Letters Supplement Your Campaign in Merchandising Electric Ranges," in which form letters are discussed and a number of good letters are shown. Other chapters are: "The Purpose and Value of Hughes Pamphlets, Folders and Other Co-operative Literature," "Two Attractive Folders Intended for Special Distribution: They Cover Important Fields," "How to Use Movie Lantern Slides to Advantage in Merchandising Electric Ranges," "Street Car Advertising Is a Useful Part of Your Publicity on the Electric Way of Cooking," "The Window Display Is a Powerful Factor in Merchandising Electric Ranges—Why?" "Two Attractive Displays for Your Windows," "Some Hints on the Store Display—How Best to Utilize Your Space," "Details Covering Your Display of Hughes Electric Ranges, Floor Plans of Exhibit," "A Little About the Value of the Demonstration as an Aid to Increasing Interest," "Tying in Your Other Activities with Your Hughes Range Demonstration," "The Why and Wherefore of Demonstrations," "Salesmanship and Sales Methods," "After the Electric Range Is Sold and Installed." Repairs and service and co-operation furnished by Hughes salesman are then dicussed together with how the Hughes home economist helps and how to order Hughes co-operative material for a logical and complete campaign, and the expense. The booklet is profusely illustrated, the style is most attractive, the type clear and the paper good. This book should be of immense value to every central-station salesman, in fact to anyone concerned with salesmanship and the art of advertising.

Cutler-Hammer Manufacturing Co., Milwaukee, Wis., has prepared four envelope folders on the "C-H Seventy-Fifty" switch for use by dealers who wish to call their customers' attention to the fact that they are selling appliances equipped with this feed-through switch and also installing them on the cords of appliances purchased before this switch was available. Three of the books are standard envelope size (3½ by 6 in.), while the fourth is a miniature of one of the larger, being 1¾ by 3 in. All of the booklets are attractively printed in two colors. The miniature contains 12 pages, while the larger one like it, contains 8. Both are entitled, "Have You One of These?" and emphasize the advantage of buying electrical appliances with the cords equipped with these switches. They follow the national advertising in that they direct the public to the electric appliance dealer. The other two folders are four pages each. One is entitled, "C-H Seventy-Fifty Switch," while the other has for its title, "The Latest Models Have Them." The latter has a reproduction showing the damage resulting from pulling out the terminal connectors of electric irons, toasters, and other appliances and points out to the user that the C-H 70-50 switch is the remedy for these annoyances, since the necessity of removing the connector plug is eliminated, and in addition, safety from fire is provided because the white and black buttons of this switch indicate whether the current is "on" or "off." Large editions of these folders have been printed to supply the requirements of electrical dealers and lighting companies who use them in various ways among their customers and prospective customers.

Current News

Weekly Record of Construction Activities—Conventions

EASTERN STATES.

Augusta, Me.—Cumberland County Power & Light Co. will extend its transmission lines from the end of its present line near Gray Corner along Poland Spring Road for two miles.

Boston. Mass.—Lighting Superintendent Mohr is advertising for bids for a contract to equip and maintain for one year 1300 mantle gas lamps and 218 mantle naptha lamps in locations where there are no gas mains or electric service.

Bridgeport, Conn. — Considerable electrical equipment will be required in connection with the construction of the proposed new isolation hospital by the City Board of Health, estimated to cost about $175,000.

Bridgeport, Conn.—Nichols Underwear Co., 395 James street, is making rapid progress on the construction of a new two-story plant and power house, about 76x195 ft., and 20x20 ft., respectively, to provide for increased capacity. The structures are estimated to cost $80,000.

New Britain, Conn.—Trumbull Electric Co. has completed arrangements for the erection of a four-story addition to its plant at Plainville, about 50x106 ft., to provide for increased operations. The company will also erect two one-story structures at the works, about 50x100 ft. and 56x100 ft., respectively. Contract has been awarded to Louis A. Miller, 68 Wilcox street, Meriden.

Brunswick, Ga.—The City Suburban Railway Co. will extend its line. Address general manager.

Elberton, Ga.—Aug. 27 an election will be held to decide the question of issuing $15,000 electric light bonds. Address W. A. Nall, mayor.

Cranston, R. I.—United Wire & Supply Co. has awarded a contract to William H. Hamlyn & Son, 35 Greenwich street, Providence, for the erection of a two-story addition to its plant in the Auburn district, about 40x250 ft. The structure is estimated to cost about $100,000.

Woonsocket, R. I.—Plans have been filed by the French Worsted Co., Hamlet avenue, for the erection of an addition to the boiler plant at its works, about 40x50 ft. Contract for the structure, which is estimated to cost about $35,000, has been awarded to Wilfred Aubin, 1103 Dimond Hill road.

Binghamton, N. Y.—In connection with the expansion program of the Endicott-Johnson Corp., including the erection of a large addition to double the present capacity of the plant, considerable additional power will be required for operation. Electric energy is furnished by the Binghamton Light, Heat & Power Co.

Brooklyn, N. Y.—Brooklyn Rapid Transit Co., 85 Clinton street, is understood to be considering plans for the erection of a large brick and stone power station at Kent avenue and South Sixth street, to provide for increased operations.

Falconer, N. Y.—Merriam Cabinet Co. plans to remodel the Chautauqua Planing Mills and install electric power units. Total estimated cost, $60,000.

New York, N. Y.—Announcement has been made of the suspension of operations of three New York traction companies, due to inadequate operating revenue. The concerns affected are the Mid-Crosstown Railway Co., operating on 28th and 29th streets; Edward A. Maher, president; the Pelham Park & City Island Railroad Co., and the Third Avenue Bridge Co. Notice has been filed with the Public Service Commission of intention to cease operations, holding that they were operating at a loss.

New York, N. Y.—Bruston Automatic Electric Lighting & Power Co., 101 Park avenue, has filed an involuntary petition in bankruptcy, showing liabilities of $60,000 and assets of about $10,000. Judge A. N. Hand has appointed Roger B. Wood receiver of the company; John P. Hopson is president, and George Wishart, treasurer.

New York, N. Y.—New York Telephone Co., 15 Dey street, has awarded a contract for the erection of a two-story addition to its telephone building at West New Brighton, Staten Island, to provide for increased capacity. Extensive alterations and improvements will also be made in the existing structure. John O'Devlin, 233 Broadway, New York, is the building contractor.

New York, N. Y.—Roechling Electric Steel Co., 173 Lafayette street, has filed notice with the Secretary of State of the dissolution of the corporation.

New York, N. Y.—Rapid progress is being made in connection with the construction of the proposed Fourteenth Street-Eastern District subway, which will extend from Sixth avenue, New York, through Fourteenth street, to a connection with the Brooklyn Rapid Transit elevated system near East New York. Contract for the work was awarded to Booth & Flinn, Ltd., at a cost of about $6,639,000, and it is expected that to complete the work will require about 10 months' time.

New York, N. Y.—Sibley-Pitman Electric Corp., 190 Sixth avenue, manufacturer of electrical specialties, has filed notice with the Secretary of State of an increase in its capital from $150,000 to $250,000, to provide for general business expansion.

Oswego, N. Y.—City intends to construct and equip a complete electric lighting system at cost of $90,000. Major Bensel, consulting engineer.

Cape May, N. J.—Board of Public Utility Commissioners has approved the sale of the Vulcan Electric Light, Heat & Power Co. to the Cape May Court House Light & Water Co. for a consideration of $35,072, and for certain proposed bond issues by the petitioner. It was held that the Vulcan company was in default on the payment of interest on outstanding bonds, aggregating $32,000.

Garwood, N. J.—The plant of the C. & C. Electric & Manufacturing Co., Center street, manufacturer of electrical specialties, etc., has been offered for sale by William Tuttle, Jr., receiver. The works are located on the main line of the Central Railroad of New Jersey on property comprising about five acres, the various structures having a total of 60,000 sq. ft. of floor space, and are fully equipped for all departments of operation.

Lakewood, N. J. — Lakewood & Coast Electric Co. has been granted permission by the Board of Public Utility Commissioners to place into effect a new schedule of rates to yield additional revenue needed to meet the increased cost of operation.

Newark, N. J.—Announcement has been made that satisfactory agreements have been entered into between the striking tool makers and machinist specialists and officials of the Splitdorf Electric Co., 98 Warren street. The strike involved about 300 persons, and it is understood that various demands of the strikers have been granted.

Newark, N. J.—Public Service Corp. has been authorized by the Board of Public Utility Commissioners to place into operation, effective Sept. 14, a new zone plan for the collection of fares. It is proposed to charge three cents for travel within the first zone mile, with a charge of two cents for each additional zone mile or part thereof. The new rates will replace the flat seven-cent fare now in force on the company's system.

Perth Amboy, N. J.—Board of Aldermen is considering plans for the purchase of the plant of the Perth Amboy Gas Light Co., to be used for municipal service. It is understood that estimates of valuation of the property are now being taken, and it is expected that this work will be completed around the end of September.

South Amboy, N. J.—City Council is understood to be arranging plans for extensions in the electric street-lighting system, and the installation of new lighting units of increased capacity. Electric service is furnished by the Monmouth Lighting Co.

Trenton, N. J.—Plans are under consideration by the City Commission for improvements in the municipal lighting system.

Allentown, Pa.—Allentown-Bethlehem Gas Co. has filed a new tariff of rates for its Allentown district, Bethlehem, Catasauqua, and Hellertown districts, effective Sept. 1. The schedule covers a minimum monthly charge of 25 cents per meter of 3 or 5 lights; 5, 10, 20 or 30-light meters, 50 cents per meter per month; 45, 60, or 80-light meters, 75 cents per meter per month; and 100-light capacity meters and over, $1 per month, all the above being service charges.

Allentown, Pa.—Board of Managers of Allentown hospital has recently completed alterations and improvements in the boiler plant at the institution, to facilitate operations.

Allentown, Pa.—S. & W. Electrical Co. has recently inaugurated operations in its new establishment at 613 Turner street. It is proposed to engage in general electrical repair and construction. William S. Solliday, formerly connected with the Lehigh Electric Co., and Edgar Weaver, also associated with the same company, are partners in the new organization.

Catasauqua, Pa.—Work has recently been completed by the Borough Council on the installation of new lighting units of increased capacity for the municipal street-lighting system. About 400 units were installed.

Harrisburg, Pa.—It is interesting to note the number of increases recently filed with the Public Service Commission, covering the issuance of stock or bonds. Among the companies notifying the Commission are: Renovo Edison Light, Heat & Power Co., Renovo, common stock, $18,500; Eastern Pennsylvania Railways Co., Pottsville, bonds, $198,000; Allentown-Bethlehem Gas Co., Allentown, bonds, $210,000; Philadelphia Rapid Transit Co., Philadelphia, equipment trust certificates, $88,000, and bonds, $174,000.

McMurray, Pa.—McMurray Telephone Co., operating in Washington county, has filed a new schedule of rates for service, effective Sept. 1. It is proposed to increase the existing rates 20%, with an extra charge for extension and installation.

Mauch Chunk, Pa.—Mauch Chunk & Lehighton Transit Co. has filed notice of the issuance of preferred stock for $50,000, common stock for $150,000, and bonds for $130,000, to provide for proposed business expansion.

Nanticoke, Pa.—Dunlap Silk Co., Hazleton, is having plans prepared for the construction of a new brick and concrete boiler plant at its local silk mills. The structure will be two stories in height, about 90x100 ft. Emil Buehler is local manager.

Philadelphia, Pa. — Announcement has been made by the Philadelphia Rapid Transit Co. of an increase in the wages of its conductors and motormen of seven cents per hour. The increase will affect about 6000 persons.

DATES AHEAD.

Michigan Section, N. E. L. A. Annual convention, Ottawa Beach, Mich., Aug 26-28. Headquarters, Hotel Ottawa. Secretary-treasurer, Herbert Silvester, Monroe, Mich.

Pennsylvania Electric Association. Annual convention, Bedford Springs, Pa., Sept. 3-6. Secretary, H. M. Stine, 211 Locust street, Harrisburg.

Washington State Association of Electrical Contractors and Dealers. Annual convention, Seattle, Sept. 11. Secretary, Forrest E. Smith, 205 Boston Block, Seattle.

Southeastern Section, N. E. L. A. Annual convention, Asheville, N. C., Sept. 17-19. Secretary-treasurer, T. W. Peters, Columbus, Ga.

New England Section, N. E. L. A. Annual convention, New London, Conn., Sept. 22-24. Headquarters, Hotel Griswold. Secretary, Miss O. A. Bursiel, Boston, Mass.

Association of Iron and Steel Electrical Engineers. Annual convention, St. Louis, Mo., Sept. 22-26. Secretary, John F. Kelly, Empire building, Pittsburgh, Pa.

American Electrochemical Society. Fall meeting, Chicago, Sept. 23-26. Headquarters, Congress Hotel. Secretary, Prof. Joseph W. Richards, Lehigh University, Bethlehem, Pa.

International Association of Municipal Electricians. Annual convention, Chicago, Sept. 23-26. Headquarters, Auditorium Hotel. Secretary, Clarence R. George, Houston, Tex.

National Association of Electrical Inspectors. Annual meeting, Springfield, Mass., Oct. 13 and 14. Secretary, W. L. Smith, Concord, Mass.

Illuminating Engineering Society. Annual convention, Chicago, Ill., Oct. 20-23. General secretary, Clarence L. Law, 29 West 39th street, New York City.

Philadelphia, Pa. — Contract has been awarded to Ketcham & McQuade, Philadelphia, for the construction of a boiler plant at the Globe Theatre, 59th and Market streets, to facilitate operations.

Philadelphia, Pa.—County Gas & Electric Co. has filed notice with the Public Service Commission of a bond issue for $1,800,000, to provide for general business expansion.

Philadelphia, Pa.—Plans are being prepared by the Department of Public Works for the construction of a one-story brick, stone and steel pumping station at the municipal waterworks plant at Lardners Point, to provide for increased capacity. It is understood that the station will be electrically-operated.

Pittsburgh, Pa.—Equitable Gas Co., the Allegheny Heating Co., and the Monongahela Natural Gas Co. are co-operating in a campaign for the economical use of gas throughout the local territory served, including both retail and wholesale consumers. The companies urge the installation of modern methods for gas burning and other features of operation to bring about greatest efficiency.

Pittsburgh, Pa.—Notice has been filed with the Public Service Commission by the Beaver County Light Co. for the issuance of bonds for $24,000, to provide for general business expansion.

Pittsburgh, Pa.—Westinghouse Electric & Manufacturing Co. has recently commenced the construction of a large building in Braddock avenue, East Pittsburgh, to be used as a restaurant for employes. The new structure will be three stories in height, and will be connected with the works by an overhead bridge. It is estimated to cost about $250,000.

Sayre, Pa.—Sayre Electric Co. has recently been awarded a contract for furnishing additional electric power for the operation of the Sayre Brass Foundry, managed by the Cayuta Mfg. Co. A total of 100 hp. is required.

Titusville, Pa.—Titusville Light & Power Co. has recently placed into effect increased rates for service.

Baltimore, Md.—Board of Awards has awarded a contract to George R. Bullen, Baltimore, for the installation of a modern heating plant at Public School No. 63, Gough and Wolfe streets.

Wheeling, W. Va.—Fire, Aug. 5, damaged the engine plant at the local branch of Wilson & Co., with total loss estimated at $10,000. It is understood that immediate repairs will be made.

Gaffney, S. C.—City will establish white way lighting system. Superintendent of Light and Water plants.

Belleview, Fla.—Belleview Utilities Co., recently organized, is arranging for the construction of a local plant, estimated to cost $10,000. It is proposed also to construct a transmission system covering seven miles for initial operations. The company recently filed articles of incorporation with a capital of $25,000. James Conway, Harvard, Ill., is engineer.

Miami, Fla.—Miami Electric Light & Power Co. is planning for the reconstruction of its local power plant, with extensive alterations and improvements, to facilitate operations. It is understood that the work is estimated to cost in excess of $150,000.

Sarasota, Fla.—City has completed arrangements for the construction of a power plant for municipal service. The structure is estimated to cost, with machinery installation, about $42,000. The Southern Construction Co., St. Petersburg, is the contractor.

NORTH CENTRAL STATES.

Cleveland, O.—Drew Electric Mfg. Co. contemplates erecting a plant, 2 stories, 80x204 ft., to cost $35,000. D. W. Morrow, Garfield building, is architect.

Hamilton, O.—The council has appropriated $15,000 additional for extension of electric plant. The director of public service was authorized to contract for the labor and material necessary for the extension of the transmission lines.

Marion, O.—The C. D. & M. Electric Co. will install 7 additional lights.

Toledo, O.—Swartz Electric Co. is preparing plans for a factory addition that will practically double the floor space.

Anderson, Ind.—Earl P. Creager, works manager of the plant of the Remy electric division of the General

Motors Corp. here, has announced that the laboratories and sales department of the Remy plant, which have been at Detroit for about five years, will be returned to Anderson within a few days. The laboratories will be in the five-story building that has just been completed at the Remy plant and which also includes the general offices of the company. The additional employes will make a total of about 3800 at the Remy plant. With these departments will come the skilled employes connected with the laboratories and sales department, including C. E. Wilson, who recently was made manager of the sales department, and Dr. M. W. Franklin, in charge of the research department.

Auburn, Ind.—A plan is under way here to organize a stock company with capital of $100,000 for the purpose of erecting 35 or 40 houses, costing from $2000 to $2500 each. Address W. H. Schaab, president, Auburn Commercial Club.

Connersville, Ind.—Ansted Engineering Co. will erect factory building 100 ft. wide and 400 ft. long. The Lexington Motor Co., to which the Ansted Engineering Co. is largely accessory, will build a stockroom and expand its heating system. Work on the foundation of the engineering company's building has just been begun. Work on the other buildings will begin about Sept. 1.

Connersville, Ind. — The Teetor-Hartley Motor Corp., owned principally by Connersville capital, but now situated in Hagerstown, Ind., has purchased ten acres near its Connersville factory area, and will begin the erection of a steel and concrete building 100 ft. wide and 1500 ft. long.

Fort Wayne, Ind.—Officials of the Fort Wayne branch of the General Electric Co. say that the constant increase in business has made the demand for help large and that the company is daily adding to the already large number of employes. With a very few exceptions every line of work carried on by the General Electric Co. is demanding more laborers, both skilled and unskilled. In case there is any slack in any department the men are transferred to departments needing them. R. F. Smith, in charge of the electrical testing and drafting courses, states that the company is still receiving applications for these courses, which are three years long.

Indianapolis, Ind.—The J. G. White Engineering Co., a Connecticut corporation, has withdrawn from business in Indiana.

Mishawaka, Ind.—Grange Elevator Co. will erect $30,000 warehouse. The company has recently been organized with capital of $50,000. M. H. Huston is the president.

Paoli, Ind—The Johnson Ice Cream Co., Bloomington, Ind., will erect $30,000 plant here.

Roachdale, Ind.—Roachdale Electric Co. has increased its capital stock from $50,000 to $100,000.

South Bend, Ind.—The Northern Indiana Gas & Electric Co. has been authorized by the Indiana Public Service Commission to issue $1,067,000 of 10-year notes for the purpose of improving its properties, these improvements to be made in South Bend, Fort Wayne, Lafayette, Logansport, Michigan City, Hammond and Peru.

Warsaw, Ind.—Winona Assembly management plans erection of a $100,000 auditorium.

Elgin, Ill.—Owing to a strike on the lines of the Aurora, Elgin & Chicago Railroad Co., which has tied up the entire light and power service in Elgin and adjacent towns, the management of the Sherman hospital has decided to install a generator. Mrs. Mary S. Pease has been named chairman of a committee to purchase the generator and equipment.

Freeport, Ill. — Electric lighting rates of the Northern Illinois Utilities Co., affecting this city and Dixon, have been increased by the Illinois Public Utilities Commission, one-half of the war emergency being allowed. The new rates add one and one-half cents to the rates in effect a year ago when war conditions made an increase imperative. Marengo, Harvard and Hampshire are also among the towns served by the company.

Medora, Ill.—An election will be held to decide the question of issuing $12,000 light and power bonds. Address city clerk.

Oswego, Ill.—Consulting Engineer John A. Buesel will prepare specifications for lighting plant equipment to cost $70,000.

Springfield, Ill.—Illinois is taking the lead in a movement to have its county highways lined with electric lights. A plan to have lights strung all the way along the Lincoln Trail, which bisects the state from Terre Haute, Ind., to East St. Louis, and on down to Cairo, is to be lighted if the plans of the promoters are carried out. It is planned to extend lights each way from cities which have plants and it is estimated that farmers will use enough current to pay the expenses. Lighted country highways will offer a novelty to motoring tourists. Illinois is spending $60,000,000 on permanent roads and the proposition to light them is gaining strength.

Lansing, Mich.—Voters have approved issuance of bonds for public improvements amounting to $1,321,000. Bond issues approved are: Municipal light and water plants, $650,000; isolation hospital, $100,000; addition to cemetery, $38,000.

Three Rivers, Mich.—Eddy Paper Co. will erect an electric power plant in connection with the construction of a 1-story paper mill. The entire project is estimated to cost in excess of $1,000,000.

St. James, Minn.—An issue of $20,000 lighting plant improvement bonds authorized by City Council.

Atkins, Ia.—The town of Atkins has decided to have a system of electric lights. At present it has not been decided whether a system be put in at Atkins or whether connections would be made with the line of Iowa Railway & Light Co.

Story City, Ia.—David G. Feshut Co. awarded contract for electric light system and power house at $36,000.

Coats, Kans.—A petition is being circulated asking the mayor and councilmen of the city to call an election to vote bonds for an electric light plant and system.

Ellsworth, Kans.—The installation of a white way is being seriously contemplated.

Ft. Scott, Kans.—All of the properties of the Ft. Scott Gas & Electric Co., including the electric plant, the gas plant, the defunct street railway, was sold at sheriff's sale July 31 to satisfy a first mortgage of $35,000, etc.

Hanover, Kans.—Engineers Black & Veatch, 507 Inter-State building, Kansas City, Mo., have prepared plans for improving electric system.

Hanover, Kans.—A power dam is to be built on Little Blue river here, to cost $150,000. A flour mill will probably be built and the city electric light and waterworks will also use the power besides furnishing power to outside towns.

Harper, Kans.—Plans are being made for a White Way in the business part of the city.

Hazelton, Kans.—Election to vote bonds for an electric lighting system carried.

Hudson, Kans. — City is having plans prepared by W. B. Rollins & Co., engineers, 209 Railway Exchange building, Kansas City, Mo., for the construction of a transmission line for electric plant. Estimated cost, $15,000.

Manhattan, Kans.—The Kaw Valley Transmission Co., of St. George, the Riverside Light & Power Co., of Abilene, the Central Kansas Power Co., of Abilene, the Marshall County Power & Light Co., and the Rocky Ford Milling & Power Co., will soon be reorganized into one company known as The United Light & Power Co.

Manhattan, Kans. — Rocky Ford Milling & Power Co. is having plans prepared for a 2-story building and will install a 7000-hp. steam engine and 3000-kw. and 2000-kw. turbines. Total estimated cost, $500,000.

Pittsburg, Kans. — Appropriation has been made by the Bell Telephone Co., at Pittsburgh, for rebuilding and remodeling the plant and installing new equipment. Work will begin in November.

Scranton, Kans.—Election will be held in the near future to vote $4000 in bonds to provide funds for the extension of the electric light system.

SOUTH CENTRAL STATES.

Hazard, Ky.—Kentucky & West Virginia Power Co. will enlarge plant by taking over three large electric power plants.

Centreville, Tenn.—$15,000 electric light bonds have been voted. Address mayor.

Chattanooga, Tenn. — Cumberland Telephone & Telegraph Co. has recently made announcement that following the return of the telephone properties by the Government to their corporate ownership, plans have been perfected for extensive improvements and additions to increase the present capacity. Extensions will be made in existing transmission systems, and other enlarged facilities will be provided for, the entire work being estimated to cost in excess of $2,000,000.

Beggs, Okla.—Beggs Power & Ice Co. is understood to be considering plans for the construction of a local electric-light plant. The structure will cost about $75,000.

Comanche, Okla.—Town Council having plans prepared for alterations and improvements in the municipal electric light plant, estimated to cost about $10,000. A. L. White is town clerk.

Eufaula, Okla.—$25,000 bond issue for electric lights and waterworks carried recently. Bids will be advertised soon.

Frederick, Okla. — The city has voted $40,000 electric light bonds. Address mayor.

Oklahoma City, Okla.—The Attorney General has approved a bond issue of $110,000 for electric lights in Newkirk.

Oklahoma City, Okla.—Oklahoma Gas & Electric Co. will take a long term lease on a three-story and basement building, 50 by 140 feet, to be erected on First street, just east of Broadway. The offices now occupied by the company have grown inadequate.

Oklahoma City, Okla.—Election to vote $350,000 in bonds for water main extension was defeated.

Oklahoma City, Okla.—Oklahoma Gas & Electric Co. will erect at once an electric sub-station at 23rd and Ollie avenue. The station will be connected with a high voltage line and will serve northwest residence section.

Perry, Okla.—A bond issue of $260,000 is being contemplated for the purpose of entirely rebuilding and equipping the electric light and water system, also for the construction of a dam. Water mains will be extended and a White Way is considered.

Perry, Okla.—$260,000 in bonds have been voted for rebuilding and enlarging electric light plant and water system.

Perry, Okla.—Plans are under consideration by the city for the issuance of bonds for $260,000 to cover the cost of enlarging and rebuilding the municipal electric-light plant, water and wire systems, etc.

Tishomingo, Okla.—Bids will be advertised about Sept. 1 for electric plant, distribution system and ice plant. F. L. Yarger, city clerk. Johnson & Benham, Firestone building, Kansas City, Mo., engineers.

Tonkawa, Okla.—Preliminary plans are in progress for the extension of the waterworks system and electric plant to cost $117,000. Election to vote the bond issue will be held in the near future. R. R. Redfield, city clerk.

New Orleans, La.—Bids will be received Aug. 30 for furnishing and installing mechanical and electrical equipment including fuel oil pumps, a sludge pump, a deep well pump, fuel oil heaters, a steel flue, superheaters, soot-blowers, plumbing and plumbing fixtures, piping, switchboard, motor-driven exciter, transformers, electric fixtures, wiring and an electric traveling crane and for installing a turbine driven exciter, one 300 and one 320-hp. boilers, two feed-water heaters, and a V notch meter in the power plant at the Naval Station. Address C. W. Parks, Chief of Bureau.

Independence, Mo.—A recommendation that $50,000 bonds be issued for the purpose of building an addition to the power house of the electric plant and for installing a new unit current for the production of current was made to the city council. Address mayor, Christian Ott.

Palmyra, Mo.—Election to vote $10,000 in bonds for the improvement of the present electric light and water plant carried. H. M. Howard, city clerk.

St. Joseph, Mo.—Plans have been completed by the St. Joseph Railway, Light, Heat & Power Co. for extensive improvements and alterations in its plant, to provide for increased capacity. The work includes the installation of a quantity of new equipment, to comprise 12,500 kw. turbine, equipped with surface condensers and auxiliary switchboard equipment, boiler feed pumps and other apparatus, and is estimated to cost in the neighborhood of $1,000,000.

St. Louis, Mo.—St. Louis Mfg. Co. has recently completed plans and awarded a contract to the A. H. Haeseler Building & Construction Co., Wainwright building, for the erection of a power plant for factory operation, about 95x150 ft. The structure is estimated to cost, with equipment installation, $125,000.

Austin, Tex.—The Southwestern Telegraph & Telephone Co. recently purchased a site for a telephone exchange building.

Breckenridge, Tex.—J. E. Lewis, of Dallas, has purchased the local light plant and is making plans for a reconstruction of the old plant and the installation of new machinery. The new company has been granted a 50-year franchise by the city council.

Bryan, Tex.—Election will be held Aug. 26th to vote $75,000 in bonds for the purchase and improvement of the Bryan power plant.

Bryan, Tex.—The Bryan & Central Texas Interurban Railway Co. will transform its motive power from electric to steam equipment. The line runs from Bryan down the valley of the Brazos river 22 miles.

Cisco, Tex. — The Southwestern Telegraph & Telephone Co. has completed a survey of the city for installation of a standard common battery telephone system.

Dallas, Tex.—Notice has been filed with the Secretary of State by the Dallas Power & Light Co. of an increase in its capitalization from $1,000,000 to $2,500,000, to provide for general business expansion.

Dallas, Tex.—S. B. Brooks, of Greenville, has purchased at sheriff's sale the physical holdings and franchise of the Eastern Texas Traction Co. Construction of this interurban electric railway, to run between Dallas and Greenville, about 50 miles, was in progress at the time the great war caused a suspension of the work in 1914. It is planned by Mr. Brooks to reorganize the company and complete the line.

Dallas, Tex.—The Dallas Power & Light Co. has increased its capital from $1,000,000 to $2,500,000.

Dallas, Tex.—The Texas Power & Light Co. of Dallas will build a power transmission line from Dublin to De Leon and Gorman. The company plans also to extend its power lines to other parts of Central West Texas where extensive oil development operations are in progress.

Fort Worth, Tex.—It is stated by H. E. Robinson of Fort Worth, president of the Fort Worth & Western Electric Railway Co., that two routes for the proposed interurban railway, between Fort Worth and Mineral Wells, are under consideration, and as soon as it is decided which will be used the construction will be started. Part of the construction material has been ordered. The line will be about 65 miles long.

Hearne, Tex.—The capacity of the Hearne city light and water plant is to be increased 100%.

Houston, Tex.—According to Ed Kenedy, of Houston, promoter of the Houston, Richmond & Western Traction Co., the construction of the company's proposed interurban electric railway, that is to run between Houston and San Antonio, with a branch from Yoakum to Victoria, will be started as soon as materials can be shipped. The main line will be about 225 miles long and the branch about 30 miles.

Houston, Tex.—Nearly $500,000 will be spent by the Houston Light & Power Co. in extending its lines down the north side of the ship channel. A greater part of the money will be spent for dynamos and other machinery.

Luling, Tex.—The question of issuing $75,000 water and light bonds will be submitted to vote. Address mayor.

Orange, Tex.—The Orange Ice, Light & Water Co. has increased its capital from $60,000 to $100,000.

San Angelo, Tex.—City has decided to build its own water, light and power plant; $500,000 has been appropriated.

Sugarland, Tex.—The Sugarland industries will install an electric power plant.

WESTERN STATES.

Libby, Mont.—The Lukens-Hazel Mining Co. will expend $240,000 for a 200-ton concentrator and power plant. A pipe line will be installed from Granite Creek which will develop 600 hp.

Grand Junction, Colo.—Movement has been started at Collbran for installation of hydroelectric plant to supply power and light to practically every section of Plateau Valley.

Boise, Ida.—Mackay Light & Power Co. has been granted permission by the Public Utilities Commission to extend its transmission lines through the Lost Valley section to Arco, to provide increased operating facilities.

Personal

Charles McKay Joins L. V. Estes, Inc.—E. N. Lake Organizes — W. S. Wyche Returns to Arkansas Valley Co.

J. Frank Harper, of Centerville, Md., has been appointed a member of the Maryland Public Service Commission to succeed Albert Towers, recently resigned.

J. F. Owens, vice-president and general manager of the Oklahoma Gas & Electric Co., was recently elected second vice-president of the Oklahoma City Chamber of Commerce.

O. A. Rofelty, manager of the Sioux Falls, (S. D.) Division, of the Northern States Power Co., was recently elected president of the South Dakota Electric Power Association.

Herman G. Hardy, formerly connected with the Old Hickory Powder Plant at Jacksonville, Tenn., is now chief mechanical and electrical engineer of the Arizona Copper Co., Ltd., Clifton, Ariz.

N. S. Braden, former sales manager, has just recently been elected vice-president of the Canadian Westinghouse Co., Ltd., of Hamilton, Ontario. H. M. Bostwick, assistant sales manager, has been appointed sales manager, to fill the vacancy created by Mr. Braden's promotion.

Edward N. Lake, formerly manager and treasurer of the Krehbiel Co., and previously resident engineer of Stone & Webster, has organized the Lake Engineering Co., of which he has become president. The company will engage in general engineering work and will be located at 139 N. Clark street, Chicago.

E. T. Sawyer has recently accepted a position as a representative of the railway sales department of the U. S. Light & Heat Corp., Niagara Falls, N. Y. Mr. Sawyer will specialize on car lighting equipment and electric arc welders and will make his headquarters at 30 East Forty-second street, New York.

Lawrence B. Chapman, of the technical staff of the Electric Boat Co., New London, Conn., has been appointed associate professor in the new course of ship construction and marine transportation instituted last year at Lehigh University. Professor Chapman is a graduate of the Massachusetts Institute of Technology.

Joseph Harris, for 30 years a dominant figure in automatic telephony and president of the Automatic Telephone Co. of Chicago, Ill., has resigned from this position to become chairman of its Board of Directors. He will be succeeded by A. F. Adams as president of the company.

Several other changes have also been made in the organization of this company. H. L. Gary has been elected vice-president and treasurer; H. A. Harris, vice president and general manager, and W. F. Benoist succeeds H. A. Harris as its sales manager.

Charles W. McKay, formerly connected with the engineering firm of McMeen & Miller, Chicago, and subsequently with the Cooley & Marvin Co., of Boston, has recently taken charge of the Appraisal Division of L. V. Estes Incorporated of Chicago. Mr. McKay is the author of the series of articles now running in the Electrical Review on the general subject of Electric Utility Rates and Valuations. Mr. McKay's removal to Chicago will be of especial interest to the readers of the Electrical Review in that it places him in closer touch with the electric utility field and will enable him to give more attention to the features of the series

Charles W. McKay.

which involve the answering of questions. Mr. McKay has been engaged in engineering and appraisal work since his graduation from Sibley College of Mechanical Engineering, Cornell University, in 1906. In July, 1906, he entered the employ of the New York & New Jersey Telephone Co. (now the New York Telephone Co.), and after serving a brief apprenticeship in the maintenance department was assigned to the plant-engineering department. In 1909 he was appointed engineer for the North Brooklyn district, having charge of the preparation of plans and estimates for all outside construction work within the district. In 1910, at the time the New York Telephone Co. absorbed all of the up-state Bell companies, Mr. McKay was assigned to special work and spent the greater part of the following year in inspecting a number of the larger of the company's newly-acquired properties, and in 1911 was appointed engineer for the Borough of Queens. During the year 1912-13, Mr. McKay was associated with Henry Floy in the capacity of assistant engineer, and while holding this position he was identified with several important appraisal cases. In the summer of 1913 he became engineer to the McCall & Clark Co., efficiency experts of New York, and in October, 1913, became affiliated with McMeen & Miller, of Chicago. While with this well known enginering firm, Mr. McKay spent the major portion of his time on problems involving the appraisement of public utility properties. He later engaged in valuation work for the Central Union Telephone Co., and continued in this capacity until his appointment with the Cooley & Marvin Co. He is a prolific writer on appraisal subjects and has contributed extensively to the technical press. The Appraisal Division of L. V. Estes Incorporated, of which Mr. McKay will have full charge, will specialize in problems involving the appraisement of electric utility and industrial properties. L. V. Estes Incorporated are known to many of the readers of the Electrical Review through their extensive work for the electric industries.

Karl G. Roebling, president of the John A. Roebling's Sons Co., Trenton, N. J., has been elected a director of the American Ship & Commerce Corp., New York City.

W. L. McCloy, Jr., Pittsburgh, has been appointed general manager of the Philadelphia Co., Pittsburgh, to succeed Caroll Miller, resigned. Mr. McCloy has been connected with the Philadelphia Co. for more than 30 years, having risen to the position of general superintendent before the final promotion to general manager.

Capt. W. S. Wyche of the Second Engineers, U. S. A., has returned from overseas and rejoined the Arkansas Valley Railway Light & Power Co., Victor, Colo. Captain Wyche was twice honored for bravery in action. Once he was decorated with the Croix de Guerre with palm conferred by Marshal Petain, and once he received a special enlarged citation from General Pershing.

Col. H. M. Byllesby is serving on the Special Technical Jury appointed to investigate and report on the cause of the recent dirigible balloon disaster of Chicago. Colonel Byllesby is also treasurer of the Illinois State Committee for the National Celebration of Constitution Day Sept. 17. This movement is in connection with efforts which are being made to counteract Bolshevism and other non-American influences.

Obituary.

Emil H. Schmidt, Rochester, N. Y., superintendent of the municipal Police Telegraph & Fire Bureau, died suddenly on August 6, following an attack of heart failure, at his home, 189 Canterbury road. Mr. Schmidt was in his fiftieth year.

Financial News

Business Conditions.

Judging by current trade and the demand for money and labor the country is in a most prosperous state. The situation is remarkable for mid-summer, when some slackening of activity, and of pressure for goods and money is usual. It is extraordinary when we recall the uncertainty as to prices and trade prospects which existed a few months ago, but illustrates how great a factor is confidence. The change is due to a re-establishment of confidence so far as the immediate future is concerned. Everybody is satisfied that a great trade is ahead for the remainder of this year, and they are now busy preparing for that. Beyond that the situation is not so clear, but the people who must buy goods now for next spring are generally feeling that they must go ahead upon the present basis and get ready for it, taking the chances. They realize that sooner or later they will be caught by a declining market, but unless they want to go out of business they must be ready to do business, making the best of vicissitudes.

At present there is a cry from all parts of the country for goods. Prices on goods ready for delivery are a secondary consideration. Practically full employment and high wages in the industrial centers is an obvious factor but underlying that is the confidence and prosperity which pervades the agricultural districts, and back of it all are the enormous purchases which other countries are making here, as shown by the astounding figures for exports. It is well to know the source to which we are indebted for this trade, because it is not a source that can be relied upon to play so large a part permanently, and there is much in the home situation that is disquieting.

U. S. Rubber Company to Increase Capital.

At a meeting of the Board of Directors of the United States Rubber Co. held in New York City on Aug. 7, an increase in capitalization was unanimously authorized. The action of the board was taken in compliance with the recommendation of Samuel P. Colt, chairman of the board, as a means of providing the capital necessary to finance the increasing volume of business that is in evidence. The directors announced their intention of placing the common stock on an 8% dividend basis, beginning next October, and stated that, if earnings warrant the action, a substantial extra dividend will be paid to stockholders in the spring of 1920.

Stockholders of record on Aug. 8 will meet on Sept. 7 to vote on the proposal for the increase of stock. If the stock issue is authorized, shares of the new common will be offered to present stockholders for subscription at par, or $100 per share, on the basis of one new share for one old share now held. After recommending the increase to provide a total capitalization of $100,000,000 preferred and $200,000,000 stock on the retirement of the present second preferred, the chairman said:

"The volume of business transacted by the company for five years in round numbers was $83,000,000 in 1914, $92,000,000 in 1915, $125,000,000 in 1916, $176,000,000 in 1917 and $215,000,000 in 1918. During that period the capital stock of the company remained substantially the same.

"The indebtedness of the company was funded in 1917 into long term 5% bonds. The surplus earnings for the years 1917 and 1918 were equivalent each year to about 30% on the common stock and the earnings for the first half of 1919 have been substantially the same as in the first half of 1918.

"Your company is engaged in a business capable, on conservative lines, of large expansion, the tire business both of passenger vehicles and trucks being a notable example of this. For the last two years your company has been unable to meet the demand for its tires and, notwithstanding its capacity has already been substantially increased, further construction has been authorized which will require in the neighborhood of $15,000,000 for its completion and which will double the present capacity of the company for producing tires. The amount of present outstanding common stock, compared with the property of the company, is relatively very small.

"In view of these conditions your chairman would recommend, upon the certificate of organization being amended as proposed, that $36,000,000 of additional common stock be issued and offered to our common stockholders at par in order to provide ample capital to meet the enlarged business of the company without the application of so large a proportion of earnings for that purpose as has been done the last few years.

"Your chairman is also of the opinion that the company is now amply justified in placing its common stock upon an 8% dividend basis and he would, therefore, recommend that dividends at the rate of 8% per annum be paid upon the common stock of the company beginning in October next, and further that an extra distribution either in stock or in cash, such as may be warranted under all conditions, be made early in 1920 to common stockholders."

July Charters for Banks.

The office of the Comptroller of Currency announces that during the month of July 20 charters for new national banks were granted and 54 applications for increases of capital of existing national banks were approved.

California Company to Issue Notes.

The Sierra & San Francisco Power Co. has asked the Railroad Commission for authority to issue five notes of the face value of $30,000 each to the United Railways Investment Co., the notes to be secured by the pledging of bonds of the face value of $200,000. The United Railways Investment Co. has offered $140,000 for the notes, and the Sierra company seeks authority to make the issue on the ground that it has been unable to dispose of the $1,000,000 of bonds authorized by the commission in May, 1918. The petition shows that the indebtedness of the company, other than the bonded indebtedness, is for current expenses and advances from consumers amounting to $164,544.03, and that the proceeds of the note issue are to be used for improvements at the Stanislaus power plant and other betterments.

Erie Lighting Stock Issue.

Paine, Webber & Co., Chicago, is offering 7% cumulative preferred stock of the Erie Lighting Co. at 92½ and accrued dividend to yield 7.57%. The Erie Lighting Co. serves a population of over 120,000 in Erie, Pa., and adjacent territory, with electricity for lighting and power purposes and does a steam heating business in Erie. The company has an installed capacity of 32,000 hp. contained in two stations which have been erected within the past six years, one of which, with an ultimate capacity of 65,000 hp. has just been completed. This utility is making gross earnings of over $1,000,000 and is showing more than 20% earned on the preferred stock after payment of all expenses.

Cumberland Valley Company Elects Officers.

At the recent annual meeting of the directors of Cumberland Valley Telephone Co., held at the offices of the company, 227 Walnut street, Harrisburg, Pa., the following officers were reelected for the ensuing year: President, William J. Lescure; vice-president, John C. Motter; secretary and treasurer, O. K. Kines; and general manager, Cameron L. Baer.

Illinois Commission Authorizes Note Issues.

The Illinois Public Utilities Commission has authorized the Decatur Railway & Light Co., Decatur, Ill., a subsidiary company of the Illinois Traction System, to issue promissory notes to the amount of $40,698. The Commission has also approved a promissory note issue of the Quincy Railway Co., Quincy, Ill., another subsidiary of the Illinois Traction System, in the amount of $104,919.

Clinton Wright Wire Stock.

Liggett & Drexel and Knauth, Nachod & Kuhne companies have formed a syndicate to purchase and resell 70,000 shares of common, $50 par, of Clinton-Wright Wire Co. The stock is being offered for public subscription at $36 a share.

United Light & Railway Surplus

Surplus earnings of the United Light & Railway Co. and subsidiary companies for the 12 months ended April 30, after payment of dividends at 6% on the first preferred, amounted to $509,658 for 1919, an increase of $15,209 over 1918 period. Reported figures of United Light & Railways Co. for four months to April 30, 1919, showed an increase of $61,276 after preferred dividend.

This improvement in surplus is qual to .89% on the 4% common stock, and compared with a surplus of $128,152 for the four months period, an increase of 47.81% over four months to April 30, 1918.

Statement of earnings of United Light & Railways Co. and subsidiaries for the 12 months period ended April 30 follows:

	1919.	1918.
Gross earning	$9,659,547	$8,232,303
Net after taxes	2,858,574	2,729,802
Balance, app. to Un. Lt. & Rys. Co.	1,955,486	1,836,610
Bal. after int. chgs.	*116,730	1,101,378
Surplus after pfd. div.	509,658	494,449

*Interest on notes and commercial loans increased $132,258 and decreased $29,447 during this period.

Earnings.

WISCONSIN EDISON.

Comparative income account of Wisconsin Edison properties, inter-company dividends and interest eliminated, is as follows:

	1919.	1918.
June gross	$1,338,932	$1,134,760
Net after taxes, etc.	306,608	245,467
Surplus after charges.	113,888	62,858
Six months' gross	8,526,651	6,827,395
Net after taxes, etc.	1,737,437	1,247,280
Surplus after charges.	567,964	146,971
12 months' gross	16,291,601	13,137,013
Net after taxes, etc.	3,458,511	3,132,293
Surplus after charges.	1,252,757	1,097,485

Income account of Wisconsin Edison Co., controlled by North American Co., is as follows:

	1919.	1918.
June gross	$ 120,139	$ 76,122
Net after taxes	119,182	75,392
Surplus after charges.	74,420	23,104
Six months' gross	621,107	276,834
Net after taxes	610,769	271,785
Surplus after charges.	320,878	*48,259
12 months' gross	1,541,547	1,334,960
Net after taxes	1,505,422	1,301,601
Surplus after charges.	898,294	678,979

*Deficit.

INTERBOROUGH RAPID TRANSIT.

	1919.	1918.	1917.
May gross	$4,019,001	$3,524,432	$3,511,496
Net after taxes	1,427,059	1,521,970	1,798,857
Total income	1,477,934	1,564,228	1,860,362
Surplus after charges	*432,136	580,523	854,317
11 months' gross	39,294,196	37,208,118	36,608,909
Net after taxes	12,470,321	16,295,094	18,837,690
Total income	13,012,653	16,786,699	19,335,906
Surplus after charges	*3,039,006	6,794,245	8,469,450

*Includes accruals under contract No. 3 and related certificates amounting to $585,879 for May, 1919, and $6,650,501 for 11 months ended May 31, 1919.

Electrical Review

Vol. 75. No. 8. CHICAGO, AUGUST 23, 1919 Three Dollars a Yea

This is the famous Hughes "50" Electric Range. Last year alone more than 10,000 Hughes Ranges went into service.

The Hughes Range installations last year brought to Central Stations nearly half a million dollars' additional revenue. A revenue producer like this is entitled to full consideration by Central Station men.

The Hughes Range is the logical Range to put onto your lines, for Hughes advertising and Hughes sales cooperation are factors the Central Station man cannot afford to overlook.

Let us go to the bottom of the Range situation with you.

Write our nearest office now.

See our display of Ranges and other electrical home equipment at the Electrical Shows:

New York — Sept. 24 to Oct. 4—Booth 91.

Chicago — Oct. 11 to Oct. 25—Section C.

Edison Electric Appliance Co., Inc.

Chicago

New York Ontario, California Atlanta

Electrical Review

WITH WHICH IS CONSOLIDATED WESTERN ELECTRICIAN AND ELECTROCRAFT.

VOL. 75—No. 8. CHICAGO, SATURDAY, AUGUST 23, 1919. PAGE 301.

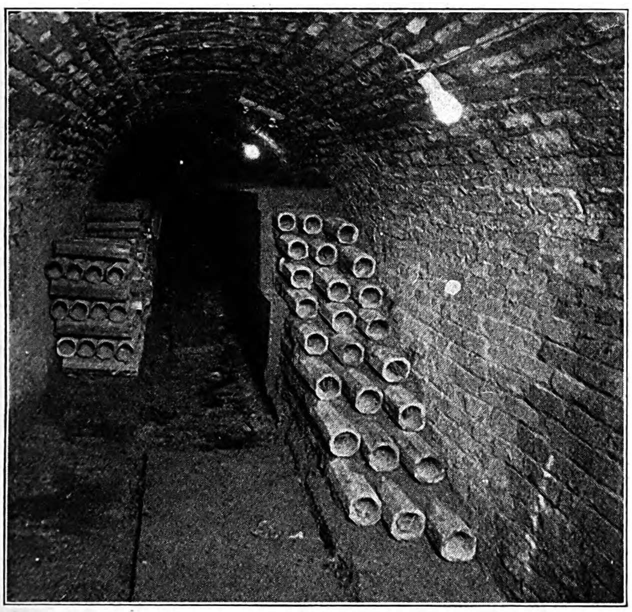


Fig. 1.—Brick Tunnel Showing Conduit in Course of Being Laid.

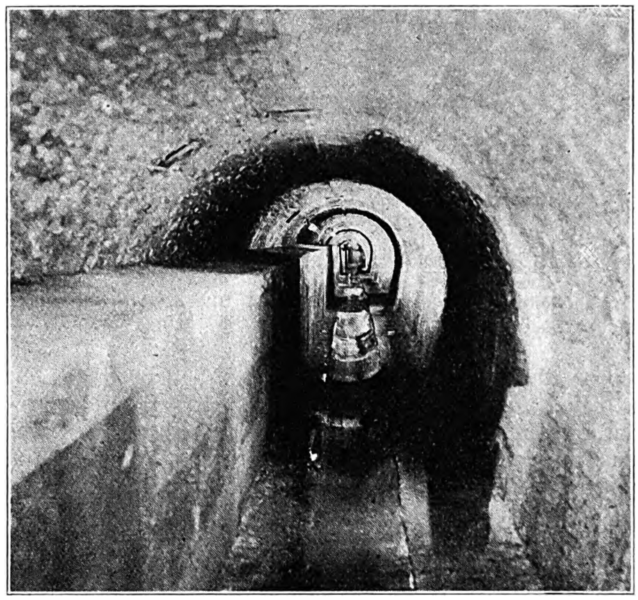


Fig. 2.—Duct Line Laid and Cemented in Tunnel of Concrete.

Conduit Construction in Telephone Cable Tunnels

Interesting Features of Latest Tunnels Adopted by the Chicago Telephone Co.—Construction Methods Employed

CHICAGO is traversed by the Chicago river, which follows a winding course through the city. The electric power and telephone utilities have found that the use of submarine cable where the river has to be crossed is unsatisfactory in the ordinary way because of the great likelihood of these cables being torn up, with resultant service interruptions and high cost of maintenance. The result is that both the telephone and light and power companies have resorted to the use of tunnels for their trunk cables or cable routes, as being a sound solution to the problem and one that guarantees safety to service and eventual economy of investment.

In the ELECTRICAL REVIEW of June 21 appeared an article by G. B. Springer on the construction of tunnels by the Commonwealth Edison Co. This article dealt with the reasons why tunnels have been adopted in preference to any other method, financial gains and structural details.

The Chicago Telephone Co. also has constructed several tunnels for its 300, 600 and 900-pair cables where the Chicago river has to be crossed. While the problems encountered by the telephone company were similar and almost identical to those that represented themselves to the power company, described in the issue of June 21, certain features of the tunnels for the telephone cables are different to those already described and a number of interesting features are brought out here.

The average length of the tunnels is about 700 ft. and their depth beneath the level of the sidewalk varies from about 80 to 90 ft. Some of the older tunnels are constructed of brick, but all the later ones are built entirely of concrete. The wall of these is 9 in. minimum thickness, about 6.5 ft. in height and 6 ft. in width. Allowing for the space occupied on both sides of the tunnel by ducts, a space of about 3 ft. 6 in. is available between ducts for persons to walk through the tunnel. The tunnel bottom is finished smooth with a grade one way to afford natural drainage. At the end of the tunnel having the lower level a sump pit is built. In this way it is an easy matter to empty a flooded tunnel of water by merely lowering a pump down the shaft to the sump pit.

The material was handled by lowering the ducts in a box made for the purpose. The box was supported by ropes fastened to each corner with a safety sling to a hook on the end of a three-quarter-inch line operated through a snatch block rigged to a derrick at the

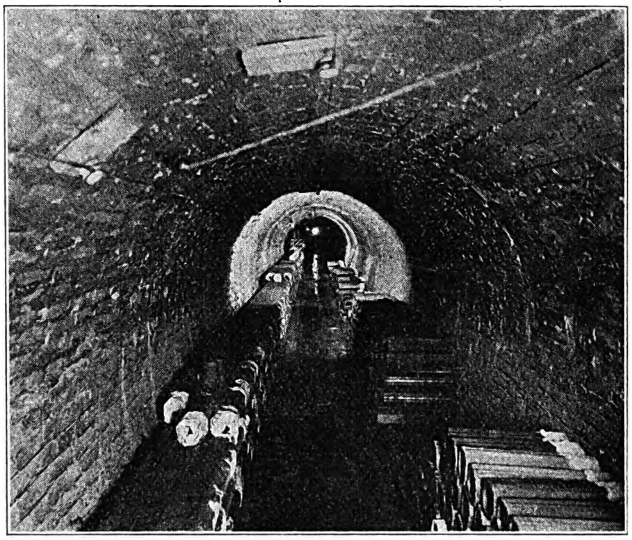


Fig. 3.—Conduit Stacked Ready for Use. Cheesecloth Is Used to Prevent Ducts From Being Clogged Up During Assembly.

top of the shaft. Sand, gravel and cement were sent into the tunnel by means of a wooden chute and material for the use of the construction through the river was mixed on the floor of the tunnel, opposite the point required. The concrete for the tunnels were mixed by hand in the tunnels. The concrete for the lining of the shafts was mixed above ground.

Details of Shafts.

The shafts leading to the tunnels are circular and all are built of concrete, the thickness being 13 in. minimum. The method employed for building these shafts depended upon the nature of the ground passed through, which was at different times quicksand, rock, clay, etc. All shafts are 6½ ft. inside diameter.

A galvanized iron step ladder was built into the shaft as it was lined with concrete, as also were 3-in. angle irons placed every 3 to 4 ft. on opposite sides of the shaft to serve as supports for the vertical duct lines. The distance between these angle irons is about 2½ ft., being therefore amply sufficient to permit a man to pass down the shaft into the tunnel. As the tunnels have been built with sufficient capacity to care for future growth, only the vertical ducts or risers on one side of the shafts have been installed to date. The opposite, or empty, side is covered at the top by a safety grating of cast iron which prevents persons falling down the shaft through the space that will eventually be occupied by conduit.

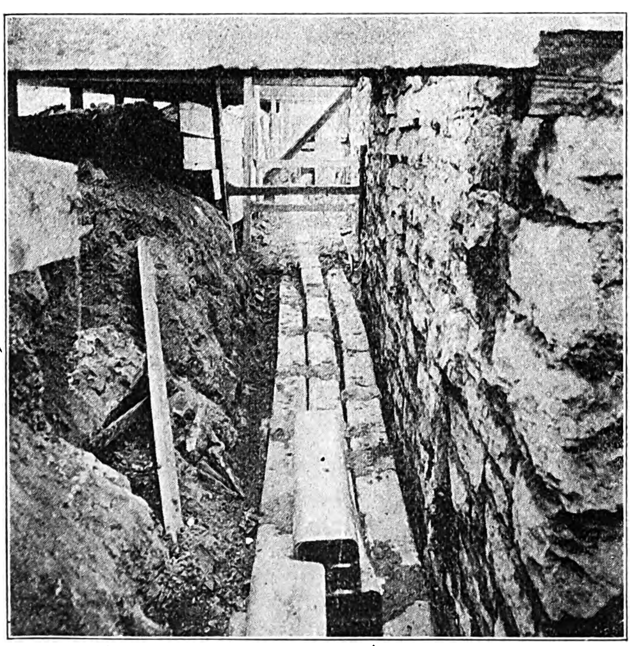


Fig. 4.—Four-part Duct as Used in Horizontal Duct Line After Single Duct Emerges From Riser From Tunnel.

Conduit Construction.

The floors of the tunnels were leveled in order to provide a straight foundation and treated with a cement mortar for the first layer pipe, which was constructed with the use of a wooden mandrel with all joints in the different rows staggered and each joint wrapped with cheese cloth to prevent any foreign substance from entering the pipe. The bottom row was laid for about 100 ft. with the next rows in rotation, until all rows were installed, when the concrete form was built and concrete placed. The conduit is covered with a 3-in. covering of cement. After the completion of the conduit through the bore of the tunnel each pipe was rodded, swabbed and fish wire installed.

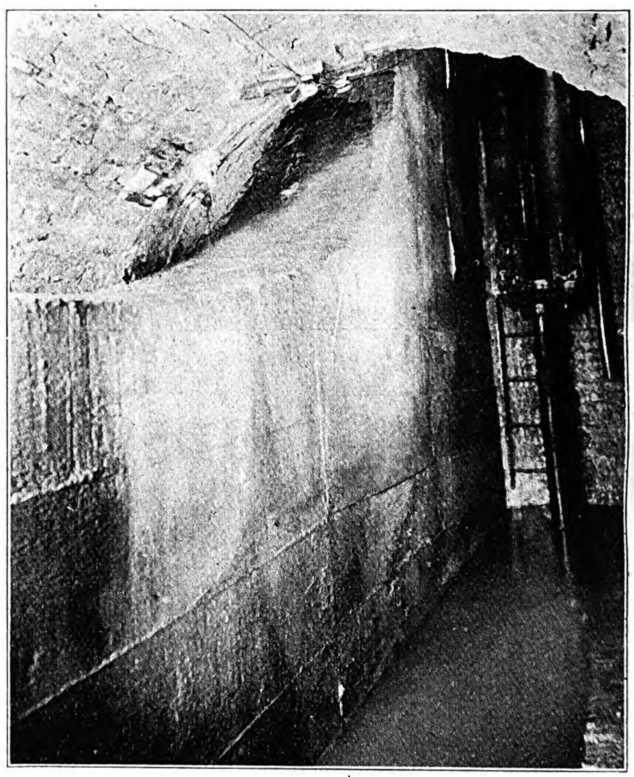


Fig. 5.—Duct Line Where Horizontal Run Changes to Vertical. View Taken of Lower Tunnel Level, Showing Collection of Drainage and Emerson Pump.

The work of building the foundations for the radius curves was next in line. This involved considerable care to provide the proper radius for the bends, which were installed with the straight pipe and a perfect radius provided. The shortest radius adopted was 10 ft. 6 in., and the largest about 14 ft. 6 in.

The construction of the riser pipes in the shafts necessitated extreme care and in order to prevent any substances from dripping on the pipes, they were plugged after each section was placed. As this work progressed, the first wire was drawn through until the job was completed, when these wires were replaced with No. 9 galvanized iron wire, after a thorough swabbing, and all ducts provided with wooden conduit plugs.

For the vertical sections or risers, the ducts are placed in position by a mandrel, which consists of a wooden rod 12 ft. in length upon which the sections of duct were threaded or strung. This assured perfect alinement of the ducts and reduced the time of building the vertical sections. Three-inch angle irons are built into the shaft every 3 to 4 ft., and to these the wooden forms are fastened after which the concrete of a mixture of one part cement, three parts gravel and five sand, is poured. Wooden forms were used for filling in and covering in the ducts. Wooden forms were, in fact, used throughout the job.

The ducts are laid three wide and 8 to 10 ft. high. The ducts are of vitrified clay with an inside diameter of about 4 in. The company in the past and for usual underground work has employed the multiple duct. However, for the work such as tunnels it has been found that the single duct is far more preferable. With multiple duct it would have been practically impossible to make the curves required at the vertical or risers with the multiple duct and castings would have had to be employed at these sections.

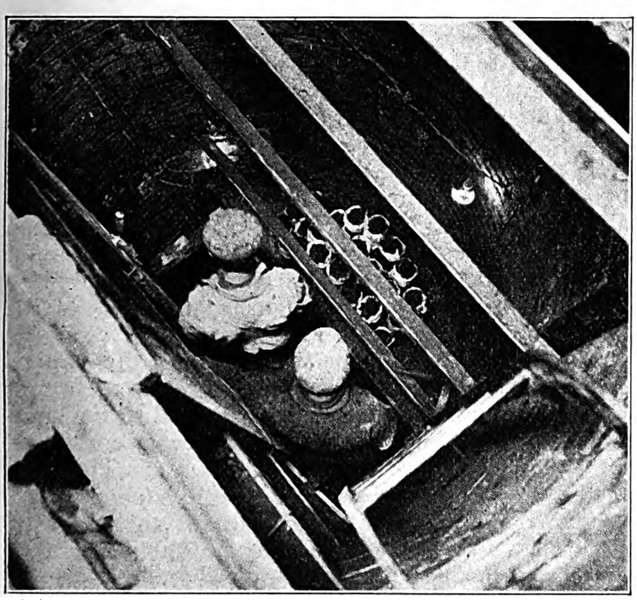


Fig. 6.—View Looking Down Brick Lined Shaft Showing Location of Ducts Ladder and Angle Irons.

Moreover, with multiple duct only six 4-duct elements could be used, holding 24 cables, whereas by employing single duct 30 cables can be carried on one side of the tunnel.

The decision of the company to use vitrified clay duct instead of iron pipe, as had been used previously in the company's former tunnels, was that iron pipe has been found quite objectionable in many ways. To begin with, iron pipe subjected to such conditions as exist in tunnels, where corrosive liquids and gases are ever present, corrode rapidly. Corrosion of the pipe occurs and also electrolytic action between the iron pipe and the lead cable sheath. Rust from the upper surfaces of the interior of the pipes falls down to the bottom, causing clogging of the pipe, which introduces difficulties when the time comes to pull out the old and pull in the new cable. At the risers it has been found that the rust from the vertical portions of the risers falls and collects at the bottom of the vertical, here also causing collection, rusting together and trouble.

WAR DEPARTMENT ANNOUNCES SALE OF CARTRIDGE CASES.

Rejected Cases Are Especially Suitable for Lamp Shades or Bases.

The Director of Sales of the War Department has announced a sale, at 20% above the current market price of their metal content, of 1,500,000 brass cartridge cases not suitable for military purposes. These cases are especially adapted for souvenir and novelty purposes and can be easily converted into lamp shades, lamp bases and similar artcraft articles.

The offering includes artillery cases of the following sizes: 75 mm., weight 2.61 lbs.; 4.7 in., weight 8.25 lb.; 6 in., weight 7.03 lb.; 3 in., anti-aircraft, weight, 6.75 lb. The metal content of the cases is approximately 70% copper and 30% spelter.

The 75-mm. cases are located at Providence, R. I., Breckenridge, Pa., Mays Landing, N. J., and South Amboy, N. J. The 4.7-in. cases are located at Burneage, Mass., Waterbury, Conn., and South Amboy, N. J. Prospective purchasers are requested to communicate with the Ordnance Salvage Board, 6th and B streets, Washington, D. C., or the Salvage division, Purchase, Storage and Traffic Division, Munitions building, Washington, D. C., or the Surplus Property Officer, Zone Supply Office, in any of the larger cities.

TELEPHONE FACILITIES IN NEW YORK TO BE IMPROVED.

Important Construction Work Now Under Way to Improve Service.

In connection with hearings being held by Public Service Commission as to the adequacy of the telephone service given by the New York Telephone Co., F. H. Bethell, vice-president of the company, in a recent letter addressed to the Commission, sets forth that the service has been seriously disorganized by war conditions, and that at the present time there should be in the New York City plant no less than $25,000,000 in additional construction to properly handle the city's traffic. It is pointed out that important new construction is already under way, including a new central office building in the Bronx, two in Brooklyn, and the installation of complete new switchboard units in four Manhattan central stations and one station in Queens. Also plans have been arranged for extensive additions to existing switchboard equipment for five Manhattan, six Brooklyn, one Queens, and one Bronx central station.

TRADE EXPERT TO VISIT LESSER ANTILLES AND HAITI.

C. Grand Pierre, West Indian trade expert of F. C. Luthi & Co., 277 Broadway, New York City, left recently for the Lesser Antilles and Haiti. One of the purposes of his trip is to continue negotiations for the organization of public utilities, including electric lighting plants, a telephone system, etc., in these places.

The company has unusually strong personal connections with the prominent people of these islands and Mr. Pierre will look into the advisability of negotiating for quite a number of public utilities which the company has in view as possibilities. The company is also preparing for some work in South America where it maintains its own offices.

Central-Station Rates in Theory and Practice

Seventh Article—The Consumer Cost, What It Includes and How It Varies—Determining the Numerical Values of the Three Elements of Cost—Analytical Valuation of Costs

By H. E. EISENMENGER

This is the seventh article of this series, which began in the issue of July 12 after a general outline in the issue of July 5. The present article concludes a discussion of the cost of central-station service, which has included detailed consideration of the three principal elements of the cost—energy, demand and consumer cost, the latter being treated in this present installment. In the next article will begin Part II of this series—The Price of Electric Service—Rates. The preceding articles have thus served as an important preliminary to the main body of the text, which will be continued weekly throughout practically the remainder of this volume.

PART I—THE COST OF ELECTRIC SERVICE—Continued.

II-A. THE THREE ELEMENTS OF COST.

3. THE CONSUMER COST.

A. CAPITAL CHARGES.

SECTION 54. There is a certain amount of money to be invested by the electric light and power company for every consumer individually over and above the capital which is invested for the consumers collectively in the central station and in the distribution lines. A large part of this additional investment is occasioned by the bare fact that the consumer is connected to the lines and this part has practically nothing to do with the amount of electrical energy consumed by the customer or with his maximum demand. It amounts to the same for a large consumer and for a small one. To make this clear, consider the following: It is general central-station practice that most equipment up to and including the consumer's meter is paid for by the electric light company, whereas the interior wiring proper, beginning behind the meter, is paid for by somebody else, usually the house-owner or the consumer. There is, therefore, a certain capital invested by the company for every single consumer individually. This consists in the cost of the so-called service wires or drop wires, that is, the connection from the street lines to the building and into the main service cutout; moreover, it includes the cost of the meter, etc. Up to a certain size of consumer this investment will be practically constant per consumer and above that size we can regard it as composed of two parts: A constant part (cost of average length of service connection, if constructed with minimum size of poles and minimum thickness of service wires; also cost of minimum size of meter, etc.) and another part proportional to the maximum demand of the consumer. Apportioning the capital charges of this latter part to the demand cost, we see that we have a certain investment left which is independent of the size of the consumer and therefore we will also have certain annual charges which are independent of the size of the consumer.

B. OPERATING EXPENSES.

55. Moreover, there are direct annual expenses, apart from the expenses caused by the capital investment, which also amount to substantially the same sum per customer, whether he be a large or a small one. Thus the electric light company generally has to send out a meter reader every month to every customer to read the amount of kilowatt-hours consumed during that month and then the company's clerks have to figure out the amount of his bill. They have to write out the bill, send it out to the customer, keep their records whether and when he has paid and more such clerical and bookkeeping work. In addition to this are the costs of maintenance and repairs to the service lines and meters, etc.

56. All these expenses, including the capital expenses for meter, etc., are caused by the mere fact that the respective consumer is connected to the company's lines and they are the same for every consumer, that is, they are *constant per consumer*. They are called the "*consumer cost*" or the "*customer cost.*" To give the beginner a rough idea of the order of magnitude of this amount, it may be stated here that different companies figure it somewhere between 50 cents and $1 per month for every customer. This is negligible in case of large consumers, who are paying a hundred or several hundred dollars per month. But it constitutes a very large percentage of the cost of serving the small consumer, whose monthly bill is perhaps somewhere between $1 and $5, or even lower.

C. INFLUENCE OF THE CONSUMER COST ON THE TOTAL COST PER KILOWATT-HOUR.

57. It has been mentioned before (Section 10) that it is frequent practice to reduce the total cost (and also the price) of serving a customer, to the unit of kilowatt-hours consumed by him, that is to say, the cost (or the price) of electricity is so much *per kilowatt-hour*. It is now clear that the total cost of serving the small consumer, per kilowatt-hour, is very much greater than that of serving the larger consumer in consequence of the fact that the consumer cost is constant per consumer. If the customer cost is, for instance, $1 per month per consumer, the cost per kilowatt-hour caused by a consumer who is using only 10 kw-hr. per month, *must* exceed 10 cents per kw-hr., since 10 cents per kw-hr. are necessary to cover the item of the customer cost alone. If the consumer is

using 10,000 kw-hr. per month, the customer cost per kw-hr. will be 0.01 cent, that is, practically negligible, and the cost per kilowatt-hour will be as low as other circumstances will permit.

D. VARIATIONS OF THE CONSUMER COST BETWEEN CONSUMERS.

58. Of course, the consumer cost per consumer although being approximately constant is not quite *strictly* constant, no more than the demand cost per kilowatt, or the energy cost per kilowatt-hour, are *strictly* constant.

If, for instance, a building is located far back from the street (where the distribution lines are run) the service lines from the street to the house will have to be longer and therefore more expensive than the average and perhaps we may even have to put up an extra pole or two for the service line. It has been shown before (Section 51) that the demand cost will be higher if the building is located in a thinly settled part of the town (which is particularly true in case of residences). Likewise, the customer cost in such districts will be higher because the meter readers, trouble men, etc., of the company will have to walk or ride so much longer from one customer to the next and therefore will not be able to cover as many customers in a day. This will apply particularly to residences in poorer districts where not every house is connected to the lines and also in some very fashionable quarters where every house is surrounded by a large garden. Furthermore, in case of residences, these employes of the electric light company will have to call twice or oftener in a certain percentage of the houses because they found the door locked and nobody at home on their first visit. This second visit is, of course, more expensive than the first one because the meterman may have to go quite a distance out of his way to reach the single house where he could not get access the day before. On the other hand, in case of "commercial customers" (this term means business enterprises) the meterman can be sure that he can get access to the premises and the meter at any time of the business day.

These differences between the customer cost of various customers are as a rule only small; an attempt to take all these small variations into consideration would generally hopelessly complicate matters and bring very little gain, just as in some cases of the variations of the energy cost and the demand cost, as already explained.

B. THE DETERMINATION OF THE NUMERICAL VALUES OF THE THREE ELEMENTS OF COST.

59. To determine for practical purposes the three items of energy cost, demand cost and customer cost, we can proceed as follows: We see from the company's books how large the expenses have been in a certain year under the various headings, for instance, for fuel, attendants' wages in the power house, salaries of the clerical forces, and dozens of other headings. We also know the value of the various parts of the plant, the life to be expected from them, etc., and consequently we can find the annual capital charges for those various parts. Now we distribute these various items of annual expenses by our best judgment under the three headings of energy cost, demand cost, and customer cost. For instance, 90% of the fuel cost may be assumed to go to energy cost and the remaining 10% to demand cost. The wages of the meter readers will go to customer expense and a certain percentage of the salaries of the clerical force goes to the same item. An intelligent scrutiny will generally give a pretty definite idea just how much of the time and the salaries has been devoted to the making out of the bills and similar work which goes to customer cost. Other expenses will be more or less in the air as far as that is concerned, for instance, the directors' salaries, advertising expenses, etc. It is plain that there is a certain element of arbitrariness in the whole procedure, but this element is smaller than would appear from this description. A large part of the cost can be assigned without much doubt to one or the other of the three items and only a moderate percentage remains questionable and has to be squeezed in somehow. After we have thus determined the total amount of each one of the three items of the cost, it is easy to divide them by the total energy consumption in kilowatt-hours, by the maximum demand in kilowatts and by the number of customers, respectively, to get the three unit costs. Corrections will then have to be made to allow for the diversity-factor, etc., as shown above.

60. As has been pointed out just now, there is in this method a certain element of uncertainty and arbitrariness about the apportionment of certain parts of the cost. We can remove this uncertainty in theory, and under certain conditions greatly reduce it in practice by a method which may be roughly characterized as taking into consideration the changes which the energy consumption, plant capacity (peak load) and number of consumers of the central station have undergone during the last few years and bringing them into connection with the simultaneous changes of the total yearly expenses. In this manner we arrive at the average values which the three headings of cost have had during the period under consideration.

This method, which implies the use of a little simple mathematics, was first proposed by the present author in 1914. An abbreviated reproduction of the original article in which this method was first put forth in this country by the author is contained in Insert VIII.

61. The preceding sections contain quite a lengthy theory of the cost of electric service and of the methods by which we can arrive at the figures for that cost. The author does not wish to convey the idea thereby that such scientific methods are generally employed by the central-station companies. Many of these companies, especially the smaller ones, are using to this day crude methods to learn what their unit costs are. We still frequently find the statement that the cost to the central station of service is so much per kilowatt-hour. This is a very convenient and intelligible statement, but—except in some special cases, where the governing conditions of service are known—it is not at all adequate. It will not be denied, however, that larger and well managed companies are employing much time and work on ascertaining their unit costs—time and work which are generally well and profitably spent.

Insert VIII—Appendix to Section 60.

NUMERICAL EVALUATION OF THE THREE ELEMENTS OF COST.

(Contains considerable mathematics in the proof, but the results contain only elementary algebra.)

This method was published by the author for the first time in English in the ELECTRICAL REVIEW AND WESTERN ELECTRICIAN of Aug. 15, 1914, of which article the following is a portion (modified to tie in with the rest of this series).

1. Calling c_1 the unknown customer cost per customer per annum,
c_2 the unknown energy cost per kw-hr. consumed,
c_3 the unknown demand cost per kw. of peak

responsibility or rather of "equivalent demand" (see Insert VI).

d the peak responsibility or the equivalent demand, respectively, of a certain customer,

e the same customer's yearly energy consumption in kw-hr.,

k the (unknown) total cost of serving that customer per annum,

we get the following equation:

$$k = c_1 + c_2 e + c_3 d \quad \ldots\ldots\ldots\ldots\ldots\ldots (1)$$

Adding these equations for all customers of the central station (considering the central station itself as a customer also, as far as its home consumption of electric service is concerned) we get

$$\Sigma\,(k) = c_1 N_1 + c_2 \Sigma\,(e) + c_3 \Sigma\,(d) \quad \ldots\ldots\ldots\ldots (2)$$

where N_1 is the total number of customers served in that year.

$\Sigma\,(k) = K_1 =$ total annual cost of the central station.

$\Sigma\,(e) = E_1 =$ total energy consumed annually in kw-hr.

$\Sigma\,(d) = D_1 =$ sum of the customers' peak responsibilities (which is equal to the sum of the customers' equivalent demands, see Insert VI, and to the central station's peak load, neglecting, in the latter case, the losses in transmission, transformation and distribution).

We have thus

$$\left.\begin{array}{l} K_1 = c_1 N_1 + c_2 E_1 + c_3 D_1 \\ \text{for the following year we find} \\ K_2 = c_1 N_2 + c_2 E_2 + c_3 D_2 \\ \text{and for the third year} \\ K_3 = c_1 N_3 + c_2 E_3 + c_3 D_3 \end{array}\right\} \ldots\ldots\ldots\ldots\ldots (3)$$

In these equations the values of K, N, E and D are known and we have, therefore, three linear equations for determining the three unknowns, c_1, c_2 and c_3. On account of the small number of the unknowns, any elementary method, such as the method of substitution or elimination, could be employed for solving the equations.

2. The following investigation will show, however, that the equations (3) can generally not be employed without further changes. The results of this investigation are expressed in simple algebra and readers who do not care to follow the author into the details of the investigation will find the simple results summarized in Section 4 *et seq.* of this Insert.

These investigations are carried out here with the help of the theory to determinants. Readers who are not familiar with determinants are referred to the author's article in the Electrical Review and Western Electrician of Aug. 15, 1914, where the same investigation is also carried out graphically with the same results.

3. The values of the three knowns are given by

$$c_1 = R_1/R, \quad c_2 = R_2/R, \quad c_3 = R_3/R$$

where R, R_1, R_2 and R_3 are the following determinants:

$$R = \begin{vmatrix} N_1 E_1 D_1 \\ N_2 E_2 D_2 \\ N_3 E_3 D_3 \end{vmatrix} \qquad R_1 = \begin{vmatrix} K_1 E_1 D_1 \\ K_2 E_2 D_2 \\ K_3 E_3 D_3 \end{vmatrix} \qquad R_2 = \begin{vmatrix} N_1 K_1 D_1 \\ N_2 K_2 D_2 \\ N_3 K_3 D_3 \end{vmatrix} \text{ etc.}$$

The theory of determinants shows that equations (3) cannot be solved by finite values if

$$N_1 : N_2 : N_3 : = E_1 : E_2 : E_3 : = D_1 : D_2 : D_3 : \quad \ldots\ldots\ldots (4)$$

because in that case determinant R becomes zero and the equations will be fulfilled either by $c_1 = 0/0$, $c_2 = 0/0$, $c_3 = 0/0$, or by $c_1 = \infty$, $c_2 = \infty$, and $c_3 = \infty$. In the first case the three equations are identical amongst one another, the problem is underdetermined, and in the second case the equations contradict each other.

The latter case (contradiction of the equations) cannot occur in practice if we take the correct figures, but the first case may take place. It is most improbable that equation (4) will be fulfilled accurately, that the number of customers will grow in exactly the same ratio as the energy consumption and the central station's peak load grows; this means in other words, it is highly improbable that the central station's load-factor E/D will remain absolutely constant and also the average energy per consumer E/N and the average peak responsibility per consumer D/N. But it may happen and it may even be expected to happen that the changes of these three ratios from one year to the next will be very small. This means that the values of the determinants R, R_1, R_2 and R_3 are small as compared to the values of the factors K, N, E and D of which the determinants are composed. The determinants consist of a number of positive and negative members, which will very nearly cancel if equation (4) is very nearly fulfilled; for instance, the determinant will be figured as $1857 - 1854 = 3$. A small percentage inaccuracy of one or more of the constituent members (for instance, 1860 instead of 1854) may, and generally will, result in a very large error of possibly several hundred per cent of the value of the determinant and may even result in negative values for c_1, c_2 and c_3.

Such inaccuracies are inevitable. For instance, the figures we get from the company's books for the annual cost are the amounts *paid* for materials, wages, etc., during the respective year, whereas they ought to be for this computation the cost of materials, etc., actually *used* during that period. That is not exactly the same. The company may have bought a certain amount of fuel, for instance, in one year and used not all of it in the same year, and, moreover, paid for it only in the following year. Or in a certain year a repair has occurred which is particularly expensive and is due to extraordinary circumstances or accidents, for instance a boiler explosion, etc.

4. The requirements of a sufficient variation of the load-factor, the energy consumption per consumer and the average demand per consumer are generally better fulfilled if, instead of three successive years, three months are chosen at different seasons since the load-factor in summer and winter, for instance, reaches entirely different values. The result is further freed from the influence of casual irregularities by choosing not, as assumed heretofore, only three such periods, but by extending the calculation over a large number of periods, such as 24 months, with the result that one obtains average values of a larger number of periods.

This results in 24 linear equations with three unknowns. There is, of course, in general no solution possible which satisfies all the 24 equations, but it is possible to find those values of the unknowns which satisfy the equations in the most accurate way, that is, with which the sum of the squares of the errors becomes a minimum, or in other words the most probable value. This is done by the method of Gauss which consists in the following:

Let the 24, or in general n, equations be (denoting the unknowns in the customary way as x, y and z):

$$\left.\begin{array}{l} N_1 x + E_1 y + D_1 z = K_1 \\ N_2 x + E_2 y + D_2 z = K_2 \\ N_n x + E_n y + D_n z = K_n \end{array}\right\} \quad \ldots\ldots\ldots\ldots\ldots (5)$$

Multiply both sides of the first equation by N_1, those of the second equation by N_2, etc., and add the equations which are obtained thereby:

This results in a new equation:

$$\begin{aligned} &(N^2_1 + N^2_2 + \ldots + N^2_n)\,x + (E_1 N_1 + E_2 N_2 + \ldots + E_n N_n)\,y \\ &\quad + (D_1 N_1 + D_2 N_2 + \ldots + D_n N_n)\,z \\ &\quad = N_1 K_1 + N_2 K_2 + \ldots + N_n K_n \quad \ldots\ldots\ldots\ldots\ldots (\mathrm{I}) \end{aligned}$$

This equation (1) is called the first normal equation. Now if we multiply the first one of equations (5) by E_1, the second one by E_2, ... etc., and add them again we obtain the second normal equation:

$$\begin{aligned} &(E_1 N_1 + E_2 N_2 + \ldots + E_n N_n)\,x + (E^2_1 + E^2_2 + \ldots + E^2_n)\,y \\ &\quad + (E_1 D_1 + E_2 D_2 \ldots + E_n D_n)\,z \\ &\quad = E_1 K_1 + E_2 K_2 + \ldots + E_n K_n \quad \ldots\ldots\ldots\ldots\ldots (\mathrm{II}) \end{aligned}$$

In an analogous manner we get the third normal equation by multiplying all equations (5) by D_1, D_2 ... D_n, and adding them thus obtaining

$$\begin{aligned} &(D_1 N_1 + D_2 N_2 + \ldots + D_n N_n)\,x \\ &\quad + (E_1 D_1 + E_2 D_2 + \ldots + E_n D_n)\,y \\ &\quad + (D^2_1 + D^2_2 + \ldots + D^2_n)\,z \\ &\quad = D_1 K_1 + D_2 K_2 + \ldots + D_n K_n \quad \ldots\ldots\ldots\ldots\ldots (\mathrm{III}) \end{aligned}$$

The three normal equations can be written in a shorter and more perspicuous way as follows:

$$\Sigma\,(N^2_m)\,x + \Sigma\,(E_m N_m)\,y + \Sigma\,(D_m N_m)\,z = \Sigma\,(N_m K_m) \ldots (\mathrm{I})$$
$$\Sigma\,(E_m N_m)\,x + \Sigma\,(E^2_m)\,y + \Sigma\,(E_m D_m)\,z = \Sigma\,(E_m K_m) \ldots (\mathrm{II})$$
$$\Sigma\,(D_m N_m)\,x + \Sigma\,(E_m D_m)\,y + \Sigma\,(D^2_m)\,z = \Sigma\,(D_m K_m) \;.\,(\mathrm{III})$$

It is seen that the 9 co-efficients of the unknowns are partly identical with each other in couples according to a law of symmetry which can be easily recognized. This makes their computation easier.

These three normal equations solved for the three unknowns x, y and z yield directly the most probable values for the latter, that is, the values which approximate most closely the simultaneous fulfillment of all the n original equations.

5. The charges found in the foregoing manner require a correction.

The kilowatt-hour charge must be increased in the ratio of kilowatt-hours generated to kilowatt-hours sold, since only the kilowatt-hours sold are paid for and not, as has been assumed heretofore, the kilowatt-hours generated.

On the other hand, the demand charge must be reduced because in practice it is based not on the "equivalent demand" of the customer or on his peak responsibility but on his individual maximum demand. The customers are classified and the ratio $\dfrac{\text{equivalent demand}}{\text{maximum demand}}$ or $\dfrac{\text{peak responsibility}}{\text{maximum demand}}$ is then found by measurements or by estimating to our best ability. The average of this value prevailing within every class of customers is then the reduction factor prevailing within that class.

6. The method described above is, of course, not restricted to the number of three charges as one can also aim from the beginning at the application of two charges only, for instance, a kilowatt-hour charge and a demand charge, and then one obtains only two unknown y and z (c_2 and c_3) in the equations. With such central stations which are also in the electric railroad operating business one could add two more unknowns to the three original ones, namely, u (that is, that part of the cost of railroad operation which is proportional to the number of car-miles) and v (that is, that part which is proportional to the length of track). It should be understood, however, that the calculation of five unknows out of about 24 equations is a rather lengthy operation even with the use of computing machines and it is probably preferable in all those cases to separate the railway cost from the beginning entirely from the rest of the cost, if possible. The expenses which are common to both branches, such as general expenses, must then be distributed arbitrarily to our best judgment between the two branches of the business. Each one of the two branches is then to be resolved into its parts according to the analytic method just shown.

7. As regards the length of the period over which the computation should be extended, it must not be too small so that accidents do not exert a disturbing influence and that a proper average can be found. On the other hand, it must not be too large since the amount of the cost for the different charges is slowly changing in the course of the years in consequence of the development of the central station (for instance, the use of more economical generators, etc.). Twenty-four monthly periods are about the proper figure under ordinary circumstances. If during that time a change of rates has occurred, this influences favorably the accuracy of the computation since thereby the character of the use of the current by the customers is changed. The load-factor or the average number of kilowatts or kilowatt-hours, or all of these factors, are liable to change and this, as shown above, makes possible a more exact computation of the unknowns.

(To be continued.)

POWER PRODUCTION AND FUEL CONSUMPTION BY UTILITIES FOR MARCH.

The following report is based on returns obtained by the Division of Power Resources, United States Geological Survey, from 3075 electric power plants engaged in public service, including central stations, electric railways and certain other plants, the output of which contributes to the public supply. The output for the month averages 101,400,000 kw-hr. per day, of which 41% was produced by water power. The average consumption of coal per kilowatt-hour of those plants using coal, was about 3 pounds.

THOUSANDS OF KILOWATT-HOURS PRODUCED.

State.	Waterpower.	Fuels.
Alabama	30,275	4,907
Arizona	6,689	21,807
Arkansas	72	6,620
California	215,914	33,939
Colorado	14,254	17,144
Connecticut	14,884	37,469
Delaware	....	4,784
District of Columbia	....	19,172
Florida	892	8,789
Georgia	37,264	6,082
Idaho	39,913	257
Illinois	15,282	207,705
Indiana	3,648	54,613
Iowa	48,502	25,051
Kansas	1,223	30,775
Kentucky	4	19,127
Louisiana	....	14,866
Maine	20,157	73
Maryland	371	13,898
Massachusetts	31,365	100,034
Michigan	59,650	96,101
Minnesota	34,881	16,848
Mississippi	....	5,399
Missouri	5,920	38,396
Montana	77,861	854
Nebraska	959	16,687
Nevada	2,450	121
New Hampshire	7,971	1,958
New Jersey	197	76,775
New Mexico	56	1,556
New York	222,318	288,191
North Carolina	46,333	7,426
North Dakota	....	2,453
Ohio	3,932	194,850
Oklahoma	183	12,981
Oregon	29,014	3,779
Pennsylvania	62,509	246,989
Rhode Island	805	18,405
South Carolina	43,417	4,045
South Dakota	3,579	4,042
Tennessee	45,222	10,680
Texas	200	48,034
Utah	15,463	....
Vermont	18,393	179
Virginia	20,221	18,774
Washington	79,347	4,521
West Virginia	1,593	58,108
Wisconsin	37,569	33,053
Wyoming	172	3,898
Total	1,300,924	1,842,214
Combined total		3,143,138

The production of the electric power reported required the combustion of fuels in the quantities indicated in the following table:

State.	Coal, short tons.	Petroleum and derivatives, bbl.	Natural gas, M. cu. ft.
Alabama	16,467	....	....
Arizona	6,160	88,011	....
Arkansas	11,177	489	85,398
California	....	185,127	181,785
Colorado	44,079	95	....
Connecticut	62,234	323	[a]12,615
Delaware	7,713	17	....
District of Columbia	20,483	....	....
Florida	5,594	199,149	151
Georgia	11,934	120	....
Idaho	111	10	....
Illinois	351,289	2,198	....
Indiana	157,896	167	2,108
Iowa	78,739	730	....
Kansas	51,932	60,233	85,996
Kentucky	39,386	351	....
Louisiana	14,560	29,419	47,458
Maine	348	7	....
Maryland	23,657	18	1,500
Massachusetts	143,453	14	....
Michigan	124,841	104	....
Minnesota	46,346	992	....
Mississippi	16,542	349	....
Missouri	90,495	19,580	....
Montana	5,686	563	960
Nebraska	32,984	3,349	....
Nevada	180	1,044	....
New Hampshire	3,696	20	....
New Jersey	116,525	103	....
New Mexico	4,438	1,360	....
New York	363,319	546	164,408
North Carolina	16,234	20	....
North Dakota	17,116	504	....
Ohio	321,987	842	[b]323,020
Oklahoma	13,153	5,594	440,094
Oregon	433	14.345	....
Pennsylvania	408,264	14	54,450
Rhode Island	22,024	....	....
South Carolina	9,540	33	....
South Dakota	12,325	3,463	....
Tennessee	28,724	84	....
Texas	34,789	181,318	179,760
Utah	61	....	....
Vermont	412	2	....
Virginia	22,475	13	....
Washington	3,473	18,804	....
West Virginia	70,717	58	142,688
Wisconsin	77,139	662	....
Wyoming	19,907	2,539	18,349
Total	2,931,037	822,783	1.740,740

[a]Artificial gas; [b]67,156 artificial gas.

Some Causes of Breakdown to Electrical Machinery

Deterioration of Insulation Due to Dirt, Mechanical Stresses, Etc.—Ventilation, Metal Fatigue, Bearings and Other Causes of Trouble—Typical Examples of Breakdowns Met in Industrial Plants

By W. C. WORRAL

In probably no other type of machinery are the causes of breakdown so numerous as in electrical machinery. The proper knowledge of breakdowns and their causes cannot be obtained only by a study of machines returned to the shops for repairs, but a full acquaintance with the conditions under which the machines operate is essential. A single breakdown may teach much, but when the same kind of breakdown is experienced many times deductive reasoning and a comparison of conditions and circumstances will generally lend to definite and accurate conclusions.

Dirt and Dampness Affect Insulation.

The vast majority of breakdowns have but one cause and no exact scientific knowledge is required to understand it. Dirt or, as it has been defined, "matter in the wrong place," is responsible and no precaution can be considered unnecessary which will prevent dirt obtaining access to the internal parts, such as the commutator, armature winding or field coils. Dampness, oil and dirt are the greatest enemies of insulation; dampness and oil are not so serious in themselves but the danger lies in their forming a conveying medium for all kinds of injurious matter.

A certain hydroelectric station was shut down for two years, the insulation resistance of the machines was practically zero and yet without any preliminary drying they were started up and put on load; after a few weeks' service the machines had an insulation resistance of infinity. These machines have since given years of service without any breakdown. Such a case is exceptional and is due to the fact that the atmospheric moisture was pure and the insulation had not suffered any deterioration.

The presence of dampness frequently causes repairs on the site to turn out very unsatisfactorily. The insulating materials may be dry when taken out of storage, but by the time they are put into the machine they are very likely to have absorbed moisture and the varnish is applied without "stoving." A very bad example of this kind occurred in a coal mine. An underground three-phase motor of 90 hp., 2650 volts, coupled to a pump broke down to ground in the stator and was repaired in position. The repaired coil broke down again in a week and as the owners refused to bring the motor to the surface, the repair was again effected in the pump chamber underground. A month later the repaired coil broke down once more and the owners then allowed the motor to be sent to the makers' works. A repair was again effected but under favorable conditions and no further trouble was experienced.

Where failure of insulation occurs, a green discoloration is sometimes observed near the point of breakdown and there seems little doubt that the discoloration is in some way associated with the failure. Chemical analysis shows that where the discoloration occurs chlorine is frequently present. One possible source of the chlorine is soldering flux. Zinc chloride has been found present in considerable quantities even in soldering paste which is guaranteed to be free from this substance. Ordinary soldering "spirit" is used in most shops for the purpose of cleaning the soldering iron and for tinning the conductor ends. A common practice is to dip the hot metal into the spirit, which splashes all round and it is quite conceivable that spots reach parts of the machine which are supposed to be entirely free from such materials. The green discoloration may also be due to the vegetable and fatty acids contained in the flexible varnish with which the insulation is impregnated. It is generally admitted that some action takes place during the process of oxidation of the varnish and even when the varnish has hardened further action may take place which may adversely affect the insulation that the varnish is supposed to protect.

Discoloration has been noticed more particularly in connection with built-up mica used in commutator construction and in this case the discoloration is probably due to the methylated spirit used as a solvent of the varnish or cement employed in the construction of the material. It is practically impossible to make a chemical analysis of the green product as the quantity present is always too small.

A very remarkable series of breakdowns in which the green discoloration was noticed occurred in connection with two 300-kw., direct-current generators and a 100-hp., direct-current motor, all of which broke down in succession at short intervals in exactly the same way. The failure was in each case due to short-circuits between the commutator segments at the bottom of one of the V-grooves. There was no sign of any foreign matter present, but around each place where a short-circuit had occurred the micanite and the copper were discolored green. The short-circuits were most likely due to the action of the solvent of the varnish on the copper, but there was also the possibility of traces of soldering spirit or even soldering paste being present. The soldering paste used was found to contain zinc chloride and the micanite also showed traces of chlorine.

Although it is suggested that in many cases of breakdown the cause lies in the nature of the insulating materials, similar machines made of the same batch of materials at the same time do not all show the same defects. The 300 kw. generators and 100 hp. motor cited above were only three machines of a 600-kw. installation, comprising chiefly, motors of 10 hp. and upwards. The remainder of the machines proved satisfactory and other machines turned out by the makers at the same time were free from defect. This naturally throws some doubt on the conclusion that the fault was inherent to the materials, for the question is at once asked, why had not other machines failed in the same way? At the same time it must be admitted that the failure of three machines in the same way is better proof that the material was faulty than the survival of the other machines was proof that the material was good. No really conclusive explanation of this particular case was arrived at, but after rebuilding the commutators the trouble was not experienced again.

Bad Effects of Producer-Gas Fumes on Insulation.

Producer-gas fumes have a very bad effect on insulation. More than one person who should be an authority on the subject has stated that the fumes have no bad effect on the insulation and the only trouble is with the conducting deposit behind the commutator. This deposit is a very fair conductor, but the effect of the gas fumes on the cotton insulation is very serious. When the armature is wound it should be dried *in vacuo* and thoroughly impregnated with a flexible varnish; merely painting with varnish is quite inadequate. Some makers have tried impregnating with gum, which is very effective, but in the event of repairs being necessary the removal of a coil is a very difficult matter. Although the insulation may have perished, it may hold together for a considerable time but when one point gives way failures at many other points follow instantaneously. A 300-kw., 220-volt, direct-current dynamo was driven by an engine using producer gas. The insulation resistance of the field coils steadily diminished to a very low value; there was, however, no sign of any actual failure until suddenly all the ten coils burnt out together. The commutator of a machine subject to gas fumes becomes coated with a copper salt, probably a sulphide, which is sufficiently non-conducting occasionally to prevent a dynamo exciting.

Conducting deposits which lodge underneath the overhang of the armature conductors at the commutator end cause the greatest trouble where they form a leakage path between the bare copper ends of the conductors and the armature spider. Much can be done by insulating the conductors right up to the commutator lugs and by varnishing the metal, but a more effective preventive is to increase the length of the leakage path and exclude all crevices where the deposit may lodge. The actual way in which this may be carried out depends upon the design of the machine, but generally a sheet of press-spahn is laid between the armature conductors and the supporting ring, the sheet is bent over and tied to the spider arms. In this way a smooth inclined surface is provided upon which the deposit cannot accumulate. For insulation, mica or micanite should be used wherever possible, as these materials resist the action of the fumes better than cotton.

The precautions suggested will greatly improve the running of electrical machines subject to producer-gas fumes, but the most effective precaution of all is to ventilate the engine room in such a way that the fumes cannot reach the machines. There should be no opening in the wall between the producer plant and the engine room, or if an entrance is necessary the door should be opened as little as possible and made to close automatically. The ventilation should be so arranged that the inlet of fresh air is close to the generators so that the gas fumes do not pass over them. Most engine houses are arranged so that the mail door and windows are near the generators, but they act as inlet or outlet according to the direction of the wind; a fan should always be provided to ensure that the air currents flow in the required direction. In the absence of a fan, a ventilator in the roof directly over each generator is of great assistance in maintaining a good atmosphere round the machines.

The effect of chemical fumes generally is much accentuated by the presence of dampness and every precaution should be taken to keep the windings dry. When a machine is not in use, incandescent lamps should be kept alight inside the enclosing case and the windings should be frequently cleaned, "stoved" and varnished, if the machines are to be kept free from an abnormal number of breakdowns.

Conducting deposits behind the commutator are not always due to gas fumes but may come from the general dust in the atmosphere. Direct-current turbogenerators run great risk of failure in this respect and should whenever possible be provided with filtered air. In the power house of an iron works two 450-kw., 220-volt, direct-current turbogenerators running at 2250 r.p.m. were run for about 12 months without being opened up for examination and cleaning. Eventually the equalizing connections at the back end of the armature of one machine burnt out and a fortnight later the armature of the other machine broke down in the same way. On examination it was found that a mixture of coal and iron dust and oil had collected underneath the connections to the commutator and had set up short-circuits between the conductors. The coal dust was burnt to ash, but the insulation of the armature conductors was undamaged except where the burning had occurred. The equalizing connections, however, were of much smaller section than the armature conductors and had overheated and burnt out. It was found necessary to strip and completely rewind both armatures in order to fit new insulation at the back end. The strong draft of the generators had drawn in dust from the atmosphere and oil from the bearings, and the mixture had not only lodged behind the commutator but filled up the air gap solid and partly choked the outlet grids on top of the machine. After the accident, air filters were provided with very satisfactory results.

A low or high insulation resistance is not always a reliable guide to the real condition of the insulation. A machine may have a low insulation resistance and yet the insulation may be in excellent condition. The pores of insulating media cannot be so impregnated or coated with varnish as entirely to prevent the access of moisture, and all varnish cracks and opens out after a certain time. On the other hand, if moisture be absent, and there is no actual fault, a machine may have a very high insulation resistance and yet be in very bad condition owing to real deterioration of the insulation.

Effect of Mechanical Stresses on Insulation.

The insulation used in electrical machines is of necessity for the most part of a very flimsy nature from a mechanical point of view and although the machines may be designed so as to relieve the insulation of mechanical stresses to a very great extent, there are still stresses due principally to electromagnetic causes which seriously endanger the machine. Generally the stresses cause a slight movement when the load is suddenly changed or the current is switched on or off, and in time the movement causes abrasion of the material. This is particularly the case with field coils. In the old days the coils were wound on metal formers and the insulation was protected, but in most modern machines the coils are only taped around and wedged on the poles to prevent movement. When, however, a coil repeatedly expands and contracts, due to heating and cooling, it often becomes loose and on switching the field current on or off the coil is moved on the pole so that in course of time the conductor becomes grounded. If the coil is on the top of the machine considerable difficulty is sometimes experienced in detecting the fault, as when the machine is running (and cannot therefore be tested) the coil is lifted and the ground appears, while when the machine is stationary the coil is resting on the pole shoe and the ground disappears. The absence of the metal former has, of course, many advantages, but if it is discarded much stronger insulation should be used and the coils more effectively secured. Another weak point is found at the end of the armature slots; in some makes of machine the coils are bent round too sharply and the edges of the slot are not sufficiently insulated.

Troubles Due to Ventilation.

The power which a modern machine will develop is generally limited by the permissible temperature rise and the actual temperature rise depends upon the effectiveness of the arrangements for dissipating the heat generated. The problem is of very pressing importance in high-speed turbogenerators where the radiating surfaces are of relatively small extent. There is not much difficulty in ventilating the stator, but the rotor presents a more difficult problem. In some makes the air passages are radial while in others they are axial. Designs are, however, continually being varied and experience has not yet led to the general adoption of any particular method or design.

The air is forced into the rotor either by fans on the generator shaft or by an external motor-driven fan, and apart from the extra cost, the advantage seems to lie with the latter system. The higher efficiency of a properly designed motor-driven fan over the type of fan usually fitted on the generator shaft appears to compensate for the extra loss incurred in driving the motor. Many generators have fans which are very badly designed and finished, thereby seriously impairing the efficiency.

In the case of an alternating-current turbogenerator, the rotor of which seriously overheated, the fan on the generator shaft had an outer set of blades to supply air to the stator windings and partly ventilate the stator core, and an inner set which was intended to supply air to the rotor and through the rotor to the stator core. The effect of the rotor fan was tested by arranging baffles to cut off the action of the outer fan and it was found that practically no air passed through the rotor. This was no doubt due to grooves which were cut in the taper portion of the rotor shaft between the fan and the rotor to conduct the air but which apparently acted as fan blades in opposition to the fan fitted on the shaft. The result of this test was confirmed by the fact that when the generator was opened up the rotor ventilating ducts were found to be quite free from dust while the stator ducts were dirty. The difficulty was overcome by cutting away the fan and installing a motor-driven external fan which produced sufficient pressure to force the air through the rotor.

Wherever there is the slightest risk of dust entering a turbogenerator air filters should be provided. Even dry dust will become hard and closely packed under the action of centrifugal force and will fill up the ventilating ducts and interstices of the windings. The rotor of a 1500-kw., three-phase turboalternator running at 3000 r.p.m. completely burnt out due to the ducts and windings being choked with cement dust. Two air filters were in use, a dry filter in a room below the turbine and directly in the main air passage and a wet filter through which the air entered the room. All the air passed through the dry filter, but it was out of order and inefficient. The wet filter would probably have been satisfactory, but a door into the room was not sealed and was often open so that the wet filter was not fully in the air circuit. The whole arrangement was badly designed and of very little use.

The design of fan which is fitted to motors is often very weak mechanically, the blades are badly secured and are liable to break away from their fastenings. In the case of a 100-hp., three-phase motor that was pipe-ventilated the blades came out through the air outlet, having been thrown up a vertical pipe 6 ft. long, round a right-angle bend and along a pipe several feet before reaching the exit. A new fan was installed but the same thing occurred again; after this series of accidents the fan was redesigned.

Troubles from Faulty Core Construction.

One would hardly think it necessary to have to emphasize the necessity of thorough mechanical construction in connection with stator and rotor cores, yet a few examples will suffice to show that this is the case.

In a two-phase induction motor of 180 hp. the rotor core plates were clamped between two end rings by means of bolts passing inside but not through the core ring. The core was keyed at one point onto the rotor arms, but the end rings were secured only by small grub screws, half into the end rings and half into the rotor arms to prevent longitudinal movement. The rotor core was thus in the form of a ring which was entirely separate from the rotor arms or hub. Shortly after the motor was started up for the first time the rotor fouled the stator and considerable damage was done to several stator bars. On examination the rotor was found to be slightly eccentric and was ground true on the outside; the motor was re-erected, but the same accident occurred again and this time it was said to be due to a slight movement on the part of the pedestal bearings. After adjustment the motor ran satisfactorily again, but each time the motor was switched off a noise was heard which indicated that at a certain point in each revolution the rotor core moved on the hub. It was also noticed that when the rotor was hot a 6-mil feeler could be inserted between the core and the rotor arms in the region opposite to the keyway, but when the rotor cooled down the space was quite closed. It was evident, therefore, that the core was loose and this probably accounted for the apparent eccentricity of the rotor in the first instance. The rotor was properly secured to the hub by screws through the arms and into the end plates, and after this had been done all symptoms of looseness disappeared. It is interesting to note that the makers have since changed their design of rotor.

A 750-kw., 2200-volt, single-phase alternator running at 490 r.p.m. began to give a great deal of trouble within a few weeks of its erection. The tooth stampings of the stator in the neighborhood of the ventilating ducts and at the ends of the stator broke off, forming in course of time holes one or two inches long between the conductors; small pieces of metal came away while the machine was running and, being carried around in the air gap, caused violent sparks to be emitted; eventually the conductors at one point were grounded and a large hole was fused in the conductors in three adjacent slots and the two teeth between them. An attempt was made to improve the machine by painting the entire surface of the stator with shellac and plaster of paris and the holes as they occurred were filled in with the same material. The fault in this case was due to insufficient support of the stator teeth and it is quite probable that the entire stator core was loose. The distance piece in the core duct consisted of a thick stamping with the teeth twisted through a right angle. The method of repair adopted did not prove very satisfactory and later fiber wedges were driven into the ventilating ducts which proved successful in preventing further teeth breaking.

A three-phase, 750-kw., 440-volt turbogenerator running at 1500 r.p.m. after eight years gave serious trouble by one line of tooth stampings breaking off and grounding the stator bars on each side. It is quite possible that the trouble had been going on for some time, but it was not observed until the bars were grounded.

Some manufacturers do not appear to realize the necessity of providing effective support for the teeth of rotor and stator cores. The magnetic pulsations which occur do not exert any considerable force, but are of very high frequency and it is most probable that after a time the metal becomes fatigued and breaks off. The effects of fatigue are sometimes not apparent until the machine has been running for some years, as in the third example given above.

Core looseness is a frequent source of trouble in small machines, although it is so easy to avoid it by proper design and workmanship. Armature and rotor cores should always be built up on a cast-iron spider or sleeve, as this provides a much sounder mechanical construction than when the core is built directly on the shaft. Bad workmanship can, however, defeat good design and when shafts and spiders are packed in with strips of metal, as is occasionally the case, a loose core is only to be expected. The present-day method of securing armature and rotor cores by circumferential keys is generally satisfactory, but great pressure must be applied to the core before fitting the keys, and the keys must be a good fit. Some makers have not the requisite plant for this and are able to apply pressure to the core only with screw clamps. The keys in one 200-kw., direct-current machine dropped out and the core plates were held together only by the armature conductors. After running in this condition the conductors grounded to the core and on dismantling the fault was discovered.

Many manufacturers use a standard key and make up any slight variations in the length of the core by running in soft metal behind the key; this scarcely seems a workmanlike job.

Wood blocks are sometimes used as distance pieces in the core ventilating ducts: this is bad practice, as the wood is very liable to become loose.

Defective Connections.

The connections, external or internal, to a machine or switch are often very badly made and many serious accidents have resulted; a few examples will be given:

A 175-hp., three-phase induction motor supplied from a private plant in a mill, commenced to hunt and the hunting gradually increased in violence until the entire electrical system was surging, with the result that circuit-breakers tripped and the entire mill stopped. This occurred several times; the load on the faulty motor was then reduced and the hunting was kept within such limits as not to disturb other portions of the system. The trouble was found to be due to a bad connection in one phase of the rotor starting switch. The connection consisted of a projecting stud on which was placed a cable lug secured by two nuts. The inner nut had crossed threads and although tight, pressed on the lug in one part only and the locknut was on for only half its thickness. Overheating had caused the contact surfaces to become fused and eventually contact was practically broken.

A 70-hp., three-phase motor overheated considerably although three other similar motors doing similar work ran quite satisfactorily. The fault was found to be due to a contact in the star-delta starting switch, which was entirely missing so that although in star connection the motor was on the three phases of the supply, in delta connection one phase was cut out.

Two 600-kw. turboalternators running at 3000 r.p.m. broke down in succession after a few hours running, owing to the rotor connections breaking off close to the slip rings. The connections were not properly secured. The rotor winding broke down to ground some time later and when opened up it was found that, although the connections at the slip rings had been made secure after the breakdown, they were left quite loose inside the end bell and the insulation was almost rubbed away by abrasion against the inside of the fan casting.

Vibration and Fatigue of Metal.

Fatigue of metal is a very serious problem in the internal connections of an electrical machine. Vibration caused by lack of balance, loose foundations or relative movement of parts, sets up tremors which in course of time seriously weaken the metal. The most common occurrence is in the commutator connections of ordinary direct-current motors and dynamos, but many other more serious examples have occurred, a few of which will be given.

A 450-kw., direct-current turbodynamo running at 2500 r.p.m. broke down owing to a commutator lug breaking at a point about 1/8 in. inside the commutator segment; the lug was ripped off the upper armature connection but carried away a piece of the lower connection.

A 370-kw., direct-current turbodynamo running at 2500 r.p.m. failed repeatedly owing to the commutator lugs breaking at the corners. The lugs had sharp bends, but when new lugs without any sharp corners were fitted the trouble was not experienced again.

The exciter of a 750-kw. turboalternator running at 3000 r.p.m. broke down in the commutator, the copper segments cracked across and the lower part of the V of one segment broke off. The armature was badly balanced and the vibration was no doubt responsible for the breakage.

The rotor of a 125-hp., three-phase induction motor was wound with enameled strip copper: the overhanging end connections were, however, not mechanically secured, in fact were quite springy. The high-frequency rotor currents during the starting operation caused the copper strip to vibrate and in time a succession of breakages occurred. In later designs of this type of rotor winding the end turns are secured by wire threaded through them but even with this method some turns are often found loose.

The necessity for the security of terminal connections and other parts cannot be too strongly emphasized as very serious risk of breakdown and fire is often caused by faults in this direction.

An induction motor with a squirrel-cage rotor is usually considered a most robust piece of machinery, but unfortunately this very fact often causes the motor to be subjected to such arduous conditions of work and great abuse as no other type of motor would withstand, and as a result it is on the average no freer from breakdowns. Except in the more recent designs, the rotor is the weakest part. The contacts between the bars and the end rings become overheated and loose and the stator frequently burns out due to the increased current taken by the motor.

The modern methods of brazing the joints, casting solid or welding are all satisfactory, but soldering and riveting are of very little use. If the joints remain good, a rotor should never need rewinding, even if the insulation of the bars in the slots is all burnt away.

Bearing Troubles.

Bearings are frequently the cause of serious trouble. A seized bearing is often a small matter compared with the damage which follows. It is this which makes a phosphor-bronze bushing preferable to white metal, except in large machines which receive more attention and where the air gap is large enough to prevent any consequential damage. When the bearing heats up the white metal melts out and allows the rotor or armature to drop onto the stationary part and damage the windings, whereas a phosphor-bronze bushing seldom causes such damage. The bushing is more difficult to remove when seizure takes place, but that is not a serious matter. If the hot bearing is discovered in time and the machine is kept running while the bearing cools down, actual seizure may be prevented. Ball bearings are advocated by many makers, particularly for induction motors where the air gaps are very small, but these are not always very reliable in practice. While such bearings are suitable for steady drives where there are no sudden jolts, such as occur in a stone or ore crusher, they are supplied by some manufacturers for all purposes without any discrimination. The jolts usually cause broken balls and the only remedy is to substitute bushed bearings. Apart, however, from unsuitability under certain circumstances, one of the main troubles is in connection with the fitting of the bearings. The importance of this cannot be too strongly emphasized as carelessness is responsible for many breakdowns, and a repair usually involves a complete new bearing which is an expensive item.

Oil throwing is another bearing trouble and it seems curious that in a series of motors built to the same standard one will throw oil while the others may be quite satisfactory in this respect. The forces which draw the oil out of the bearing are of very small magnitude and the points to be observed in order to prevent the trouble would, to an inexperienced mind, seem very trivial. Oil throwing can be prevented and it is pleasant to find that the best class of manufacturers are now running no risks and take proper measures without first trying to do without them. Some machines seem to develop oil-throwing properties some time after they are put in service. This may be due to the special circumstances of the drive, such as the shape and size of pulley, the belt, arrangement of the ventilation; it may also be due to the nature of the lubricating oil, but is generally due to dirt on the oil-throwers. The presence of very little dust will allow oil to creep past the oil-throwers and the centrifugal action, which the oil-throwers are supposed to cause, is of no avail. Oil-throwers should be turned solid with the shaft, as if they are loose, oil will sometimes creep along the shaft under the oil-thrower.

Access to bearings during running is of great importance. Great carelessness is often shown in the arrangement of the pulley in two-bearing machines. The pulley often is so close to the bearing that the inspection hole is surrounded and the rings cannot be seen at work. At one works not only was this the case but the outer bearing was in a hole in a brick wall.

Care Best Preventative.

Case after case could be cited of costly breakdowns which might have been prevented by a little more care in connection with the bearings.

Some manufacturers do not take the trouble to make any inquiries regarding the conditions under which the electrical plant is to work, and many of the troubles which are experienced might be obviated if some attention were paid to suitability. It is often a question of price and the manufacturer may find it difficult to persuade a customer to pay extra for a more suitable machine or switch; but there are many cases in which price scarcely comes in and it is only a matter of thoughtlessness on the part of the designer of the installation. For instance, many excellent installations are considerably reduced in reliability by a poor quality of regulator in the exciter circuit, or a weak crossbar on a circuit-breaker; locknuts are usually left off the connections behind the switchboards; the springs on motor switches are often not securely attached; the handles on starting switches break off or become loose; switch and fuse contacts open and lose their springiness. Examples will, no doubt, occur to everyone and it seems a great mistake not to pay more attention to such matters.

The contract for the electrical equipment of a certain cotton mill contained a clause that if during the guarantee period the entire mill were stopped for a continuous period of two hours due to a fault, a heavy penalty could be enforced. The generator, cables, motors and motor switchgear were all of first-class quality; nothing in the workmanship was left to chance, yet the regulating resistance in the shunt circuit of the exciter was of the most indifferent quality. This resistance showed signs of overheating and as a precaution a second resistance of the same pattern was installed by the contractor as a standby. It was fortunate that the precaution was taken for one or other of the resistances failed several times, before a more robust piece of apparatus was supplied.

COLORADO STATE ROAD TO BE ILLUMINATED.

According to recent press dispatches, plans have practically been completed by the Colorado State Highway Commission for illuminating the road between Colorado Springs and Denver, Colo. This road is 75 miles in length and, according to the chairman of the commission, it will be the only one of its kind in the world when completed.

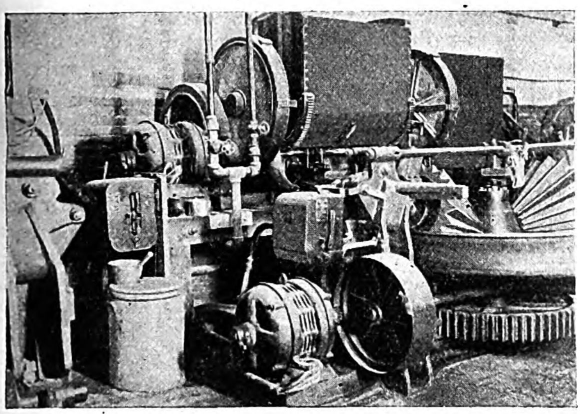
The Application of Electric Drive in Macaroni Plant

Features of Installation at Fould's Milling Co., Libertyville, Ill.—Advantages of Central-Station Service for this Work—Description of Process

By PAUL B. FINDLEY

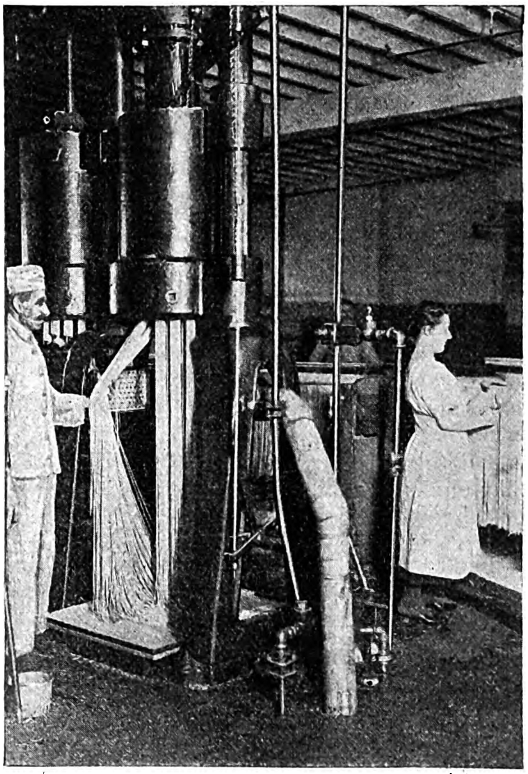
CONTRARY to the general impression, the process of making macaroni and other alimentary pastes is essentially one of manufacturing rather than baking. Moreover, the amount of power used in the process is considerable and easily adapted to the application of electric drive. On this account and because very little heat is required in the process which makes it desirable to purchase the electric service needed, central-station companies find such industries ready to adopt their service which usually proves profitable and advantageous to both, especially when the efforts of both are united to secure the most efficient and productive installation.

An interesting example of such co-operation between a central station and an industrial plant is that of the macaroni plant of the Foulds Milling Co., at Libertyville, Ill. When this plant was acquired, the Public Service Co. of Northern Illinois got the opportunity to make a study of the possibilities, and as a result complete electric drive was installed, nearly all the apparatus being individually driven and the installation has proven very satisfactory. As a bit of personal interest, it might be added that Glenn A. Hoskins, who engineered the work for the central-station company, later became manager of the plant.



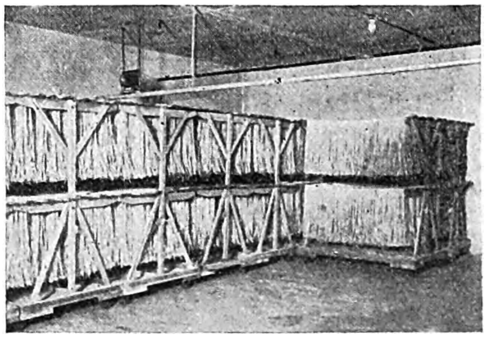
Westinghouse 15-hp. Motors Driving Mixer (Above) and Kneader (Below).

In this plant, the principal ingredient, flour, is received in barrels and taken up a conveyor to the sifting and storage rooms located on one of the upper floors. From this room it is run through chutes in appropriate quantities to the mixers on the floor below. Each mixer has two curved knives which, revolving, cut and fold the flour as water is added by the operator. When the mixing operation is completed, the dough is dumped into the pan of the kneading machine. This pan is turned under large toothed wheels, which knead the dough until all the lumps have been broken up and the mass is of uniform consistency. For these operations 15-hp. squirrel-cage motors are used on the newer mixing units and similar 10-hp. motors for the kneaders.



Macaroni Press at Fould's Milling Co. Plant.

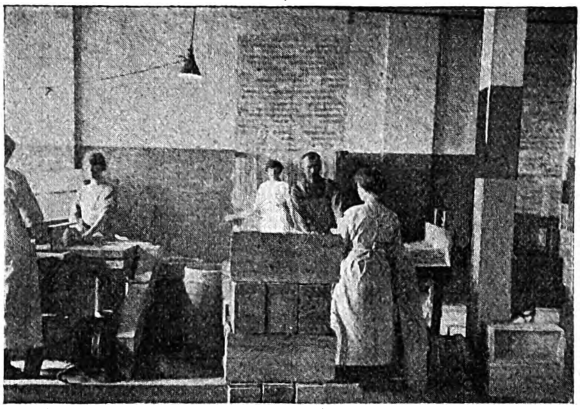
After it is kneaded, the dough is cut into blocks and taken to the presses where it is forced under pressure through holes, giving it the desired shape and size. Each of these presses has two cylinders, one of which is charged while the other one is under the press. In the bottom of each cylinder is a die-plate with the appropriate holes. In the cylinders a pressure of 3400 lb. per sq. in. is obtained. Oil is used in the press cylinders and the pressure is obtained from



Macaroni Drying Room at Libertyville Plant.

a battery of heavy duty pumps driven by a 30-hp. type CW Westinghouse motor.

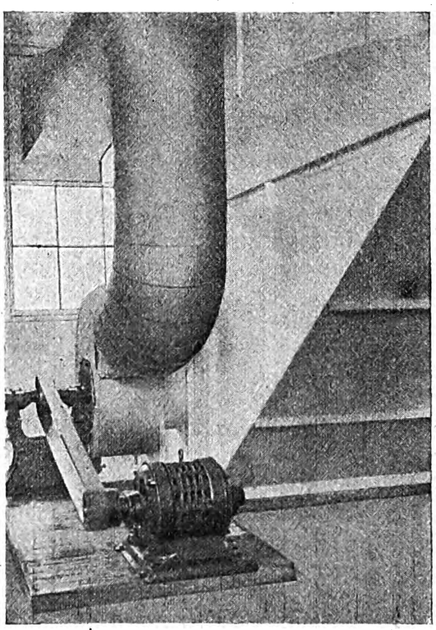
As the long strings of dough come out of the orifices, they are cut in suitable lengths and hung on wheeled racks which are then taken into the drying chambers. The drying operation is one requiring very close control of the humidity of the air. In the



Macaroni Saws Driven by Westinghouse Type-CS Motors.

drying rooms of the Foulds' plant it is secured by passing the air through a Carrier air conditioner. Motor-driven fans drive the air through a spray chamber and over heating coils; other fans exhaust it later from the drying rooms.

When the product is thoroughly dried, it goes to circular saws, each driven by a 5-hp. Westinghouse motor where it is cut in lengths suitable for packing. It is then sent in containers down a conveyor to the packing room on a lower floor. This conveyor is motor driven and arranged so that it can be operated

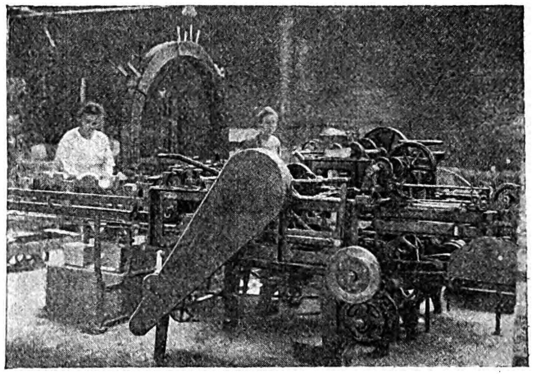


Motor Driven Exhaust Fan.

in the reverse direction to bring back the empty containers. The conveyor motor is controlled from either floor by three-way snap switches and a Westinghouse reversing-contactor panel.

The familiar yellow-and-red cardboard boxes in which the Foulds macaroni is sold are received flat and are opened and placed in automatic motor-driven box-sealing machines, of which three are installed. In these machines they are shaped, filled with the product—macaroni, spaghetti or noodles—and then sealed. They are then taken to the shipping room and packed in cartons for shipment. One sealing machine is driven by two 2-hp. Westinghouse motors; the other two by a single 5-hp. motor.

In the manufacture of noodles the process is slightly different. In addition to flour and water,



Automatic Box Sealer Driven by 2-hp. Motor.

eggs are also mixed into the noodle dough. The dough is rolled into a thin flat sheet and cut into ribbons by a gang of knives. Then it is further cut into shorter pieces which are placed on shallow wire trays. These trays are stacked one above the other in a conditioning room, over a wind box connected to the intake sides of several disc fans. Two such fan units are installed, each consisting of a Westinghouse motor belted to two fans. Each fan is in turn connected to three stacks of trays. An older form of dryer is served by a blower driven by a 5-hp. motor. This dryer is equipped with wire-bottomed drawers through which the air blows.

The electric power for the operation of this plant is furnished by the Public Service Co. from its 4000-volt three-phase lines through a bank of three transformers. The service used in the plant is three phase, 220 volts for power and three wire, 110-220 volts for lighting.

COST OF RUNNING ELECTRIC VEHICLE AT KETTERING (ENG.).

Municipal Truck Hauls Coal and Clinker at Cost of 46 Cents Per Ton.

A "G.V." electric vehicle of 3½ tons operated by the Kettering (Eng.) municipal electric supply department gave the following results for its second complete year's running, that is, from April, 1918, to March, 1919. The coal carted was 6839 tons and the clinker 1263 = 8102 tons. Cost per ton 46 cents; mileage 4392. The detailed figures for the year are as follows:

Depreciation, 10% on chassis less battery and tires, *i.e.*, $3900	$ 390
Increase at 5% on decreasing capital or 2½% on $3900	100
Current, 5958 units at 4 cents per unit	250
Tires, 4392 miles	85
Battery upkeep	500
Insurance	65
Wages (driver and mate)	2,050
Repairs, oil, etc.	485
Total	$3,925

NEW ELECTRIC AUTOMOBILE CONTAINS MANY NOVEL FEATURES.

Light Weight and Low Cost Promise Great Field for New Vehicle—Features of Design.

The coming "Ford" of electrics is the claim advanced by its manufacturers, Henry E. Dey, Inc., for the Dey Electric automobile. This car will be remembered by many as it created quite a sensation at the time of its introduction some years ago. At that time a company was formed for its manufacture and sale but very little was done. The new company was recently incorporated for this purpose and expects to put this machine on the market shortly.

The Dey Electric differs in many respects from any other electric automobile produced at this time especially as it is very light in weight and consequently much cheaper in cost. In order to cut the cost and weight of the cheapest and lightest electric now on the market in half, and at the same time not reduce the factor of safety or size of the car, which has the same dimensions as the Ford, it naturally follows that it must have many new features of design.

The most revolutionary change is in the motor and gearing. The motor has both its armature and field magnet rotatable, one element connecting with one driving wheel through a pair of reduction gears, while the other element connects in a similar manner to the other wheel. This arrangement produces a perfect differential substitute and, in addition to saving in its cost and weight, it is claimed to increase the capacity of the motor 100% for a given rotative speed. The reason for this is that the parts revolving in opposite directions cut the magnetic lines twice as fast, thus producing the results of a motor of double the velocity, which also adds to its electrical efficiency. The weight of the motor is still further reduced by placing the armature, which is a toothed Gramme ring, so that it surrounds the field. The field has six poles, all energized from one coil, and is especially designed for low field losses and light weight. The total weight of the field with shaft is less than 20 lbs. The total weight of the motor, which has a capacity equal to many heavier standard automobile motors is 51 lbs.

The commutator is of the face type, inclined at an angle of 10° in order that the brushes will have a similar inclination. The purpose of this is to neutralize the increased friction of the brushes against their holder caused by centrifugal force against the brushes at high speeds.

The motor is centered on the center line of the axle. An eccentric, of 7/32-in. throw, is fixed to the outer end of each shaft. An internal gear is carried by and rotates upon the field shaft eccentric. An external gear, concentric with the shaft, is keyed to the stationary housing and meshes with the internal gear which connects by means of a flexible jointed shaft to the wheel hub. It will be noted that only one of the gears is rotatable, the other one being held absolutely rigid. At the armature end the construction differs by mounting the external gear, instead of the internal one, upon the eccentric, and keying the internal one fast to the housing. From this point the construction duplicates the other end.

When the internal gear is the rotative element, as at the field shaft end, the direction of rotation remains unchanged between the motor and the wheel, but with the external gear as the rotating member, as used at the armature end, the direction is reversed. The opposing directions of the motor elements are thus rectified without recourse to intermediate gears.

Because of the large diameter of the pinion

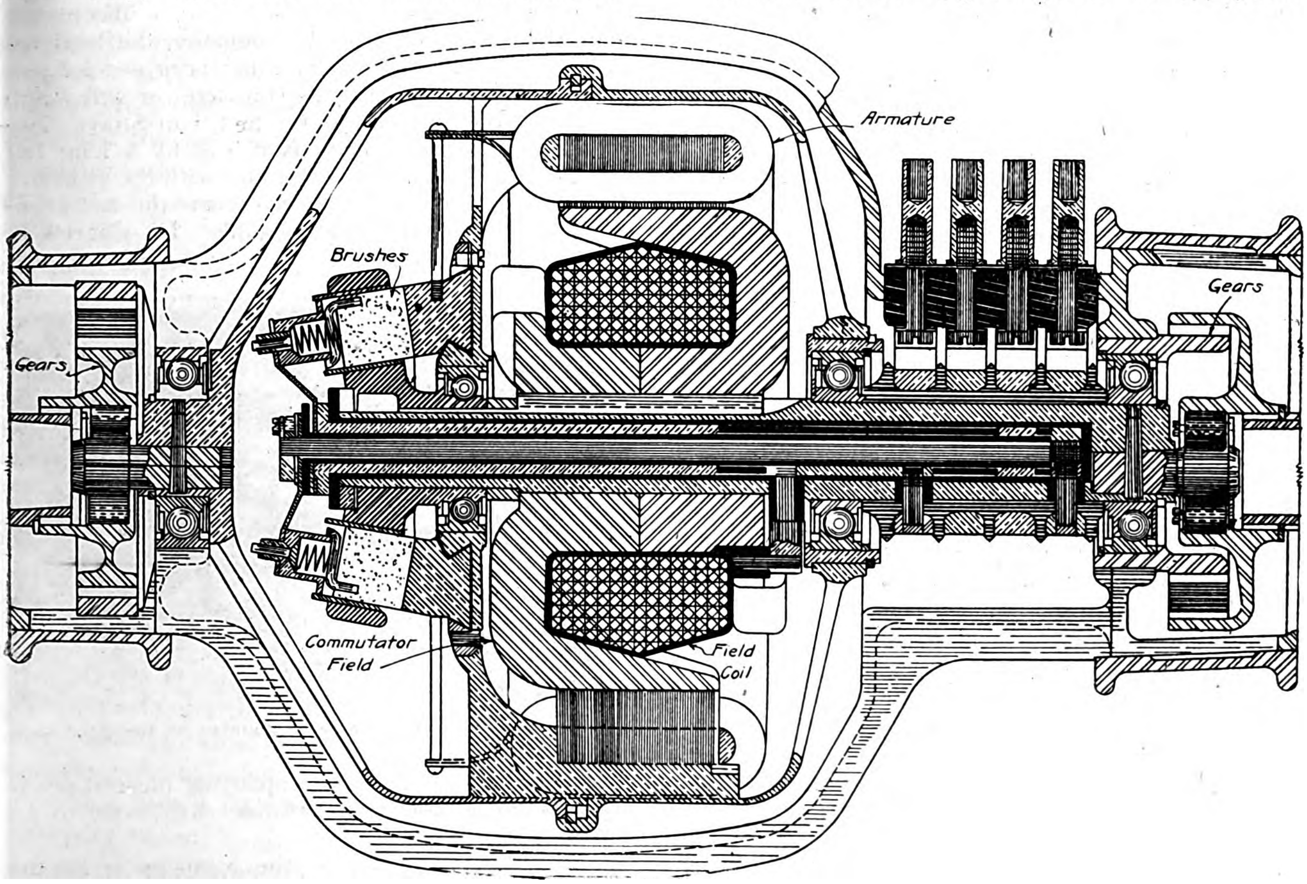
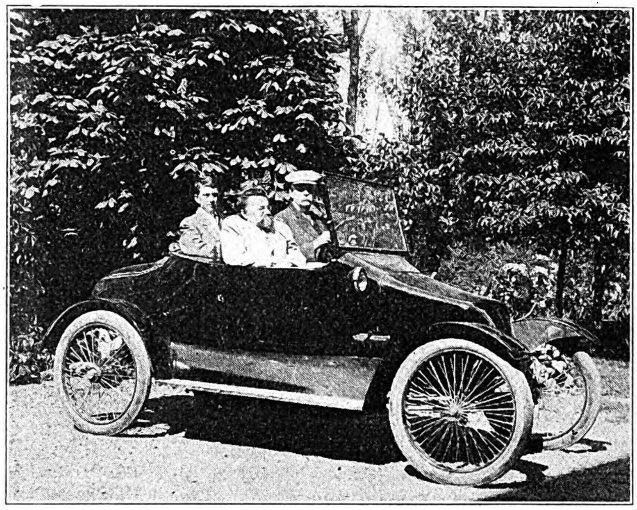


Diagram Showing Arrangement of Motor Parts and Gears.

element and the consequent large arc through which the gears mesh, dividing the stresses through a large number of teeth, they are very durable. This feature also provides noiseless operation, minimum wear and high efficiency, for there is practically no rubbing action during contact to cause noise, wear and friction.



"Dey" Electric Experimental Car.

The total weight of the four gears, two on each end, is 4⅝ lbs.

The axle is made up of a steel housing for the motor and gearing at the middle section, with steel tubing extensions to the wheels. Caps covering the gears hold the power plant in position; these caps are held in place by taper rings that can be driven off in less time than would ordinarily be consumed in removing a single bolt or nut. These rings also retain a light aluminum cap that covers the unprotected side of the motor. The current is taken into the motor by means of slip rings and there is, therefore, no necessity of disconnecting wires when removing the motor.

In the latest design the control is very similar to that of a gas car with the gear shifting left out. For speed variation a foot lever is used in a manner identical with that of a clutch lever. When the foot is removed from this lever the car runs at full normal speed. A slight pressure inserts resistance, giving the effect of a slipping clutch, and as the pressure is increased, resistance is added, until the current is completely shut off. Any further movement converts the motor into an electric brake, and an extreme movement applies the mechanical brake. There is also an additional emergency brake, and as a further means of stopping the car the motor can be reversed through resistance. An accelerator pedal, acting upon the field, increases the speed to 30 or more miles per hr. Another lever providing "forward," "reverse" and "neutral" is interlocked with the speed control, to permit shifting only in high resistance or open circuit.

On down grades the motor recharges into the battery at a speed as low as 3 miles per hr. This automatically slows down the speed as the grade becomes steeper, thus making the driving unusually safe. An increase of speed may be obtained at any time, however, by means of the accelerator.

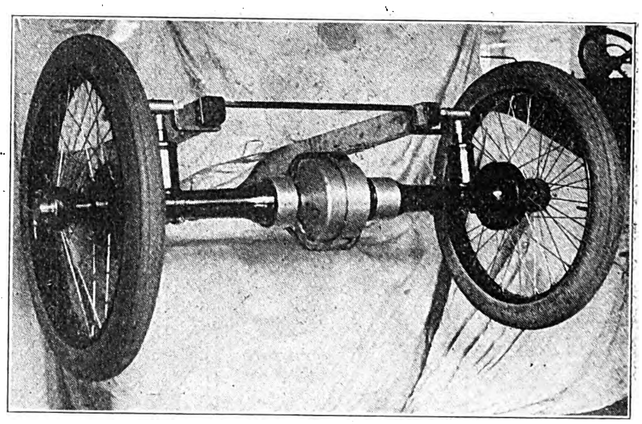
The frame of the chassis is of wood, with truss rods under the side bars. The battery is carried beneath the floor, attached to the truss rod posts. This allows the body to be used exclusively for passengers and luggage, and also avoids all troubles due to spilled electrolyte. The method of suspension is such that the battery can be readily lowered to the floor by one person and the top is accessible for adding water by lifting a trap door in the floor. This location is ideal for obtaining low power consumption and gives a very low center of gravity that conduces to a comfortable riding and safe car. The vehicle is also equipped with air springs.

In the design of this car special attention has been given to keep it as light in weight as possible without decreasing its reliability or limiting its sphere of action. As a result the battery used is also much lighter than ordinary and it is claimed will provide power in excess of 100 miles per charge. This lightweight factor also permits the car to be produced at a much lower cost.

The car is also equipped with a portable charging plant, weighing about 100 lbs., which is carried under the bonnet. It consists of a 4-cylinder, 4-cycle air-cooled engine, minus a flywheel. It is direct-connected to the ring armature of a dynamo, which acts as a flywheel, very similar in design to the motor. The field of this dynamo, however, is stationary. This gas engine can also be used to drive the car, if desirable, and when operated in this manner offers many economies over the ordinary gas automobile.

The gas-engine plant will charge the battery at any time, while the car is running or standing. An automatic switch cuts off the battery and stops the engine whenever the battery becomes fully charged. The dynamo acts as a starter when charging is desired. If the daily mileage is less than the battery capacity the plant can be removed from the car and used as a stationary charging plant for the car or for lighting or other work. It can be easily replaced in the car when necessary. The car will be manufactured both with and without the charging plant.

Up to the present time, due to the incomplete financial arrangements of the company, the final details of marketing the car have not been decided. It is expected, however, that the complete car will weigh less than 1000 lbs. and sell for less than $1000. According to present indications it will fill a long felt want in the electric vehicle line and with the auxiliary charging plant added, should overcome the last argument against this type of automobile. Dr. Charles P. Steinmetz, of the General Electric Co., Schenectady, N. Y., who in one of the accompanying illustrations is shown riding in the demonstration car, is one of its advocates.



The Small "Dey" Electric Motor Is Mounted on the Rear Axle.

The temporary office of the company is at 303 Arlington avenue, Jersey City, N. J.

Editorial Comment

Energy Production and Fuel Consumption of Public Utilities

PRODUCTION of electrical energy by public utilities for the month of March, as compiled by the United States Geological Survey, and appearing elsewhere in this issue, together with the fuel consumption, offers material for considerable thought. The data is not complete, unfortunately, because applying to only about 89% of the total generating capacity of public utility companies, but it may safely be taken as indicating the approximate production by those whose primary function is power production, and the fuel consumption involved.

A monthly energy consumption of 101,400,000 kw-hr. is deserving of special mention. A careful and reasonably close knowledge of the energy consumption for every month of the year is a true index of the industrial activity of the country. Sulphuric acid and several other basic materials have been referred to at different times as the indices of a country's commercial activity, but surely with the rapid growth of public utility supply the kilowatt-hour may come to more truly indicate the status of the country's industrial activity.

To some, the fact that 41% of the total energy generated was obtained from water power may be somewhat of a shock. The fact is that the central stations are better able to utilize water power in a big way than the individual industrial interests because the transmission line modifies geographical drawbacks and links up source of power production with the market for it. Moreover, load-factors of the utility are more favorable for making the hydroelectric development financially worth while. Of course, if a comparison of the total power produced by all producers of power were considered instead of only those producers who have done most to utilize water power, the good showing made by water power in the data referred to would be less pleasing.

Decreasing Electrical Machinery Breakdowns

BREAKDOWNS of electrical machinery do not occur nearly as frequently as in days gone by, thanks to the lessons taught by many years of experience in design, construction and operation of motor, generators and other rotating machinery. When a machine is subjected to much more violent service and abuse than it was designed to withstand it is not surprising when it gives way under the abnormal strain. When a breakdown occurs in perfectly normal service however, it is indicative of faulty design or construction, and the occurrence of failures of this kind from time to time shows that we still have much to learn or at least to put into effect to make motor and other electrical machinery service still more reliable than it is.

For this reason all the information based on experience in investigating and remedying breakdowns should prove of value in making their recurrence extremely rare. The article on this subject, published in this issue, gives such information. The author, Dr. C. W. Worral, narrates a considerable number of interesting experiences in which motor and generator failures were thoroughly investigated until the cause of the trouble was found out and removed. These cases occurred chiefly in English industrial plants and may represent some conditions not so commonly met in American practice. However, most of the lessons they teach are applicable here also.

Briefly, these lessons may be summarized as follows: Use high-grade insulation, carefully applied, and in service protect it from deleterious substances; take pains with the details of construction of cores, connections, bearings, ventilating accessories, etc.; make the construction so rugged as to eliminate metal fatigue due to vibration. These are by no means the only precautions to observe in order to improve the dependability of electrical machinery service, but at times they prove of paramount importance and are therefore worthy of serious consideration.

Why Not Built-In Electrical Appliances?

THERE is an increasing tendency to equip modern apartments and homes with built-in devices such as ice boxes, book racks, buffets and even beds. By so doing great conveniences can often be obtained in arrangement, etc.

It has long been the practice to equip laundries with built-in or stationary wash tubs, thus eliminating the need for lifting tubs and carrying water. The modern electric clothes washer is, of course, a great improvement upon old methods and in certain classes of homes its movable feature is a great convenience which offsets in a way the inconveniences attending the filling and emptying of the washer. Homes and apartments equipped with spacious laundries, however, still lack built-in electric washing machines, yet the machines, with a few minor changes, could easily be adapted to this purpose. The present washing machines can, of course, be permanently located in a laundry and a plumber employed to make desirable plumbing connections and an electrical contractor to install permanent wiring. This, of course, suggests a field that is now being overlooked by electrical contractor-dealers, namely the installation of permanent, approved types of wiring connections for permanently located washing machines.

The washing machine manufacturers, with perhaps one exception, appear to be overlooking the need for a built-in washing machine that can be installed as an integral part of a laundry just where it is wanted and with its own plumbing facilities that will permit of easy filling and emptying as well as cleaning.

Manufacturers of dish-washing machines are also overlooking the same need. A dish-washing machine is claimed by some to be as much of a bother to keep clean and operate in a family of two as is the old method of washing dishes by hand. A built-in dish washer with its own faucets and drains could be kept clean easier and would most likely meet with good demand from house owners and the higher class apartments.

Although a dish-washing machine leaves the dishes practically dry because of the hot water used, they are not always perfectly dried. This suggests the advisability of combining a stationary dish-washing machine with a dish-drying device that will eliminate hand drying of both dishes and silver entirely by the passage of a current of hot air over the dishes.

It will not be far in the future before people will be demanding built-in laundry and dish-washing machinery because of the great convenience they offer. Tenants do not desire to invest in relatively expensive apparatus for these purposes and to have them add to their moving burdens, yet practically all would most likely be willing to pay a slightly higher rent if these appliances formed an integral part of the building.

Washing-device manufacturers can well afford to give these matters their serious thought and attention.

Reach the Middle Classes First

PROMINENT department store in one of our large cities that was doing a very prosperous business decided several years ago to remodel on an extensive scale which it did at considerable expense, feeling that its more inviting and pleasing appearance would further increase trade.

When the remodeling was completed, however, its dream failed to materialize. Trade in place of increasing was rapidly declining. Old customers were sought and asked why they had ceased to trade at the store. It was found that a number of women frankly stated that they felt out of place in the store, that they did not feel well enough dressed to enter the store without a feeling of embarrassment due to the store's luxurious appearance and fittings making them feel as if they were poorly clothed and out of place in such an atmosphere. The store then realized the mistake it had made. The bulk of its trade was derived from the middle classes. It could not hope to do business with only the richer classes without sacrificing the greater part of its trade. The store was remodeled again, its luxurious fittings removed and merely an atmosphere of simple refinement without extravagance or show introduced. Trade immediately began to build up again.

This is but the experience of one store. It represents one extreme. The other extreme, too, must be considered. The person of average means feels he is out of place in a store in the slum districts of our larger cities and would feel equally as out of place if such stores were located in better districts but retained their slum atmosphere.

An electric shop to be successful must cater to those classes of people from which it can expect the most trade. This is what is largely responsible for the success of the Ford Motor Company. It realized that the number of people who could afford to buy high priced or medium priced cars were few, that the lower it could make its price, the more cars it could expect to sell and, hence, the greater its success, because of the greater number of people having modest and smaller incomes. Such people form by far the bulk of the population of the world, of our country and of practically all communities.

It is within this class that the greatest number of electrical appliances are sold. The prices of such appliances are within the reach of most pocket books. This, of course, means that the more wealthy classes are also good prospects for the sale of electrical appliances, but being relatively very few in number, a contractor-dealer or a central station cannot afford to cater to them and neglect the middle classes which are numerically much greater, and, hence, represent a better and larger market.

The electrical dealer or central station should, hence, bear this in mind in locating its store, in decorating and furnishing its interior and exterior, in selecting salespersons, in writing and designing its advertising matter, etc. One of the secrets of success in merchandising is finding where one's best and largest market exists and then going after this trade in the manner that this trade demands. The best and largest market for the sale of electrical appliances is among middle classes. It is the market that the central station or electrical dealers should consider first and which will yield the best returns with a minimum of sales effort, advertising effort and expense. The cost of reaching a large fertile market is less per person than the cost of reaching a smaller market.

Greater efforts can be made to reach the richer and poorer classes after the middle classes are being cultivated properly. Advertising and sales efforts designed to reach the middle classes will bring returns also from the richer and poorer classes, more so than advertising and sales efforts designed to reach either of these two classes, will bring results from the middle classes.

Sell the middle classes first—reap the best grain first.

Current Events

A. I. E. E. Committees and Development Report — Joint Convention — Sales Managers Meet — Convention Plans

NEW A. I. E. E. ADMINISTRATION APPOINTS COMMITTEES.

List of Chairmen and Members of Edison Medal Committee Announced.

At the first meeting of the Board of Directors of the American Institute of Electrical Engineers for the administrative year beginning on Aug. 1, 1919, held in New York, Aug. 12, President Townley appointed committees for the administrative year beginning Aug. 1, 1919.

The chairmen of the committees appointed are as follows: Finance—N. A. Carle, Newark, N. J.; Meetings and Papers—W. I. Slichter, New York; Editing—Henry H. Horris, New York; Board of Examiners—F. L. Rhodes, New York; Sections—W. A. Hall, Lynn, Mass.; Student Branches—C. Francis Harding, Lafayette, Ind.; Membership—R. W. Krass, New York; Public Policy—H. W. Buck, New York; Headquarters—N. A. Carle, Newark, N. J.; Committee on Technical Activities—Wilfred Sykes, Pittsburgh; Standards—L. T. Robinson, Schenectady, N. Y.; Power Stations—Philip Torchio, New York; Transmission and Distribution—E. B. Meyer, Newark, N. J.; Traction and Transportation—W. S. Murray, New York; Industrial and Domestic Power—A. G. Pierce, Pittsburgh; Lighting and Illumination—C. E. Clewell, Philadelphia; Economics and Electric Service—William McClellan, Philadelphia; Protective Devices, D. W. Roper, Chicago; Electrochemistry and Electrometallurgy—E. F. Northrup, Princeton, N. J.; Electrophysics—F. W. Peek, Pittsfield, Mass.; Telegraphy and Telephoney—Donald McNicol, New York; Marine—Arthur Parker, Camden, N. J.; Use of Electricity in Mines—W. A. Chandler, Uniontown, Pa.; Electrical Machinery—B. A. Behrend, Boston; Instruments and Measurements—S. G. Rhodes, New York; Iron and Steel Industry—W. F. James, Philadelphia; Educational—J. C. Parker, Ann Arbor, Mich.

In accordance with the by-laws of the Edison Medal Committee the Board confirmed the appointment by President Townley of three members of that committee for terms of five years each, namely: Edw. D. Adams, New York; H. H. Barnes, Jr., New York, and Benjamin G. Lamme, Pittsburgh; the board also elected three of its own membership as members of the Edison Medal Committee for terms of two years each, namely: Wilfred Sykes, Pittsburgh; W. A. Hall, Lynn, Mass., and G. Faccioli, Pittsfield, Mass.

ARRANGEMENTS COMPLETED FOR CONVENTION OF EDISON COMPANIES.

Program of Convention of Edison Illuminating Companies, New London, Sept. 15 to 18.

All the necessary arrangements, together with the business and entertainment programs, have been completed for the 38th annual convention of the Association of Edison Illuminating Companies. This convention will be held at the Griswold hotel, Eastern Point, New London, Conn., Sept. 15 to 18, inclusive. As this is the first convention of the association in three years it is looked forward to with considerable interest.

As in previous years, the business program has been divided into five sessions, Tuesday morning and evening, Wednesday morning and evening and Thursday morning. In addition to the reports of the various committees, four papers will be presented for consideration and discussion, two of which will be by representatives of the manufacturing interests on timely subjects. The other two subjects are of vital importance to the association at this particular time, namely: "A Symposium of Lamp Renewal Practice" and "The Labor Situation." Further, there will be two addresses by men of high standing, as follows: "Lessons of the War" and "Fuel, with Special Reference to Pulverized Coal and Coal Oil."

An elaborate entertainment program has also been arranged. The location selected for the convention offers unusual opportunities for sports and outings of all sorts and in addition a naval exhibition is planned. Golf and putting contests, archery, croquet, tennis and trap shooting are as usual a part of the program and attractive prizes have been secured for the winners. An informal banquet will be held at the close of the meeting.

For the accommodation of the western members, Godfrey H. Atkin, Electric Storage Battery Co., Marquette building, Chicago, will assist in arranging any details of transportation.

Requests for reservations should be made without delay to Herbert W. Moss, assistant secretary of the association, 39 Boylston street, Boston, Mass.

INSPECTORS' CONVENTION TO OFFER MANY ATTRACTIONS.

Visits to Turners Falls Development One of the Many Features.

Arrangements are being rapidly completed for the reconstruction convention of the National Association of Electrical Inspectors to be held in Springfield, Mass., Oct. 13 and 14. Extra efforts are being exerted to make this the most successful convention ever held by the association and a program of unusual interest is being arranged. In addition, the city of Springfield offers many attractions to convention visitors, which assures a large attendance. In order to illustrate these local attractions the association is sending out an illustrated folder showing views of Springfield and the surrounding country and describing the municipal auditorium, where the convention is to be held.

Another feature which promises to add to the interest of the convention is contained in a letter from George W. Lawrence, president of the Turners Falls

Power & Electric Co. The stations of this company and its system are objects of great interest to electrical men and in his letter Mr. Lawrence cordially invites all attendants at the convention to visit those located in the vicinity of Springfield. Representatives of the company will be in attendance at the convention, and will provide automobiles and guides to all who wish to visit this development. That such provision may be adequate those who intend to make this visit should communicate as soon as possible with Milton S. Nettleton, 98 Hobart street, New Haven, Conn., chairman of the association's entertainment committee.

POPULAR ATTENDANCE AT I. E. S. CONVENTION SOUGHT.

Public as Well as the Trade to Be Welcomed to All Sessions of Illuminating Engineering Society.

Local attendance at the 1919 convention of the Illuminating Engineering Society at Chicago Oct. 21-24 will be stimulated in several ways. The Chicago Electrical Trades Exposition which will be in progress at that time will afford one excellent means of getting convention advertising to the public. For this purpose colored posters are being prepared for exhibition at the electrical exposition calling attention to the fact that the sessions are open to the public and offering suggestions as to where programs can conveniently be obtained. These posters will be displayed in many parts of the show.

The Chicago section of the Illuminating Engineering Society will put on an active membership drive just before the convention. This too is expected to have its effect on the local attendance.

NATIONAL FOREIGN TRADE CONVENTION TO MEET IN SAN FRANCISCO.

The seventh National Foreign Trade convention will be held in San Francisco, Cal., on May 12-15, 1920. It will be the first of these important conventions to be held on the Pacific Coast, previous conventions having been held at Washington, D. C., New Orleans, St. Louis, Pittsburgh, Cincinnati and Chicago. In deciding on San Francisco for the convention city, the National Foreign Trade Council was influenced by the growing importance of the Pacific Coast in the foreign commerce of the country, and by the enthusiastic support which the Far West has given all previous foreign trade gatherings.

While the convention itself will be held in San

Unique Convention of Household Utilities Manufacturers, Jobbers and Dealers

The convention of household utilities interests briefly reported here will undoubtedly be the forerunner of many similar gatherings, as the pressing need for the interchange of ideas and experiences in this field are obvious. Commenting on the value of such conventions, C. S. Beardsley, general manager of the United Electric Co., says: "It was the most unique and successful convention I have ever had the pleasure of attending. It was unusual in that it included manufacturers, jobbers, dealers and salesmen. It gave us all some new angles on the household utility business and impressed upon all of us the magnitude to which this business has grown."

There was held in Minneapolis, Minn., Aug. 14, 15 and 16, an unique convention. It is the first time in the history of electrical trade that a convention was held of the manufacturers, jobbers, dealers and salesmen.

It was called by the Sterling Electric Co. of Minneapolis and the Kelley Hardware Co. of Duluth.

It was the original idea of Harry Bohn, general manager of the Household Utilities Department of the Sterling Electric Co.

All of the dealers and salesmen handling the Gainaday washing machine, the Ohio-Tuec vacuum cleaner, the Simplex ironing machine, the Ruud automatic water heater and the White portable sewing machine, were invited to the convention.

There were about 200 in attendance.

The salesmen were given an opportunity to present their views, the dealers their views, the jobbers their views, and the manufacturers their views.

It was a highly successful meeting.

The program was carried out as follows:

The manufacturers furnished the statistics on the magnitude of the household utility business and impressed upon the jobbers, dealers and salesmen the necessity of getting very busy and reaping the benefits of the big business which is now at hand.

Among those attending the convention was W. L. Rodgers, president of the Pittsburgh Gage & Supply Co.; J. R. Spencer, sales manager of the same company; H. G. Grosse, president of the American Ironing Machine Co.; C. S. Beardsley, general manager of The United Electric Co.; A. P. Brill, general manager of the Ruud Manufacturing Co.; W. H. Vilett, president of the Sterling Electric Co.; Harry Bohn, general manager of the Household Utilities department of the Sterling Electric Co.; W. N. Hart, general manager of the Kelley Hardware Co.; R. Hilgedick, sales manager of the Household Utilities department of the Kelley Hardware Co.; Fred P. Tosch, president of the Farmers Electro Lighting Corp.; J. P. Hanley, secretary and treasurer of the Farmers Electro Lighting Corp.; G. N. Hollway of the Mason City Electric Co.; P. D. Kline, vice-president and general manager of the Wisconsin-Minnesota Light & Power Co., together with eight managers of their various plants; Guy Bisbee, president of the Fixture Equipment Co., and others from North Dakota, South Dakota, Iowa, Wisconsin and Minnesota.

It is hoped that this will set an example to other manufacturers, jobbers and dealers to get together in these conventions for the reason that there is no doubt it will stimulate the use and sale of electric appliances of all kinds.

Francisco, it will really be a Pacific Coast gathering, and the cities of Seattle, Tacoma, Portland, and Los Angeles will share with San Francisco in the attention of the visiting delegates.

CENTRAL-STATION SALES MANAGERS HOLD INTERESTING CONVENTION.

Getting New Business, Principal Topic of Discussion at Annual Meeting at Association Island.

Over 40 central-station people, including sales managers and representatives of other commercial activities, were present at the Sales Managers' convention at Association Island, Henderson Harbor, New York, Aug. 4, 5 and 6. The program included 15 papers on pertinent and timely subjects relating to new business getting and prompted thorough, extended discussion. This was the first convention since August, 1916, and the resumption of these unique gatherings was welcomed.

A special feature of the program came in the second session, Monday evening, when W. D'A. Ryan, illuminating engineer of the General Electric Co., gave a talk illustrated with lantern slides on "Mazda Searchlights and Intensive Street Lighting with Special Reference to the Saratoga System."

The meetings were held in the new Meeting building, which has been erected by the Association Island Corporation to take the place of a tent formerly used. Acting Chairman J. F. Becker, of the United Electric Light & Power Co. of New York City, presided at the first meeting. The president's chair and table used were the gifts of the Sales Managers' convention of 1916 to the Association Island Corporation.

The program of papers was as follows:

First session, Monday, Aug. 4.—"Expense Accounts," R. S. Hale, superintendent of the Special Research department, The Edison Electric Illuminating Co. of Boston; "Merchandising Central-Station Service," John G. Learned, assistant to the vice-president, Public Service Co. of Northern Illinois, Chicago; "Motor Rules for Central-Station Lines," R. H. Tillman, manager, New Business department, Consolidated Gas, Electric Light & Power Co., Baltimore, Md.

Second session, Monday evening, Aug. 4.—"Mazda Searchlights and Intensive Street Lighting with Special Reference to the Saratoga System," W. D'A. Ryan, illuminating engineer of the General Electric Co., Schenectady, N. Y.; "The Incandescent Lamp from the Standpoint of the Manufacturer," S. E. Doane, chief engineer, National Lamp Works of General Electric Co., Cleveland, O.

Third session, Tuesday morning.—"Co-ordination of Central-Station Service with Private Plant Operation," L. R. Wallis, superintendent Sales department, The Edison Electric Illuminating Co., Boston; "Isolated Plant Costs as Influenced by the War," John W. Meyer, assistant commercial manager, Philadelphia Electric Co., Philadelphia; "Comparative Power Sales, an Index to Trade Conditions," H. H. Holding, general power representative, Public Service Electric Co. of New Jersey, Newark, N. J.; "Will Industrial Power Customers Approve Increases in Rates to Compensate for Increase in Operating Costs?" also by Mr. Holding; "Typical Report of a Large Office Building with Hydraulic Elevators," W. H. Whitton, general agent, and H. T. Luscomb, acting commercial engineer, New York Edison Co., New York.

Fourth session, Tuesday evening.—"Advertising by Central Stations—A Review and Analysis of Policies—Recommendations for Improved Practice," L. D. Gibbs, superintendent of Advertising department, The Edison Electric Illuminating Co., Boston; "Merchandising Electrical Appliances," Ernest A. Edkins, general manager of Electric Shops, Commonwealth Edison Co., Chicago; "Some Observations on the Tendency Toward Restriction of Central-Station Merchandising," G. E. Miller, sales manager, Cleveland Electric Illuminating Co., Cleveland, O.

Fifth session, Wednesday morning.—"Merchandising Incandescent Lamps," T. I. Jones, general sales agent, and G. J. Liebman, chief clerk, Sales department, Brooklyn Edison Co., Brooklyn; "Progress in Electric Melting of Non-Ferrous Metals," John D. Noyes, senior sales engineer, Detroit Edison Co., Detroit; an explanation of the work of the educational courses, conducted by the Committee of Education, Commercial Section, N. E. L. A., Fred R. Jenkins, manager, Central Station Institute, Chicago.

Sixth session, Wednesday afternoon.—"Delivery of High Tension Service to Large Consumers," Rawson Collier, operating and sales manager, Georgia Railway & Power Co., Atlanta, Ga.; Question Box discussion.

The following is a list of those present grouped under the companies represented: Cleveland Electric Illuminating Co., Cleveland, O., G. E. Miller, sales manager; Commonwealth Edison Co., Chicago, Ernest A. Edkins, general manager of Electric Shops; Oliver R. Hogue, head-lighting agent, and Fred R. Jenkins, manager, Central-Station Institute; Brooklyn Edison Co., Brooklyn, N. Y., T. I. Jones, sales manager, and G. J. Leibman, chief clerk, Sales department; Public Service Co. of Northern Illinois, Chicago, John G. Learned, assistant to the vice-president: Georgia Railway & Power Co., Atlanta, Ga., Rawson Collier, operating and sales manager; Public Service Co. of New Jersey, Newark, N. J., H. H. Holding, general power representative, and F. D. Pembleton, assistant new business agent; New York & Queens Electric Light & Power Co., New York, Charles A. Barton, general sales agent, and L. J. Montgomery, assistant general sales agent; New York Edison Co., New York., A. A. Pope, assistant general commercial manager; W. H. Whitton, general agent, wholesale; A. Hetz, statistician; Walter Neumuller, assistant to the general commercial manager; C. K. Nichols, general agent, power; H. T. Luscomb, acting commercial engineer; C. N. Lewis, heating engineer, and C. L Law, manager Bureau of Illuminating Engineering; Detroit Edison Co., Detroit, Miss S. M. Sheridan, sales manager; John D. Noyes, senior sales engineer, and Philip J. Savage, assistant to the general manager; A. H. Touscany, appliance sales, and Miss Florence Norwell; The Edison Electric Illuminating Co. of Boston, L. R. Wallis, superintendent of Sales department; R. S. Hale, superintendent of Special Research department; L. D. Gibbs, superintendent of Advertising department, and C. E. Greenwood, superintendent of Appliance department; Potomac Electric Power Co., Washington, D. C., H. A. Brooks; The United Electric Light & Power Co., New York City, J. F. Becker, sales manager; Drake V. Smith, district sales manager, A. F. Berry, commercial engineer, and S. H. Gillerup, advertising manager; Philadelphia Electric Co., Philadelphia, Joseph D. Israel, district manager; Charles J. Russell, general commercial manager, and John W. Meyer, assistant commercial manager; Consolidated Gas, Electric Light & Power Co. of Baltimore, Md., R. H. Tillman, manager New

Business department; General Electric Co., Schenectady, N. Y., W. D'A. Ryan, illuminating engineer, and H. E. Mahon; National Lamp Works of General Electric Co., Nela Park, Cleveland, S. E. Doane, chief engineer; National Electric Light Association, Commercial Section, New York City, A. Jackson Marshall, executive representative.

The officers of the convention for the ensuing year are: Chairman, T. I. Jones, sales manager, Brooklyn Edison Co., Brooklyn; Miss S. M. Sheridan, sales manager, Detroit, Edison Co., Detroit; R. H. Tillman, manager New Business Department. Consolidated Gas, Electric Light & Power Co., Baltimore, Md..

COMMITTEE ON DEVELOPMENT, A. I. E. E., PRESENTS REPORT.

Board of Directors Approves Recommendations in Principle and Suggests Further Communications Be Considered.

The report of the Committee on Development of the American Institute of Electrical Engineers which has aroused considerable interest in engineering circles was presented to the Board of Directors of the Institute at a meeting held in New York City, Aug. 12, 1919. After the presentation of the report by Calvert Townley, chairman of the committee, the following resolutions were adopted by the board:

Resolved, That the report of the Committee on Development be received, with an expression of hearty appreciation of the valuable services rendered to the Institute by the committee.

Resolved, That the recommendations in the report of the Committee on Development, dated Aug. 12, 1919, be hereby approved in principle and that the president refer the various parts of the report to qualified committees, either existing or special, the president being hereby authorized to appoint such special committees as he deems desirable, with the request that these committees formulate definite plans of procedure with estimates of expense involved, for bringing into effect such changes in present practice as the committees deem desirable; also that these committees give careful consideration to such additional communications as may be received from the membership relating to subjects with which the committees are dealing. These reports to be presented at the October meeting of the board.

Resolved, That the report of the Committee on Development, dated Aug. 12, 1919, be released for publication, with particular reference to the technical press; and that it be published in full in the next issue of the Institute *Proceedings*, with a request to membership that the report be carefully considered and that comments upon it or additional suggestions relating to Institute activities be forwarded promptly to the secretary of the Institute, so that they may be received by him prior to Oct. 1 and be promptly referred for consideration to the various committees and officers concerned with the particular activities to which the communications may relate.

Resolved further, That the Committee on Development be continued, with particular reference to the consideration of the Institute's participation in joint activities with various other engineering and technical organizations, which activities are now under consideration by the Joint Conference Committee of the development committees of several national engineering societies.

The first part of the committee's report reviews briefly, the activities of the committee, since its formation. The Committee on Development was appointed by the president, pursuant to a resolution of the board, in the latter part of 1918. At a meeting on Jan. 10, 1919, the board passed a further resolution authorizing the appointment of an Executive Committee from the membership of the Committee on Development.

This Executive Committee held a meeting on Feb. 4, 1919, and prepared a communication to its section members, dividing the subject to be considered into three major headings, namely:

1. The relation of the institute to its members.
2. The relation of the institute to other engineering organizations.
3. The relation of the institute to the public.

Under each heading a series of questions was set up designed to bring out as full a discussion as possible and to make it clear that it was the duty and privilege of the committee to consider every angle of Institute affairs. This letter in addition to being sent to each member of the Committee on Development was brought to the attention of the membership and the sections in order to encourage suggestions. At a meeting of the Executive Committee on May 8, communications had been received from 16 sections and from a number of individual members. Most of these communications showed clearly that the sections had given the matter earnest and careful study, and realized the opportunity that was being offered and were anxious each to do their part. These communications expressed such a general unanimity of opinion on many of the questions considered as to indicate very clearly the wishes of the great body of the members and incidentally to make the work of compiling the views of the different sections remarkably simple.

A summary of the views presented was prepared and a tentative plan of procedure outlined by the Executive Committee and sent to the section members of the committee on May 13th with the request for further comment and criticism. Several responses to this communication were received. The tentative plan of procedure was very generally endorsed either entirely or with minor modifications.

A third meeting of the Executive Committee was held June 16 and a report to be presented to a meeting of the full committee at the annual convention was prepared, the same being the original tentative plan as modified to meet the criticisms received.

At the Lake Placid convention the meetings of the section delegates and the Development Committee were merged. The president, the Board of Directors, several past-presidents and a few guests were present at this meeting and the entire report was very fully discussed. On the following morning the chairman presented the recommendations to an open session of the convention which adjourned until the evening of the same day and discussed the report at length. The recommendations presented are the result of these proceedings and the committee believes they express the consensus of opinion of the membership at large.

These recommendations as presented are substantially as follows.

Recommendations Affecting "Proceedings."

Concerning the *Proceedings* the committee found an almost unanimous view that it does not seem sufficiently to interest the membership at large, and the suggestions of a remedy cover a wide range of possibilities. The value of the class of papers which heretofore have been published is appreciated and it is insisted that the high standard should be maintained but it is believed that this view is not inconsistent with a recognition of the rights of 90% or perhaps 95% of the total membership who are concerned with the day to day engineering problems and with the personal side of engineering relationships. It is believed that if the *Proceedings* can be properly expanded that publication will serve better to both bind the present membership closer together and furnish an added incentive for membership. The committee devoted a great deal of time to discussions of this matter but felt that with the recommendations of the various sections and the stenographic report of the Lake Placid meetings to be considered, further study should be given to this matter. They, therefore, submitted the following recommendations, to wit:

Publication.—That the Publication Committee be asked to consider and recommend to the Board improvements in the present plan of publishing the *Proceedings* and the *Transactions* and of printing and distributing copies of institute, section and branch papers.

That in dealing with these questions the Publication Committee consider:

A. Enlarging the editorial and executive publication staff for the purpose of expanding the *Proceedings* to contain additional live matter of interest and value to the membership as a whole without giving less importance to the principal activities of the Institute, *i.e.*, the promotion of the fundamental advance in the art and the encouragement of original investigation in the field of electricity.

B. Publishing all Institute papers and occasional papers of unusual broad general interest and value from sections or from other sources; publishing a set of abstracts of every paper presented to every section so that each month there will be a complete record of this class of Institute activity.

C. Eliminating as far as may be feasible the duplication of expense now incurred by twice publishing the papers heretofore distributed (in both the *Proceedings* and the *Transactions*) but without depriving the membership of the *Transactions* in some form.

D. Publishing discussions in the *Proceedings.*

E. Endeavoring to increase the revenue producing capacity of the *Proceedings* by expanding its advertising policy and if necessary changing its page dimensions.

F. Printing pamphlet copies of some or all section and perhaps branch papers and economizing on the cost of printing Institute and such section and branch papers by limiting their quantity and free distribution while making them available for the membership.

In considering the foregoing summarized recommendations the Publication Committee was asked to examine the stenographic report of the Lake Placid sessions of the Development Committee and of the institute.

Closer Personal Contact Urged.

Another unanimous desire of the membership is for closer contact between the institute officers, prominent engineers and the sections as a means of improving the morale of the organization, stimulating section activities and of interesting the membership at large, particularly the younger members, in institute work. On account of the large number of sections and branches this is not considered practical under present conditions. An alternative is to have more officers and let them be chosen from different parts of the country. If this be done and these officers are to be participants in the management means must be provided to insure their attendance at institute and board meetings. It is believed that these objects can be accomplished by decreasing the number of institute meetings and by holding them in different parts of the country and by paying the expenses of board members when in attendance. If the institute meetings are not to be held in New York it follows that the New York members should organize a section. In order to accomplish these results, the committee made the following recommendations, namely:

Organizations.—(*a*) That a New York Section be organized and conducted on the same lines as existing sections elsewhere.

(*b*) That the present practice of holding some of the institute and directors' meetings in different localities, where local sections are established, be extended, instead of holding nearly all of these meetings in New York as at present. It may be desirable to reduce the frequency of Institute and directors' meetings and hold them every two months or perhaps even less frequently instead of every month as now.

(*c*) That the country be divided into geographical divisions corresponding in number to the number of Institute vice-presidents. If more than six divisions should be thought desirable, they should be established and the number of vice-presidents increased to correspond. In order to allow for the future shifting of membership density and at the same time to escape the necessity of cumbersome constitutional amendments, the number and delimination of geographical divisions should be specified in the by-laws instead of the constitution to provide for ready amendment by the Board of Directors.

(*d*) That one vice-president be selected from each geographical division, the president and managers to be elected from the membership at large as at present.

(*e*) That the institute should pay the traveling and living expenses of the officers and board members when attending Institute meetings.

(*f*) That it be the duty of each vice-president to visit each section in his own division at least once a year, the Institute to pay his traveling and living expenses for such visits. Of course it would also be desirable if the vice-presidents could exchange visits.

(*g*) That the vice-presidents' term of office be lengthened from one year to two years and the constitutional inhibition against the election of a vice-president as manager be removed. Provide against too extended tenure of office by a constitutional provision that except in the case of a manager or a vice-president, who may be elected president, no member may continuously hold office longer than six years.

Activities.—(*a*) That committee work be decentralized as far as it may be found feasible and desirable by substituting section committees for Institute committees. Appoint a general committee to study this question and make recommendations.

(*b*) That more high grade papers of general engineering interest be presented.

(*c*) That a committee be created in each section charged with the duty of assigning to the younger members specific participation in designated meetings by the preparation of papers, discussion or otherwise. It is hoped by this means and by the appointment of a reasonable number of the younger men to the larger committee membership caused by decentralization, that the interest of the younger men will be stimulated and their loyalty increased.

Encourage Participation in Public Affairs.

It is recognized that engineers do not participate as actively or as prominently in public affairs as they should and that both the public welfare and their own individual advancement would be promoted if this condition could be rectified. Two general reasons are believed to be responsible for this, one a lack of any general organization of engineers which would facilitate such co-operation, and second, too great technical specialization in the engineering curricula of technical schools and colleges.

The first of these reasons was very generally brought up in one form or another by the sections and although it is recognized that a corrective can be applied only by co-operation with other engineering bodies, it was felt that a constructive step would be taken by adopting a skeleton plan for co-operation and then appoint conferees to discuss the matter with other societies. With this object in mind, the committee recommended:

Local Federation.—(*a*) That a comprehensive but flexible uniform outline for the federation of local engineering bodies be prepared, taking advantage of the experience already gained by existing affiliations.

(*b*) That we use our endeavors to have the other national societies establish and support local sections along lines similar to ours but do not confine local federations to such branches, rather planning to include all the worthy engineering bodies.

(*c*) That wherever such federations can be organized there be established under an appropriate name a federated local council of engineers to be made up of a properly apportioned number of representatives from the different locals.

National Council.—(*a*) That there be established a direct touch between each local federated council and a National Engineering Council composed of delegates from as many national engineering societies as are willing and worthy to participate.

(*b*) That through the medium of the national and the local federated councils there be perfected a working arrangement for engineering co-operation in all public affairs where such is desirable.

Engineering Congress.—That there be inaugurated the custom of periodically holding an engineering congress, the delegates to which should be selected from all parts of the country under a plan to be developed for suitable representation, this congress to consider and take action on such matters of general interest to engineers and to the public as may merit its attention and as have been previously advertised, for a sufficient length of time, to permit locals everywhere to give them consideration and when possible to send instructed delegates.

The second reason, although of great importance, has not been generally considered. It was, however, the unanimous view of the members attending the convention that this matter should receive early and thorough consideration by the Institute, and the following preamble and resolution was there presented and adopted:

As the individual engineer cannot look for greater public recognition or individual advancement than his training and fitness warrant;

And, in the belief that the bigger development of the profession consists in broader social and public service by publicly-minded engineers;

Recognizing that on the one hand young engineers are employed for too long a period at work which does not stress their capabilities and, on the other, that the demands of industry for ever-increasing numbers of technicians must be supplied;

And having in mind the excellent precedents established by the medical and legal professions;

This committee would welcome the establishment at the earliest date practicable of a normal six years' collegiate course in engineering, two years of which at the least should be devoted to training in the humane arts and sciences including, for example, political science, economics, history and general letters, the last four years being devoted to sound training in the sciences and in only the fundamentals of diversified engineering.

With or prior to such a development we would endorse a program for the marked extension of vocational training in the industrial centers in order that the needs of industry may be met.

To the accomplishment of these ends this committee requests the appointment of representatives to serve on a joint committee of engineering organizations to promote such a national educational program as shall provide for the future necessities of the engineering profession consistent with the needs of society.

A motion has also been adopted that a committee be appointed to confer with the representatives of the student branches and recommend what if any changes should be made in relationship of the branches to the institute and to development in order that this very important part of institute activities should have full consideration and be given the attention which it merits.

Although the board's resolution did not specifically instruct the Development Committee to confer with similar committees from the other national engineering societies, the chairman was informally advised that where such conferences could expedite and help to crystallize the viewpoint of the several organizations concerned without committing the institute to any line of action they would be desirable. Responding, therefore, to a suggestion from the Development Committee of the American Institute of Mining and Metallurgical Engineers and to an invitation from a similar committee from the American Society of Mechanical Engineers, Messrs. Scott, Robinson and the chairman, conferred with representatives of these societies and also of the American Society of Civil Engineers, and the discussions are in progress relative to joint action by these societies. These discussions had not proceeded far enough to indicate what if any recommendations the several governing bodies may be agreed upon but the committee reported progress and stated that the spirit of co-operation was manifested by the other conferees.

STRONG FINANCIAL POSITION OF MARCONI WIRELESS TELEGRAPH CO.

The report of the directors issued in London at the end of July shows that for the year ended December, 1918, the net profit was $2,989,692, and adding to this the balance brought in from 1917 there stands to credit of profit and loss account $4,873,494. This is dealt with thus:

Dividend on preference shares 22% for the year	$ 275,000
Dividend on ordinary shares 25% for the year	$1,529,560
Put to general reserve (making it $6,250,000)	$ 750,000
Carried forward to 1919	$2,318,934

The directors stated that the above figures did not include anything in respect of its claims arising out of the war or for services rendered during the war as settlements had not been arrived at with government departments in respect of these. Since then the courts have completed the hearing of the company's claim for $35,000,000 in connection with the abandonment of the Imperial Wireless chain scheme, and have awarded between $2,500,000 and $3,000,000. The Marconi Wireless Co. holds shares in associated companies and patents which appear at the cost price in the balance sheet, *i.e.*, $6,825,547. The par value of the shares now stands at $11,729,828 exclusive of shares which have no capital denomination.

The issued capital of the company is $7,368,240 of which $1,250,000 is in preference and the balance in common stock.

RADIO STATIONS TO KEEP IN TOUCH WITH AIRPLANES.

Propose to Erect Chain of Stations Across the Continent as Aids to Aircraft.

Plans are announced by the American Flying Club for the construction of a chain of radio stations across the continent so that airplanes may be in communication with them at 30-minute intervals. The club will work in conjunction with the Government, which has already started a series of radio stations in connection with the airplane mail-delivery service.

DATES FOR IOWA STATE CONVENTION ANNOUNCED.

The date for the annual convention of the Iowa State Association of Electrical Contractors and Dealers has been set for Sept. 22 and 23. The meeting will take place in Sioux City, Iowa. F. Bernick, Jr., of Oskaloosa, Iowa, is state secretary.

Commercial Practice

Sales in Small Towns—Electric Makes 300-Mile Journey School for Salesmen Opened — Aerial Delivery of Lamps

PERCENTAGE OF SALES IN SMALL TOWNS SHOWN.

Public Service Co. Finds 95% of Sales Are Made in Larger Communities.

Some interesting facts regarding the influence of local stores are brought out in a recent article in the "Sales Bulletin" of the Public Service Co. of Northern Illinois. Out of a total of over 88,000 customers to whom the company is supplying electric service, more than 31,000, or over 35%, live in small towns in which the company does not maintain an office or store. Referring to the sales report it is found that 95% of the company's appliance sales were made in the towns in which an office is established. In other words, only 5% of the total appliance sales are made to the 31,000 or 35% of its customers living outside the towns where offices are located.

However, the amount of business in these towns is not sufficient to warrant the establishment of a store there and these figures were published to point out to the company's salesmen and its employes the opportunities that exist in these towns and to encourage them to get out after the business in the smaller communities.

The company has adopted several methods of reaching this trade, one of the most successful being its "income boosting" plan. According to this plan any of its employes in these districts may sell appliances for the company and receives a commission on the sale in addition to his regular salary. The results of this plan have been very satisfactory, not only for the company but for the employes, many of whom receive substantial checks every month for their extra efforts in this way. Another plan that has been adopted is to enclose return cards describing the appliances with the customers' bills.

LONG VACATION TRIP MADE IN ELECTRIC VEHICLE.

Recent Journey from Chicago to Cambridge, Wis., Made by Four Ladies.

The adaptability of the electric passenger vehicle for long trips was demonstrated by a 300-mile journey made in one recently. The unique feature of this trip was the fact that it was made by four ladies, alone, without any preliminary arrangements being made other than to plan where charging stops should be made. The route covered was from Chicago to Cambridge, Wis., and return, after a two weeks' vacation, via Rockford, Ill. The car was driven by Miss Jessie C. Stevens of Chicago.

The electric was equipped with a 42-cell, 11-plate battery. The following log of the journey is taken from an article in the *Round Table* of the Commonwealth Edison Co., Chicago.

FIRST DAY.

10 a. m.—Left Magnetic Motors Corporation, 25th street and Calumet avenue.

12 a. m.—Arrived Becker's garage, Highland Park, Ill. Car charged.

2 p. m.—Left Becker's garage.

3 p. m.—Arrived Colwell's garage, Waukegan, Ill. Car charged.

7 p. m.—Left Colwell's garage.

10:30 p. m.—Arrived Wilson's garage. Milwaukee. Wis. Car charged.

SECOND DAY.

11 a. m.—Left Wilson's garage.

12:15 p. m.—Arrived Waukesha, Wis.

12:45 p. m.—Car charged by Waukesha Auto Co.

3:45 p. m.—Left Waukesha Auto Co.

5:35 p. m.—Stopped at Helenville, Wis., for tea.

8:45 p. m.—Reached Cambridge garage, Cambridge, Wis., destination. Car charged.

RETURN—FIRST DAY.

9 a. m.—Left Ingleside, Wis.

12 m.—Arrived Janesville Contracting Co., Janesville, Wis. Car charged.

SECOND DAY.

7 a. m.—Left Janesville, Wis.

8:30 a. m.—Arrived Beloit, Wis. New cell put in at Beloit service station.

11:45 a. m.—Left Beloit, Wis.

12:55 p. m.—Arrived at Rockford, Ill. Car charged at Phillip's garage.

7 p. m.—Left Rockford, Ill.

9:45 p. m.—Arrived Marengo, Ill.

THIRD DAY.

7 a. m.—Left Marengo, Ill.

8:55 a. m.—Arrived Elgin, Ill. Car charged by battery service station.

7 p. m.—Left Elgin, Ill.

9:45 p. m.—Arrived Garfield Park, Chicago.

11 p. m.—Arrived 106th and Prospect avenue, Chicago, over 10 miles more power left in the battery.

The party is perfectly satisfied with the performance of the electric during the entire trip and enjoyed it even more than had a gas car been used.

SCHOOL FOR SECURITY SALESMEN.

Doherty Organization Opening Salesman's Course.

The Doherty Organization is to open a school for the training of young men as salesmen of securities. The school will be in charge of Leonhard Felix Fuld, who has had a wide experience in service instruction. He was with the United States Bureau of Education for several years and published a book for the government on education. For eleven years he had charge of the personnel for the City of New York.

The school for salesmen will probably open about the first of September. All of the details have not been worked out as yet but it is planned to offer young men desiring to enter this field of activity an opportunity to enter the school. School hours will probably be arranged so as not to conflict with regular office hours.

The opening of this school is another extension of the idea that has characterized the success of Henry L. Doherty and the Doherty Organization in the business world. The school will be well advertised and it is expected that there will be a large number of applicants for attendance. The length of the course has not been decided nor the hours that the school will be open.

AERIAL MAIL DELIVERY OF MAZDA LAMPS.

Republic Electric Co., Cleveland, Receives Order by Air from New York.

A package containing the latest development in lamp construction, the Edison white Mazda lamp, addressed to Louis Griesser, president of the Republic Electric Co., Cleveland, Ohio, was recently shipped by airplane from Belmont field, New York City. Leaving at 5:00 o'clock in the morning, it was delivered through the regular channels and in good condition at 2:00 o'clock in the afternoon.

This is understood to be the first electric lamp delivery made to a customer by Aerial Mail Service, but Mr. Ruehl, in charge of the transportation department of the Edison Lamp Works at Harrison, states that from now on aerial mail delivery service in emergencies will be a regular part of shipping service wherever the Government makes provision for such delivery.

On the present schedule, planes leaving Belmont Field, New York, at 5:00 a. m. are due to arrive in Cleveland at 9:30 a. m., connecting with planes for Indiana, Kentucky, Michigan and Ohio. Other mails will be taken to Chicago for distribution, connecting with planes for all western states, British Columbia and the northwestern territory of Canada.

When Heller field at Newark, N. J., the largest landing field in the east for Aerial Mail Service, is complete, all aerial mail will be sent direct from Newark.

Packages sent by this service are necessarily limited in size to 30 in. in length and girth.

CITIES SERVICE CO. OPENS CONSUMERS' OWNERSHIP BRANCH.

Plans Being Developed to Interest Consumers in Securities of Company and Subsidiaries.

The bond department of the Cities Service Co. of New York has opened a branch that will be devoted to the sale of securities of that company and its subsidiaries to its consumers. The work of this branch according to *Sparks,* the publication of the Toledo Railway & Light Co., one of the subsidiaries, will be handled by L. F. Wiegand of the bond department.

For some time the Doherty organization has been considering the opening of this branch, realizing the opportunities and advantages of the sale of securities to the consumers of the products of its subsidiaries. The new branch will inaugurate an active campaign along these lines, and one of its main purposes will be the development and maintenance of good will between the consumers and the public utilities.

By becoming interested financially in the public utilities from which they purchase gas, light or street car service, the consumers are in a better position to understand the problems and financial requirements of the companies in their localities. The usual difficulties encountered in the maintenance of fair relations with the public are materially lessened. Practically all the advantages of public ownership are attained through such a partnership without the sacrifice of the greater advantages of private ownership that occurs when public ownership is substituted for private ownership.

Details of the operation of the Consumers' Ownership Branch will be announced in the near future.

BRITISH MUNICIPALITY TURNS TO ELECTRIC TRUCKS.

A report recently issued by the engineer of the Hackney Borough Council is most strongly in favor of adopting the electric truck for handling the municipality's refuse.

The report summarizes in a lucid way the advantages of mechanically propelled vehicles, and as his conclusions may be helpful to other engineers, we reproduce them. They are as follows:—(1) That removal of house refuse by mechanically propelled vehicles is advantageous and more economical than horse-drawn vehicles when expedition in collection is obtainable. (2) That the conditions of working and the general arrangements of collection in the districts visited are not comparable with the conditions existing at the present time in Hackney. (3) That to secure economy by the use of mechanically propelled vehicles for house refuse collection it is essential that, as far as practicable, a continuous collection be made, and that "waiting time" be entirely avoided during the hours of working. (4) That "electric" vehicles are suitable for the work if the conditions of working warrants the use of mechanically propelled vehicles. (5) That "electric" vehicles are easy to manipulate and work and are economical in working, but more costly to purchase than other kinds of mechanically-propelled vehicles. (6) That to secure economy and efficiency by the use of mechanically propelled vehicles in Hackney, the "calling at" and the "entry" of the workmen into houses and private premises after knocking or ringing and waiting for entry must be abandoned. (7) That more frequent collections should be inaugurated and the occupiers of all premises, as is the case in all districts visited, be required to place the refuse in suitable receptacles, on the footways or in accessible situations, at times to be specified. (8) That it is expedient that a trial of the use of mechanically-propelled vehicles in this district should be undertaken by the purchase of three or four vehicles before any general scheme is adopted, such vehicles being used in different areas of the borough with a view to obtaining reliable data of cost under such improved conditions of working as can be adopted in the borough.

In Hackney at present there are thirty-four horse-drawn vehicles engaged on the work daily, and about 33,000 tons of refuse are annually collected, and the Public Health Committee believes that by an improved system of collection and the use of mechanically-propelled vehicles, a considerable saving per year can be effected.

Four trucks are to be purchased, two of 2½ and two of 3½-ton capacity.

Operating Practice

Installation of Electrically Operated Valves — Insulator Maintenance— Cable Coverings— Water Turbine Blading

COMPLETE SYSTEM OF ELECTRICALLY OPERATED STEAM VALVES.

Interesting Installation by Rochester Railway & Light Co.

The Rochester Railway & Light Co. is installing a very complete system of remote controlled steam valves in turbine and boiler room at its station No. 3. The aim of the installation is to add to the safety and flexibility of the station by enabling the important valves to be operated from a safe distance.

The original layout consisted of the proposed operation of 17 valves with the "Dean" control system. These consist of three 14-in. valves above the boilers in the old boiler house, eight boiler and two main steam line valves in the new boiler house, and four stations in the engine room, controlling steam to turbines Nos. 1, 2, 3 and 4. The steam valve on the line to turbine No. 4, while located in the new boiler house, is entirely controlled from the engine room.

To this layout for the control of 17 valves has been added recently a similar control of the Chapman valves used on boilers Nos. 12 and 21, the latest installed, and one turbine No. 5, just recently tested out and now running on the line.

All valves on lines supplying steam to the several horizontal turbines, called turbines Nos. 1, 2, 3, 4 and 5, are entirely controlled in the turbine room. These valves are in or near the upper galleries. The hold-in switches are located on the galleries near the valves, but the Dean controllers are operated from the turbine floor. Each of the turbines has an individual controller placed near the machine for close and handy operation; each has also a remote controller placed in the engine room opposite to and farthest from the machine, the steam valve of which might require emergency control. For example, on the east wall of the engine room is mounted a steel plate, on the face of which are installed the three controllers remotely operating the valves of steam lines, to turbines 1, 2 and 3. These controllers are lettered respectively Turbine 1, Turbine 2, Turbine 3, and represent in miniature the machines themselves, and the mounting plate is painted with a red band to indicate the walls and west part of engine room. In addition there is mounted on this panel—in miniature facsimile—the steam lines, with their valves, which supply steam to the turbines. The miniature valves and pipes connecting the controllers, represent the actual steam lines connecting the turbines. This system will be more fully covered later in describing the remote control panel boards for the boiler room live steam system.

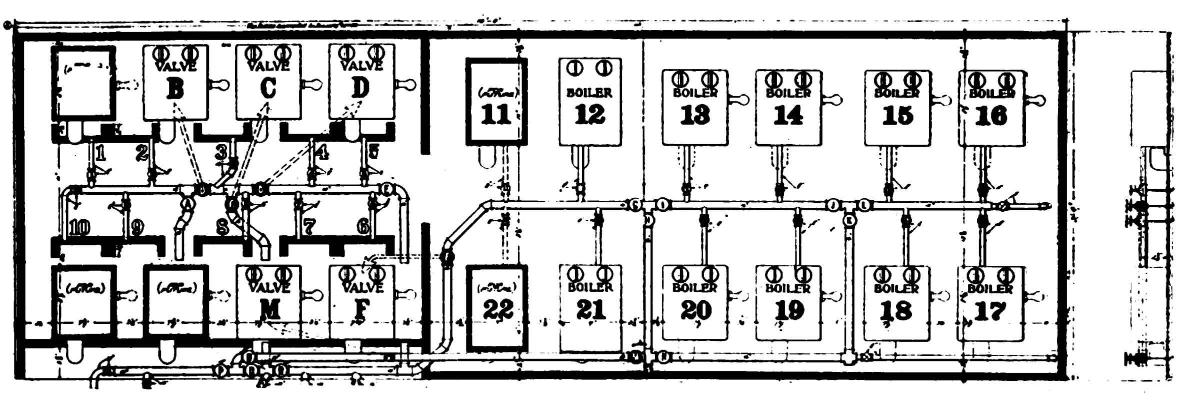
Below is a plan of the principal controller panel boards at which are operated at present 15 valves with a capacity for mounting five additional controllers. There are two similar panel boards, one located in the anteroom of Station 3 office, the other located in a steel and brick penthouse especially built for it on the north wall of the boiler house and just outside the north doorway of the boiler room. They consist of steel plates 3 ft. 4 in. high by 10 ft. long supported on steel angle legs and framework.

The face of the board, also the controllers and conduits on the board, are painted black; a red band is used to indicate the building walls; also to indicate the ten B. and W. boilers of the old boiler house. The controllers mounted in that part representing the new boiler house indicate in miniature each the exact boiler the valve of which is operated by the controller so mounted.

Ten Dean controllers represent boilers 12 to 21, inclusive. They are so marked and operate the valves of the live steam connections from these same boilers to the main steam headers supplying the turbines.

The ten B. & W. boilers of the old boiler house do not have electrical control of their individual steam valves, but five valves of the main steam headers are electrically controlled, as indicated on these panel boards and in the same manner as the boiler steam valves above mentioned. The controllers operating these valves are marked as Valve B—C—D—M—F, thus relating each controller to the valve it will operate.

In addition to the controllers representing valves or boilers, the valves of which they operate, the entire live steam piping system of the boiler room also is represented in miniature by small piping with all



Control Board Showing Layout in Miniature and Pilot Lights.

fittings, valves, etc., mounted at about one-twentieth true size. Eight-inch steam lines are represented by one-eighth inch pipe, 10 and 12-in. lines by ¼-in. pipe; 14 and 16-in. lines by ⅜-in. pipe. A small wheel disc on a stem, threaded and fitted into a tee, makes a "Dummy" valve to indicate each steam valve.

This miniature piping is true to the actual station steam pipe layout generally, except in a few places, where the details are shown more directly and in diagrammatic form. For example—all the boilers have live steam connections with large U bends—so they are represented on the panel boards as straight connections to the main steam header.

A color scheme for lettering or numbering valves, controllers and other apparatus is also being used. As each controller box is given the name and number of the boiler whose valve it operates, so the faces of the related hold-in-switch box, enclosed rheostat and fuse boxes, and face plate of the valve motor unit are each lettered with the same name and number, in white upon the black finish of the apparatus. Each valve which is electrically operated will have its key number or letter painted on the body in white upon a red ground; and the "dummy" of this valve located on the panel boards will have its wheel disc painted red with the same letter or number in white upon it.

Each valve which is not electrically operated will have its key letter or number painted on the body of the valve in white upon a black ground, and the "dummy" of it located on the panel boards will have its wheel disc painted a black ground color with the number or letter in white upon it.

The miniature valves by their color show plainly which ones are electrically operated; and the signal lamps at the top of each controller show by their color, red or green, at all times whether the valve which it operates is open or closed.

The entire system is before one like a map with its operating status indicated in detail, thus giving the operators not only a knowledge of the existing status, but also allowing the operation of any valve in any manner desired in the shortest time, under normal or emergency conditions.

METHOD OF MAINTAINING INSULATORS EMPLOYED IN GEORGIA.

Inspection Segregated from Making Repairs Improves Routine.

The Georgia Railway and Power Co. operates a very extensive system of transmission lines. Experience has proved to this company that it is far better to keep their high-potential lines in good condition than to allow them to deteriorate and then overhaul them. It is well known that insulators deteriorate with time and this company has adopted a method by which insulators can be watched and units that are becoming defective can be located and replaced before causing shutdowns and service interruptions.

The method of detecting defective insulators employed is that developed by Mr. Johnson, superintendent of transmission wires of the Georgia Railway and Power Co. This method is applicable to live lines, since it utilizes the leakage current over the defective insulators to locate the defective units. By the method employed it is possible to examine by the Johnson method the insulators on as many as 125 poles in one day and in one tour of inspection recently completed by the company 65 miles of line were inspected between June 30 and July 25.

In making these tours of inspection or search for insulators that are becoming defective the only equipment employed is the "buzz" stick used for measuring the leakage current. When an insulator is found to be defective it is painted with a daub of red paint and a report is sent in. A gang following the inspectors changes the insulators. This method has been found most satisfactory.

THREE-PART PROTECTIVE COVERING FOR CABLE SHEATHS.

Cement, Clay and Cheesecloth Recommended for Cable Covering.

Probably the best way, and always the cheapest way, to protect cables in manholes from damage from an external source is to wrap the sheath on outside of the cable with some form of covering or protective shield. In adopting a covering it is important that it serve three functions: It should radiate readily the heat which is generated within the cable; it should protect the cable from mechanical injury; it should protect the cable from heat caused by a fire in the manhole or by the burning up of adjacent cables.

The following is a good way of covering cables, and has proven most satisfactory and inexpensive in comparison to other coverings.

First, wrap the cable with a layer of cheese cloth made up in lengths of 4 in. wide. On the top of this a coating of cement and sand is plastered from ½ to ⅝ in. in thickness, and on this wrap another strip of cheese cloth. Ordinary bank sand in which there is some loam is used for the mixture, and it is mixed in 2 to 1 proportion with very little water to the consistency of very stiff mud. In winding this on with cheese cloth as above mentioned, the cloth is pulled tight, thus forcing the grout to ooze out between the meshes of the cloth, and this provides a finished outer surface for the cable. It is not considered advisable to go over this with a coating of neat cement, as this provides too fine a covering and cracks will result.

It is evident that a cement coating of this thickness will perfectly protect the cable from any mechanical injury, and it is a fact that it will protect it from a very intense heat from without.

LEAD COATING TO PROLONG LIFE OF TURBINE BLADES.

It is a matter of experience, and one which has been discussed from time to time, that if attempts are made to clean iron surfaces that are covered with lead by means of the sand blast, that the lead covering cannot be removed. It seems that the lead is forced into the depressions and interstices of the iron surface, thus becoming tightly imbedded.

Upon this fact experiments are being carried on by which it is aimed to increase the life of the blading or water turbines operating under high head with high-velocity water, as the Pelton wheel. The lead can be applied by the Schoop process, giving a smooth and uniform covering of lead to the iron surface of the blades. In this way the effect of silt and sand carried down by the water at high velocity can be made less objectionable in wearing away the surface of the turbine blades.

Contracting-Construction

Suggestions for Wiring Electric Ranges—Important Factors in Repair Business — House Wiring on Installment Plan

PROPER WIRING INSTALLATIONS FOR ELECTRIC RANGES.

Abstract of Wiring Specifications Contained in Electric Range Handbook.

With the rapidly growing demand for electric ranges the necessity of suitable and adequate wiring installations for them is becoming more important. For this reason the Society for Electric Development, Inc., has devoted a chapter of its Electric Range Handbook to the subject of wiring specifications which contains many valuable suggestions and ideas on such work. These specifications are not intended to give detailed instructions on the methods to be used but to furnish an outline of certain general arrangements and requirements which should be followed. Each job presents a different problem which must be solved bv the man on the ground and the completed job made to conform with the requirements given and the code rules.

Service wires from the outlet to the switch should be three-wire, 110-220 volts and No. 8 wire should be

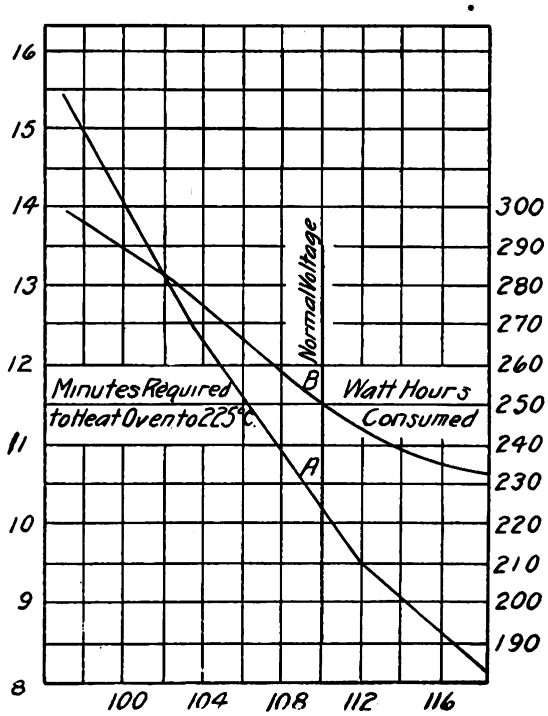


Chart Showing Importance of Maintaining Voltage in Electric Range Operation.

the minimum size used. In new buildings the exact wire size will be largely determined by the ultimate load to be installed. At present the code requires that mains feeding more than one range be large enough to supply the total load of all the ranges at one time. This ruling, however, is often modified by local authorities. However it is well to provide for the maximum requirements in the original installation rather than to change later.

In installing a range in an old residence using electric service a new meter location and switch should be installed and the present lighting mains connected to it, unless the present wiring has sufficient capacity to take care of the additional load. In apartment buildings the existing meter locations should be used if possible and a new circuit installed to the building outlet.

The service switch in a range installation should be a three-pole, single-throw, fused knife switch of 60-amp. capacity or larger. The range circuit should be three-wire No. 8 or larger depending on the size of the installation and the distance from the meter to the load. To assist in determining the proper size of wire the following table may be used:

WIRING TABLE.

TWO PER CENT DROP.

Load, watts.	Distance in feet for 110-220-volt, three-wire circuits. No. 8, 35 amp.	No. 6, 50 amp.	No. 4, 70 amp.	No. 2, 90 amp.	No. 1, 70 amp.
1,000......	375				
1,500......	250				
2,000......	185	295			
2,500......	145	235			
3,000......	125	198	316		
3,500......	105	170	270		
4,000......	93	148	236		
4,500......	83	132	213		
5,000......	76	118	188	300	
5,500......	68	108	172	273	
6,000......	62	99	158	250	312
6,500......	58	92	145	231	289
7,000......	54	85	135	215	268
7,500......	50	79	126	200	250
8,000......		74	118	187	234
9,000......		66	105	166	208
10,000......		59	95	150	187
12,000......			79	125	156
15,000......				100	125
20,000......					94

The minimum size wire, No. 8, may at first appear too large for many installations but it has been found desirable to recommend this size as it will permit installing a larger range without changing the wiring.

In addition to the service switch, a master switch, preferably of the enclosed safety type should be installed at a point within easy access of the range. Where water heaters and ranges are supplied from the same circuit this same switch must be arranged or another installed to provide for it.

The frame of the range and all conduit used should be permanently and effectively grounded in accordance with the code requirements. In addition the neutral wire of three-wire circuits should be grounded at the main switch and at the range.

It has been assumed that the range manufacturer has balanced the heating circuits connected to each leg of a three-wire range. If this is not the case the units must be reconnected of the size of wire, switches and fuses increased to amply provide for the maximum current on the more heavily loaded side.

The importance of maintaining voltage, which is largely dependent upon the wire size is shown in the accompanying chart. From this chart it can be seen that not only does it require a longer time to bring the range oven to the desired temperature when the voltage is low but the actual consumption is greater than when the proper voltage is maintained. It is evident, therefore, that the selecting of wires of a proper size is of utmost importance.

IMPORTANT FACTORS IN CONDUCT OF SUCCESSFUL REPAIR BUSINESS.

Papers at Repair and Sale of Used Apparatus Section Meeting Brought Out Interesting Discussion.

In the lively discussion that took place following the presentation of the papers at the meeting of the Repair and Sale of Used Apparatus Section of the National Association of Electrical Contractors and Dealers recently, many interesting and important factors in the conduct of a successful repair business were brought out.

In quoting prices, for example, the desirability of taking all jobs, except those on which there can be no question as to the extent of the necessary repairs, on a time and material basis was shown. It was pointed out that the average customer is concerned more in having the damaged or defective apparatus put in first class condition again than in having the particular defect that caused the breakdown remedied. To illustrate, he does not want to have a field rewound and have another breakdown occur in a few months due to a defective bearing that could and should have been replaced at the same time. As the extent of such repairs can not be ascertained without a very thorough inspection and test that it is often impossible to make until the machine is being overhauled, the cost of putting it back in good condition can not be determined until that time.

Along this line the fallacy of estimating the cost of making the necessary repairs roughly at first sight or over the telephone was also shown. Such a figure, no matter how carefully the estimator explains its inaccuracy, is always accepted by the customer as being the maximum price and if the cost of the repairs is higher he will be dissatisfied. On the other hand, if the estimate is too high it will tend to scare the customer into the purchase of a new machine.

The advisability of conducting a department for repairing autostarters, ignition systems and other electrical equipment used on automobiles in conjunction with the regular repair business was also fully discussed. The consensus of opinion among those present seemed to be that such a department could be profitably conducted if the volume of business was sufficient. However, such work can be properly done only by specialists in that line and these men are seldom capable of doing regular repair work in the shop. For this reason the volume of auto repair work handled must be enough to employ all their time or a large portion of their unoccupied time will be lost.

Handling presents another important problem, especially with the larger machines and apparatus. Very often the cost of getting such machines to the repair shop and back in place at the customer's premises again is much higher than the cost of doing the actual repair work on them. It is evident, therefore, that the relation of the cost of a job to the handling cost varies in practically every job and should be figured separately in billing.

In order to prevent complications when there is more than one job from the same customer in the shop at the same time, many of those present give every piece of work a shop or job number by which it is identified in the shop. This method also assists the office force in keeping its records of the various jobs.

Another important item is in keeping the time on jobs correctly. This is especially important in a repair shop inasmuch as nearly all the work is done on a time and material basis. If the keeping of labor records is left entirely to the workmen, discrepancies are sure to creep in which will penalize one job and make the charges on another too small. The majority of companies overcome this difficulty by using a time clock on which the men register the time when they start and leave any job.

The proportionate labor charges for work done in the shop and on the customer's premises was also discussed. Due to the fact that work done on the customer's premises presents difficulties and inconveniences not encountered in the shop and as such work is usually of the emergency order, the majority of the members were of the opinion that it should be charged for at a higher rate than work done in the shop. In addition to this higher rate the time required for getting to the work and back and transportation expenses should also be charged.

GOODWIN ENCOURAGES PART-PAYMENT PLAN FOR HOUSE WIRING.

Would Prefer House Wiring on Installment Plan to Appliance Sales That Basis.

Many electrical contractors do not care to do old house wiring on the installment or part-payment plan because there is no immediate method of collecting should the customer fail to pay. In the case of removable articles, such as appliances, the dealer can of course take them back, but with wiring such a recourse is impractical. Of course a mechanic's lien can be placed on the building which will interfere with its sale or further mortgaging, but this does not effect an early settlement.

With house wiring on this plan, however, there is an added moral factor that adds greatly to its reliability. It is on account of the existence of this factor that W. L. Goodwin, author of the "Goodwin" plan stated at the recent meeting of the Association of Municipal Electrical Engineers that he would prefer to take this business on installments rather than appliances. His statement in this respect as reported in the *Bulletin* of the Ontario Hydroelectric Power Commission is as follows:

"Of the choice between the selling of appliances on installments and house-wiring on installments, so far as security is concerned, I will take the house-wiring. We know from the experience of over 20 years, in every line of endeavor, that the credit losses on installment sales are less than 1%. As a matter of fact, they average one-quarter of 1% in the case of all the big installment houses throughout the United States. You are selling to what might be regarded as the most unreliable kind of purchaser, the one that has to buy on the installment plan, but there is something about the people of this continent that makes them keep their installment payments as faithfully as they will keep their religion. If you give a man a washing-machine on 60 days' credit, he will beat you right and left, and if you sell it on the installment plan you will have to chase him all over the country. In the case of house-wiring, however, he cannot move it away and it becomes a lien on the building."

New Appliances

Pipe Fittings with Composition Bushings — New Development in Electric Washers — Attractive Lighting Fixture

Adapti Line of Pipe Fittings With Composition Bushings.

A new line of pipe and fittings and composition bushings is being placed on the market by the Adapti Co., Cleveland, Ohio, makers of the "Adapti" line of outlet boxes and similar fittings. These fittings are especially intended for use in protecting the wires in conduit systems where they enter cutout, service and panel boxes. Being of composition, the bushings offer great mechanical and dielectric strength and involve no danger of breakage, as is the case with those made of porcelain.

They are made in all standard sizes, with a standard pipe thread that screws into the fitting itself. They can, therefore, be securely fastened in knockout holes with standard conduit locknuts and are also adaptable for use with standard couplings.

Surf Electric Washing Machine.

Recognizing that the real cleansing action in washing clothes is obtained through thorough agitation of the clothes with soapy water and that rubbing adds nothing to the real cleansing action, a new type washing machine has been developed in which all friction has been disposed with and the foregoing principle applied exclusively. It is known as the "Surf" electric washer and is made by the Surf Manufacturing Co., 518 Grand Ave., Milwaukee, Wis. As shown in the accompanying illustration, this machine operates on the oscillating cylinder principle, but makes use of a new development in this line. In the lower portion of the cylinder is placed a screened, raised bottom plate, the end portions of which are closely perforated, as can be partly seen in the illustration. The cylinder itself has no ribs nor projects to break the flow of the water. Below the bottom plate referred to, there is room for about a pail and a quarter of hot water. The clothes are thrown in on this bottom, the cover closed tightly and tub placed into oscillation. This action causes the tub to tip the clothes back and forth into this water. The water pours through the screened plate and through and over the clothes. The rising of the tub on that side lifts the clothes but drops them again in the next moment, thus meeting a rush of water coming from underneath and thoroughly showering the batch of clothes. It is from this surf-like action of the water that the machine gets its name. The water is forced through the clothes 72 times a minute, thus giving specially thorough mingling of the soapy water with the clothes.

With the exception of parts of the wringer, all of the machine is made of metal, the tub being either of galvanized iron or copper. The machine is made in one size only, having a capacity of 8 sheets, or their equivalent. It has a 12-inch reversible and removable swinging wringer provided with a safety release. All of the driving mechanism is inclosed in an oil-tight case. The drive from the motor is direct through suitable gears and shafts, a safety clutch being placed in the motor shafts to prevent burning out of the motor in case there should be any clogging in the machine. There is no opportunity for the operator to be injured in any moving exposed parts since these are all inclosed or guarded. The framework is of substantial angle iron well braced and is mounted on roller bearing castings. The machine is very simple, both in construction and operation, and is almost noiseless. It is easily controlled by means of a conveniently placed handle which covers the cylinder and another handle for controlling the wringer. A switch starts and stops the motor.

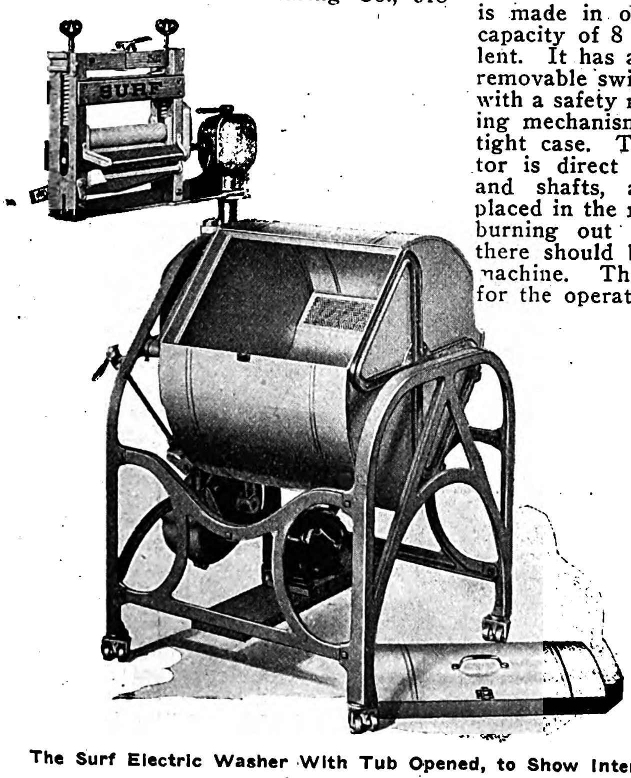
The New E-lite Lighting Fixture.

A new fixture called the E-lite has been produced after careful and exhaustive tests by the Luminous Unit Co., 2615 Washington avenue, St. Louis, Mo. This unit, in the opinion of the company, is destined to become the most popular of all fixtures for home, school and other such places.

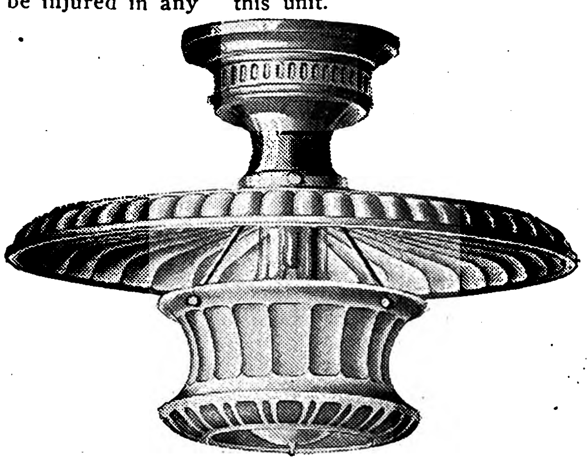
The fixture consists of a metal canopy, a white glass reflector 13 in. in diameter, and a white glass or Adam embossed etched cylinder of 6-in. diameter. Contrary to the usual design of such fixtures the lamp is encircled by the cylindrical shade but is exposed at the bottom, thus providing a certain amount of direct illumination. This feature also prevents dust from collecting in the shade and makes it easier to clean.

The unit is aesthetic, utilitarian and attractive—yet economical. It produces a soft tonal illumination and obtains maximum results from the Mazda type-C bulb which is used, and its reflector working in conjunction with the bowl produces an excellent ray distribution and eliminates shadows. It is furnished in both ceiling and chain design in three sizes for use with 75, 100 or 150-watt lamps.

The name E-lite is also significant and was adopted for two reasons; the word itself, E-lite meaning to describe the high quality of the fixture, and the "E" standing for the efficiency of this unit.



The Surf Electric Washer With Tub Opened, to Show Interior Construction.



E-lite Lighting Unit Especially Adapted for Home, School and Similar Uses.

Trade Activities

Belden Co. Erects New Building — Chicago Pneumatic Tool to Remove Headquarters to New York — Literature

The Babcock & Wilcox Co., with main offices at 85 Liberty street, New York City, has removed its Seattle office from the Mutual Life building to Rooms 1914-1917 L. C. Smith building.

Acme Wire Co., New Haven, Conn., announces that due to the increasing volume of its business in the Middle West and the desirability of keeping in closer and more frequent touch with the requirements of its customers it has opened an office in Cleveland, Ohio. Its sales representative is J. T. Crippen, the office address is 521 Guardian building, and the telephone number is Main 2024. The step taken by the Acme company will undoubtedly result in a closer and more effective association with its many friends in the Middle West.

Quigley Furnace Specialties Co., 26 Cortlandt street, New York, has been awarded the contract for the complete equipment for preparing, distributing and burning the fuel to be installed in the Falcon Steel Co.'s new sheet mill at Niles, O. This mill will use powdered coal throughout for firing boilers and furnaces and the power-plant boilers will be powdered-coal fired, using the Quigley compressed-air system for transporting and burning the coal. The pulverized coal will be transported from the milling plant through standard four-inch diameter wrought pipes to furnaces and boilers for various distances, aggregating 800 ft., and will be switched from the main distribution line to a storage bin in the power house for use as required for the boilers.

Crystal Washing Machine Co., Detroit, Mich., is distributing a "Special Merchandising Plan Book" to the trade which explains the assistance offered by this company to its dealers in promoting the sale of Crystal electric washers. This, accordng to indications, will be a particularly fruitful field for the sale of this labor-saving device and for that reason such sales helps as are described in this book should prove especially valuable to the contractor-dealer or central station. The sales helps described are all furnished by the company and consist of striking window displays, newspaper advertisments, in either matrix or electrotype form, demonstration book for the house-to-house salesman, window cards, moving picture slides, complete instructions on the preparation and maintenance of a mailing list, together with two sales letters and an outline of direct-by-mail campaign, and literature for distribution to prospective customers. This plan thoroughly analyzes the field and makes use of every known advertising strategy in leading prospective customers to the dealer's store.

Black & Decker Mfg. Co., Baltimore, has issued a catalog giving a full and illustrated description of electric air compressors, portable electric drills and electric valve grinders. A copy of the catalog will be mailed free upon application.

Youngstown Sheet & Tube Co., Youngstown, Ohio, has commenced the publication of a house organ, the initial number being dated August 15. It is a plant paper of a rather unique type, and its purpose is to promote friendliness, acquaintance and a fellow feeling among the employes of the company. So far as practicable, it will be the work of its own people exclusively. All of the matter including the art work in the first issue was done by men in its works.

Chicago Pneumatic Tool Co. is planning for the removal of its general offices from Chicago to New York. An office building is being erected at 6-8 East 44th street, New York, and it is expected that the building will be ready for occupancy early in 1920, at which time the transfer will be effected. The structure, which is being built by Westinghouse-Church-Kerr Co., is of combination steel, brick and limestone, and will comprise initially ten stories, all to be occupied by the company. The ground floor is to be an attractively designed permanent exhibition room and will contain a display of the many Chicago Pneumatic products, including Boyer pneumatic hammers, Little Giant pneumatic and electric tools, rock and coal drills, air compressors, etc. In conjunction, a completely equipped service station will be maintained. The company maintains six American plants and 26 sales and service branches, the operation of which will be more economically directed from New York. A sales and service organization more extensive than at present will be continued in Chicago.

Dantzig, Pfeiffer & Ritt announce their organization as a firm of consulting mathematicians, with offices located at 500 West 116th street, New York City. This firm undertakes to handle all problems arising in industry for the solution of which the knowledge of a mathematical specialist may be necessary. Each of the members of the firm has been privately engaged for some time in work of this nature, in addition to his other professional activities, and it was at the suggestion of clients that the decision was made to set up a consulting service which would extend to the industrial world the resources of modern pure and applied mathematics. Dr. Dantzig is a graduate of the University of Paris of the Ecole Superieure d'Aeronautique et de Construction Mecanique. He has taught at Indiana University and at Columbia. During the war he was in charge of the mathematical work of the instrument section of the U. S. Ordnance. Dr. Pfeiffer received the degree of Mechanical Engineer from the Stevens Institute of Technology and the degree of Doctor of Philosophy from Columbia University. He has taught mathematics at Harvard, Princeton and Columbia. He is an associate editor of the Annals of Mathematics. Dr. Ritt took the degree of Ph.D. at Columbia University. He was for three years at the Naval Observatory and has since taught mathematics at Columbia. During the war he was one of the chief ballisticians in the U. S. Ordnance.

Belden Manufacturing Co., Chicago, is erecting a new four-story building to be designated building No. 8. This building will correspond to the present structures in that it will be of absolute fireproof construction, no wood whatever being used. Each floor contains about 10,000 sq. ft. of clear space. The first floor is to be used for a shipping, receiving and stock room until the permanent structure to house these departments is built. The second floor will be devoted to the excess needs of several of the departments. The third floor will be used entirely for the manufacture of textile magnet wire, while the fourth floor will be given over to the manufacture of "Beldenamel" magnet wire, being so designed that the entire process can be conducted on one floor. A spur track from the belt line railway adjoining the tract of land will be built facing these buildings on the street side, but even with the second story. This will permit loading and unloading by a special conveying system designed to eliminate so far as possible handling of goods. The space in the present factory building now occupied by the magnet wire and enameled wire departments will be used for expansion of the rubber-covered wire and cord departments, which have grown rapidly in the past few years.

New Buildings of Belden Manufacturing Co.

Current News

Weekly Record of Construction Activities—Conventions

EASTERN STATES.

Lynn, Mass.—Davis Storage Battery Manufacturing Co., Chestnut street, is considering plans for the erection of a new addition to its plant. The structure is estimated to cost about $150,000.

Providence, R. I.—Ground has recently been broken by the Atlantic Mills, Equitable building, Boston, Mass., for the construction of a new three-story turbine building at its local plant on Manton avenue. The structure will be about 46x98 ft., and is estimated to cost $20,000. O. D. Purington & Co., Industrial Trust building, Providence, is the contractor.

Brooklyn, N. Y.—Plans have been filed by the R. H. Comey Co., 73 19th street, for alterations and improvements in the boiler plant at its works, to facilitate operations. Contract for the work has been awarded to Gibbons & Co., 316 Columbus street, Brooklyn.

Mt. Morris, N. Y. — Mt. Morris Illuminating Co. is making rapid progress in the construction of a power plant on the north side of the Genesee river, and it is expected that the work will be completed at an early date.

Newburgh, N. Y.—Alberger Pump & Condenser Co., 140 Cedar street, New York, has awarded a contract to the J. W. Cowper Co., Fidelity building, Buffalo, for the construction of a new addition to its local plant, to provide for increased capacity.

New York, N. Y.—Following the approval of a bond issue for $30,000,000 for various city improvements, the Board of Estimate has arranged plans for the construction of a new power plant and boiler house at the institution to cost about $200,000.

New York, N. Y.—In connection with the construction of a large new six-story cold storage plant at 780 First avenue, by the United Dressed Beef Co., considerable electrical equipment and refrigerating apparatus will be required. The structure is estimated to cost $250,000.

New York, N. Y.—Third Avenue Railway Co., 2396 Third avenue, has had plans prepared for improvements and alterations in its one-story shop building at 251 East 133rd street, to facilitate operations. Estimated cost about $6000.

New York, N. Y.—Lion Electrical Appliance Co., Inc., has filed notice with the Secretary of State of an increase in its capital from $25,000 to $100,000, to provide for general business expansion.

New York, N. Y.—Electric Bond & Share Co., 71 Broadway, has recently broken ground for the construction of a one-story extension to its power oil plant at Third and Kelley streets, Wichita, Kans., about 48x100 ft., to provide for increased operations.

New York, N. Y.—Announcement has been made that negotiations have been completed by the New York Edison Co. for the acquirement of the East Broad-Top Railroad, together with the coal mines and lands formerly owned by the Rockhill Iron & Coal Co. The entire property, which was secured for a consideration of about $5,250,000, is located in Huntingdon and Bedford counties and was purchased in order that the lack of coal should not interfere with the operation of the various plants of the company.

New York, N. Y.—Contract has recently been awarded to the New York Edison Co. for electric service for the operation of the new studio and laboratory building of the Fox Film Corp., 10th avenue and 55th street. Included in the structure are 12 complete theaters with entire electrical accessories, a large room in which a hundred sets may be erected and twenty companies work at one time, restaurant, executive and business offices, gymnasium, fire department, etc., requiring four service lines from the street to carry current for light and power, comprising two lines of 5000 amperes capacity and one of 4000 amperes for lighting, the fourth being a power connection of 400 kw. The total requirements aggregate 2800 hp. available 24 hours daily.

Oswego, N. Y.— Peoples Gas & Electric Co. has filed notice with the Public Service Commission of an increase in its capitalization from $1,000,000 to $1,300,000, to provide for general business expansion.

Watertown, N. Y.—Northern New York Utilities Co., 56 Public Square, has awarded final contracts for the construction of the proposed power plant and dam, with canal development on the Black River, Watertown. The project is estimated to cost about $250,000. The Walsh Construction Co., Watertown, is the contractor for the erection of the power plant, while Burns Brothers & Haley, Bank building, will be in charge of dam and canal work.

Bordentown, N. J. — Fire recently destroyed the engine plant and a portion of the works of the Independent Brick Co. Plant No. 2, near Fieldsboro, with total loss estimated at about $10,000. It is understood that the company is considering plans for rebuilding.

Camden, N. J.—Fire recently destroyed considerable rolling stock and a portion of the terminal of the Public Service Railway Co., Newton avenue, near Haddon avenue, with total loss estimated in excess of $250,000.

Gloucester City, N. J.—City Council is arranging plans for the installation of a large quantity of new equipment at the municipal water works, to increase the present capacity, an appropriation of $45,000 recently having been approved, to cover the cost of the work. It is understood that a like sum will be expended at a later date on further improvements at the plant.

Harrison, N. J.—Driver-Harris Co., Middlesex street, manufacturer of electric wires, cables, etc., is having plans prepared for the construction of a new three-story reinforced concrete addition to its plant, about 50x100 ft. The structure is estimated to cost $50,000.

Irvington, N. J. — In connection with the construction of a new two-story plant at 167-77 Coit street, by the Yocum Chemical Co., plans have been arranged for the erection of a boiler plant for general factory operation.

Newark, N. J.—Luthy Storage Battery Co., 420 Ogden street, has filed notice with the Secretary of State of an increase in its capital from $700,000 to $750,000 to provide for proposed expansion. The company has had plans prepared for the erection of a new extension to its plant.

Newark, N. J.—Washington Electrical Supply Co., 219 Washington street, has filed notice of organization to deal in electrical supplies. C. Katz, 115 16th avenue, heads the company.

Newark, N. J.—United Electrical Specialty Co. has filed notice of organization to operate at 207 Market street for the production of electrical supplies. William J. Bowen, 2 Broad street, heads the company.

Newark, N. J.—Plans have been completed by Stengel & Rothschild, Main street, for alterations and improvements in the boiler plant at their works, to facilitate operations. Estimated cost, $12,000.

Trenton, N. J. — City Commission has approved plans for the installation of new pumping machinery and equipment at the city water works plant, estimated to cost about $150,000. E. E. Brownell, Philadelphia, Pa., is consulting engineer for the commission.

Trenton, N. J.—Trenton Electric & Conduit Co., Tyler street, is planning for the construction of a two-story addition to its plant to cost about $10,000.

Trenton, N. J.—City Commission

is considering plans for the installation of a new ornamental arc lighting system along Sanhican Creek, from Calhoun street to the Log Basin, being an extension to the local park electric lighting system. Commissioner George W. Page will be in charge of the work.

Aspinwall, Pa.—Mackintosh-Hemphill Co., Pittsburgh, Pa., manufacturer of electrical appliances, has recently completed negotiations for the purchase of property at Aspinwall comprising about 26 acres, as a site for the construction of a new plant.

Cheswick, Pa.—The contracts for the new power plant of the Duquesne Light Co. have been awarded to Dwight P. Robinson & Co. Address A. W. Thompson, president of the company.

Dinsmore, Pa. — Breensburgh & Connellsville Coal & Coke Co. is having plans prepared for the erection of a new one-story power plant and coal tipple at its properties, to cost about $100,000. Baton & Elliott, National Bank building, Pittsburgh, are mining engineers for the company.

Grove City, Pa.—City is having preliminary plans prepared for the construction of a new addition to the municipal electric light plant to provide for increased operations. The structure is estimated to cost about $50,000. Sidney B. Martin, Penn building, Pittsburgh, is engineer.

Harrisburg, Pa. — Bethlehem Steel Co. has ordered a 5000-hp. electric plant built for its blooming mills at the Steelton plant.

Harrisburg, Pa.—Notice has been filed with the Public Service Commission by the Penn Central Light & Power Co. and the Northern Cambria Light, Heat & Power Co. of the addition of a coal clause to the schedules of rates for service.

Hershey, Pa. — Announcement has been made by the Hershey Chocolate Co. that plans are being arranged for the complete electrification of the company's private railroad, in connection with other extensive improvements and additions, estimated to cost in excess of $5,000,000.

Lewiston, Pa.—Considerable electrical and mechanical equipment will be required by the City Council in connection with the construction of the proposed disposal plant to cost about $60,000.

Philadelphia, Pa.—Connery & Co., Inc., Second and Luzerne streets, manufacturer of boilers, etc., has arranged for the construction of a new one-story brick addition to its assembling shop, about 75x90 ft.

Philadelphia, Pa.—Board of Managers of the Lankenau Hospital, Corinthian and Girard avenues, has awarded a contract to the A. Raymond Raff Construction Co., 1635 West Thompson street, for the construction of a new one-story brick transformer building at the institution.

Pittsburgh, Pa.—Fire recently damaged the plant of the Miller-Owen Electric Co., Lexington avenue and Thomas boulevard, to the extent of approximately $50,000. A quantity of electrical machinery, including dynamos and motors, was destroyed by the fire.

DATES AHEAD.

Michigan Section, N. E. L. A. Annual convention, Ottawa Beach, Mich., Aug. 26-28. Headquarters, Hotel Ottawa. Secretary - treasurer, Herbert Silvester, Monroe, Mich.

Pennsylvania Electric Association. Annual convention, Bedford Springs, Pa., Sept. 3-6. Secretary, H. M. Stine, 211 Locust street, Harrisburg.

Washington State Association of Electrical Contractors and Dealers. Annual convention, Seattle, Sept. 11. Secretary, Forrest E. Smith, 205 Boston Block, Seattle.

Southeastern Section, N. E. L. A. Annual convention, Asheville, N. C., Sept. 17-19. Secretary-treasurer, T. W. Peters, Columbus, Ga.

New England Section, N. E. L. A. Annual convention, New London, Conn., Sept. 22-24. Headquarters, Hotel Griswold. Secretary, Miss O. A. Bursiel, Boston, Mass.

Association of Iron and Steel Electrical Engineers. Annual convention, St. Louis, Mo., Sept. 22-26. Secretary, John F. Kelly, Empire building, Pittsburgh, Pa.

American Electrochemical Society. Fall meeting, Chicago, Sept. 23-26. Headquarters, Congress Hotel. Secretary, Prof. Joseph W. Richards, Lehigh University, Bethlehem, Pa.

International Association of Municipal Electricians. Annual convention, Chicago, Sept. 23-26. Secretary, Clarence R. George, Houston, Tex.

National Association of Electrical Inspectors. Annual meeting, Springfield, Mass., Oct. 13 and 14. Secretary, W. L. Smith, Concord, Mass.

Illuminating Engineering Society. Annual convention, Chicago, Ill., Oct. 20-23. General secretary, Clarence L. Law, 29 West 39th street, New York City.

Pittsburgh, Pa.—Negotiations have been completed by the Westinghouse Home Co. for the acquirement from the Westinghouse Airbrake Co., nine tracts of land in Wilmerding, including a number of new brick dwellings, for a consideration of about $1,000,000. It is understood that the property will be utilized by the company for the construction of new dwellings for the service of employes connected with the Westinghouse interests.

Waynesboro, Pa.—City Council is considering plans for the construction of a new electric light plant for municipal service.

Baltimore, Md.—In connection with the proposed waterfront improvements planned by prominent local interests, estimated to cost in excess of $5,000,000, arrangements have been made for the construction of a new power plant to cost in the neighborhood of about $86,000.

Seat Pleasant, Md.—Plans are under consideration by the City Council for the construction of a new electric light plant for municipal service.

Warren, Md. — Warren Manufacturing Co. has had plans prepared for the installation of new power and boiler equipment to cost about $35,000 in connection with the proposed additions and improvements to its plant, estimated to cost about $250,000.

Wheeling, W. Va. — Gee Electric Co. is installing the electrical work for a big coal-stripping operation about to be started by the R. L. Culbertson Coal Co. near Cadiz, Ohio. The electrical work represents one of the largest electrical installation contracts of its kind in this section of the country. It includes motors aggregating 150 hp., electrically operated apparatus for cleaning coal and a complete lighting system for night operations.

Charleston, S. C.—Bureau of Yards and Docks, Navy Department, is considering plans for the installation of new mechanical stoker equipment and turbogenerator at the local Government station. The work is estimated to cost about $50,000.

Summerville, S. C. — Summerville Public Service Co., recently incorporated with a capital of $25,000, has acquired the local electric light and ice plant, and is understood to be considering improvements and alterations for increased service. M. Barshay is president.

Columbus, Ga. — Georgia-Alabama Power Co. is planning for the inauguration of activities on the proposed water power development near Albany, Ga., to include the construction of power plant, dam, and transmission system at Porter Shoals on the Flint river, near Albany. It is proposed to have a capacity of 15,000 hp. The project is estimated to cost in excess of $1,000,000. Baxter Shemwell, Lexington, N. C., is president of the company.

Locust Grove, Ga.—Plans are under consideration by A. R. Scott, McDonough, La., for the establishment of a local electric plant for supplying electric energy to Locust Grove and Stockbridge.

Springfield, Ga.—Citizens in mass meeting requested city officials to order election upon issuance of $10,000 of bonds for establishing light system. And building water works system.. Address mayor.

NORTH CENTRAL STATES.

Cleveland, Ohio. — Martin Bariss Co. will erect a $100,000 sawmill and power house. The specifications include electrical equipment. Architect George S. Reder, Century building, has prepared plans.

Anderson, Ind. — Anderson Foundry & Machine Co. has announced that it will enlarge its capacity with additional buildings and equipment to cost $100,000.

Connersville, Ind.—Teetor-Hartley Motor Corp., owned principally by Connersville capital, but located in Hagerstown, Ind., will soon begin the erection of a steel and concrete building, 100x1500 ft. The Ansted Engineering Co. will build a similar structure 100x400 ft. The Lexington Motor Co., to which the Ansted Engineering Co. is largely accessory, will build a new stockroom and expand its heating system.

Fort Wayne, Ind. — General Electric Co. has made two large purchases of ground within the last two weeks. One purchase was for $24,000 and the other was for $40,000. The sites acquired will be used for future extensions of the Fort Wayne plant.

Indianapolis, Ind. — Irvin Robbins

Co. will build a two-story brick and steel building, 60x400 ft., to cost $100,000.

Muncie, Ind.—Indiana General Service Co., according to a ruling of the Indiana Public Service Commission, must furnish electricity to the Muncie public library and other public buildings at a rate 25% lower than that charged consumers. The lower rate is provided for in the surrendered franchise of the company.

Chicago, Ill.—Wilson-Jones Loose Leaf Co. has purchased a site for erecting a modern factory estimated at $400,000. The specifications include a power house. Address general manager, 3021 Carroll avenue.

Deer Creek, Ill.—A company has been formed here to supply light and power to Deer Creek, Cruger and adjacent territory. J. A. Danforth is the president and F. L. Belsley, secretary-treasurer. Power will be furnished by the Peoria Light & Power Co., this company to put in a reducing station at Cruger at which point the new organization will attach on their lines. The new company has been capitalized at $25,000.

Dundee, Ill. — Packard Electric Co. will open one of its branch stores in Dundee, Sept. 1.

Elgin, Ill.—Plans and specifications for the new municipal light and power plant, for which a bond issue, is soon to be voted by the people, are being prepared in the Elgin city hall. The new plant will cost approximately $200,000.

Knoxville, Ill.—F. M. Willard and Leo Allen have formed the Knoxville Electric Co. to deal in general electrical merchandise and will make a specialty of overhauling motors and generators.

Monmouth, Ill.—Altenberg Tire & Equipment Co. will remove its factory frcm Davenport, Iowa, to this city. The company plans the erection of a four-story building to cost $100,000.

Ottawa, Ill. — Wilson & Co. have secured the contract for wiring the new high school at Marseilles for $496.

Peoria, Ill.—A new $500,000 factory will be erected by the Western Structural & Machine Works, recently incorporated.

Peru, Ill. — Peru Construction Co. has been awarded the contract to build an addition to the building now occupied by the Western Clock Co., the addition to have 33,000 ft. of floor space.

South Pekin, Ill. — The village board will advertise for bids for a lighting system, and will award a franchise to the most favorable bidder. Louis O. Dunkelberg, village attorney.

Vassar, Mich.—The council is planing ways and means to improve the light and water system. Address village clerk.

Montevideo, Minn. — The Sioux Falls-Pipestone electric transmission line has been practically completed as far as Dell Rapids and it is estimated that the line will be completed to serve Pipestone by the middle of October.

St. Paul, Minn.—Northern States Power Co. is now supplying the electrical energy requirements of the new St. Paul Athletic Club, amounting to about 287 hp. in motors.

Chetek, Wis.—Election will be held soon to submit to voters proposal to purchase distribution system of Chetek Light & Power Co.

Port Washington, Wis.—Plans are being made by Douglas Cahill, engineer, Gross building, Milwaukee, for an additional municipal power house. The plant will be 20x40 ft. and will cost about $30,000.

Waupaca, Wis. — Stock Co. will soon let contracts for a hydroelectric power plant. Address F. H. Josslyn, general manager, Algoma building, Oshkosh, Wis.

Hastings, Mich.—It is said that the General Motors Corp. has purchased the plant of the Hastings Consolidated Press & Tool Co. for $1,000,000 and that the capacity of the plant will be quadrupled to employ 1200 men.

Burlington, Iowa.—A special election will be held to vote on the question of issuing $30,000 bonds for municipal electric light plant. Address E. P. Weinstein, clerk.

Davenport, Iowa. — Tri-City Railway & Light Co. has been granted permission to install a transmission power plant from Brady street road at city limits, of Davenport to Five Mile house.

Monticello, Iowa. — Monticello Electric Co. is making improvements at its power plant which will cost $20,000. The new equipment will include two 112-kv-a. vertical type generators and also two vertical turbine water wheels. These two turbine water wheels will develop over 80% more power than that obtained from the wheels now in use.

St. Joseph, Mo.—St. Joseph Railway, Light, Heat & Power Co. will expend $1,000,000 in improvements and extensions. Address general manager.

Auburn, Neb.—Citizens have petitioned the city council asking for permission to hold a special bond election to extend the facilities of the municipal light plant so that it can enter into the business of furnishing commercial light and power.

Lincoln, Neb. — Plans now under consideration to install a power plant at the University of Nebraska Medical College to cost $60,000. Address Samuel Avery, president.

Minden, Neb.—$35,000 bonds have been voted to be used in the extension and improvement of the city light plant. Address city clerk.

Gregory, S. D.—At a special election $122,000 bonds for improvements to municipal electric light, waterworks, and sewer system bonds were carried.

SOUTH CENTRAL STATES.

Owensboro, Ky. — Kentucky Electric Lamp Co. has had plans prepared for the construction of a new three-story brick and concrete plant, about 60x100 ft., to provide for increased capacity. It is proposed to increase the output from about 3000 to 8850 lamps daily.

Birmingham, Ala. — Alabama Port Co., which has purchased property of Selma Lighting Co., will construct power lines between this city on the Coosa River, a distance of 57 miles.

Hobart, Okla.—$135,000 in bonds have been voted for an electric light plant. V. V. Long & Co., engineers, 1300 Colcord building, have prepared plans.

Perry, Okla.—City Council is considering plans for the issuance of bonds for $260,000, to cover the cost of improvements and extensions in the municipal electric light and water systems.

Tishomingo, Okla. — Engineers Johnson & Benham, Firestone building, Kansas City, will prepare plans for a light and water plant. F. L. Yarger, city clerk.

Dallas, Tex.—Dallas Hotel Co. will expend $20,000 enlarging the power plant of the Adolph Hotel. Address George W. Wells, supervising engineer, 4308 Washington boulevard, St. Louis, Mo.

WESTERN STATES.

Libby, Mont.—Tukens-Hazel Mining Co. is considering the construction of a power plant and 200-ton concentrator at its property 9 miles from here. Estimated cost, $200,000 and $240,000 concentrator.

Colorado Springs, Colo. — The Spruce street car line will be erected. The extension on the Spruce line calls for about 4 miles of trackage, to cost about $150,000. The whole proposition is only tentative at present and the outcome depends entirely upon the reports submitted by the engineers and surveyors. Should the line be extended on to the Stark-Corley lines, it would represent a large outlay of cash, as the road would have to cross several ravines, necessitating the building of a number of bridges. Address A. E. Carlton, president of the Pikes Peak Fuel Co.

Pueblo, Colo.—The city of LaJunta has decided to discontinue operation of its steam plant for pumping the city water supply and has contracted with the Arkansas Valley Railway, Light & Power Co. for electrical energy for this purpose.

Manti, Utah—City has authorized a bond issue of $20,000, the proceeds to be used to cover the cost of the construction of a new municipal electric light and power plant.

Kelso, Wash.—North Coast Power Co. has recently awarded a contract to N. A. Strand, Kelso, for the construction of a new brick substation near its office building. The company has also recently commenced the rebuilding of its power line from Kelso to Kalama, increasing the carrying capacity to 66,000 volts. The total cost of the work is estimated at about $40,000.

Seattle, Wash.—City Council has passed bill favoring extension and authorizing issuance and sale of

$1,350,000 light and power utility bonds to cover the cost of steam plant on Lake Union, adjoining present plant.

Tacoma, Wash. — City officials, in support of a proposed bond issue of $300,000 to purchase Lake Cushman power site on Skokomish river, state that the business of the municipal power plant has doubled in the last two years, and that the rate of increase is now about 33% annually. The Lake Cushman development, as outlined, will require an expenditure of about $6,500,000.

Tacoma, Wash. — Provided voters authorize bonds for the Lake Cushman power project, the city in constructing the 45-mile transmission line will erect a record breaking overhead span across the Narrows.

Bend, Ore.—T. H. Foley, manager of the local interests of the Bend Water, Light & Power Co., announces that the construction of a 1000-kw. steam plant to cost $100,000 will be started here within the next two weeks. It is expected the new plant which will double the power output of the power house here, will be completed by February, 1920. Plans for construction of a $125,000 plant on Tumble creek, work on which was to have started the latter part of the summer, will be halted until next summer.

Dallas, Ore. — Recent additions to the electrical energy load of the Dallas division of Mountain States Power Co. include an additional 25 hp. in motors for the Central Tile Co., and an addition at the gravel plant at Independence, making the Gravel plant's requirements 205 hp.

Klamath Falls, Ore.—California-Oregon Power Co., which has in progress the construction of a dam on Link river for water-power purposes, is defendant in a suit in the Federal court brought by the land owners who live near Upper Klamath lake. The plaintiffs seek to have the company enjoined from completing the dam, contending that the dam will raise the water in the lake to a height that will cause serious overflow of farm land. The company, however, claims it is only preparing to hold the water at flood level.

Portland, Ore.—The estimated expense of building an electric railroad from the St. Johns municipal terminal connecting with the Portland Railway Light & Power line and St. Johns is $30,000, according to figures compiled by Engineer Hegardt of public dock commission.

Roseburg, Ore.—William Polman, Baker, Ore., operating the local electric light and water plant, is arranging plans for extensive improvements to facilitate operations. It is also proposed to make improvements and alterations in the pumping and power plant on the North Umpqua river.

Avalon, Cal.—An election will soon be held to vote on an $88,000 bond issue for light and water plant construction.

Chico, Cal.—A surveying party will enter Chico canyon to make surveys of proposed site for a municipal power plant. Address F. S. Robinson, city engineer.

Fresno, Cal.—The Board of Supervisors of the county of Fresno of the Raisin City Lighting District of Fresno county invites and advertises for bids for furnishing, installing, maintaining and keeping in repair all necessary apparatus and caring for and maintaining the lights for Raisin City lighting district of Fresno county and for supplying district with electricity for operating and maintaining lights to be installed within district for a term of 5 years. Address D. M. Barnwell, clerk of board.

Los Angeles, Cal.—Contract has recently been awarded to H. H. Walker, Marsh-Strong building, for the installation of electric wiring, etc., in the new hotel building to be erected by the Wilshire Boulevard Hotel Co. on Wilshire boulevard, at cost of $27,612.

Los Angeles, Cal.—Pacific Electric Railway Co. has completed plans for the erection of a power plant at Los Angeles harbor. The structure is estimated to cost about $12,000.

Mayfield, Cal.—Town council is considering plans for the issuance of bonds for $20,000, to provide for the installation of a new electrical distributing system and $5000 for a new pump and motor equipment at the municipal water works.

Orange, Cal. — City trustees are having plans prepared for the installation of a new electric street-lighting system, ornamental type, on Glasswell street and Chapman avenue. About 157 standards will be required.

Oroville, Cal.—The Great Western Power Co. has awarded a contract to the Stone & Webster Co., Boston, for the construction of the proposed power plant at Caribou, near Belden.

Palo Alto, Cal.—City has authorized the issuance of bonds for $75,000, the proceeds to be used to cover the cost of the installation of a Diesel engine and generating unit at the municipal power plant. It is expected that the proposed work will be completed within 90 days.

Reedley, Cal.—Town Council recently awarded a contract to the Reedley Electrical Works for the installation of an electrolier system at $11,800.

San Diego, Cal.—San Diego Consolidated Gas & Electric Co. is making a short extension of its transmission line to furnish power to the city of San Diego for constructing a new $750,000 dam at Barrett, which will increase the city's water supply.

Whittier, Cal.—Southern California Edison Co. has had plans prepared for the construction of a one-story brick office and garage building, about 100x100 ft.

FOREIGN TRADE

[Addresses of firms referred to in these trade opportunities may be obtained by writing to the Bureau of Foreign and Domestic Commerce, Washington, D. C., or its branch and local co-operative offices. Request for each opportunity should be on a separate sheet and the file number given.]

Electrical Goods (29,796). — The agency and purchase of novelties, hardware, food products, oleomargarine, lard presses, electrical goods, general merchandise, canning machinery and machinery to make tin cans are desired by a firm in Australia. References.

Electrical Implements (30,190).—A business man in France wishes to secure the representation of exporters of agricultural implements, machines, automobiles, electrical implements, and, in general, all industrial material. Correspondence should be in French.

Pumps (30,192).—The purchase of pumps of all sorts and pump machinery, such as a full line of turbine, centrifugal, and steam pumps, is desired by a firm in Spain. Quotations should be given c. i. f. Spanish city. Correspondence may be in English. References.

Electrical Goods (30,175).—A firm in Brazil desires to secure the representation of American steamship companies, and agencies for the sale of sugar mill machinery and supplies, glassware, paper, arms and ammunition, furniture, hardware, cement, line, drugs, electrical goods, paints, dyes, automobile tires, motorcycles and automobiles. Correspondence may be in English. Reference.

PROPOSALS

Cranes, Motors, Etc.—Bids will be received until 10:30 a. m., Sept. 2, by A. L. Flint, general purchasing agent, Panama Canal, Washington, D. C., for cargo handling cranes, air compressors, electric motor and spare parts, starting panels, motor-driven triplex pump, Hamilton-Corliss engine, fiber conduit bends, etc.

Motors—Bids will be received Sept. 3, at Room 406 City Hall, Chicago, for constructing and delivering f. o. b., two wound rotor induction motors with necessary starting apparatus, and other electrical equipment for the Chicago avenue pumping station, according to specifications on file in the office of Room 406, City Hall. Address Charles R. Francis, commissioner of public works.

Switchboards and Generator Equipment.—Until Sept. 4, bids will be received by J. H. McAlpin, mayor of Hollandale, Miss., for the installation of new switchboard and generator equipment at the municipal electric light plant, and for the furnishing of new street-lighting fixtures. Xavier A. Kramer, Magnolia, Miss., is consulting engineer.

Electrical Material.—The Bureau of Supplies and Accounts, Navy Department, Washington, D. C., will receive bids for 79 branch, composition boxes; 10,000 incandescent socket bushings; a miscellaneous quantity of midget push buttons; 50 lb. pressed plate, flexible, Grade A mica; 400 hard rubber, telephone transmitter mouthpieces, and 50 non-water-tight telephone plugs to be delivered at South Brooklyn, N. Y. (Schedule 4241), and 3000 mogul lamp sockets, for delivery at Portsmouth, N. H. (Schedule 4269).

Motor-Driven Pump.—The town of Leland, Miss., will receive until Sept. 2 bids for the boring of a 10-in. well, to be about 500 ft. deep with top, to be 16-in., to depth of about 100 ft. Well to be equipped with electric motor-driven pump and necessary machinery to deliver 600 gal. of water per minute. All bids must be accompanied by New York Exchange or cashiers' check for $500, and be in the hands of J. H. O'Quinn, town clerk, on or before 6 p. m., Sept. 2.

NEW PUBLICATIONS

"New Forms of Instruments for Showing the Presence and Amount of Combustible Gas in the Air" is the title of Scientific Paper 334, published by the Bureau of Standards, Department of Commerce. This paper contains a description of experimental work upon the combustion of gas at the surface of an electrically heated wire and the application of this phenomenon to the design of instruments for detecting the presence or indicating the amount of combustible gas in the air. The copy is now ready for distribution and those interested may obtain a copy by addressing a request to the Bureau of Standards, Department of Commerce, Washington, D. C.

INCORPORATIONS

New York, N. Y.—Monroe Electric Supply Co., Inc. Capital, $10,000. To manufacture electrical supplies. S. and J. Weiner, and J. A. Herman, 996 Home street, are the incorporators.

Buffalo, N. Y. — Mighty Manufacturing Co., Inc. Capital, $50,000. To manufacture electrical and mechanical devices. Incorporators: George N. Chaltas, E. Pappas, and E. L. Crabb, Buffalo.

Newark, N. J.—Amann & Finn. Inc. Capital, $50,000. To manufacture motors, etc. C. and E. F. Amann, Irvington, and D. J. Finn, New York, are the incorporators.

Harrison, N. J.—Gilby Wire & Dye Co. Capital, $125,000. To manufacture electrical wires, etc. Incorporators: Walter and Stanley Gilby, and T. W. Pell, Harrison.

New York, N. Y.—Humil Corp. Capital, $300,000. To manufacture electrical apparatus, etc. Incorporators: J. Van Harder, H. H. Thurlow, and F. D. Hagan, 55 Liberty street.

Hartford, Conn.—Perry Electric Co. Capital, $20,000. To operate a general electrical engineering and contracting establishment. Incorporators: E. C., G. W., and S. J. Perry, Hartford.

Philadelphia, Pa.—American Electric Storage Battery Co. Incorporated under Delaware laws with a capital of $1,000,000. To manufacture electric storage batteries. E. M. MacFarland, F. R. Hansell, Philadelphia; and J. V. Pimm, Camden, N. J., are the incorporators.

Burnsville, N. C.—Burnsville Electric Co. Capital, $15,000. To operate a local electric light and power plant. William C. Skaggs is the principal incorporator.

Greenville, S. C. — Piedmont Electric Co. Capital, $10,000. To manufacture electrical goods. R. E. Starnes is the principal incorporator.

Elkhart, Ind.—Mann Electric Co. has been incorporated with capital of $10,000, to engage in a general electrical contracting business. The incorporators are Vernon V. Mann, Fred Lemon and S. W. Long.

Walla Walla, Wash.—Lewiston and Walla Walla men have incorporated the Electric Equipment Co. The company will do a general business in electric light equipment. The incorporators are J. G. Harlan, C. O. Hawkinson and others.

West Point, N. D.—Bentinck Telephone Co. has incorporated with a capital of $1500. Address John Kuich.

Sioux Falls, S. D.—Electrical Brokerage Co. has incorporated with a capital of $100,000. It will manufacture, buy and sell and generally deal in electrical machinery and equipment and install electric light plants. The incorporators are W. L. Patterson, O. Shakstad, and E. S. Requa, of Sioux Falls.

Ivor, Va.—Ivor Light & Power Co. has incorporated with a capital of $5000. T. A. Saunders is president; L. C. Pulley, secretary and treasurer; H. M. Rawls, engineer.

Coon Valley, Wis.—Coon Valley Electric Co. has incorporated with a capital of $10,000. Incorporators are Anton Clum, Lizzie Bekkum and others.

Greenville, Ala.—Electric & Manufacturing Co. has incorporated with a capital of $50,000, to manufacture electrical specialties, etc. R. A. Beeland is the principal incorporator.

Dover, Del.—S. N. Blake & Co., Inc., has incorporated with a capital stock of $100,000, to operate various public utility companies, etc. Incorporators: Frank Jackson, W. I. N. Lofland, and C. L. Harmonson.

Dover, Del.—Dannenhauer, Inc., with a capital of $100,000, to manufacture electrical appliances, etc. Incorporators: W. A. Dannenhauer, G. H. Speakman, Wilmington; and J. J. Justice, Newport, Del.

Belleview, Fla.—Belleview Utilities Co. has incorporated with a capital of $25,000. Water works extension will be made, including galvanized iron pipes, wood frames, to cost $2500, to supply 23 families; electric double acting pump, 5000-gal. pressure system will be installed. Address Edw. S. Stench, secretary.

Champaign, Ill.—The Champaign Hotel Co. has been incorporated with a capital of $250,000 to erect reinforced concrete and steel hotel, to contain 156 rooms, specifications include special lighting plant.

Port Byron, Ill.—The Coe Light & Power Co. was incorporated with a capital of $10,000. It will furnish electric light and power in this village. Incorporators; S. L. Woodburn, Wm. Saddoris, and others.

Charlottesville, Ind.—Charlottesville Electric Light, Heat & Power Co. has been incorporated with capital of $5000. Address W. S. Lane, Charlottesville, Ind.

Berwick, Kan.—The Berwick Transmission Line Co. has been chartered with $25,000 capital by Nathias Strahm, E. T. Ukele and Norman Fike.

New York, N. Y.—Liberty Appliance Corp. has incorporated with a capital of $15,000, to manufacture electric and gas fixtures, etc. Incorporators: L. M. Rosenthal, J. Hohenstein, and Edward Meyer, St. Louis, Mo.

Mount Jewett, Pa.—Mount Jewett Electric Co. has incorporated with a capital of $25,000, to operate a local electric plant. W. H. Brown, Ridgway, is the principal incorporator.

Mount Pocono, Pa.—Mount Pocono Electric & Improvement Co. has incorporated with a capital of $20,000, to operate a local electric light and power system. W. J. Schaffer is the principal incorporator.

Portsmouth, Va.—Miller Bros. Electrical Co. has incorporated with E. R. Bardsdale president, and H. G. Walker, secretary.

Charlestown, W. Va.—Charlestown Heat & Light Co. has incorporated with a capital of $50,000. Incorporators: Jay Gates and others.

Syracuse, N. Y.—Hughes Electrical Construction Co. Capital, $25,000. To engage in electrical contracting. Incorporators: L. V., F. D., and J. J. Hughes.

New York, N. Y.—International Incandescent Lamp Works. Capital, $25,000. To manufacture electric lamps. Incorporators: I. Goldberg, C. Schickerling and C. F. Lyngass, Great Kills, S. I.

Somerville, Mass.—American Electric Co. Capital, $25,000. To manufacture electrical equipment. Incorporators: Joseph V. Pierce, Jay T. Cook and Almon W. Preble.

Chicago, Ill.—Wheeler Battery Co. Incorporated in Delaware with capital of $2,000,000. To engage in manufacturing, electrical engineering and contracting. Incorporators: Samuel C. Wood and Arthur M. Brody, Chicago.

Mount Oliver, Pa.—Walsh Storage Battery Co. has incorporated with a capital of $5000 to manufacture storage batteries. Morris Walsh, Knoxville, is the principal incorporator.

Summerville, S. C.—Summerville Public Service Co. has incorporated with a capital of $25,000. J. A. Guerin is one of the principal incorporators.

Hayesville, Ga. — Public Service Co. has incorporated with a capital of $125,000. Incorporators: G. H. Hairler and others.

Personals

Richard L. Wildauer Appointed Central District Manager Arrow Electric—J. A. Massie Retires—Other Changes

P. A. ERLACH has been named secretary of the Central Illinois Public Service Co., with headquarters at Springfield, Ill. Mr. Erlach has been serving as auditor for several years.

J. D. WHITTEMORE, general manager of the West Virginia Traction & Electric Co., Wheeling, W. Va., has recently been appointed receiver for the company by Judge Dayton, of the United States District Court.

GUY S. HAMILTON, advertising manager of the American Steam Conveyor Corporation, Chicago, has been appointed editor of the *Booster*, the corporation's newly established sales organ.

H. S. VALENTINE, for more than five years connected with the Link-Belt Co., has accepted the appointment of sales engineer in charge of Philadelphia territory for the American Steam Conveyor Corp.

R. A. CREWS, of Charleston, Ill., has been named auditor of the Central Illinois Public Service Co., with headquarters at Mattoon, Ill. He will succeed P. A. Erlach, who has been named secretary.

THOMAS O. MORGAN, until recently head of the service department of the New York office of the American Steam Conveyor Corp., has been promoted to the position of sales engineer and will handle Long Island and Connecticut territory.

H. R. WICKERSHAM, Allentown, Pa., manager of the local branch of the electrical contracting firm of the Macan Jr. Co., recently tendered an interesting address on the development of the uses of electricity at the meeting of the Kiwanis Club at the Hotel Allen.

WILLIAM S. MURRAY, for many years chief electrical engineer of the New York, New Haven & Hartford Railroad and recently president of the Hoosatonic Power Co., which supplies power to some of the lines of the Connecticut company, has opened an office as consulting engineer in New York.

A. S. WITMER, formerly of the commercial department of the Louisville Gas & Electric Co., has been selected to head the million dollar Industrial Foundation. The Foundation under the leadership of Tampton Aubuchon has secured the location of 25 new factories in Louisville during the past two years.

W. P. NASER, manager of the Trumbull Electric Manufacturing Co., Chicago, has tendered his resignation to take effect in October, 1919. He has been connected with the Trumbull company for nearly seven years. He opened a branch for the company in San Francisco during the World's Fair and was later promoted to the larger Chicago branch. "Bill" Naser is well known in the Middle West, the South and on the Coast.

B. C. Condit, who served several years as construction engineer for the Northwestern Electric Co., Portland, Oregon, within which period the company's steam-electric plants were built, now occupies the position of consulting engineer for the same concern.

RICHARD L. WILDAUER, formerly assistant sales manager, Arrow Electric Co., Chicago, has been appointed manager of the central district for the Arrow company, succeeding E. M. Scribner. Mr. Wildauer has a wide acquaintance in the electrical field, especially in the Middle West, and his many friends unite in expressing gratification over his well deserved promotion. He has been connected with the Arrow Electric Co. in the Chicago territory for the past 10 years and previous to that was with the American Circular Loom Co., Chicago, for two years.

Richard L. Wildauer.

J. A. MASSIE, for several years sales manager for the Hoyt Electrical Instrument Works, Penacook, N. H., has retired from active service with the company and will take a long and well earned rest. He will, however, continue to be identified with the organization through his interest in the Burton-Rogers Co., which has been made the sales department of the Hoyt Electrical Instrument Works, M. T. Rogers taking over Mr. Massie's duties.

CHARLES S. RUFFNER, vice-president and general manager of the Union Electric Light & Power Co., St. Louis, has been elected a director and vice-president of the North American Co., New York, the controlling company of the St. Louis utility. Mr. Ruffner relinquished the local management of the St. Louis subsidiary when accepting the appointment with the parent company. He retains the offices, however, of vice-president of the Union Electric Light & Power Co. and the St. Louis County Gas Co. and president of the American Light & Power Co., St. Charles, Mo., the Commercial Telephone Co. and the Arrow Engineering Co., all of which are subsidiaries of the North American Co. Mr. Ruffner was born in Chicago in 1880 and was graduated from the University of Missouri in 1900 with the degree of Bachelor of Science in electrical engineering. He entered the engineering profession with the Telluride Power Co. and Central Colorado Power Co. doing large power transmission work, and since 1911 has been an officer of subsidiaries of the North American Co. He is a manager and fellow of the American Institute of Electrical Engineers and a member of the American Electrochemical Society. He was also appointed associate member of the Naval Consulting Board in 1916.

FREDERICK S. DELLENBAUGH, Columbia University, 1910, ARTHUR L. NELSON, Massachusetts Institute of Technology, 1915, and F. B. PHILBRICK, Massachusetts Institute of Technology, 1918, have been appointed instructors in electrical engineering at the Massachusetts Institute of Technology. Mr. Dellenbaugh was a captain of the Signal Corps in overseas service during the war. He was graduated from the electrical engineering course at Columbia, and has been in the employ of the Crocker-Wheeler Manufacturing Co. and the Westinghouse Electric & Manufacturing Co. in the departments of design and commercial engineering. His particular duties in his new appointment will be in the teaching of dynamo design and the mechanical applications of electric power. Mr. Dellenbaugh will also give a portion of his time to research along lines relating to electrical machinery. Mr. Nelson was graduated from the electrical engineering course of the Massachusetts Institute of Technology. During the war he was a lieutenant in the Engineer Corps of the Navy with important work relating to construction of power plants and supply of power at the submarine base. After graduating he had experience with the C. H. Tenney Co. in construction and operation of electric plants. Mr. Nelson's work will be instruction relating to central stations and distribution systems. He will also carry on some work as a consulting engineer. Mr. Philbrick since graduating has been in the employ of the General Electric Co. His work at the Institute will be instruction in electrical measurements under the direction of Professor Laws and carrying on researches relating to electric circuits which Professor Laws has on hand.

Electrical Review

Vol. 75. No. 9. CHICAGO, AUGUST 30, 1919 Three Dollars a Year

Electrical Review
WITH WHICH IS CONSOLIDATED WESTERN ELECTRICIAN AND ELECTROCRAFT.

VOL. 75—No. 9. CHICAGO, SATURDAY, AUGUST 30, 1919. PAGE 341.

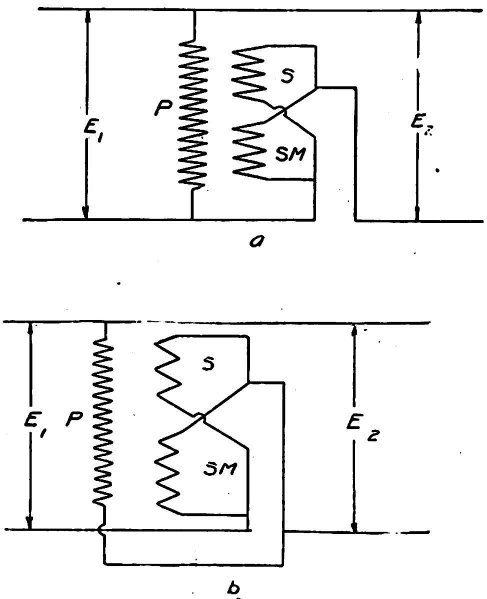


Fig. 1.—Single-Phase Boosting Transformer with Secondary Coils in Parallel.

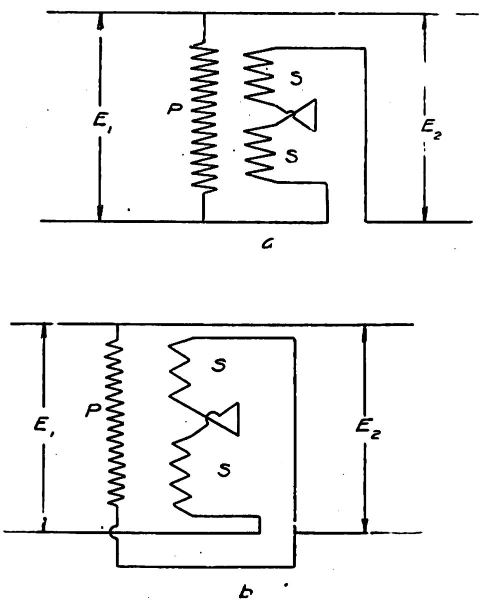


Fig. 2.—Single-Phase Booster with Secondary Coils Connected in Series.

Principles of Booster Transformers

The Elements of Boosting and Choking by Transformers—Formulas for Finding the Percentage of Boosting and Choking of Single-Phase and Polyphase Transformers Under Different Conditions

By C. M. JANSKY

Associate Professor of Electrical Engineering, University of Wisconsin, Madison, Wis.

IT IS quite common practice to use transformers for temporarily boosting the voltage to compensate for line drop. Tables have been prepared showing the percentage of boosting obtained by using transformers of different ratios and different connections. The writer, however, has been able to find in print very little of the fundamental principles of calculating the boosting effect under different conditions. This may be due to the fact that the principles are quite simple, and hence explanations may seem unnecessary. Nevertheless, they are often misunderstood and, as some of the tables are inaccurate, an analysis of the principles may be appropriate.

The time-phase difference between the primary and secondary voltages of a transformer is one-half a period. If we represent the two voltages by vectors on a clock diagram they are 180° apart. It is thus evident that when the primary and secondary windings of a transformer are connected in series, their electromotive forces will be either added together or subtracted one from the other, depending upon the connections employed. This is the fundamental principle of the booster and choke transformer.

The percentage of boosting or choking will be determined by the manner in which the coils are interconnected, and will also depend upon the interconnection of the circuits.

The simpler connections of single-phase transformers for boosting the voltage are shown in Figs. 1 and 2. In Fig. 1a the secondaries are connected in parallel and one end of the primary winding is connected directly to the secondary and the other end of the secondary winding is then connected to the line. The voltage across the line on the secondary side is the algebraic sum of the primary and secondary voltages. This is known as straight or simple boosting. The connections shown in Fig. 1b differ from those in 1a in that the primary is connected to the far side and the booster itself is subjected to the boosted voltage. Fig. 2 shows similar connections for the secondary coils in series.

Percentage of Boosting.—The percentage of boosting may be calculated as follows:

Let R = ratio of transformation,
E_1 = primary voltage,
E_2 = secondary or load voltage.

The percentage of boosting will depend upon the connections employed, hence two cases must be considered. When the connections of Fig. 1 (a) are used, the secondary voltage is evidently given by

$$E_2 = E_1 + \frac{E_1}{R} = E_1 \frac{R+1}{R} \quad \ldots\ldots (1)$$

and percentage boosting $= \frac{E_2 - E_1}{E_1} \times 100 = \frac{100}{R} \ldots (2)$

When the connections shown in Fig. 1 (b) are employed the secondary pressure is given by

$$E_2 = E_1 + \frac{E_2}{R}$$

or $E_2 = \frac{E_1 R}{R-1}$ ....(3)

The percentage of boosting $= \frac{E_2 - E_1}{E_1} \times 100 = \frac{100}{R-1}$ (4)

Example.—A transformer whose ratio is 10 to 1 is used as an augmented booster. If the primary voltage is 2200, what is the load voltage, and what is the percentage of boosting?

Since $E_2 = \frac{E_1 R}{R-1}$

we have $E_2 = \frac{2200 \times 10}{9} = 2444$ volts.

Percentage boosting $= \frac{100}{9} = 11.1\%$.

The percentage of boosting by a simple booster would be 10%.

Booster Transformer on Polyphase Circuits.

The effect of boosting transformers on polyphase systems will be modified by the connections employed.

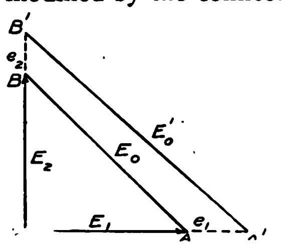


Fig. 3.—Three-Wire, Two-Phase Booster Diagram.

Since a four-wire two-phase system is the same as two single-phase systems, the process of calculating the boosting effect on such a system is exactly like that on single-phase circuits.

When three-wire two-phase systems are used the boosters are inserted into the outside wires. The percentage of boosting between either outside wire and

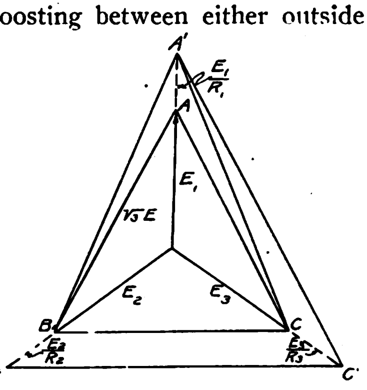


Fig. 4.—Y-Connected Three-Phase Network with One Phase Boosted.

the neutral is the same as for single-phase circuits. The increase in the voltage between the outside wires will be the same percentage as the phase voltages when these are boosted the same percentage. If, however, the phase voltages are raised by different amounts, then the voltage between the outside wires will also be increased by a different percentage. In Fig. 3, let $OA = E_1$ and $OB = E_2$ be the phase voltages, and let E_1 be boosted by E_1/R_1 and E_2 by E_2/R_2. Since $E_1 = E_2$

$$A'B' \text{ or } E_0' = \sqrt{\left(E_1 + \frac{E_1}{R_1}\right)^2 + \left(E_1 + \frac{E_1}{R_2}\right)^2}$$

$$= E_1 \sqrt{2 + \frac{2}{R_1} + \frac{2}{R_2} + \frac{1}{R_1^2} + \frac{1}{R_2^2}} \quad \ldots\ldots (5)$$

And percentage of boosting

$$= \frac{100}{\sqrt{2}} \left\{ \sqrt{2 + \frac{2}{R_1} + \frac{2}{R_2} + \frac{1}{R_1^2} + \frac{1}{R_2^2}} - \sqrt{2} \right\} \ldots (6)$$

When $R_1 = R_2$, this reduces to $\frac{100}{R}\%$. When $R_1 = \infty$, or when only one phase is boosted, then the percentage of boosting becomes

$$\frac{100}{\sqrt{2}} \left\{ \frac{1}{R} \sqrt{2R^2 + 2R + 1} - \sqrt{2} \right\} \ldots\ldots (7)$$

By substituting $R-1$ for R, the above formulas will give the percentage boosting when the augmented booster connections are used.

The calculation of the boosting effect in a three-phase system is not so simple as in the single-phase system and it also depends upon the type of circuits employed. In a Y-connected four-wire system, each phase voltage may be boosted separately by connecting a booster into the phase wire. In this case the percentage boosting is calculated in exactly the same way as for single phase.

The effect of the booster on the voltage between phase wires may be calculated by the aid of Fig. 4, where E_1, E_2 and E_3 represent the voltages between phase wires and neutral, and AB, BC and CA represent the phase voltages, respectively. When E_1 is boosted the voltages between A and B, C and A, are both increased the same percentage, while that between B and C is unaffected. Now

$$(A'B)^2 = E_2^2 + \left(E_1 + \frac{E_1}{R_1}\right)^2 - 2E_2\left(E_1 + \frac{E_1}{R_1}\right) \cos 120^\circ$$

$$= E_2^2 + E_1^2 + \frac{2E_1^2}{R_1} + \frac{E_1^2}{R_1^2} + E_2E_1 + \frac{E_1E_2}{R_1}$$

$$= E_1^2 + E_1^2 + \frac{2E_1^2}{R_1} + \frac{E_1^2}{R_1^2} + E_1^2 + \frac{E_1^2}{R_1}$$

$$= 3E^2 + \frac{3E_1^2}{R_1} + \frac{E_1^2}{R_1^2}$$

$$= 3E_1^2 \left(1 + \frac{1}{R_1} + \frac{1}{3R_1^2}\right)$$

Therefore $A'B = \sqrt{3}\, E_1 \sqrt{1 + \frac{1}{R_1} + \frac{1}{3R_1^2}}$

and the percentage boost

$$= \left(\frac{1}{\sqrt{3}R} \sqrt{3R^2 + 3R + 1} - 1\right) 100 \text{ per cent.} \ldots (8)$$

If E_3 is boosted the same per cent as E_1, it is evident that the voltage between C and A is boosted the same per cent. The percentage boost for BC is given by (8).

The boosting of the voltage of one phase of a three-wire three-phase system affects the voltage in two phases, but to a different extent; and when the voltage of two phases is boosted, all three are boosted, but no two alike. The connections for a simple three-wire three-phase booster are shown in Fig. 5. The relations between the line voltages on the generator side are represented by the equilateral triangle, Fig. 6, where E_1, E_2 and E_3 represent the voltages between lines AB, BC and CA, respectively. Suppose that the ratios of transformers 1, 2 and 3 are R_1, R_2 and R_3, respectively; then each phase voltage will be boosted a different amount and the resulting load voltages will be represented by the triangle $A^1B^1C^1$, Fig. 6.

Let $e_1 = \frac{E_1}{R_1}$

$e_2 = \frac{E_2}{R_2}$

and $e_3 = \frac{E_3}{R_3}$

Then
$$(E_1^1)^2 = (E_1 + e_1)^2 + e_2^2 - 2e_2(E_1 + e_1)\cos 120^\circ = (E_1 + e_1)^2 + e_2^2 + e_2(E_1 + e_1)$$

Likewise $(E_2^1)^2 = (E_2 + e_2)^2 + e_3^2 + e_3(E_2 + e_2)$

and $(E_3^1)^2 = (E_3 + e_3)^2 + e_1^2 + e_1(E_3 + e_3)$

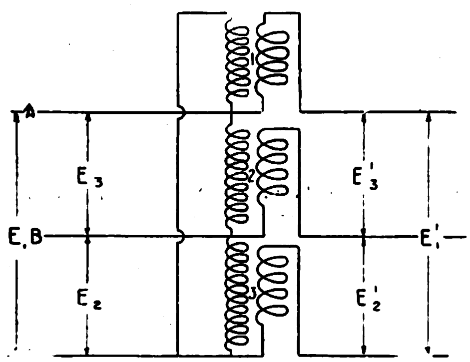


Fig. 5.—Connections of a Simple Delta-Connected Three-Phase Booster.

Since $E_1 = E_2 = E_3$, the subscripts may be dropped and upon substituting E/R_1 for e_1, E/R_2 for e_2, and E/R_3 for e_3, and reducing we get

$$E_1' = E\sqrt{1 + \frac{2}{R_1} + \frac{1}{R_2} + \frac{1}{R_1R_2} + \frac{1}{R_1^2} + \frac{1}{R_2^2}} \quad \ldots\ldots (9)$$

The percentage of boosting becomes

$$100\left\{\sqrt{1 + \frac{2}{R_1} + \frac{1}{R_2} + \frac{1}{R_1R_2} + \frac{1}{R_1^2} + \frac{1}{R_2}} - 1\right\} \quad \ldots\ldots (10)$$

In the same way,

$$E_2' = E\sqrt{1 + \frac{2}{R_2} + \frac{1}{R_3} + \frac{1}{R_2R_3} + \frac{1}{R_2^2} + \frac{1}{R_3^2}} \quad \ldots\ldots (11)$$

and
$$E_3' = E\sqrt{1 + \frac{2}{R_3} + \frac{1}{R_1} + \frac{1}{R_1R_3} + \frac{1}{R_1^2} + \frac{1}{R_3^2}} \quad \ldots\ldots (12)$$

The percentage of boosting may be calculated by formulas similar to formula (10).

In many cases these formulas can be simplified, as when R_2 and $R_3 = \infty$, from (9) we have

$$E_1' = E\sqrt{1 + \frac{2}{R_1} + \frac{1}{R_1^2}} = E\sqrt{\frac{R_1^2 + 2R_1 + 1}{R_1^2}} = \frac{E(R_1 + 1)}{R_1} \quad \ldots\ldots (13)$$

and percentage of boosting

$$= \frac{100}{R_1} \text{ as for single phase} \quad \ldots\ldots (14)$$

In the same case (when R_2 and $R_3 = \infty$) substituting in (11) we find $E_2^1 = E$ and percentage of boosting is zero; in the same case, substituting in (12) we find

$$E_3' = E\sqrt{1 + \frac{1}{R_1} + \frac{1}{R_1^2}} = \frac{E}{R_1}\sqrt{R_1^2 + R_1 + 1} \quad \ldots\ldots (15)$$

and percentage of boosting is

$$100\left\{\frac{\sqrt{R^2 + R + 1}}{R} - 1\right\} \quad \ldots\ldots (16)$$

When $R_1 = R_2$ and $R_3 = \infty$, then from (9) we find

$$E_1' = E\sqrt{1 + \frac{3}{R_1} + \frac{3}{R_1^2}} = \frac{E}{R}\sqrt{R^2 + 3R + 3} \quad \ldots\ldots (17)$$

and percentage of boosting is

$$100\left\{\sqrt{1 + \frac{3}{R_1} + \frac{3}{R_1^2}} - 1\right\} \quad \ldots\ldots (18)$$

also from (11)
$$E_2' = E\sqrt{1 + \frac{2}{R_2} + \frac{1}{R_2^2}} = E\sqrt{\frac{R_2^2 + 2R_2 + 1}{R_2^2}} = \frac{E(R + 1)}{R}$$

and percentage of boosting is $\frac{100}{R}$.

also from (12)
$$E_3' = E\sqrt{1 + \frac{1}{R_1} + \frac{1}{R_1^2}} = \frac{E}{R_1}\sqrt{R_1^2 + R_1 + 1}$$

and percentage of boosting is

$$100\left\{\frac{1}{R}\sqrt{R_2^2 + R + 1} - 1\right\} \quad \ldots\ldots (20)$$

When $R_1 = R_2 = R_3$, it is evident that $E_1^1 = E_2^1 = E_3^1$ and that the percentage of boosting is the same for each phase and is given by formula (18) above.

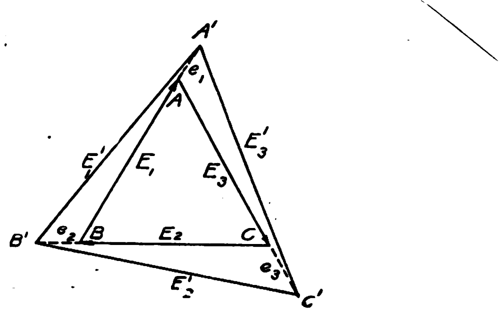


Fig. 6.—General Case of a Delta Three-Phase Booster with Unequal Boosting of Each Phase.

The same formulas may be used for calculating the boosting effect when augmented booster connections are used. It is only necessary to change R to $(R - 1)$.

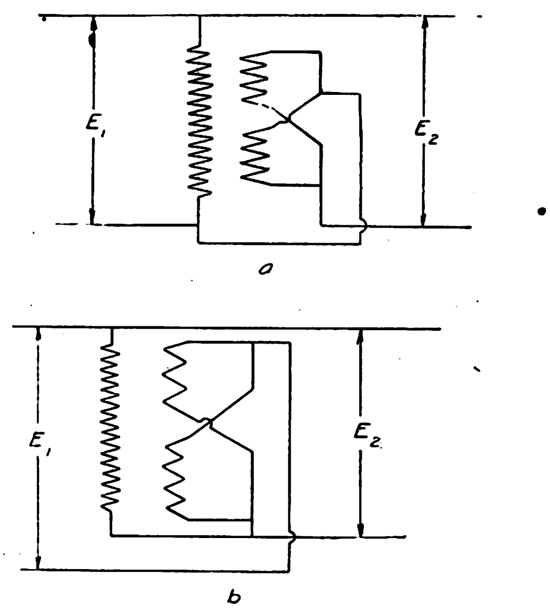
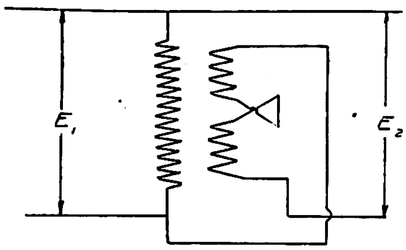


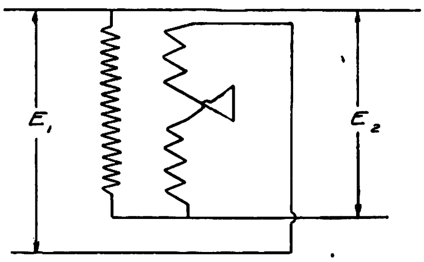
Fig. 7.—Single-Phase Choking Transformer with Secondary Coils in Parallel.

CHOKING CONNECTIONS.

If the secondary winding is connected so that its voltage opposes the primary voltage, the line voltage will be reduced. A transformer so connected is known



a



b

Fig. 8.—Single-Phase Choking Set with Secondary Coils in Series.

as a choking transformer. The connections for choking that correspond to the boosting connections, Figs. 1 and 2, are shown in Figs. 7 and 8.

The methods of calculating the choking effect are the same as for boosting. When the connections are as shown in Fig. 7 (a) the load voltage $E_2 = E_1 - \frac{E_1}{R}$

$$= \frac{E_1 (R-1)}{R}$$

$$\text{Percentage choking} = 100 \left\{ \frac{E_1 - \frac{E_1 (R-1)}{R}}{E_1} \right\} = \frac{100}{R} \ldots\ldots (21)$$

When the connections are as shown in Fig. 7 (b) the load voltage is $E_2 = E_1 - \frac{E_2}{R}$

$$= \frac{E_1 R}{R+1}$$

$$\text{Percentage of choking} = \frac{100}{R+1} \ldots\ldots\ldots\ldots\ldots (22)$$

A brief analysis will show that the formulas for the effect of boosting in polyphase systems may be used for calculating the diminishing effect, provided the terms containing the first powers of R have their signs changed. Thus the choking formulas for a three-wire two-phase system become

$$E_0' = E_1 \sqrt{2 - \frac{2}{R_1} - \frac{2}{R_2} + \frac{1}{R_1^2} + \frac{1}{R_2^2}} \ldots\ldots\ldots\ldots (23)$$

and percentage choking

$$= \frac{100}{\sqrt{2}} \left\{ \sqrt{2 - \frac{2}{R_1} - \frac{2}{R_2} + \frac{1}{R_1^2} + \frac{1}{R_2^2}} - \sqrt{2} \right\} \ldots\ldots (24)$$

Formulas (23) and (24) correspond to (5) and (6) for boosting.

When $R_1 = R_2 = R$, (24) reduces to $-\frac{100}{R}$%.

When one phase alone is choked, that is, either R_1 or $R_2 = \infty$, (24) becomes

$$\frac{100}{\sqrt{2}} \left\{ \frac{1}{R} \sqrt{2R^2 - 2R + 1} - \sqrt{2} \right\} \ldots\ldots\ldots\ldots\ldots\ldots (25)$$

In the same way, the formulas (9), (11) and (12) for boosting on three-wire three-phase circuits upon changing signs become

$$E_1' = E \sqrt{1 - \frac{2}{R_1} - \frac{1}{R_2} + \frac{1}{R_1 R_2} + \frac{1}{R_1^2} + \frac{1}{R_2^2}} \ldots\ldots (26)$$

$$E_2' = E \sqrt{1 - \frac{2}{R_2} - \frac{1}{R_3} + \frac{1}{R_2 R_3} + \frac{1}{R_2^2} + \frac{1}{R_3^2}} \ldots\ldots (27)$$

$$E_3' = E \sqrt{1 - \frac{2}{R_3} - \frac{1}{R_1} + \frac{1}{R_1 R_3} + \frac{1}{R_1^2} + \frac{1}{R_3^2}} \ldots\ldots (28)$$

and percentage choking for (26) becomes

$$= \left\{ 1 - \sqrt{1 - \frac{2}{R_1} - \frac{1}{R_2} + \frac{1}{R_1 R_2} + \frac{1}{R_1^2} + \frac{1}{R_2^2}} \right\} 100$$

When $R_1 = R_2 = R_3 = R$, the percentage choking is the same for each phase and is given by

$$\left\{ 1 - \frac{1}{R} \sqrt{R^2 - 3R + 3} \right\} 100$$

NATIONAL CONFERENCE ON INDUSTRIAL CONDITIONS.

The vital problems of business, multiplied by post-war and industrial developments, will be discussed at a national conference to be held in Chicago on Sept. 8 and 9 under the auspices of the Illinois Manufacturers' Association. The sessions will be at the Congress Hotel.

Trade and industrial associations in every line have been invited to appoint delegates, and to participate in what is believed will be a meeting of moment, inasmuch as it will enable business to present concretely its attitude on some of the questions now before the lawmakers at Washington and some of the proposals of a revolutionary nature that have been presented from various sources in the past few months.

Representation is to be given at the conference not only to business, but to the farming interests, since it is pointed out that agriculture, after all, is one of the greatest businesses of the country. The farmer has his capital invested in land, he is an employer of labor and he is concerned with the maintenance of conditions which will permit him to obtain a fair return upon his investment and his management of his enterprise.

Leaders of organized labor have also been invited to state where the demands of workers are going to stop.

Some of the subjects which it has been suggested be discussed at the conference are the following:

Participation in private business on the part of the Federal Government.

Nationalization of industry.

Influence of exports on prices and production.

Possibilities of increasing production.

The relation of the United States to the rehabilitation of industry in Europe.

Stabilization and guarantee of contracts.

Definition of profiteering.

The attitude of employing farmers and manufacturers to labor.

Adjustment between property rights and community interests.

Participation of labor in the management of industry.

Increasing the purchasing power of the dollar.

Distribution of the war debt.

Governmental price fixing.

The Plumb plan.

The solidarity of farming and business interests.

Use of Industrial Electric Trucks and Tractors in Warehouses

Advantages of this Class of Apparatus in Storage Buildings and Warehouses of All Sorts — Difficulties Encountered in Application — Analysis of Handling Operations—Special Advantages for Utility Service

By BERNARD J. DILLON

THIS is the third of a series of articles dealing with the application of industrial electric trucks and tractors in representative industries. In this the application of such equipment to the handling problems of warehouses and storage places of all types is described. The particular advantages which their introduction for this work offers and the more common difficulties encountered are pointed out and the handling operations of this industry are carefully analyzed. In addition the article calls attention to the use of this apparatus for general utility work in such places.

WAREHOUSES of all sorts, including storage, cold storage, wholesale houses, etc., are generally considered as offering one of the best fields for the application of the electric industrial truck and tractor. This is due to the nature of this business and the conditions that exist in it.

The function of such places, as far as this article is concerned is one of receiving, storing and delivery or distribution. This involves several handling operations, unloading from a carrier into the warehouse, locating it in the warehouse and loading it again onto a carrier to be transferred to its destination. To these may be added, as in the case of wholesale or jobbing houses, other packing, assembly, or similar minor manufacturing operations.

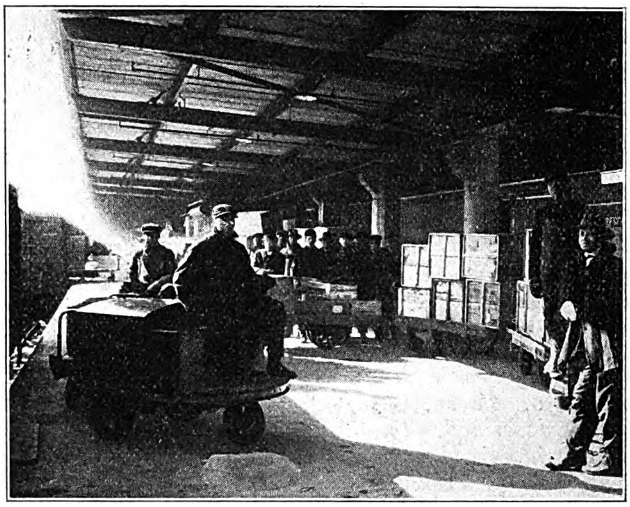
Handling the goods is of course one of principal items entering into the cost of conducting a warehousing or storage business. Not that the cost of this operation is any greater in this business than in others but it does constitute a greater percentage of the total expense, and any saving that can be affected in it therefore, is much more readily appreciated. For example, a 50% reduction in the cost of handling in a warehouse may effect a 20% reduction in the total operating expenses, whereas, a similar saving in handling in an industrial will only result in a saving of perhaps 2% in the total expense. Furthermore, handling is about the only major operation in warehousing that lends itself readily to improvement by the application of efficiency methods—the other items, investment, insurance, overhead, light, heat and power, being either fixed or largely controlled from outside sources.

The labor problem is also a factor that adds to the value of electric apparatus for such work at the present time. Unskilled labor, such as is used in

The 9th Street Terminal Warehouse in Cleveland, Ohio, Uses an Electric Lift Truck to Good Advantage in Handling Goods of All Kinds.

this work, is scarcer now than ever before, demands much higher wages than formerly and is hard to keep.

Another advantage which the electric truck or tractor offers is due to the frequent occurrence of peak periods in such work. Such peaks usually occur at certain times of the day or on certain days



The Electric Tractor Can be Used to Advantage in Unloading from Cars into the Warehouse.

with the arrival of boats, trains or a number of street trucks. During these periods the material must be handled with all possible speed in order to free the boat, cars or trucks and relieve congestion. At such times if the trucking is done by hand an extra large number of men are required. During the intervals between these periods, however, very little work is done which means a considerable loss of time. On the other hand if electric trucking apparatus is used, the work during the peak period is greatly facilitated, the congestion relieved and the time lost during the off-peak hours is greatly reduced.

Difficulties Encountered in Application.

In spite of these apparently promising and simple conditions the problem of applying electric industrial trucks and tractors to warehouse work is a difficult one and requires a great deal of care and thought before it can be successfully accomplished.

Perhaps the most common difficulty encountered arises from the design and construction of many warehouse buildings. Such buildings are usually located on either railroad or water frontages or in some similar place where the facilities for outside transportation are favorable. As such property is valuable the desired floor space is secured by constructing buildings many stories in height rather than to spread them out over a large territory and only a few stories high. In addition, such construction, before the introduction of electric industrial trucking apparatus offered one of the best means of increasing handling efficiency, for it decreased the hauling distance and permitted the use of elevators to advantage. This building construction problem is increased by the fire prevention ruling that requires fire walls to be erected segregating such buildings into small areas.

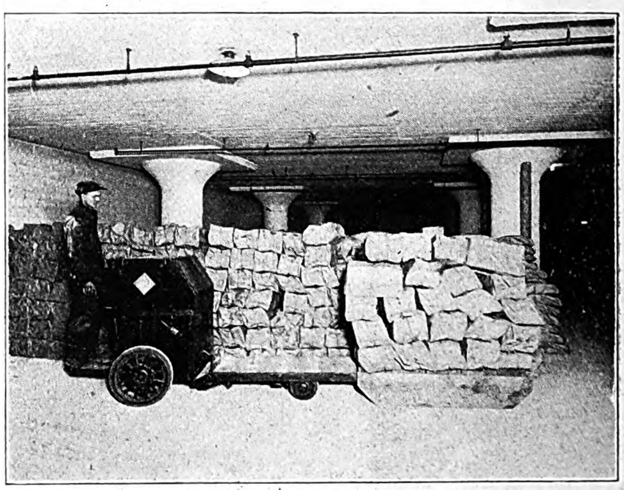
The size and type of goods handled and the methods of distributing are also important factors to be considered. Where the goods are received or shipped in lots stored in one place and are of approximately the same size or type this is a comparatively simple matter. But where the goods are handled in lots consisting of a varied assortment of all sizes and stored in various parts of the building the problem is a very complicated one.

In order to more clearly analyze the handling problem in warehouses it is divided in this article into four operations: Unloading or receiving from an outside carrier into the warehouse; distribution within the warehouse; picking and taking from storage to the shipping room; delivering or shipping from the warehouse to another carrier. In practice these operations often overlap each other to a considerable extent, for example, where the goods are taken directly from a receiving carrier to the storage place, and in addition, the problems which they present are common in many respects. In this analysis the operations in a distributing warehouse are particularly considered, that is a warehouse that receives the goods in large shipments and distributes in the same or smaller ones composed of miscellaneous items. In some warehouses this operation is reversed and for these the order and the subjects must also be reversed.

Use of Electric Industrial Apparatus in Receiving.

Receiving and unloading incoming goods offers perhaps the greatest opportunity for the application of electric apparatus. Shipments are usually received in large quantities from cars or boats and are stored in one certain part of the building. These cars or boats cannot be spotted or placed in the most advantageous unloading positions on account of their size which of course complicates the handling problem. In addition it is essential that they be unloaded as quickly as possible in order to free them for further use. As the material must be hauled over a certain level distance the greater speed and capacity of the electric are very desirable.

The value of the electric in this operation is not generally appreciated, however, due to the fact that with manual labor the goods in unloading are only taken a short distance from the unloading point which of course results in congestion that apparently prohibits the use of the electric to advantage. As a matter of fact with the electric, the material could be taken directly to the elevator or storage space at once or at least far enough removed from the platform to relieve the congestion and permit their operation.



The Electric Lift Truck Can Also Be Used in Distributing Within the Warehouse if the Material Can Be Loaded on Skids.

Where this operation is conducted independently of the other handling operations the electrical industrial tractor is perhaps better suited than any other type. In using the tractor, suitable trailers can be loaded directly from the car or in the ship and picked up and hauled away in trains to their desired location by the tractor. This of course greatly facilitates the operation and permits a more efficient application of the electric apparatus for no time is lost in loading or unloading it and several trailers can be hauled at once.

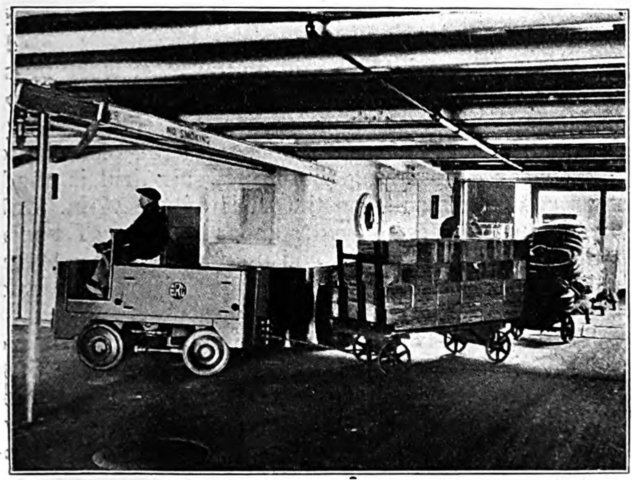
Where the unloading is combined with the other handling and the electric lift truck or some other type is found more suitable for this second operation it is usually desirable to use the other type in unloading also.

Distribution Within the Warehouse and Picking Orders.

In those warehouses that cover a large ground area and are only a few stories high the problem of applying electric apparatus to distribution within the building is a simple one. If the goods handled are mostly of uniform size so that they can be loaded on low skids to be picked up by an electric lift truck and taken to their storage space and left on the skids to facilitate removal this type of apparatus is preferable. It is also well to provide such skids with small wheels or casters so that they can be easily moved short distances by hand. If, however, the material handled consists of a varied assortment of goods of all sizes and weights an electric tractor with trailers will afford the best method of handling. In some places the electric utility truck or one equipped with a gantry crane attachment will be most desirable.

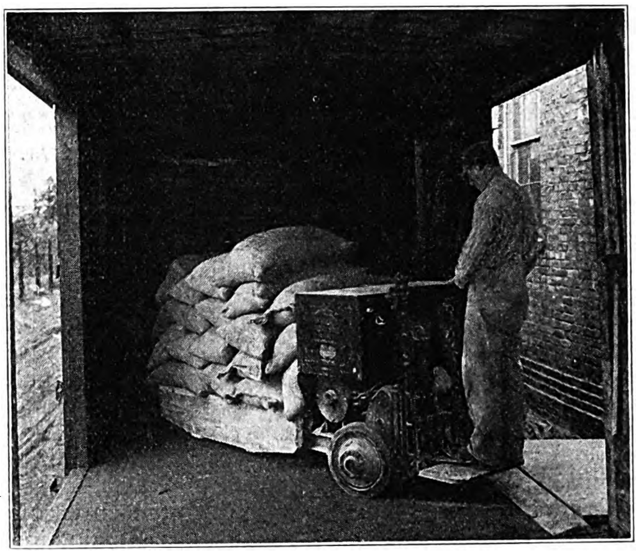
In the taller warehouses where numerous elevators or lifts are used the problem is a much more difficult one. Electric tractors cannot be used to advantage above the unloading floor as the elevators are seldom large enough or have sufficient capacity to accommodate both the tractor and a trailer at the same time. Furthermore elevators are usually located so that the distance over which the goods must be hauled on each floor is very short.

If the material is such that it can be handled by a lift truck however, this type of machine can be easily applied to distributing. As the machine itself occupies but little more space than the load it can easily be carried with the load on an elevator or the load can be quickly placed on the elevator and taken off on another floor by another lift truck. Moreover, they can be easily operated in the dead end passages or aisles such as are encountered in storage buildings.



The Electric Industrial Tractor in Use on the San Francisco Waterfront.

Picking or filling orders in distributing warehouses requires a large amount of trucking and offers a good field for the application of electric apparatus. Orders are usually composed of a number of different items located in various parts of the warehouse which must be collected, assembled, marked, or packed for shipment. All this, with the exception of the packing, is usually done by one man or several men as a crew, unless the number of commodities handled is very great. In such cases sections or departments are formed and the work in each department is done separately.



In Close Quarters Such as This, the Lift Truck Offers Many Advantages.

In one large warehouse where the commodity handled is nearly all packed in bags electric lift trucks are used in this work and each truck replaces the work of six men. In this warehouse a crew consisting of two men with a lift truck collects the order, marks it and takes the completed order to the shipping room where it is left on the skids until called for. The truck then picks up the skid with its load and delivers it to the gravity conveyor from which it is loaded. The bags weigh about 100 lb. each and as many as 40 are carried at one time.

The 9th Street Terminal Warehouse in Cleveland, Ohio, which handles a much larger variety of merchandise composed of barrels, boxes and packages of all sizes and weights also uses the electric lift truck to considerable advantage not only in order filling but in loading and unloading as well.

Under certain conditions the electric tractor can also be applied to this operation but its success will depend largely upon the type of warehouse and the material handled. It is especially adapted to places where the orders received and the quantity of the different items are too large to be carried on skids.

Delivering Merchandise from the Warehouse.

In delivering or loading goods from the warehouse the problem is similar in many ways to that of receiving into the building. The opportunities for the application of electric industrial apparatus for this work in distributing warehouses, however, are not as great as they are in receiving, due to the fact that the orders are usually loaded onto street vehicles which can be placed in the most advantageous position to receive them. Nor are the peak periods as frequent or marked as occur in receiving for the goods can be placed in position for delivery beforehand and the arrival of the trucks can be more easily regulated. Very often however these conditions are reversed and the problem of delivery becomes a much more difficult one than that of receiving and the application of electric apparatus is more desirable in the former than in the latter.

Special Advantages of Electric Industrial Apparatus in Warehouses.

For practically every branch of warehouse work the electric industrial truck or tractor offers special advantages in addition to the regular handling work, that adds greatly to its value. In cold storage warehouses, for example, the greater speed with which the commodities can be transferred from the warehouse to a refrigerator car are particularly desirable. Many of the items handled spoil if allowed to melt in the open air and any unnecessary exposure to normal temperatures must of course be avoided. In addition the goods can be taken in or out of the refrigerating room much more quickly which enables the temperatures of these rooms to be maintained more easily.

The general utility features of the electric are also a decided advantage in warehouses. These places are seldom equipped with power devices for handling exceptionally heavy work. The performance of such work by hand labor not only tires the men quickly but makes them dissatisfied with their jobs and they often quit rather than continue to do it. By using the electric apparatus to assist in this work it can often be accomplished very easily.

The value of the electric tractor for such work was illustrated in a large department store warehouse recently. At that time a large shipment, about 40 carloads, of burlap was received, packed in bales weighing about 2000 lbs. each. Each car was loaded to capacity, there being only about 6-in. headroom between the top of the bales and the roof of the car. The men absolutely refused to unload the shipment even though an extra wage was offered for the work. By using a block and tackle and attaching the cable end to an electric tractor used in the building the cars were unloaded without any extra effort on the part of the workmen and in a much shorter time than would be required if the car had contained lighter material and hand labor used.

Spotting freight cars is another duty which adds to the advantage of electric apparatus for warehouse work. Very few warehouses maintain switch engines for their own work and when a car is to be moved, even although the distance is only a few feet, they are forced to wait until an engine comes from the railroad or accomplish the moving by slow tiresome manual effort. If an electric tractor is used the car can be easily moved by attaching it to the tractor with a cable of sufficient strength.

ADVANTAGES OF ELECTRICITY FOR OPERATING PORTABLE DRILLS SHOWN.

A Comparison of Costs and Efficiencies Between Electric Power and Compressed Air for This Work.

During the past few years remarkable developments have been made in the design and construction of electrically operated portable drills which permits their application for all sorts of drilling work. The greater efficiency and lower operating costs of this apparatus over compressed air drills are not generally realized and for this reason a comparison of these methods has been made by the engineering department of the Van Dorn Electric Tool Co., Cleveland, Ohio. This comparison is of interest to the production manager and factory superintendent in deciding either of two questions: Will it pay to replace air equipment with electric equipment, or will new installations be pneumatic or electric? The three factors to be considered are: Source of power, distribution, and performance. Cost is a function of all three of these factors.

Usually electric power is available, either central-station service or from a private plant. In such cases the source of power item can be dismissed. Where electric power is not available, the choice is between generating it or compressing air. It requires about 22 b.-hp. to deliver 100 cu. ft. of free air per min. at 90 lbs. pressure. This same 22 b.-hp. will deliver 14 kw. driving a generator with 85% efficiency.

The question of distribution must then be considered. The distribution of electric power is flexible, permanent, efficient and much cheaper. The maximum allowance that need be made for loss is 10%. Assuming a 14-kw. source, there will be therefore 12.6 kw. at the tools.

An air line is costly to install, inflexible, subject to freezing, leaks and generally high cost of upkeep. Furthermore, the allowable loss of pressure by friction is 10%, offsetting the electrical distribution loss. It is impossible to prevent leakage, even with constant replacements of hose and repair of joints, and the cost of this item may be tremendous. To illustrate, the amount of leak for very small holes in a 90-lb. system will be:

Size hole.	Amount of leak in cu. ft. per min.
1/16 in.	6.0
1/32 in.	1.5

The leakage, however, is a very uncertain item that may reach almost any figure if the system is not carefully maintained and it is safe to assume that this loss is also 10%. There will be therefore about 90 cu. ft. of air at the tool to operate it under about 80 lbs. pressure.

The question of which will do the most work must then be considered. The efficiency of an electric motor is constant throughout its life, but the efficiency of an air motor falls continuously as the piston and valves wear. Assuming that a new air drill is used, let us compare results on the basis of the ½-in. tool. The manufacturers of two standard makes of pneumatic tools give the air consumption of the ½-in. drill as 15 cu. ft. for the 4-cylinder piston type and 20 cu. ft. for the rotary piston type.

This air supply would therefore take care of five or six ½-in. pneumatic drills. It is safe to state that a ½-in. electric drill with 550 watts input will outdrill the air tool and at this consumption the 12.6-kw. available electric power supply will operate 23 electric drills.

In addition the efficiency of the tool in the hands of the operator is affected by weight, balance and vibration. The advantage of weight obtained in some sizes of air tools is more than offset by the better balance and lack of vibration in the electric tool which enables the operator to handle it much more comfortably and efficiently.

The Newer Aspects of Advertising by Central Stations

A Review and Analysis of the Policies of Leading Utilities with Concrete Recommendations for Improved Practice

By L. D. GIBBS

Superintendent Advertising Dept., Boston Edison Co.

[This interesting comment, which was submitted by Mr. Gibbs, formed the basis of a paper which he presented before the recent convention of central-station salesmanagers at the recent convention of central-station sales managers at a discussion on the Economics of Advertising, by R. S. Hale, also of the Boston Edison Co., which will be presented in a later issue.]

CENTRAL-STATION advertising men in common with advertising men in all other fields were confronted when we went into the war by the problem, "what can we do?" The advertising profession was conspicuously one that had to develop its mission and its field of work. As one man it rose to the occasion. Never before has advertising exerted so great a force for good; never before has it had so wonderful an opportunity in every one of the broad fields of endeavor. Wherever our government discovered a need to be met or a gap to be filled advertising rose to the situation. Our millions of people were "sold" to an ideal, and for that ideal they gave their money, their clothes, their food and their lives. Thus was proved, so every man could see, what advertising can do.

Now, therefore, is our time and opportunity. Our controlling business men have a higher appreciation of the value of advertising service than they ever had before, an appreciation which they never would have gotten—in the central-station business at least—from anything we could have said or done in the ordinary way. It is not too much to assume that they are waiting now for us to make good in our business field as we all made good in the patriotic field. They are not, however, going to hand us advertising appropriations for the indiscriminate exploiting of ideals. They have got to be "shown."

How Representative Central Stations Consider Advertising.

A study of a questionnaire received from a number of central-station sales managers shows:

(1.) That the annual expenditures for all forms of advertising have been modest.

(2.) That, although most of the companies report definite budgets, their advertising expenses have really been, for the most part, contingent upon what the managements felt were the exigencies of the situation, and the expenditures have, for the most part, become "budgets" only after they were placed upon the ledgers at the close of the year in which they were made.

(3.) That consistent campaigns based on appropriations have been running only comparatively a few years out of the relatively long existence of most of the corporations as public service companies. The notable exceptions are the large companies. It has been interesting to note in looking over this review of advertising that usually the starting of advertising campaigns has been coincident with some climax in antagonism on the part of the public, or the discovery of some near-critical state of the central-station's finances.

(4.) The distribution of the advertising charges upon the accounts of the departments most obviously interested appears to be general. One company of the 12 reporting makes its advertising expenditures stand by themselves—apparently, a general operating expense; another, divides these expenses between new business and a "publicity" account. These methods of charging are perhaps as indicative as any of the appreciation of advertising.

It shows that in those companies they have reached the point of admitting advertising to the ranks of the constructive activities of their companies. Most of us have not yet gotten away from the notion that somehow or other anything spent for advertising must be charged into the cost of getting new customers or selling appliances.

(5.) Six of the 12 companies have advertising departments, and 6 conduct the advertising under the direct supervision of the sales departments. Of the 3 companies that had not reported when this was written 2 have advertising departments. This indicates a growing appreciation of the importance of putting the advertising work on its own basis. It is the only proper way; although, of course, any advertising department is expected to work in complete harmony with every other branch of the business.

(6.) Only 2 companies of the 12 have conference or advisory committees, which discuss sales and appliance campaigns well in advance of the time when they will become active, and pass, in a general way, upon the advertising copy.

(7.) Only in a few instances is it reported that campaigns along special lines have been conducted for any extended period. This shows a failure to get the most out of advertising expenditures.

(8.) Eight out of 12 have used street-car card advertising; 5 have used illuminated billboards; 3 have used advertising on the backs of their monthly bills; 2 use stickers attached to their bills; 1 makes enclosures with bills; all have used so-called "follow-up or direct-by-mail" advertising; and all have used newspaper advertising. Only 2 report the use of "house organs" at the present time, but probably most of the companies have at one time or another used this medium.

(9.) Only 2 report that their advertising programs are laid out a year in advance; 1 reports that an effort is made to conform to this plan, and the others, for the most part, report no policy. Copy is apparently prepared by practically all of the companies just previous to its use.

(10.) None of the companies attempt to check advertising results except on "follow-up."

(11.) Five of the 12 use advertising agencies to handle their newspaper advertising; only 1 reports employment of an advisor, and with 4 of the 5 companies the agencies do their work for the commissions they receive from the newspapers.

(12.) Four companies would use any possible extra appropriation entirely in advertising; 4 would divide the appropriation as needed; 1 would divide the appropriation 1/3 for increasing the sales force and 2/3 for extra advertising; another would give 2/3 to increase the sales force and 1/3 to extra advertising: 1 would use the appropriation for increasing the sales force.

The answers to Question 12 are so significant of the appreciation of the value of advertising as to warrant their reproduction here.

The question was: "If you could have an extra appropriation to spend in new business development, how would you prefer to spend it—in increasing your sales force or in advertising?"

Views on How to Spend Appropriation.

The replies are as follows:

A. As far as the new-business work is concerned both solicitation and advertising are important, and one is vital to the other. Industrial work requires considerable more personal solicitation and engineering work, but should be followed continuously by advertising, both newspaper and direct mail. For residential new business, a great amount of advertising followed by personal solicitation is required; such solicitation should be divided into districts and prospects thoroughly canvassed. Both advertising and solicitation will have to be increased to obtain the business that the central stations deserve, and this work must be continuous and persistent to get results.

B. I would increase advertising and sales force. Advertising is absolutely necessary to the success of the selling force. We have found that the most experienced salesman cannot go into a cold field and get as much business as an inexperienced salesman in a field that has been warmed up with advertising.

C. Two-thirds in advertising and one-third in increasing the sales force—under present conditions.

D. It would depend upon the branch of the new-business work to be developed and whether or not we had a full complement of sales people.

If it were power business to be developed and we did not have a complete sales force we should prefer to spend the money for salesmen. If we did have a complete power sales force we would spend the money for advertising.

If it were lighting or appliance business to be developed and we had a complete sales force we should prefer to spend the money for advertising. Even if we did not have a complete sales force it is likely we would spend the money for advertising and put on an additional sales force on a straight commission basis.

E. An extra appropriation to be spent for new business would undoubtedly be entirely spent for advertising rather than for an increase in sales force.

F. At the present time in more men.

G. 60% sales force—40% advertising.

H. In advertising.

I. Just at present, owing to a very radical reduction which was made in our sales organization at the beginning of the war, we need additional sales force. We are also planning some special advertising booklets—the first one being a booklet on Electrical Heat Applications for Commercial Purposes such as electric furnace for melting, heat treating, enameling, japanning, baking, etc. Material is now being prepared to get out this booklet the cost of this having been included in our annual budget made up nearly a year ago.

Our reply to this question, therefore, is that additional expenditure in the sales department would be for both salesmen and advertising.

J. I would say that under our conditions I would much prefer increasing our sales force rather than advertising, but if we were seeking to build up a residence business (which is not necessary here, as the residence business is so developed), I should certainly spend money on advertising.

K. Both. Advertising to disseminate the word broad-cast and stimulate—Additional salesmen to make the actual sales.

These answers clearly show an appropriation of the value of advertising for special drives such as any extra appropriation would probably be used for, and that appreciation must be predicated upon results secured from regular advertising.

Further development of central-station advertising can only come with a clearer understanding of what we want to gain so that the campaigns can be effectively directed.

How to Sell the Advertising Idea.

If we are to sell the advertising idea we must show that we are able to adapt the idea to the needs of our companies. We must learn first where the advertising can be applied, prove that we can get the results when and where they should be secured, and develop our work in its scientific application.

There is no reason why we cannot do this. We have struggled with it, sometimes we have produced results that could be shown, but too often the outcome has been intangible.

Down deep in their hearts, the executives of central stations, the boards of directors and the leading stockholders believe in the power of advertising. When a big emergency arises, where the public must be informed quickly, they turn without a moment's hesitation to publicity and it is spread with a lavish hand. The campaigns are at once big with influence and ring with the truth of conviction. When the emergency passes the inclination to stop expense very naturally comes to the front.

Continuous publicity explaining the growth, stability, kinds of service, reductions in rates, comparisons of costs of electric service with other kinds, business policies, etc., should be kept up. Executives are not yet ready to adopt this policy; deterred possibly by memories of the costs of special campaigns along these lines, and fearful that the cost of continuous campaigns would be proportionately greater.

There is no reason why this kind of publicity should be charged against the operating expenses of a sales department, and usually a sales manager joins with his superiors in opposing such campaigns if he must pay for them. We can, however, push the advertising for building up business in certain localities, and promoting sales of appliances, in the hope that the favorable impressions resulting from successful work along these lines will reflect favorably upon the larger ideals.

Advertising Should Be Laid Out in Conference.

The conference method of laying out advertising campaigns for at least a year in advance will be the quickest way to accomplish results. This is the common sense method; it takes our advertising out of the class of intangibles, forces the advertising man to argue his case and defend his suggestions; brings new ideas to the minds of other officials around the conference table, and in general, tends to clarify the whole situation. Men cannot regularly get together in conference and not come to appreciate one another's view-point. It is perfectly possible to plan our advertising policies a long ways ahead, certainly as far ahead as one year.

Continuous Advertising Pays Best.

The absence of any advertising campaigns extending continuously over a period of years further discloses our haphazard methods. We appear to be all the time dealing in special campaigns, special sales and drives, when a moment's reference to the returns resulting from a continuous campaign on one line running for two or three years shows what could be accomplished if we focused attention on a particular line of sales effort year in and year out. Nearly every central station nowadays follows consistently the new building field, getting on the job before the foundations are laid even for small dwellings. A number of companies have followed well-defined policies in securing the wiring of old houses. Isolated plants are vanishing before consistent and persistent attacks. But these policies must become general so that the results will be definite and tangible from every point of investigation, if we expect to really prove up on advertising.

The kinds of advertising and the mediums used must be proved up. It is a strange mixture that shows central stations using the newspapers, miscellaneous follow-up schemes, street-car-card advertising, illuminated billboard advertising, stickers on bills, enclosures with bills, and house organs in most cases for only short periods at a time—not long enough to get real results. Where are the data to show the value of these mediums? Why do we jump from one thing to another? We seem to have settled on the newspapers as a regular medium, but not one of the central stations represented in this convention makes any attempt to check the results.

How Good Will of Newspapers Is Acquired.

An erroneous belief still seems to exist that a few columns of paid advertising will influence a newspaper to treat us kindly, which some people still think means leaving us alone. Long experience in the newspaper business, and a wide acquaintance with newspaper publishers, editors and reporters has proved to me that the paper that has a tangible influence will not be swerved by a little advertising. What really does happen is that as a result of the personal acquaintanceships developed in the course of business, central-station men and newspaper men are brought together. Each side finds the other human. The newspaper men find there is no mystery about the central-station business, and mutual understanding promotes good fellowship—the really satisfactory basis of all business relations. But let us try some of the other mediums more continuously and efficiently; give attention to the checking of results; practice some "follow-up" on ourselves.

Central stations seem in their appliance business to be always bargaining, dickering, restlessly shifting from one thing to another, campaigns on this article; campaigns on that article; and when a manufacturer comes along with something new, or some new model of something old, we jump to start a special sale on it. Business houses use special sales for cleaning-up time, they put their goods on the shelves and handle them on a regular merchandising plan. If for any reason the stock fails to move, then it is dumped through special sales. I wonder if the public does not get the impression that the central stations are all the time dumping something.

Arriving at a Fair Appropriation.

Department stores of recognized standing and reputation do not plan to spend more than 2% of their gross receipts in any one year in advertising. Businesses that are building up must spend as high as 5%. Some lines in which the merchandiser depends on so-called class and distinction spend 7%. In other lines where special appeal is made to style and exclusiveness retailers spend as little as 1%, but the manufacturers from whom they buy spend in national advertising what would be equivalent to 2 or 3% more for the local dealer in his field. The dealers in electrical appliances are in the class of the retailers, whose merchandise has class and distinction, and have extensive co-operation through the national advertising of the manufacturers. We have thus far exerted too little effort to co-operate. Too frequently we fail to realize that the manufacturer is giving us a service of inestimable value. We forget that the manufacturers are making not only their appliances but electric service household words.

If central stations will intelligently apply only 1% of their annual gross receipts to advertising they can take advantage of every form of co-operative help to the fullest extent, and put themselves in the strongest possible position.

NEW GERMAN LOW-POWER LAMP DEVELOPED.

The British Government Review of the Foreign Press (Technical Supplement) contains particulars of a new German low-power lamp which was described in the *Electrotechnische Zeitschrift* for April 24. The lamp depends on the discharge of electricity in an atmosphere of neon. The lamp is made for 220-volt circuits, and has a consumption of 1 to 5 watts. It is suitable for use as a signal lamp, or in places where inflammable gases are met with, as it is immediately extinguished if the bulb is damaged. They may be used as polarity testers, insulation testers, and rectifiers. The glass bulb contains a mixture of neon and helium at a pressure of 8 to 10 mm. The cathode is of large area and hemispherical shape, and the anode, in the form of a wire, reaches to such a small distance from the edge of the cathode that a brush discharge starts, without external aid, at 220 volts. The voltage of the lamp sinks, when the discharge begins, to about 190 volts, and the remaining 30 volts are absorbed in an external resistance. The cathode may be made of various metals, but iron is preferred, owing to its easy production in the form of thin sheet, its small capacity for absorbing gas, and slight tendency to volatilize. The orange color of the neon light is corrected by mercury vapor, and a pinkish-white color is thus obtained. With direct current the lamp must be connected with correct polarity to the mains, and with alternating current the anode should not be too small in area and thickness relatively to the cathode. A 210-volt lamp with iron electrodes gives 0.44 Heffner candlepower at 19.2 milliamperes, with 186 volts across the lamp terminals, thus taking 4.03 watts from the line, and 9.2 watts per Heffner candlepower.

Central-Station Rates in Theory and Practice

Eighth Article—General Discussion of the Price of Service —Three Principles on Which Price or Rate Systems May Be Based—Cost, Maximum Earnings and Value of Service

By H. E. EISENMENGER

This is the eighth article of this series, which began in the issue of July 12 following a general preliminary outline of the entire series in the July 5 issue. The first seven articles have considered the cost of electric service, a knowledge of which is necessary before any system of rates can be determined on, because the income of any central station must in any case exceed the costs of rendering its service. In the present article is begun the discussion of the principles governing the selection of a rate system, more particularly the general policies underlying the questions of what amount of profit shall be desired and in what proportion shall the different classes of customers contribute to that profit. These articles will be continued throughout practically the entire volume.

PART II—THE PRICE OF ELECTRIC SERVICE.

1. General Remarks About the Three Principles of Establishing the Profit Over Cost.

SECTION 62. The price is cost plus profit; in other words, the price is made by adding a certain percentage of profit to the cost. This percentage may be constant for all units of the commodity[1] and consequently for all customers so that the prices or charges to every customer are proportional to the cost. Or the percentage of profit may be varied between the different units of the commodity sold, in an endeavor to make the customers pay a larger percentage of profit for those units which they value more highly and for which they are therefore willing and able to pay higher prices than for those units which have a smaller monetary equivalent and which possibly would not be bought at all at higher prices. In this case we will charge to different customers prices involving different profits for the same service[2] and, on the other hand, we will charge the same customer prices involving different profits for different kinds of service. For instance, we may charge him a different percentage of profit for heating current and for lighting current.

63. These two differentiations—kind of service and customer—go together and intermingle. If, therefore, in the following theoretical discussions sometimes, for the sake of brevity, only the differentiation between customers is mentioned, it must be understood that this always includes differentiation between classes or kinds of service, unless a remark is made to the contrary.

64. The first one of the two principles mentioned above (that of collecting the same percentage of profit from all customers) is called the *"cost-of-service principle,"* because the price is based on the average cost of the service (see Section 3). The second method of price calculation may be embodied either in the principle which is effectively designated as *"charging what the traffic will bear"* ("maximum-earnings principle") or in the so-called *"value-of-service principle."*

65. The term "What the traffic will bear" means: Collect from every customer and for every kind of the service prices as high as the customer is willing and able to pay[3], and not lower, but refuse to sell service in all cases where the prices sought are so low that they do not cover the cost (more exactly speaking, that they reduce the earnings, see Section 72), so that the earnings of the vendor reach a maximum; in other words, extort from the public as much profit as you possibly can.

The lengthy term "what-the-traffic-will-bear principle" will in the following be replaced mostly by the shorter term, "maximum-earnings principle."

66. The "value-of-service principle" differs from this inasmuch as its aim is not primarily a maximum of profit to the vendor, but it attempts to bring the greatest good—in the form of good and price-worthy service—to the public and to let the greatest number of people partake of the benefit of the respective service. The value-of-service principle charges higher prices for those kinds or classes of the service for which the respective customers are willing and able to pay such prices without reducing their consumption, but it differs from the "what-the-traffic-will-bear" policy inasmuch as it uses the excess income from these higher prices to reduce the prices to those who would otherwise use less service or who would not be customers at all, for instance, to the poorer people.

Under the "maximum-earnings" principle (see Section 65) the earnings can never be high enough. Under the "value-of-service" principle, if the earnings become abnormally high, lower rates are offered. either mainly to the profitable customers, or to the unprofitable ones who heretofore had not been served. or to both groups. We can thus either (a) give to the profitable customers the advantage of lower rates,

[1]This means in case of electric service it is constant for all kilowatt-hours where an energy charge is made and constant for all kilowatts wherever a demand charge is made and also constant for every customer as far as a customer charge is concerned.

[2]Restricting ourselves, from here on, for the sake of convenience of expression to such commodities as are services, although th same deductions apply to all commodities.

[3]Each consumer has, consciously or unconsciously, established certain limiting prices which he is willing to pay for the various parts of the service, even though the line beyond which he is not willing to buy the service may be a more or less hazy one. If he is charged more than this limit for any part of the service, he will forego the use of that part and restrict himself to the remaining parts of the service until, with increasing prices, he will finally drop out as a customer entirely. Thus with an increase of electric lighting rates a customer will refrain from burning certain lamps at certain hours.

or (b) extend the benefits of the service to new customers, or (c) we can combine the two advantages, each one in a lesser degree than under (a) and (b), respectively; that is, we grant a lesser degree of the rate reduction to the profitable customers and extend at the same time the service in a lesser degree to new customers (see Sections 88-93 in a later installment).

The value-of-service principle "discriminates," so to speak, between customers by charging different percentages of profit from them, whereas the cost-of-service principle "discriminates" between customers by charging different percentages of the prices which their valuation of the service would prompt them to pay. The discrimination of the value-of-service principle is of the same order as the discrimination of an income-tax system which does not collect the same sum of money from everybody objectively, but endeavors to make each one bear the same financial burden, measured subjectively at what money is worth to the respective person.

67. With the possible exception of such cases where the valuation of the respective parts of the service is determined by the price of a competitive service of equal quality, we can never hope to have more than a roughly approximated and hazy knowledge of that valuation. Nevertheless, the discussions hereafter of a few theoretical questions in this connection may be of interest and usefulness, although they start from the assumption that the valuations by the customers of the various parts of the service are exactly known in dollars and cents.

In the same manner the theory of structural strength of materials is useful as giving us an exact insight into the conditions, although in practical application to engineering structures invisible and unknown irregularities or defects in the interior of the material and other factors introduce such an element of uncertainty and haziness into the calculations that we have to choose a large factor of safety in practice and cannot go far towards exact application of our theory. Likewise in figuring the voltage drop in transmission and distribution lines we possess very elaborate theories but if we apply them in practice we find that the basis of the computation, the load to be expected, is generally known only very approximately, mostly even only from guesswork. Yet nobody will deny that these theories are useful, because they show us in what way various factors influence the result.

II. The Principle of Charging What the Traffic Will Bear (Maximum-Earnings Principle).

68. The principle of charging what the traffic will bear ("maximum-earnings principle") takes care of the interests of the producer only, in an entirely one-sided way, to the detriment of the other party concerned; that is, of the consumer who, especially in the case of public service corporations, represents the general public. This principle is therefore unethical and its further examination might be dispensed with if it were not for the fact that the "value-of-service principle" is a development of the maximum-earnings principle with certain corrections to take care of the consumer's interests and, as it is thus based on the maximum-earnings principle, we will have to investigate the latter as an introduction to the study of the value-of-service principle.

69. The sum of the total charges collected from all the customers is the *gross revenue* or *gross income*. Deducting the cost of production from the gross revenue, we get the *net revenue* or *net income*.

In the case where the capital is to bear a fixed percentage of interest (bonds, see Section 2) we will require from the point of view represented by the "what-the-traffic-will-bear" principle that the *net income* becomes a *maximum*. If, however, the percentage of return on the capital is variable (stock dividend), we are not interested in a maximum of the net income, but *in a maximum of return* on the capital.[4]

70. The maximum "earnings" to which the "what-the-traffic-will-bear" principle aspires may therefore either be a maximum net income or a maximum rate of net return (dividend). The term "earnings" will hereafter be used to embrace the meanings of both "net income" and "rate of return" and for the sake of generality the meaning "gross income" will be included also.

71. The requirements of a maximum net income and of a maximum return are not fulfilled by the same conditions. A change of prices may, for instance, increase the net income, but it may at the same time increase the necessary capital in a greater measure[5] so that the rate of return is reduced. (Compare Section 4 of Insert IX.)

72. If we want the earnings to become a maximum, we must arrange the rates according to the following two principles: (1) We must attempt to charge for every unit of the commodity just the maximum limit at which it can still be sold under the circumstances and not less, and (2) we must refuse to sell

---

[4]The last sentence is in general subject to a certain correction: If the enterprise is prosperous, it will for the following reason be of advantage to grant a reduction of prices within certain limits, even though this will be connected with a reduction of the rate of return. The reduction of prices will result in an increase of the demand for the commodity, a larger amount of the commodity will have to be produced and this requires an increase of the capital invested. If the price reduction remains within certain limits it must of necessity result in an increase of the net income (as proved in Section 4 of Insert IX). If now the additional ("increment") net income is large enough in comparison to the additional ("increment") capital, the additional investment will be profitable in itself without any reference to original investment. If we have for instance, prices which produce 50% net return on a capital of one million and if a reduction of prices will reduce the net return to 40% but at the same time make the investment of another half million necessary for increasing the producing facilities (in case of a central station), we will prefer 40% of 1½ million to 50% of one million, the more so, if the money can be raised by bonds. The additional half million will bear

$$\frac{0.40 \times 1{,}500{,}000 - 0.50 \times 1{,}000{,}000}{500{,}000} = 20\%,$$

which is so handsome and attractive a net rate of return that we would not hesitate to reduce the price still further in order to obtain the opportunity for the investment of further capital at a lower percentage than 20%. The rate of return on the additional capital decreases with every price reduction and we will continue the price reduction until the return on the increment capital ceases to be attractive.

By induction from this example we can say: The most desirable price from the point of view of the producer (central station) is found if, starting from the price which furnishes a maximum rate of return, we lower the price so long—and not longer—until a further very small price reduction will furnish an increment income barely large enough to yield a rate of return on the increment capital, which is just at the limit of being attractive to new capital. The total (or "average") net return on the capital is then smaller than the maximum possible net return but larger than the rate of return which is still just attractive to new capital. Likewise, it can be easily seen that the most desirable price is lower than the price which furnishes a maximum rate of return but higher than the price which furnishes a net return barely at the limit of being attractive to new capital. At the same time this price can, of course, never reach down as low as to the price p_n (which furnishes a maximum of the net income n) because the increment net income at that price is zero and therefore the (gross) rate of return on the increment capital will also be zero which after deduction of depreciation and other fixed capital charges would make the net return (dividend) on the increment capital not only not attractive but even negative. (Compare Section 18.)

Wherever the most desirable price is situated, we are safe in the statement that at least as long as a reduction of the price results in an increase of the net return this reduction is advisable from the producer's standpoint. With this understanding the following investigations will assume that the most desirable price is that which brings about a maximum net return, although it is actually lower and situated between the price which produces a maximum net return and that price which produces a maximum net income.

[5]By increasing the quantity of the commodity which can be sold and which therefore is to be produced.

any unit of the commodity at a price which reduces the earnings.

73. The first one of these two points implies that we have not only to make different charges for the same service to different individual customers—or at least to classes of customers—but also to charge the same customer differently for different kinds of service, for instance, for heating and lighting current. We have even to go further than that; we must charge different units (for instance, different kilowatt-hours) of the same service differently to the same customer, as the following example will make clear. A certain customer may use 100 kw-hr. per month for his lighting if he has to pay an energy charge of 6 cents per kw-hr. If he gets a cheaper price, he will generally use more current for his lighting by increasing his illumination, or his burning hours, or by using indirect lighting methods, etc. The additional kilowatt-hours are worth less to him than the original ones; they have more the character of a luxury, as is plainly demonstrated by the fact that he is not willing to buy them if he has to pay 6 cents, whereas he does buy the first 100 kw-hr. at that price. Let us assume that the number of kilowatt-hours he is willing to purchase per month at various unit prices of the kilowatt-hour with a given constant demand charge is given by curve[6] *m*

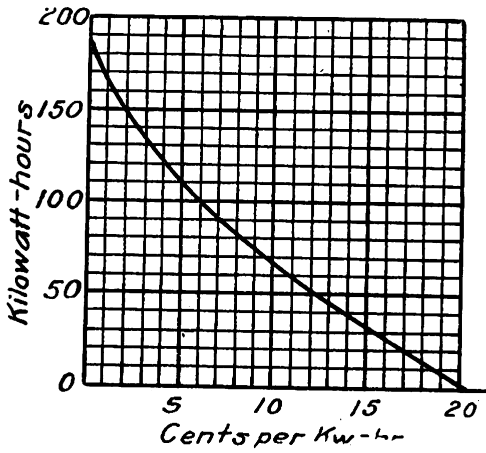


Fig. 2.—Customer's Sales Curve.

in Fig. 2, which shows that at 6 cents per kw-hr. he will use 100 kw-hr. and if the charge is lowered to, let us say, 4 cents per kw-hr., his consumption will rise to 125 kw-hr. If we want to sell that latter amount to him, we need not lower the unit price for the first 100 kw-hr. per month because the customer is willing to pay 6 cents for every one of them, but we must lower the unit price to 4 cents per kw-hr. for each one of the next 25 kw-hr.[7] In pursuance of this same method of reasoning we find from the curve that (choosing unit prices stepped off by whole cents) we ought to charge a price of 3 cents per kw-hr. for the next 13 kw-hr. (i. e., from the 125th to the 138th), etc., until we reach the limit mentioned in the following section (74).

Extending the same principle to the other (right) side of the curve we will find that instead of charging 6 cents per kw-hr. for the first 100 kw-hr. we should rather charge the customer 20 cents per kw-hr. for his first 2 kw-hr., 19 cents for each of the next 5 (3rd to 7th), 18 cents for the next 6 (8th to 13th), and so on, until we arrive at a unit charge of 7 cents for all kilowatt-hours from the 81st to the 90th and of 6 cents from the 91st to the 100th kw-hr. To be quite exact, we would have to deal with steps smaller than 1 kw-hr. and smaller than 1 cent; strictly speaking, the steps should be of infinitesimal size.

74. The second one of the two points in paragraph 72, that under the maximum earnings principle we must refuse to sell any unit of the commodity at a price which reduces the earnings, obviously means the following:

(a) If we aim at a maximum *gross income* it is evident that every sale will increase the same. There is no price above zero in existence which reduces the gross income.

(b) If we aim at a maximum *net income* we must avoid any sales of which the gross income does not reach at least the increment cost over the cost of all the commodities already produced before[8], that is, only such sales must be made of which the *increment net income is positive.* If the increment net income is positive, the *rate of return of the increments* must of necessity be positive also, and *vice versa*; we are designating by this term the rate of return which the increment net income provides for the increment capital.

(c) If we aim at a maximum *rate of return* it is not enough that a positive "rate of return of the increments" result from the respective sale, but it must be *greater than the rate of return* produced by all of the other sales which have been made before the addition of the respective sale.

75. We can also express the contents of Section 74 in the following manner: Under the maximum-earnings principle we must refuse to make any sales at prices which are lower than the cost increment per unit[9], the term "cost" being defined in each case as those portions of the expenses (see Section 2) with which the respective kind of "earnings" (gross income, net income and rate of return, respectively) is concerned in the following way: *Gross income* is not concerned with the cost at all, inasmuch as cost does not play any part in the makeup of the gross income and we have to set the cost in this case = 0; as the cost is therefore constant, the cost increment is also = 0 and the lowest price which is permissible under the maximum-earnings system in order to obtain a maximum gross income is zero, that is, any sale, however low the price obtained, will swell the gross income

---

[6]To be called "sales-curve" of the customer, compare Section 1 of Insert IX.

[7]The first 125 kw-hr. cost then a total of 600 + 100 = 700 cents, or an average of 700/125 = 5.6 cents per kw-hr. It might seem on superficial observation that the effect is the same if we charged 5.6 cents per kw-hr. uniformly for every kilowatt-hour throughout, from the first to the 125th. It must not be lost sight of, however, that if we charge uniformly 5.6 cents per kw-hr. the customer will not use 125 kw-hr. but a lower number (somewhere between 100 and 125 kw-hr): according to the curve he will use only about 105 kw-hr. with a resulting revenue of only 105 × 5.6 = 588 cents instead of 700. On the other hand, if we attempt to make the customer use the whole amount of 125 kw-hr. under a uniform price for every kilowatt-hour he will have to go down as low as 4 cents per kw-hr., which will reduce the income to 500 cents.

[8]See Section 3 of the first of this series of articles and the footnote to Section 25 of Insert IX. The increment cost depends not only on the amount of the commodity added but also on the amount of the commodity produced before the addition of the incremental amount of the commodity. The increment cost from 100 to 200 units will generally be greater than the increment cost from 1100 to 1200 and greater than the increment cost from 10,100 to 10,200 units. The same applies to the increment capital.

[9]Note the difference between the meanings of the following three terms: (a) increment of (total) cost or cost increment; (b) increment of unit cost and (c) cost increment per unit.

If, for illustration, it costs $500 to produce the first 100 units of a certain commodity (for instance castings) and $600 to produce the first 150 units, we will get the numerical values for the above three terms for an increase of the production from 100 to 150 units as follows:

(a) The cost increment is $600 — $500 = $100.

(b) The increment of the unit cost = unit cost for a production of 150 units minus the unit cost for a production of 100 units = $600/150 — $500/100 = —$1. The increment of the unit cost is therefore a negative amount and it would in this case be more convenient to use the term "decrement of the unit cost."

(c) The cost increment per unit = $100 / (150—100) = $2.

Net income is affected by the cost of labor, material, etc., as explained in Section 2, but it is entirely independent of the capital charges, such as interest, depreciation, etc., and we will therefore define the term "cost" in this case as excluding the capital expenses. Where we are interested in the *rate of return* (dividend) the term "cost" must be understood to include the capital expenses on the increment capital[10] figured at the same rate of interest which all the other aggregate sales yield on the aggregate capital.

We see that, with exception of the case dealing with a maximum of the gross income (which has no practical importance), the question whether or not a certain sale is desirable under the maximum-earnings principle can be answered only if we take into account the sales already made before the addition of the respective sale, because the increment cost and the increment capital depends on the number of units produced. In case we consider the rate of return, the profitability of the other sales has also an important bearing on the question; for instance, a certain sale netting a rate of return of 15% on the increment capital will be desirable, if the other sales together produce an average return of 10%, but it must be avoided if the rate of return of the other sales averages to 20%.

76. If we consider not one single sale but ask which ones of all the possible sales shall be accepted and which ones refused to get a maximum of earnings, we will first pick out those which produce a maximum gross income per unit because they will produce a greater increment net income and "rate of return of the increments," respectively, than any other sales, regardless of the way in which the increment cost and the increment capital, respectively, are figured. This means we start with the sales which bring higher unit prices than any other ones; then we add gradually sales with lower and lower prices until we arrive at prices which begin to reduce the earnings (either a negative increment net income or a "rate of return of the increments" smaller than the average rate of return resulting from the sales considered heretofore).

77. We see from the foregoing *that the average cost per unit has no influence on the price of a certain unit* under the maximum-earnings principle. The price of a certain unit which is sold profitably may be higher or lower than the average cost. The same applies for the value-of-service principle.

[10]The increment capital to be figured in the same way as the increment cost; see the preceding footnote of this Section.

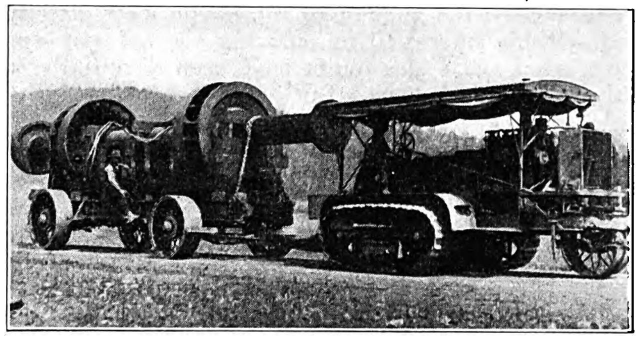
(To be continued.)

HEAVY POWER-PLANT MACHINERY HAULED BY TRACTORS.

Caterpillar Tractor Used to Move Hydroelectric Machinery to Long Lake Water-Power Plant.

An interesting example of the utilization of caterpillar tractors and trucks for hauling heavy machinery this summer was that made by the Washington Water Power Co., Spokane, Wash., in transporting to Long Lake the equipment required for the installation of its new hydroelectric unit in its existing plant. This required a haul of eight miles from the nearest railroad to the plant, over the earth bed of an old railroad grade.

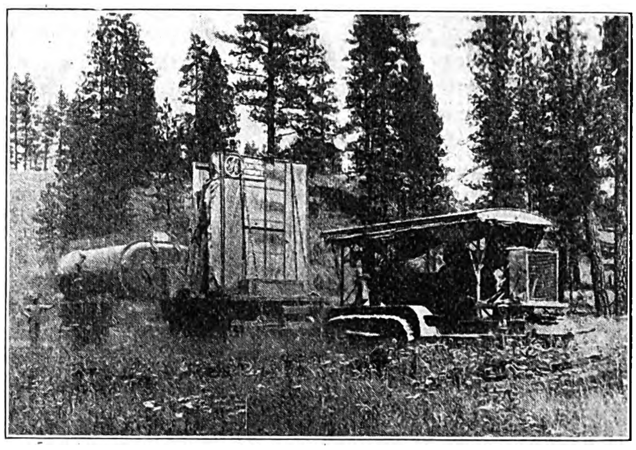
The heaviest load, illustrated herewith, consisted of the turbine runners and shaft which weighed 38½ tons. This was hauled upon a Holt 30-ton wagon, and was drawn by a Holt 45-ton tractor. The axles of



Holt Caterpillar Tractor Pulling 38½-ton Load Consisting of Turbine Runners and Shaft.

the wagon were strengthened so they would support the load. The generator parts in three pieces, similarly transported, weighed 15 to 16 tons each. The lightest load of the trip was 20 tons, for which four three-wheel logging trucks were used. In the latter operations two 10-ton trucks were pulled by one caterpillar. In one of the illustrations there are shown two trucks, one bearing a transformer element and the other a tank, drawn by a tractor.

Incidentally, it may be said, that the penstock of a length of 239 ft. for the new unit at this plant is



Transformer Element and Tank Being Hauled on 10-ton Trucks by a Holt Caterpillar Tractor.

complete, and that the installation of the turbine, generator and other equipment will be completed by Nov. 1, 1919.

PSYCHOLOGY IN CAR FARES CRITICISED.

Apparent Advocacy of Home Rule Criticised by H. S. Cooper, Well Known Consulting Engineer of Texas.

To the Editor:

I have read with much interest the editorial in the August 16 issue of the ELECTRICAL REVIEW and have also read with equal interest the similar views of Secretary Baker, those others of like opinion who have testified their beliefs and experiences before the Federal Electric Railways Commission and the many who are putting similar opinions into print in newspapers, magazines and special publications. "Boiled down to clear syrup," the idea is that all increases in fares should be submitted entirely to local decision, that outside or extraneous authority, such as State Public Utility Commissions, should be debarred from any authority or control in the matter. If such an idea had been offered by one or many who did not have cognizance of the facts or by those who were directly and selfishly interested in retaining the old fare—or lowering it—that idea might have been dismissed for either of those reasons. But when men of authority in, and supposed knowledge of, local electrical transportation operation give vent to such ideas and when such magazines as the ELECTRICAL REVIEW give them currency and echo them, then it seems time to put in a most urgent protest.

Outside of the fact that the last two years have pretty conclusively proved that not 1% of the municipalities will allow any increase in their street-railway fares if it can possibly be prevented, lies the further fact that in this matter, as in other matters relating to their public utilities, no community is capable of equity and justice in its communal decisions where those who actually make these decisions are directly and financially interested individually in but one phase of the matter—that which will be of advantage to each one without reference to what disadvantage it may cause to others.

Further, consider the case as it stands when those in the community who will be affected by a certain condition on which their decision will be the last and only one, are made the final arbiters. Is it in human nature as at present constituted to take the side which is the equitable and just one and to do so knowing that that decision will bring financial loss or increase of living expense? That is too much to ask of fallible human beings except in such dire emergencies as occurred during the late war—and it would seem from the many "investigations" now being made that even the stress of war times did not rid certain classes of taking advantage of any opportunity to better themselves, no matter how low or selfish the motive.

Outside of the known and acknowledged fact that "home rule" of the local utilities by their communities always means an admixture of politics and demagoguery in the settlement of any question in which the utilities are interested, lies the further present fact that such decisions as are now made in these matters are never made by the responsible element in the community. Before the advent of the automobile, when the street car was the necessity vehicle of every class, any question with reference to it was a common and universal topic of interest among all citizens. At the present time, outside of such laws or ordinances which restrict reckless or careless driving and which are an outcome of street-railway traffic, or outside of parking restrictions on streets which have street-railway tracks on them, the automobile owners and users have only an academic interest in the street railway and little or none in the matter of its fares. Except to oblige a friend, to settle a grudge or to carry out a theory, no automobile owner or user will exert himself to vote or otherwise affect the decision of the community. Those who do so vote, or shout, are either those whose daily expenditure will be measurably increased by an increase of street-car fare, those who have an axe to grind—politically or financially—those infested with municipal ownership or other socialistic isms and ologies and those who are "ag'in all corporations."

Beyond all this is the fact that to allow any community to be the court of last and only resort for its local utilities is to upset all our ideas of equity and justice, and the fact that this has been permitted in the past and is being urged and condoned at the present time does not alter the ethics of the case. What would be thought in equity and law of any trial in which one party was plaintiff, prosecuting attorney, jury and judge all rolled into one and all having a selfish personal and individual interest in but one verdict and sentence? And yet that is exactly the case in "municipal home rule" when it is calmly and dispassionately analyzed. Here is a portion of the community—the portion which always votes in matters which indirectly or directly affect it in any individually selfish manner—permitted, nay, even urged, by those who should know better, to make a decision, a final decision, a just and equitable decision, on a matter which touches their pocketbooks. Could not anyone tell long beforehand what that decision would be? Let those who know the deciders put themselves in their places—would *they* care whether the stockholders had a "reasonable return" on their investment if *they* owned no stock? Would *they* care whether the crippling of the local utility injured outlying property or investments if they were not personally interested in such? Would anything move *them* in such a case and under their personal environment except individual benefit and selfishness? Of course they would not. Outside of a few bankers, real-estate owners and others largely and directly interested in the growth and facilities of any community, what individuals in the community realize the danger of laming or killing the local utilities, recognize and realize that danger sufficiently fully and strongly to make them decide against their personal and individual selfish interests?

If there is any "psychology" in the matter it is the psychology of personal selfish interest and if that is to be the guide in matters of utility service and emoluments and if that is to be limited to those businesses alone then it is a pretty poor prospect for them. "Lord, defend me from my friends, I can take care of my enemies." Mr. Tripp stated before the same commission that "we had all been living in a fool's paradise" and when electric transportation men and journals advocate the continuation of the very ills which "home rule" injected into the local utility business years ago and from which the business has only been at all cleared by state commissions, it would seem that a lot of us still remain in Mr. Tripp's Elysium and that we would get better and more practical results if we descended to the plains of common sense and justice.

H. S. COOPER.

Dallas, Texas, August 20, 1919.

STREET - RAILWAY SITUATION OF NATIONAL CONCERN.

The New York *Times* said recently: "Any idea that the troubles of the electric railway companies are local merely because they mostly do a local business and are subject to local regulation cannot survive the evidence now being offered to the Federal investigators whose appointment was approved by the President when he was at Paris. The operation of a thousand miles of track has been abandoned. Sixty companies have actually dismantled and junked their properties. Sixty-two companies operating 6000 miles are in the hands of receivers. The net income in 1917 was $41,800,394, and in 1918 $10,712,726. It appears to be clear that fares must be increased, or many riders must walk. Last year there were eleven billions of electric railway passengers."

This statement by one of the leading newspapers of the country shows that it has investigated this problem carefully and in an unbiased manner, and therefore in striking contrast to so many other newspapers that have shown the most violent hostility to the street-railway companies.

Editorial Comment

Electric Trucks and Tractors in Warehouses

INDUSTRIAL electric trucks and tractors offer one of the best means of solving the handling problems of storage warehouses and similar places as pointed out elsewhere in this issue. In their application for this work, however, considerable difficulty is encountered due to the design and construction of the buildings which, to a certain extent, prevents their introduction.

To entirely overcome such difficulties in existing buildings is of course impractical, but they can be avoided in future construction by a little co-operation from the rest of the electrical industry. There are very few such buildings designed where some branch of the electrical industry is not called in to act in an advisory capacity. At such times if the advantages offered by this apparatus are pointed out the design of the building can readily be modified to permit their satisfactory and efficient application.

Individuality in Daylight Saving

PASSAGE of the law repealing daylight saving over the veto of the President brings to an end after October 26 the nationally legalized practice of turning the clock an hour ahead during the summer months and thereby making available for general usefulness and recreation an hour of daylight that would ordinarily pass before the working day for most of us commenced

America is so far as we know the only country reverting to the old order of things. France, Great Britain and other countries adopting Benjamin Franklin's suggestion of saving daylight as a necessary step in economy created by the war, are adhering to a practice that proved its worth in helping to win the war. America is a backslider, not because we do not need to save coal, not because we are not desirous if not anxious to reduce our summer lighting bill by a million or more dollars, not because we do not need more time for recreation, but because a certain element or elements have created an impression that their will is the will of the majority. It is known that those farmers employing help are the ones that have opposed the daylight saving. It has also been claimed that some of the lighting utilities have opposed the same law, though no evidence was offered to verify this. But we do know that that extra hour of daylight is a boon to the city dweller and its *raison d'etre* is sound from every economic aspect.

However, it is only the compulsory observance of daylight saving that is denied us. We still have the privilege of voluntarily adhering to it or of obtaining the same benefits in other ways. It was advocated in these columns long before daylight saving became a law that the stringent custom of starting and ceasing work during the summer months during certain very narrow limits be extended and modified and in so doing reduce the unpleasantness, the delays, the dangers and the high cost of transportation. That can still be done and should be done.

We shall all gain if the employer of labor permits his employes to change their hours of commencing and ceasing work during the summer months. The employer, likewise, will gain, because his employes will be more efficient and therefore do better work. The demand upon the traction systems will be spread out over a longer period. For the power companies the summer peak will be different, less capacity will have to stand ready for service and less coal will be consumed for banked fires and peak loads.

We humans are habit-forming animals, and often our habits are not the wisest. Now that saving for usefulness that additional hour of daylight will be a matter of choice instead of necessity in the summers to come, it is hoped that the individuality in us will assert itself and that many of us will adopt our own daylight-saving habits when the summer comes back each year.

The Contractor-Dealer in the Scheme of Things

INTO almost every phase of the electric utility industry one hears mention of the contractor-dealer.

At the recent meeting of the Executive Committee of the National Electric Light Association in New York two of the matters that came up call for special reference. One of these was that of publicity, the other that of the contractor-dealer.

The N. E. L. A. is now taking up in earnest the education and assistance of the small contractor-dealer as to the sale of current-consuming appliances and merchandising methods. The contractor-dealer is part of the scheme of things, a link in that long chain of electric supply, that has come more and more interwoven into the fabric of our national life with every year. In the past, many central stations have failed to appreciate the function of the contractor-dealer or their responsibility toward him. Things are changing, have changed rapidly of late, and we look forward to the close harmony and mutual understanding between the utilities and the contractor-dealers that should exist for the welfare of both, the central-station industry as a whole, and the public whom they both serve.

Good Will and Psychology in Car Fare Increase

GOOD WILL is a very important, though intangible, asset in any business, be it mercantile, industrial or public utility. In public utility valuation the element of good will is frequently denied, on the assumption that any business which is more or less of a monopoly cannot suffer from ill will and the public *must* patronize it willy-nilly. The fallacy of making this belief general has often been exposed. Especially when severe exactions have been imposed on a utility company that could not list (often through no fault of its own) the good will of the public among its assets has the reality and value of public good will been made clear.

Probably at no time has it been more desirable to have the public good will on the side of the utilties than right now when so many of them, especially electric railways, are compelled to seek higher rates to meet rising operating costs or face bankruptcy. Through the public service commissions, which happily are now established in nearly all our states, the utilities can in most cases find at least temporary relief for the desperate conditions confronting them. In many states, however, the commissions have not been in existence long enough for the general public to fully understand their function and authority. Formerly nearly all rate cases before commissions involved rate changes downward, whereas, now when the commissions in all fairness find that rates must be raised the public does not readily grasp that the commissions are obligated to adjust rates down or up as conditions may require. Thus arises one of the chief causes for renewal of home-rule agitation, demands for curtailment or extinction of commission authority and bitter resentment at the higher rates.

We believe, and many authorities on public utility service agree on this, that the agitation for home rule and the resentment at higher rates would be largely overcome by a judicious effort of the utilities to place their case frankly before the public so "that the people may know," in the words of Mr. Henry L. Doherty, the merits of the case before it is formally brought before the commission or other body authorized to act on it. Failure to provide the preliminary publicity gives opportunity to those demagoguic interests in the community who usually are waiting for just such a chance to allege that the matter is being railroaded through some remote commission and others without thinking quickly accept this assertion of conspiracy. Thus the good will or at least fair attitude of the public that could have been gained by a candid presentation of the actual facts is replaced by the ill will toward the utility corporations that many politicians and professional agitators do their utmost to foment for their own ulterior motives.

These ideas were briefly set forth in an editorial entitled "Psychology and Car Fares" that we published in our issue of August 16. We endorsed a certain statement by Secretary of War Baker along these lines. In a letter that we publish elsewhere in this issue, Mr. H. S. Cooper of Dallas, Texas, well known as the secretary of the Southwestern Gas and Electric Association for many years, takes spirited exception to the editorial in question. It may be that on account of the discomforts of a torrid day the idea aimed at was not presented very clearly, but Mr. Cooper reads into it much more than was intended, especially when he accuses us of favoring home rule and attacking commission regulation of public utilities. As other readers may have misunderstood our stand on the question, we take this opportunity to make it clear.

The ELECTRICAL REVIEW has for over ten years been a sincere and consistent advocate of commission regulation and has on countless occasions shown the fallacy of arguments seeking to have home rule of utilities restored. The evils so commonly connected with home rule, especially that of keeping utility questions in politics, have been repeatedly exposed, as have also the common shortcomings of municipal ownership. Instead of attacking commission regulation, we have warmly advocated its extension so as to give a single state commission full power to solve even the labor problems of the utilities. We have no apologies to make for this steadfast attitude toward utility regulation and pride ourselves that among our constant readers there are not a few who have commended us for taking a stand on this question in advance of current practice.

Utility commissions, like the courts, are not publicity mediums. Their function is to weigh the merits of the case and render a decision thereon which is made public, usually with a review of the salient features of the case. But a very small percentage of the public studies the decision and the evidence on which it is based. The time for publicity in a public utility case is chiefly before the case is presented in detail to the commission so that the public may have a grasp of the essential facts at issue before the decision is rendered and therefore will be prepared to see the wisdom thereof. Several electric railway companies have through newspaper advertising or pamphlets distributed among their patrons presented simple and clear statements of the facts and figures of increased costs and thereby gained the good will of the patrons toward the increased fares that were inevitable in spite of all possible economies.

In Illinois the central station, gas, electric railway and telephone utility associations have formed a mutual Committee on Public Utility Information and the National Electric Light Association is right now considering the creation of similar publicity committees in the other states. This shows that the idea of more extended and persistent utility publicity is gaining ground. It is bound to increase the good will of the public toward the utilities.

Current Events

Report of Michigan Meeting — Plans for Pennsylvania Convention — N. E. L. A. Activities — Electrical Shows

MICHIGAN SECTION, N. E. L. A., HOLDS BIG CONVENTION.

Many Subjects of Central-Station Interest Discussed at Largely Attended Meeting at Ottawa Beach, August 26-28.

The first meeting in three years of the Michigan Section, National Electric Light Association, proved a very successful affair on Tuesday, Wednesday and Thursday of this week. It was the sixth annual convention and was held at the Hotel Ottawa, Ottawa Beach, Mich. An unusually large number of members and guests was present.

The first session opened Tuesday morning with the presentation of the address of President Thomas Chandler, Sault Ste. Marie. Mr. Chandler was in active service as a captain of engineers during the late war and during the summer of 1918 he went to France with the 56th Engineers, an anti-aircraft searchlight organization. In his address he referred to the excellent manner in which the association's affairs had been conducted during his absence. He then discussed important topics of the day, dwelling on daylight saving, the great demand for house wiring and electrical appliances, the need for greater economies and higher rates to meet increased costs, more careful consideration of the subject of rates, training and education of employes, the new Michigan Utilities Commission, and association matters in general.

After the appointment of some committees, a paper on "Courtesy" was presented by John Swanson, Consumers Power Co. This pointed out the importance of courteous treatment of patrons by all utility employes who come in contact with them, whether directly or by means of the telephone. The subject was discussed by Herbert Silvester, F. A. Newton and R. A. Gordon. These speakers pointed out that courtesy can do a great deal to develop the good will of the public.

A paper on "Electrical Merchandising" was presented by A. H. Touscany, Detroit Edison Co. This reviewed especially the work that is being done in Detroit and nearby cities in the sale of cleaners, washing and ironing machines, electric sewing machines and other appliances. Many important points were brought out. This paper will be treated at greater length in an early issue.

Discussion of the subject was opened by Mr. Johnson, of Jackson. The sale of merchandise by the Consumers Power Co. of that city amounted last year to $15 for each meter installed. This compares favorably with the revenue received from lighting accounts. The sale of appliances has also been the means of increasing the load-factor. The discussion turned to the question of whether it is undignified for a central station to push the sale of appliances by house-to-house canvass. Mr. Touscany thought that it was not proper for the central-station company to do this. Mr. Johnson stated that in one of the Ohio cities a list was made up of central-station customers who did not have any electrical appliances. The list was divided into groups of 20 names which were given to separate salesmen with 20 flatirons each. Results showed that 18 to 19 of these 20 patrons bought the irons. H. H. Koelbel said that it was a bad thing to permit department stores to sell cheap heating appliances as it has a tendency to injure the appliance business.

"The Central Station and the Contractor-Dealer" was the subject of a very interesting paper by R. A. Gordon, Houghton County Electric Co. In this paper the relationship of these two branches of the industry was discussed and the conscientious efforts being made by both to come together on a common ground and co-operate were shown. The author is strongly in favor of this movement and stated that the task of forming or promoting joint co-operative organizations wherein all branches of the industry would be represented should be the task of the central stations and they should welcome the opportunity to perform this service. He explained the great need for co-operation in the electrical industry at the present time and the attitude of other organizations, particularly the National Association of Electrical Contractors and Dealers, towards such a movement. He also gave several valuable merchandising suggestions and pointed out the advantages of a proper merchandising policy.

On Tuesday evening William A. Durgin, Commonwealth Edison Co., Chicago, presented an illustrated lecture and demonstration on industrial lighting, using a special model for effectively showing the very superior results obtained when a good system of general illumination is installed.

H. J. Burton, Consumers Power Co., in his paper entitled, "Working Safely on High-Tension Lines," discussed the hazards of working on power lines, taking up the dangers due to induction, lightning, falling objects as well as those due to electric shock from a live circuit itself. The selection of men for the work, construction of lines and the importance of training men were taken up, after which Mr. Burton discussed individually insulating tools and appliances, rubber gloves, shields and protectors, linemen's spurs, safety belts, boots, coats and similar equipment. He described special tools necessary to permit insulators to be changed with safety on live lines and the precautions that should be observed in work of this kind.

The evening session was concluded with the showing of a two-reel educational film, "The Queen of the Waves." This showed the wonderful progress being made of the use of electricity in navigation.

On Wednesday morning the first paper presented was by Robert Davey, of the Consumers Power Co., entitled "Accounting for Plant Investment of Public Utilities." This paper discussed the various methods used in making the yearly budget and accounting of same.

James V. Oxtoby, a prominent attorney of Detroit, then made an address on "The New Public Utilities Law." He briefly explained that the new Public

Utilities Commission created by the last Legislature has replaced the former Michigan Railroad Commission and has all the powers of the former body. It also has the power to make rates. All new rate schedules proposed must be sent to the Commission but are not effective until approved by it. F. A. Newton, Consumers Power Co., who was formerly associated with the Wisconsin Railroad Commission, urged that a committee be appointed to help the members keep informed as to the activities of the Commission. Rates should be made so that each class of service makes a fair profit. He strongly advocated getting and keeping records of costs and income so that new rates can be made which are proper for each class of service.

On Wednesday evening was held the annual banquet at which the principal speaker was F. G. R. Gordon, of Haverhill, Mass., who delivered a very instructive address on "The Trend and Menace of State Socialism in America." This was followed by an entertainment program. A report of the concluding sessions of the convention will be given in our next issue.

LARGE ATTENDANCE EXPECTED AT PENNSYLVANIA CONVENTION.

Program Includes Many Noteworthy Speakers and Elaborate Entertainment Features.

The approaching convention of the Pennsylvania Electric Association, to be held at Bedford Springs, Pa., Sept. 3 to 6, inclusive, is confidently expected to be the best of the many successful and enthusiastic gatherings of this association.

Among the guests of honor who will deliver addresses are included the Hon. Wm. C. Sproul, Governor of the Commonwealth of Pennsylvania; the Hon. Wm. D. B. Ainey, chairman of the Public Service Commission, and Walter H. Johnson, vice-president of the National Electric Light Association.

The papers to be presented at this convention form a well balanced group, covering those phases of the industry which are uppermost in the minds of those responsible for the success of the central station.

A condensed outline of the program follows:

Thursday, 10 a. m.—President Sproule's address; reports of officers and committees; appointment of committees.

Thursday, 8:30 p. m.—Address by Gov. Wm. C. Sproul of Pennsylvania; address by Wm. D. B. Ainey, chairman, Public Service Commission; address by W. H. Johnson, vice-president, N. E. L. A.

Friday, 10 a. m.—Paper, "The Effect of the War on Boiler-Room Practice," by John A. Barnard, combustion engineer, Philadelphia Electric Co.; "Economical Boiler-Room Practice for Medium-Sized Plants," by H. B. Bryans, engineer, Counties Gas & Electric Co., Norristown, Pa.; "Selecting a Switchboard for a Plant of Moderate Size," by G. E. Wandle, assistant general manager, Lycoming Edison Co., Williamsport, Pa.; "Management and Men," by H. P. Weaver, general manager, Independence Bureau, Philadelphia.

Friday, 2:30 p. m.—Paper, "Increasing Capacities of Existing Lines and Cables," by E. C. Stone, system operator, Duquesne Light Co., Pittsburgh; "The Story of Insulations," by C. E. Skinner, Research Division, Westinghouse Electric & Manufacturing Co.; "Meter Department Practice in a Large Scattered Territory," by E. H. Tyson, superintendent meter department, Lehigh Valley Light & Power Co., Allentown.

Saturday, 10 a. m.—Paper, "Isolated Plant Costs as Influenced by the War," by John Meyer, Philadelphia Electric Co.; "Power-Factor Correction by Means of the Static Condenser," by O. C. Roff, General Electric Co.; reports of committees, election of officers.

A novel feature of the convention will be an exhibition by some 30 manufacturers, the displays being made in a large tent that will include a club section.

The return of the social features of the convention will be welcomed by all as affording the opportunity for renewing that goodfellowship which always characterized the "pre-war" conventions of this association.

ATLANTIC DIVISION SUPPLY JOBBERS TO MEET.

Next Meeting of Supply Jobbers to Be Held Sept. 17 in Philadelphia.

The Atlantic Division of the Electrical Supply Jobbers' Association will hold its next meeting at the Bellevue-Stratford hotel, Philadelphia, on Sept. 17. The meeting will be held in two sessions, both of which will be open. The first meeting will be called at 10:30 a. m.

A special effort will be made at the hotel to provide jobbers and manufacturers with information as to the names of those representatives who are present at this meeting. For this reason all attendants are requested to register upon their arrival when they will be provided with an identification badge.

According to present indications, a large number will attend this meeting and an interesting meeting is anticipated. Those expecting to be present or represented should notify the secretary, E. Donald Tolles, 52 Broadway, New York City, as early as possible.

AIMS OF THE GEOGRAPHIC SECTIONS OF N. E. L. A.

[Responding to a request for his ideas in relation to the scope and objects of the Geographic Sections, President R. H. Ballard, of the National Electric Light Association, transmitted to President Thomas Sproule of the Pennsylvania Electrical Association, the following in communication form in connection with a letter expressing regret at his inability to attend the convention of that organization which convenes at Bedford Springs, on Sept. 4.]

In the Geographic Section we provide the electrical industry with the intermediating link between the central station, which is the unit of activity from which ideas naturally germinate, and the National Electric Light Association, which is transcontinental in its policies and its aims.

In the Geographic Section the greatest opportunity is offered for personal contact and interchange of ideas between executives and employes of the companies and all others interested in the electrical industry within the territory where conditions are frequently identical and usually similar.

In the Geographic Section the results of progress made and new ideas demonstrated by one company, may be quickly conveyed to other companies in the same territory.

In the Geographic Section opportunity is afforded men to think in broader terms and to apply their reasoning along sectional lines. This is the logical sequence of development—company to section; section to nation.

The natural foundation for this line of progress is the company sections, and its importance is inestimable.

In the Geographic Section the maximum opportunity is presented for cementing all branches of the industry into one harmonious whole; of increasing the sphere of influence exercised by those engaged in our profession, and in eventually creating a better understanding between the public served and those whose duty it is to serve the public.

In the Geographic Section a complete understanding should be reached between central stations, manufacturers, jobbers and contractor-dealers, as to the rightful place in the industry occupied by each group and in establishing the relations of one branch of the industry to the others.

In the Geographic Section we have a place where misunderstandings, frictions, petty jealousies and fancied injuries can be ironed out and adjusted by bringing about a full and complete realization by all members of the section of the responsibility of service to the public and the joy of working out practical accomplishments of the ideal.

In the Geographic Section can best be worked out a definite plan by which the public may be kept informed on the true status of utility service in the district served.

In the Geographic Section there is ample opportunity for constructive initiative, and the opportunities for its exercise could be amplified indefinitely the scope of achievement having no limitation but brains and ability.

In the Geographic Section we have the medium of crystallization; demonstrating and applying locally when local, and making universal when universal all of the constructive creative forces that exist in the minds of the great membership of the National Electric Light Association.

SITE FOR NEXT N. E. L. A. CONVENTION TO BE SELECTED IN SEPTEMBER.

All Southern California Cities Are Eager for Meeting—Executive Committee to Decide Next Month.

Already there is an interesting rivalry among the cities of Southern California for the honor of being selected as the place of holding the 1920 convention of the National Electric Light Association. The news that the next convention of the national organization was to be held somewhere in the southwest was well rated by the committees of city councils and chambers of commerce of the larger cities of the southwest, and President R. H. Ballard is in receipt of a number of invitations which he will submit to the Executive Committee at its meeting in September. A selection will no doubt be made at this meeting, after which the first preliminary work for the session will be put under way.

Los Angeles, the metropolis of the southwest, with a national reputation as a convention city and rated for the hospitality it extends to those who visit it as representatives of important organizations, is eager to secure the convention. Its magnificent hotel accommodations, its central location, its proximity to the chain of beach resorts and its wonderful roadways and interurban electric lines, radiating in all directions, have much to commend it.

Pasadena, the Crown City of the San Gabriel valley, under the shadow of Mt. Wilson and in the center of some of the most beautiful scenery in Southern California, and only nine miles from Los Angeles, would be an ideal place for the session.

Riverside, in the center of the great orange and lemon belt with superb scenery on every hand and close to some of the great hydro-electric plants, desires to be considered.

San Diego, on one of the most remarkable natural harbors in the world, with magnificent hotels and all of the attractions that eastern visitors enjoy, has presented its claims.

Santa Barbara, the romantic and historic city by the sea, with its lore of other days, its wonderful old mission, some of the best hotels in the west and excellent facilities for entertaining, has also put in a request for the coveted honor.

President Ballard says he will try to present all of these requests to the members of the Executive Committee in as impartial a manner as possible, requesting the members to make the selection, as he feels those who reside in other sections of the country should be best qualified to choose the place that would best suit the visitors to Southern California.

EXECUTIVE COMMITTEE, N. E. L. A., HOLDS MEETING IN NEW YORK.

August Meeting Hears Reports and Plans for the Year's Work by Sections and Committees.

A meeting of the Executive Committee of the National Electric Light Association was held at the headquarters in New York City on August 14, attended by 17 men. In the absence of President Ballard, Vice-President Martin J. Insull presided. Treasurer H. C. Abell submitted a budget for the year ending June 30, 1920.

In connection with a discussion concerning the necessary reprinting of the Salesman's Handbook and the Overhead Line Construction Handbook, the general question of the method of distribution of these and other handbooks to the membership was brought up and was referred to a special committee which will report at the next meeting of the Executive Committee. John G. Learned was appointed chairman of this committee, of which the other members are the chairman of the Membership Committee, the chairman of the Company Sections Committee, the treasurer, and the chairmen of all national sections issuing handbooks.

Chairman Perry presented the report of the Exhibition Committee, reviewing the work done in advance of the convention scheduled for Atlantic City in 1917 and the work accomplished this year. He reported that prizes of $150, $100 and $50 for the best papers describing the exhibit as a whole had been awarded, that there were 85 exhibitors this year, the largest from the standpoint of number and square feet of space in the history of the association, and that 25 exhibitors had to be refused on account of their late applications. Mr. Perry also reported the list of officers and members of the Executive Committee elected for the year 1919-1920, which was given in the ELECTRICAL REVIEW, May 24, 1919.

Acting-secretary Sewall presented numerous applications for membership, the applicants being elected as follows: Class A 6, Class B 199, Class C 1, Class D 7, Class E 4, foreign 1; total 218. Mr. Sewall also presented the membership report as of July 31 showing a membership of 10,202 divided as follows: Class

A, 1059; Class B, 7812; Class C, 91; Class D, 273; Class E, 923; foreign, 44. This total of 10,202 compares with 11,209 on July 31, 1918, and means a net loss of 1007.

Mr. Insull read a letter from E. W. Lloyd which stated the Committee on Insurance Matters appointed at the last Executive Committee meeting felt that the interests of the N. E. L. A. with regard to insurance questions—such as the relative rating of electrical apparatus and other properties, and keeping in touch with the laws of the different states as to the possible liabilities of central-station companies as to fires and accidents caused by wiring beyond their control, etc.—should be under the control of the association working through a committee composed of members of the Technical and Commercial Sections. It was voted that the question of a committee on this subject be referred to President Ballard.

Vice-president Insull reported that John F. Gilchrist had accepted appointment as chairman of the Publicity Committee, and Mr. Insull read a letter from Mr. Gilchrist outlining his plans, which provide for the establishment in each state of a committee on public utility information similar to that already organized in Illinois, which committees will finance themselves and will furnish news bulletins to their members; the chairmen of the state committees are to form the personnel of Mr. Gilchrist's main committee. Mr. Gilchrist felt that it would be desirable to include the railway, gas and telephone interests, and that this would probably mean that in some cases the chairmen of the state committees would not be electrical men, but he did not feel there was any objection to this.

Mr. Insull also read a letter from President Ballard outlining his plans for his September trip East, stating that he planned to call a meeting of the Executive Committee during his visit, and suggesting the advisability of holding a national conference at that time and also a meeting of the Public Policy Committee. The question of a conference was discussed and it was felt that such should be held under the direction of the Public Policy Committee.

Vice-president Smith reported that he had asked Arthur Williams to serve as chairman of the Bulletin Committee; this appointment was confirmed. Mr. Smith also suggested that the personnel of this committee should include S. A. Sewall, Walter Neumuller, S. H. Giellerip, and the chairmen of the National Special Sections.

Mr. Insull reported that John F. Gilchrist and John G. Learned had represented the association at the convention of the National Association of Electrical Contractors and Dealers in Milwaukee in July. The principal subject discussed was a plan for educating the small dealers and contractors in selling appliances. The manufacturers agreed to raise a certain sum provided the other interests would recommend the plan. Mr. Gilchrist had advised Mr. Insull to recommend to the N. E. L. A. that its members approve the plan and endorse it, but he felt that no steps should be taken until the plan had been worked out more in detail.

Mr. Learned added that the only action the association could take would be to recommend to the members that they support the plan. The money will be raised locally and will be spent locally. He suggested that when it is decided to take any action, a letter should be sent to Class A member companies. He also called attention to the fact that in the Commercial Section a new committee has been appointed on relations between contractors, dealers, jobbers and manufacturers. On motion it was voted to refer this matter to the Commercial Section to report at the next meeting.

Chairman Foster of the Electric Vehicle Section reported progress and stated that all of the committees are actively at work, with the exception of the Insurance Committee whose work will be held in abeyance until a decision has been reached on the suggestion that a general committee on insurance be appointed.

Mr. Foster also reported that it had been brought to his attention that the municipal authorities of New York City were investigating the broad subject of harbor, steamship and railroad terminal facilities, including the transportation of freight over the city streets to such terminals and the handling of materials in the terminals. As the street transportation phase of this investigation is closely associated with the electric vehicle, Mr. Foster thought that efforts should be made to bring to the attention of the commission investigating this matter the merits of electric transportation. While this, of course, is purely a local situation, the recognition of the electric vehicle in solving this problem is of national importance, and therefore the co-operation of everyone concerned, particularly the central-station interests in and about New York City, is very essential.

For the Commercial Section Chairman Learned reported that a two-day meeting had been held at Association Island during the first week in August, at which time the bureaus and committees were appointed.

ELECTRICAL EXPOSITION WILL REOPEN GRAND CENTRAL PALACE.

Famous Exhibition Building Being Reconverted from Gigantic Army Hospital.

Having done its bit by serving effectively as an Army hospital, Grand Central Palace, New York City's largest exhibition building, is about to resume its normal peace-time status. Its return to the field of industrial exhibitions will be signalized on Sept. 24 next when the Electrical Exposition opens there for its customary run of 10 days. Excepting last year when the great electrical industry was too busy helping win the war to take time to show its latest inventions to the public, this exposition has been held annually in New York since 1907.

A large force of skilled workmen is now busily engaged in restoring the exhibition floors of Grand Central Palace to their original state. Already the numerous partitions built in making hospital wards have been removed, as well as the big theater constructed on the main floor for the entertainment of patients. An idea of the extent of this interior reconstruction is had from the fact that as many as 3700 bed patients have been there at one time, and besides the wards there were offices, reception rooms, operating and dressing rooms, mess halls, kitchens, store rooms, etc.

One hospital feature will remain as a part of the electrical exposition. This will be an electric therapeutic exhibit by the Medical department of the Army. It will serve to train doctors in the many new uses of electricity in the theraputic field and to enlighten the public on the benefits possible therefrom. As a whole this year's Electrical Show will be more varied and interesting than heretofore because this time it will disclose two full years of developments in the electrical field.

BIG ELECTRIC SHOW TO BE HELD IN BUFFALO.

All Branches of Industry Co-operating for Success of Show to Be Held Oct. 16 to 25.

Plans are being rapidly completed for the Buffalo Electrical Show to be held in Buffalo, N. Y., Oct. 16 to 25. This is the first show of its kind to be held in that city since 1914 and according to present indications will surpass all previous shows in every respect. Although the show is to be conducted under the auspices of the Buffalo Electric Show, Inc., of which Edmund D. McCarthy is chairman, all the electrical interests of Buffalo are taking an actual part in the arrangements by representation on the various committees through the officers and members of the Buffalo Electric Club.

The Broadway Auditorium, where the show will be held, is the largest hall in Buffalo for such purposes. It is centrally located, being accessible by direct car lines from all sections of the city and within easy walking distance of the principal hotels. A large portion of the available exhibit space has already been purchased by prominent manufacturers and this feature promises to be especially interesting.

The decorations and color scheme are elaborate and designed to make the most artistic and pleasing impression upon the public on entering the hall. An artistic and spectacular illumination is assured by the fact that W. D'Arcy Ryan, illuminating engineer of the General Electric Co., has been consulted and the arrangement of the exhibits will be governed by the illumination plan for the inside of the hall. Broadway, from Lafayette Square at Main street to the Auditorium, will be generously illuminated.

The program of the show will be an attractive souvenir filled with interesting articles on the history of the art and descriptive of the electrical development on the Niagara frontier as well as that brought about by the war and the use of the wireless telephone and aeronautics.

GREATER POSSIBILITIES FOR SOCIETY FOR ELECTRICAL DEVELOPMENT.

Letter to Members Outlines Present Activities and Urges That Duplication of Effort Cease.

The following letter has been sent to all the members of the Society for Electrical Development by J. M. Wakeman, general manager, and gives an interesting and timely resume of the important work that is being carried on:

It is evident that the Society for Electrical Development should "get its story across" to more men in the industry.

Do you realize what it does?

For the past five years this society has been getting the finest kind of publicity for the industry in the best magazines and newspapers of the country. The list of publications using stories, articles and material supplied by the society has been printed and sent out over and over again.

The statistical development of this society has more information filed and available covering applications of electricity to the various manufacturing industries than has any other organization.

This society has for 5 years been supplying member contractor-dealers, jobbers, manufacturers and central stations with sales ideas, writing advertising copy, laying out sales campaigns, supplying cuts, mats and other material without charge.

The "Special Service" department is under constant pressure responding to the calls for information, suggestions, articles, etc., from the general public, the industry, the trade press, popular magazines and newspapers.

And yet, in spite of all this, every now and then someone suggests that some association ought to render such services to its members, convince the public of the advantages of electricity, gather statistics, help the dealer with sales ideas, write advertising copy, etc. Generally, the meeting at which such suggestions are made receives them with enthusiasm and decides to go ahead. A great shout goes up that real co-operation is assured!

For other organizations to duplicate the work of the society is wasted effort; it would not be attempted if everyone knew what this society does. There is plenty of work to be done without duplication.

Won't you as a member of this society help to "get the story across"? Printed matter alone won't do it. The assistance of our members is needed to tell it. The staff tells it but the number they can reach is comparatively small. If all our members would tell it, the society's activities would quickly become known and efforts at duplication cease.

PLANS FOR MEETING OF MINING AND METALLURGICAL ENGINEERS.

Chicago Meeting in September to Include Inspection Trips in Addition to Over 150 Papers.

In view of the large number of coal mines centered about Chicago, it is planned to make the Chicago meeting of the American Institute of Mining and Metallurgical Engineers to be held at the Congress Hotel Sept. 22 to 26, of especial interest to the coal industry. A large proportion of the 150 technical papers prepared for discussion will be on subjects related to coal, coal mining and coke. Among these is a carefully prepared symposium on sulphur in coal. Excursions have been arranged during the meeting that will be particularly attractive to the coal man; on Thursday the trip to La Salle will include the inspection of operating coal mines in the district, and late Thursday night a party will leave for the mines in Franklin and McCoupin counties, where some novel and ingenious ideas in plant design and methods of operation have been adopted and proven practicable. The trip to the Gary steel mills on Tuesday will include an inspection of the immense coke ovens and by-product plant.

Metallurgists and electrical engineers will be much interested in the demonstration to be made of the production of metallic tungsten and molybdenum at the plant of the Fansteel Products Co., North Chicago, on Tuesday, Sept. 26. As a part of the program for the Chicago meeting, an excursion has been arranged to Milwaukee, to visit the various mining machinery plants in the vicinity, and a stop will be made en route at the Fansteel plant. The entire metallurgical process will be shown, from the preparation and purification of the commercial concentrates, and including sintering the pulvurent metal obtained into homogeneous billets by the use of currents of enormously high amperage.

The National Exhibit of Chemical Industries is being held at the Coliseum, Chicago, the same week as the Institute meeting.

Commercial Practice

Line Extensions in Small Communities—Central-Station Employes Buy Government Food—Detroit Operating Costs

LINE EXTENSIONS IN MEDIUM AND SMALL SIZED COMMUNITIES.

Important Problem Discussed in Paper Read Before Southwestern Gas and Electric Association.

By B. F. Cherry,
Weatherford Water, Light & Ice Co.

When first assuming the management of our plant a little more than eight years ago, I found no set rule for making electric extensions. The price of line material was, at this time, very reasonable, so we decided in making line extensions to set one pole and run one span of wires for each new customer who would agree to use our electric service for at least twelve months. We tried this plan and to a certain degree it was a success. We received many orders for extensions and had a large increase in the number of customers.

When the price of line material of all kinds began to advance, my knowledge and experience began to advance also. We soon saw that the original plan must be discontinued and a new one established. To make this change we decided to set only one pole as an extension for every two customers who would agree to use electricity for lighting and other purposes for a period of at least twelve months.

After using the above mentioned plan for about two years we stopped, and after reviewing the new customers whom we had secured during these two years by our extensions, we decided that our plan was a failure. The plan was a failure for many reasons, but I will mention only two here. First, not more than 50% of our new customers carried out their agreement as to the length of time that they would use the service; secondly, the more we gave, the more they expected and demanded. They expected too much, and so it was a very difficult matter to satisfy them.

The next move was to study out a better plan and to try to correct the mistakes that had been made. It is an easy matter to make an error but a most arduous task to correct one. That was my experience in this instance.

What I had experienced and observed during these two years as manager of a central station in a small town led me to believe that a man who had heretofore neglected having his home wired for electricity and who had not had the pleasure of using electric lights and other electric conveniences, when he did start using these and began to enjoy the full 100% of service that we, or any other central station in a medium sized or small town should give, that man really got more out of the service than so much per kilowatt-hour.

Going on the theory that "That which costs the most is appreciated the most," we decided to check up a little on soliciting new customers and making new extensions and to adopt a plan whereby the would-be customer must pay for something more than merely the wiring of his house. Now, man to man, it is nothing but just and right that he should.

For any and all new extensions we would stand half of the expense, while the person, or persons, desiring the extension must pay the other half; the line was to be our property, we, of course, to maintain the same; or, if the person, or persons, desiring the extension preferred, they could stand the entire expense of the extension and we would pay back to them in monthly payments the entire cost of same at the rate of 50% of their monthly electric bill for current consumed. We would, of course, advise and talk up the plan of equal division of expense, arguing that with this plan there would be no unfinished business to bother with or possibly have trouble over, and, with the exception of a few extensions for motor service, this plan was favorably received and was, or is, a great success.

Occasionally we would be confronted with the argument that we should stand the entire expense of the extension, for the reason that they would have to pay us for all current consumed. This can be answered in many ways, but we always referred them to the fact that an electric line running to, or by, their home would enhance the value of the same more than the entire extension cost, to say nothing about the fact that we stood half the cost and when it was necessary.

A few times we have had to meet the argument that we should make an extension free of charge for the reason that the party desiring same had to pay the high city tax. To this we frankly assured them that they did not have to pay one cent of the city tax on account of the electric light plant being located or doing business within the city limits. In every instance, in connection with an extension, we make, or try to make, the party feel and know that in his getting the extension and our electric service, he is favored just as much as the central station and that we were under no more obligation to him than he was to us, on account of the deal.

One other thing that has been a great help to us in the way of extensions is the fact that we wire houses. In almost 50% of the cases where a party desires electric line extended to his home or property, he will simply ask what it will cost to put electric lights in his home, and then, of course, we would figure the line extension, house wiring, etc., and give him the total cost in a lump sum, and since we do house wiring at practically cost of time and material, he could get electric lights in his home for a less amount that he would if we had stood the entire cost of the extension and if he had to have gotten an independent contractor to have wired his house. And when it becomes necessary to close the deal for an extension, we explain and make this fact plain to them.

After eight years of just such experience, my advice to any and all central-station managements in medium-sized or small towns is, first, to get ready to deliver the goods, give good service, full one hundred percent, and then put into the minds of the people that you serve, or may serve, that while you are their servants you are not beggars but instead give full value for everything received. Above all, don't beg too hard for new business or extensions. This may work in the cities, but will not in small towns, or that has been my experience. I would rather have one new customer who applied to me for the extension, or service, than to have two or three whom we would beg into taking the same, for one satisfied customer is worth more to any central station than two or three, or even more, disgruntled customers.

I feel sure that our plan of extension will be adversely criticized, for the reason that we do not go minutely into the cost of and the probable return that we might expect from same, and without due consideration and study it would seemingly be a just criticism. However, our experience has been when a man is willing to dig down into his pocket and pay for one half the cost of the extension or pay all of it to get it returned to him in small bits, he is interested enough to make a good customer and the return from such an investment is, in almost every instance, satisfactory.

So far we have had no one to try to force us to make an extension, and have made estimates on a number that did not go through. If extreme care is taken to explain in detail all the matters in connection with an extension, I hardly think there would be any trouble over an extension where a system similar to ours is used.

CENTRAL STATION ASSISTS EMPLOYES IN PURCHASING FOOD.

Commonwealth Edison Co. Buys Food at Government Rates for Distribution Among Employes.

In order to make it more convenient for the employes of the Commonwealth Edison Co., Chicago, to take advantage of the government rates on surplus army and navy food, notices were sent out during the sale advising the various departments that orders for canned goods could be given through the Commonwealth Edison Section of the National Electric Light Association. This organization had arranged to purchase a large supply of this food from the Government. Any employe with the company for three months was eligible, and the order was not to exceed 25% of any employe's monthly salary.

All orders were accepted up to noon, Aug. 21. Cash accompanied them when convenient, but if the employe so elected, the company advanced the money. This money to be refunded by the employe by Oct. 15, $10 to be taken on the first pay day after placing the order, and the remainder at the rate of $10 each semi-monthly pay day. The orders will be filled by the Stores department and delivered just as soon as the supply is delivered by the Government.

COAL CLAUSES SHOULD BE ABOLISHED.

In connection with a decision in a rate case brought by the Slate Belt Electric Co. against the Pennsylvania Utilities Co., of Easton, Pa., in favor of the latter, which furnishes energy for the operation of the Slate Belt Company's electric railway lines, the Pennsylvania Public Service Commission points out the fallacy of coal clauses in contracts for electric power, saying as follows:

"The total clauses were brought about by the war with its rapid fluctuations of prices for fuel and were perfectly proper in the emergency. With the return of price stability, however, they have almost passed out of tariff structures, and while the Commission does not view them as illegal, there no longer appears a reason for their retention, and they should be superceded by more definite rates carried into tariff schedules and calculated to produce the required revenue."

The present rates of the Pennsylvania Utilities Co. are pronounced as "just and reasonable."

EFFECT OF MATERIALS AND LABOR COST UPON COST OF OPERATION.

Data for Twelve Months Applies to Detroit Edison Co.'s Connors Creek Station.

The accompanying figures, compiled by the statistical department of the Detroit Edison Co., showing details of comparative kilowatt-hour costs covering various twelve months' periods, are very illuminating, showing, as they do, the actual results in operating following the fluctuating of materials and labor.

COMPARISON OF PRODUCTION EXPENSE PER KW-HR. OUTPUT
CONNORS CREEK POWER HOUSE

Production.	Twelve-Month Periods Ending— June 30, 1916.	Dec. 31, 1916.	June 30, 1917.	Dec. 31, 1917.	June 30, 1918.	Dec. 31, 1918.
Operation—						
Superintendence	$0.013	$0.013	$0.010	$0.010	$0.009	$0.009
Wages	.043	.042	.047	.050	.055	.061
Fuel	.158	.174	.240	.325	.368	.382
Water	....	....	....	....	....	....
Lubricants	.001	.001	.001	.001	.001	.001
Station supplies and expense	.005	.006	.005	.005	.006	.009
Maintenace—						
Station buildings	.006	.007	.011	.010	.008	.007
Steam equipment	.019	.016	.019	.024	.025	.023
Electrical equipment	.003	.003	.001	.001	.002	.001
Total	$0.248	$0.262	$0.334	$0.426	$0.474	$0.493
Kw-hr. output—net	125,158,800	162,117,600	210,039,700	249,192,200	280,814,700	327,020,500
Maximum demand (30-minute)	35,000	36,000	50,000	58,000	59,000	80,000
Average load	14,300	18,500	23,900	28,400	32,100	37,300
Load-factor	.409	.514	.478	.489	.544	.466
Coal per kw-hr.—lb.	1.44	1.45	1.52	1.61	1.63	1.63
B.t.u. per kw-hr.	19,700	19,800	20,040	20,470	20,930	20,900

Operating Practice

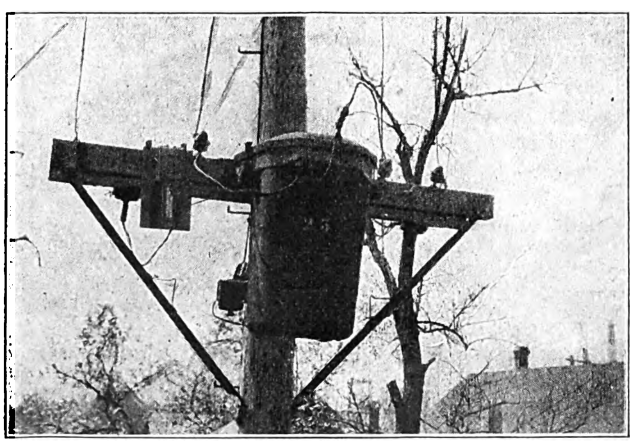
Measuring Distributing Transformer Demand—Insulating Outdoor Wires—Furnace Loads—Eliminating Harmonic

MEASUREMENT OF LOAD ON DISTRIBUTING TRANSFORMERS.

Considerations Involved in Measuring Demand—Practice of Commonwealth Edison Co.

It is frequently necessary and often desirable to know the actual or approximate load which is carried by a distributing transformer. In working up data, such as the load-factor of a certain class of business, the exact load carried by the transformer must be determined. If the estimated load on a transformer of 15 kw. or larger is near 100%, it is advisable to make tests of the actual load before connecting any new customers having a relatively large demand. For economical distribution the transformer size should be adapted to the load, with a reasonable allowance, of course, for future business. An over-sized transformer requires heavier supporting equipment and is also less efficient than a transformer nearer the size of the load. An overloaded transformer is a hazard. Due to excessive transformer drop, the voltage will be below normal. It may burn out any time with resultant interruption to service and may possibly open the primary circuit.

There are several sources for selecting transformers which are to be measured. The record of connected load or local conditions might indicate that the actual load is close to the transformer rating. If through voltage tests made in a pressure survey on account of a complaint of poor service it is found that the voltage at the transformer is low when the primary pressure is known to be normal, the transformer is likely to be overloaded. The repeated blowing of primary fuses may be due to a heavy overload. If the average demand factor for all transformers on a circuit, as determined by the ratio of the maximum kv-a. indicated by station instruments to the connected kv-a. transformer capacity, is near 100%, it is reasonably certain that some of the transformers are overloaded. The selection of transformers suspected of being overloaded will then have to be made by one or more of the methods mentioned.



Maximum Demand Meter Installed Upon Pole for Measuring Demand on 25-Kw. Transformer.

The simplest and easiest way to determine the maximum load carried by a transformer is by means of a Wright demand meter connected in the primary side. A method of installing the meter is shown in the accompanying illustration. A Wright demand meter is mounted on a board which is fitted with hangers so that it can be hung from a crossarm. Rubber-covered leads from the meter are connected to a wooden plug which is made exactly like the primary porcelain fuse plug. For convenience in handling this special plug is fitted with a large handle through which the leads are passed. The primary fuse plug on the neutral side of the transformer to be measured is removed and the wooden plug is substituted. This makes an inexpensive equipment which is entirely satisfactory for measuring transformers to 40 or even 50 kw. For measuring larger transformers it is advantageous to use a recording ammeter and split-ring current transformer. The chart will show the characteristics of the load, which will allow one to take into account diversity when determining if new load can be connected. The ammeter must be mounted in a weatherproof box which can be hung from a crossarm. A split rubber hose should be slipped over the lead to be measured before the split-ring transformer is clamped on, and the transformer should then be covered with a waterproof cloth. If quick and approximate results are wanted the measurement can be made with a split-ring transformer and indicating ammeter at the time when it is thought that the maximum demand occurs.

It must be borne in mind that these tests must be made at the time of the year when the transformer is carrying the heaviest load, otherwise due allowance must be made for the seasonable increase in load.

The illustration shows a Wright demand meter as installed by the Commonwealth Edison Co. for metering the maximum demand on a 25-kw. transformer.

CONSENSUS OF OPINION FAVORS WEATHERPROOF WIRES FOR 4400 VOLTS.

A circular letter sent out by a committee appointed by the Hydro-Electric Power Commission of Canada to determine the sentiment for and against weatherproof covering for conductors carrying high-potential currents has brought out some very interesting information as to the opinions of practical men engaged in the construction and maintenance of overhead lines. R. H. Martindale was chairman of this committee.

The questions submitted in this questionnaire were as follows:

(1) Considered from the standpoint of safety to life, is weatherproof line wire safer than bare wire for general distribution on voltages over 750?

(2) If so, at what voltage is a covering of no value?

(3) Is weatherproof wire any advantage from

an operating standpoint, as regards crosses, grounds, or freedom from foreign wire troubles?

(4) Are you in favor of it being abolished entirely for line work for voltages over 750?

As "safety to life" and "continuity of service" are possibly the two most important factors from a practical man's standpoint, the question, it will be noticed, covered these points only.

In all, 128 inquiries were sent out and a total of 65 answers received. The replies have been tabulated as follows: From Hydro municipalities, 45; from other municipalities, 9; other public service corporations, 11.

(1) In favor of weatherproof insulation from safety of life standpoint: Hydro, 39; municipal, 5; company, 11; total, 55, out of 65.

Not in favor of weatherproof: Hydro, 6; municipal, 4; total, 10, out of 65.

(2) Voltage limit for weatherproof: 750 volts, 7; 1100 volt, 3; 2200 volt, 21; 4400 volt, 17; total 48.

(3) Advantage of weatherproof from operating standpoint is covered by question No. 1.

(4) In favor of abolishing weatherproof for voltages over 750: 10.

It will be noticed that of the eleven companies that have reported, none are in favor of the bare.

CONSIDERATIONS INVOLVING EQUIPMENT FOR ELECTRIC FURNACE LOADS.

Wide Range of Current Necessitates Choice of Apparatus Accordingly.

By M. A. Montague.

The usual characteristics of the electric furnace load are such that the current fluctuates between about half rated load as a minimum and 250% of full load as a maximum. This latter occurs as swings and is rarely sustained for any length of time. It is important that the above-mentioned current fluctuations be borne in mind when deciding upon the cross section and layout of conductors and the capacity behind the furnace, otherwise rate of melting may be cut down because of poor voltage regulation and high line loss, the former due to both copper loss and induction.

The choice of instruments is also influenced by the wide current variations that usually occur. Instruments should be so chosen that their range will not be exceeded during the heavy current swings on the one hand, nor yet operate too low on the scale during normal operation. Sensitive instruments are not ordinarily required for electric furnace installations. Sensitive instruments are more subject to damage due to short circuits than the less sensitive instruments, and are more likely to become deranged due to their smaller air-gap by dirt such as abounds around foundries.

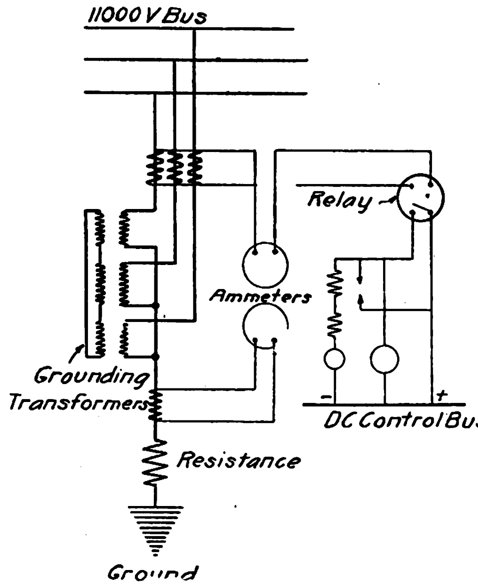
In choosing an integrating wattmeter for electric furnace loads, one having full-load capacity equivalent to about 125% furnace rating will be found to give an accurate load record and answer the purpose best. If maximum demand meters are to be employed for giving indications of what an electric furnace is actually doing in the way of demand upon the utility's circuits, a fifteen-minute period has been found to be satisfactory. For this service a graphic meter is recommended. Special provision should be made that all instruments located in close proximity to the furnace are well protected against dust entering the case.

DELTA-CONNECTED TRANSFORMERS TO BY-PASS THIRD HARMONIC NEUTRAL CURRENT.

Interesting Connection of Transformers Used by Duquesne Light Co.

The Duquesne Light Co. of comparatively recent date adopted the practice of grounding the neutral of its high-tension transmission system. As this company's system operates at 60 cycles, it was advisable to take steps to reduce as much as possible, if not prevent entirely the flow of the triple-frequency current, or third harmonic in the neurtal, as this current would create havoc with telephone and telegraph circuits in proximity.

The elimination of the third harmonic from the neutral or ground circuit was performed in a very simple manner with standard apparatus, as shown in the accompanying illustration. Instead of directly grounding the neutral of the star-connected generator bus, a grounding bank of transformers is used, these being connected to the generator neutral bus at the Brunots Island generating station. These transformers are connected in star on the bus side, the neutral or middle point of the star connection being connected



Connections by Which Third Harmonic Is Eliminated.

through a bank of resistance grids to earth. The secondary windings of these transformers are connected in closed delta, which acts as a short circuit for the free circulation of the triple-frequency current, thus eliminating it from the earth circuit and preventing inductive interference with neighboring telephone and telegraph circuits. The resistance value adopted is such as to limit the current rush to earth during times of trouble to such limit as will enable the relays to function yet without being excessive.

It will be seen from the sketch that two ammeters are installed to measure the current that passes to earth through the grounded neutral connection. The current transformers operating these ammeters have different ratios so that the one ammeter indicates 500 amperes for full scale deflection, the other 200 amperes full scale deflection, the former indicating heavy grounds such as occur during breakdowns, etc., while the latter indicates light grounds. The resistance inserted in the neutral limits the neutral current to 500 amperes.

Contracting-Construction

Valuable Suggestions for Contractors — Interesting House Organ — Powerful Screw Driver — Proposed Legislation

SELLING ELECTRIC SERVICE RATHER THAN A WIRING JOB.

Recent Paper by R. A. Gordon Contains Valuable Suggestions for Contractors and Dealers.

In a paper read at the recent convention of the Michigan Section of the National Electric Light Association, R. A. Gordon of the Houghton County Electric Light Co. submitted several valuable suggestions for subjects of co-operative effort between central stations and contractor-dealers. These suggestions are especially worthy of consideration by electrical contractors and dealers for they point out the ways in which they can assist in improving conditions in the industry, rendering better service to the public and at the same time increase their own profits.

These suggestions are as follows:

"1. The contractor-dealer should cease selling a wiring job and sell electric service.—Central stations have spent millions of dollars to create a demand for electric service by educating the public to an appreciation of the fact that electric lighting is better than any other form of lighting, and that electric service is sure, safe and economical. The general public is fast realizing these truths, and when they go to the contractor-dealer for an estimate on wiring their homes, stores and factories for electric service, they are not thinking in terms of wire, knobs and tubes, but in terms of convenience and comfort. It is, therefore, the duty as well as the opportunity of the contractor-dealer to sell the customer not a wiring job, but an electrical service, which combines utility with safety, convenience and comfort. This kind of service demands that the contractor-dealer sell to the customer the convenience of better meter locations, additional baseboard and sidewall outlets, the comforts of numerous switches properly located, and the economy of additional capacity of the wiring at the time of the original installation to take care of future requirements of electric cooking and heating appliances.

"2. Quality electrical work will enable a customer to enjoy his service long after its cost is forgotten.—Such quality electrical service as suggested above will make a permanent and satisfied customer of the average consumer of electric service to the mutual benefit of the central station and contractor-dealer.

"3. Do not wait for the manufacturer—Standardize on uniform plugs and receptacles in your own community.—The many advantages of uniform plugs and receptacles are so apparent that it is hard to understand why the manufacturers and jobbers have not been able to come to an understanding on this important subject. This deplorable condition can easily be worked out in each individual community if the different interests will co-operate to that end.

"4. Contractor-dealers should make up a merchandising schedule and co-ordinate their advertising.—Electrical supplies and appliances are fortunately not seasonable merchandise. However, it goes without question that the public naturally buys fans in the summer and heating pads in the winter. If the central station and contractor-dealer would make up a merchandising schedule and co-ordinate their advertising, they could soon educate the public to the many uses of the fan in winter, and of the many applications of the electric heating pad as an all-the-year-around appliance. The two appliances in question are perhaps the best examples of those which hitherto were considered seasonable, yet are now gradually being recognized as articles useful throughout the year.

"5. Adopt a uniform 'Cost to Operate' schedule.—Every central station commercial man knows what a task it is to satisfactorily adjust a customer's complaint of a high bill when he finds the cost of such high bill was the use of an electric heater, which the customer was told when purchasing, would use only about one-third or one-half the amount of current it would actually use. Two different dealers could give to the same customer a different 'Cost to Operate' charge and both be correct, because one might base his figures on the maximum use of such appliance, and the other base his figure on the average use. A uniform 'Cost to Operate Schedule' based on fair averages and adopted by all would eliminate many complaints of excessive bills for current and result in more sales of electric appliances by all.

"6. Co-operate to the end that electric service will be recognized as the most valuable commodity in the community.—Proper co-operation on the part of the central station and the contractor-dealer will make it possible for them to make electric service the most universally liked and most valuable commodity in their community.

NEW YORK CONTRACTOR DISTRIBUTES INTERESTING HOUSE ORGAN.

Monthly Pamphlet, "Cut-Outs," Being Published by Wm. J. Shore.

A very clever and interesting pamphlet is being distributed monthly by Wm. J. Shore, an electrical contractor-dealer and engineer, located at 1123 Broadway, New York City. It is entitled "Cut-Outs" and its purpose is to help business men electrify their business.

A radical departure from the usual run of such publications like this consists chiefly of pointed business paragraphs and humorous short sayings, many of which are original and the remainder chosen to fit a purpose from noted authorities. These add greatly to the interest of the pamphlet and it is almost impossible when once one starts to read it, not to continue to the end. And all through it there runs the idea that electric service is the best for all business and Shore is the man to do it.

A few of the more pertinent paragraphs of the last issue follow:

"It was in 1752 that Ben Franklin first demonstrated that lightning and electricity were one and the same. And yet there are still manufacturers who don't know what electricity will do for *their* business.

"The man who waits for prices to drop may not be able to get his work done at *any price*. Better have me in *now*—tennyrate, let's talk it over. Consultation sans obligation.

"Are you going to keep pace with times or be pinched for blocking business traffic? Do it electrically. Install motors, replace old, shop-worn power equipment, improve, repair, rebuild, if necessary, but Do It Now. Shore Service really SERVES.

"When a competitor damns you put him on your payroll."

PROPOSED LEGISLATION THAT AFFECTS CONSTRUCTION WORK.

Attention of Construction Industry Called to Bills Now Pending in Congress.

The National Federation of Construction Industries, Drexel building, Philadelphia, an organization composed of building material manufacturers and others interested in construction work, is sending out a letter to its members calling attention to proposed Federal Legislation covering matters of vital interest to the construction industry as a whole. Among these matters are two bills now pending in Congress that are especially worthy of support by the electrical contracting fraternity.

The first of these bills, S. 1469, H. R. 5514 and H. R. 7597 is designed to aid in financing the construction of homes. The second, H. R. 7014, is designed to establish in the Department of Labor a Bureau of Housing. The association in its letter approves both of these bills and urges their passage, modified as may seem desirable, as a valuable aid to the construction of homes throughout the country, and as an agency in the development of thrift on the part of house owners and better housing conditions.

ST. JOSEPH, MO., ELECTRIC PLANT TO BE ENLARGED.

W. J. Squire, proprietor of the Squire Electric Co., Kansas City, Mo., has received the engineering contract, and is preparing plans and specifications for the municipal plant improvements at St. Joseph, Mo., to be made under a bond issue of $500,000. The improvements include remodeling of building, installation of new machinery, the revision of the street lighting system throughout, and some commercial and power lighting incidentals. The new plan will probably have two 3000-kv-a. turbines and three 500-hp. watertube boilers. The new plant will be equipped with stokers, economizers, and other up-to-date items.

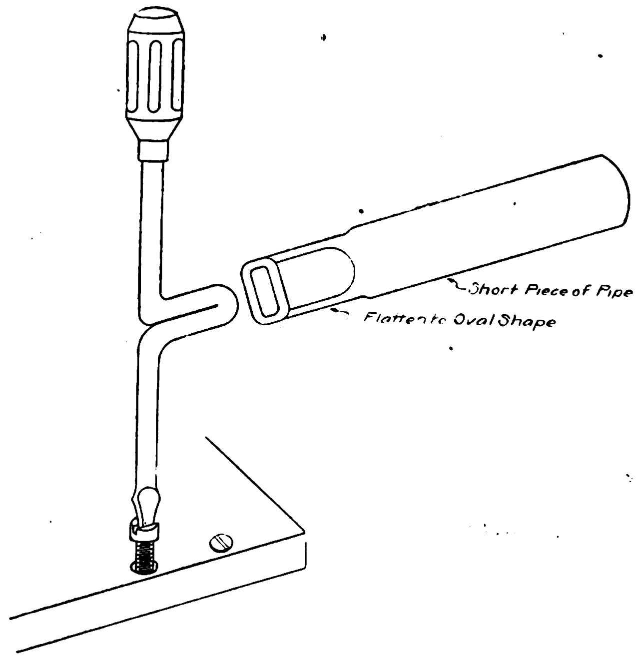
The street lighting system will be equipped with tungsten lamps and there will be probably 300 ornamental lamp posts. The rest of the lighting will be suspended over street corners.

A POWERFUL HOMEMADE SCREW DRIVER.

By Charles H. Willey.

The electrician or plant maintenance man in his daily work is often required to remove screws from machine and motors parts that are stuck or rusted in place so tightly that they cannot be removed with an ordinary screw driver. In order to remove such screws the writer uses the handy homemade device shown in the accompanying sketch.

In making this device the blade of a long bladed screw driver is heated and bent into a crank shape as



A Handy Method of Applying Extra Power to an Ordinary Screw Driver.

shown. A short piece of pipe is then flattened at one end into an oval shape that will fit over the bent part of blade. By using this pipe as a lever a very powerful force can be applied to the screw driver that will suffice to loosen all ordinary screws. A monkey wrench can be used instead of the pipe if desirable and the same results will be obtained.

REVISED RULES FOR GENERATING AND SUBSTATIONS.

The Bureau of Standards, Washington, D. C., is getting out in tentative form the changes proposed for Part 1 of the National Electrical Safety Code which covers rules for the installation and maintenance of electrical supply stations and equipment. These changes are not radical in character but are intended to cover points which were omitted in the previous editions of the Code or which seemed to need clarification.

The principal changes suggested as well as the entire scope of the new rules will be discussed more fully in an early issue.

OKLAHOMA CITY SETS NEW RECORD IN BUILDING HOMES.

During a period of 80 days recently the residents of Oklahoma City, Okla., took out building permits for more than $2,000,000 in new residences. This is the result of "build your own home" campaign, which has been in progress for several months. More homes have been built in Oklahoma City during the campaigns than in any other similar campaign for the same period of time. All the local electrical interests co-operated in this campaign and were in a large measure responsible for its great success.

New Appliances

Improvements in Remote-Control Oil Switches — Willys Light Plant—New Bell Ringers—Compartment Condenser

Developments in Oil Switches for Remote Control of Outdoor Lighting Circuits.

Control of outdoor lighting circuits can be effected by switching at the power house when the circuits extend thereto, but in case they do not it has until a few years ago been necessary to send out a patrolman or lineman to turn on or off the switch of the circuit desired wherever it might be; an alternative was to install a time switch at this place, but the latter required attention periodically and was somewhat costly in the outdoor type. To meet the evident need for power-house control of distant circuits there was developed a line of oil switches known as the R. C. O. C. type that was described in our columns some three years ago. These switches were the product of the South Bend Current Control Co., South Bend, Ind.

In the intervening years this line of switches has been further developed along lines based on the experience gained in large numbers of installations, the result being improvements in the construction of the switches, new combined types thereof and many additional uses to which they have been found well adapted. All of the switches have contacts breaking under oil of high dielectric properties and all are inclosed in iron cases closely resembling the standard distributing transformer.

Fig. 1 shows one of the improved pole type switches with case partly broken away to show the mechanism. The latter is carried by a frame of carefully kiln-dried maple that is boiled in oil, thus giving high mechanical and insulating strength. Each switch is tested to 10,000 volts, or several times normal voltage. All switches are solenoid-operated, the solenoid being energized over any convenient circuit already installed. Fig. 2 shows a typical subway or manhole type switch. Both subway and pole type switches are made in the two-in-one special type where it is necessary to conserve either space or weight.

Seven types of the R. C. O. C. switches are now made: Form AN is for all-night lamps where these are to run for the same hours as the solenoid control circuit. Form MN is especially for lamps operated until midnight and is controlled by a special locking device shown in Fig 3 which alternately opens and closes at the will of the power-house operator, who has merely to "wink" the control circuit. Form MNS is a modification of the MN especially adapted for cutting off part of a series circuit at midnight or other hour differing from the main series circuit. There are three forms of two-in-one switches, one comprising two AN switches, another two MN switches, and a third an AN and an MN switch; these are used only for 440 volts or less. Finally there is a special line of double-throw switches built to particular specifications. Fig. 3 shows not only the special locking device above referred to, but also the fluctuation compensator consisting of two strong springs that allow a considerable vertical movement of the U-shaped floating solenoid armature without opening the contacts of the controlled or load circuit; this takes care of 60% fluctuation in the solenoid control circuit without affecting the load controlled.

These switches and switch combinations make possible solving a large number of control problems on both series and multiple circuits remotely located, and involving all-night or short operation of lamps; motor circuits and other power, lighting or heating circuits may also be controlled successfully at a distance. Diagrams have been worked out for some 60 different control problems that can now be successfully handled by the R. C. O. C. system.

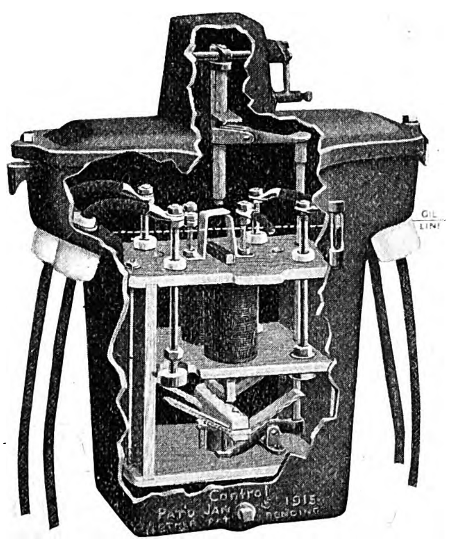


Fig. 1.—Pole Type R. C. O. C. Switch with Case Partly Broken to Show Interior.

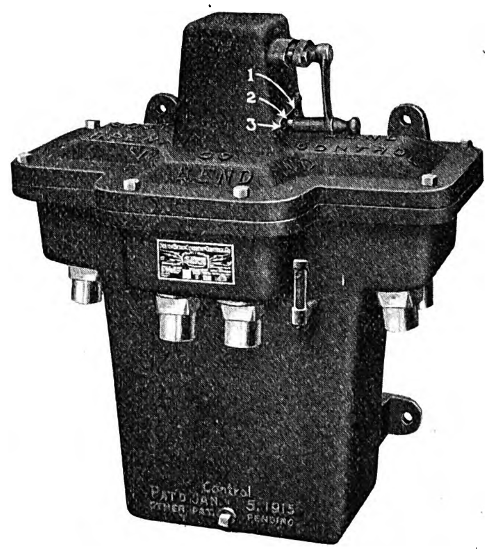


Fig. 2.—Subway Type R. C. O. C. Switch.

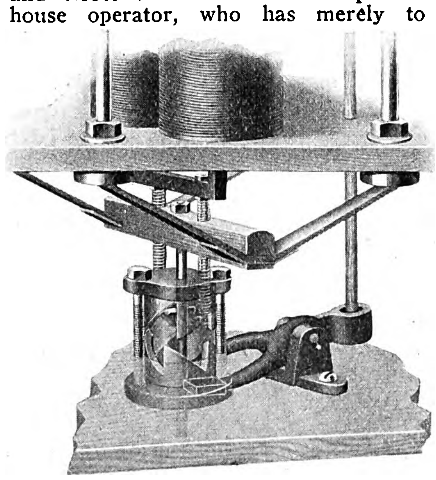
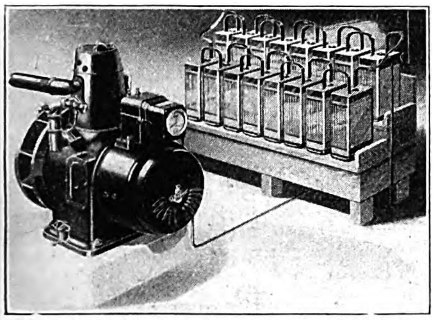


Fig. 3.—Contact Mechanism With Fluctuation Compensator and Special Locking Device.

Specifications of Willys Light Plant.

In our issue of July 19, 1919, we published a general description of the new self-contained electric light plant recently placed on the market by the Willys Light Division of the Electric Auto-

Lite Corporation, Toledo, Ohio. It has the backing of John N. Willys of automobile fame and is known as the "Willys Light" plant. We have now secured a photograph of the new outfit, which we reproduce herewith, and a



The Willys Light and Power Plant.

condensed set of its specifications, from which the following facts are of special interest.

The rating of the plant in 20-watt lamp equivalents operating for 8 hours intermittently is 83 lamps when both generator and battery are carrying the load, and 45 lamps when the battery alone is supplying the service. The battery is of the lead type, of Exide or U. S. L. make, and contains 16 cells. A 2-hp. Willys-Knight engine is used that can burn either gasoline, kerosene, distillate or gas; it is started electrically by the generator acting as a motor fed from the battery. The drive to the generator is direct and the generator is a 32-volt shunt machine of ¾ kw. rating. Control of the whole set is semi-automatic.

New Line of Bell-Ringing Transformers.

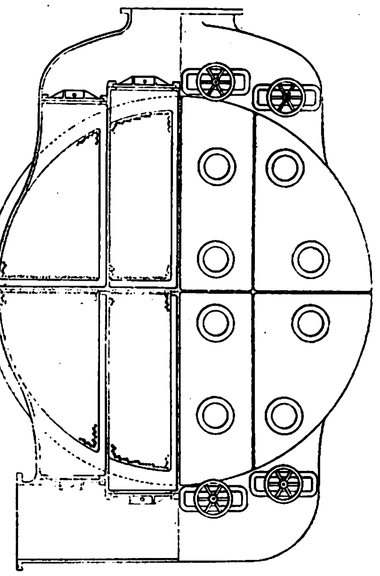
Bell-ringing transformers are coming into extensive use because of their many advantages over wet or dry cells or storage cells for ordinary signaling circuits. This accounts for the increasing demand and for the development of new types to meet it. Among these is an entirely new line just placed on the market by the Standard Transformer Co., of Warren, Ohio. This company was recently incorporated and has already taken over the bell-ringing transformer business of the Packard Electric Co., of Warren, to which it is adding its own designs to cover various requirements.

Its entire line is clad in blue-glazed porcelain cases. It offers the residence type of 15-watt capacity for operating the front, rear and table bells and for other signal service found in any home. This type is made for 100-230 volts and for 25, 40, 50 and 60-cycle circuits. The bell side of the transformer has 11 volts on open circuit or under no-load conditions and is inductively wound so that a short circuit on the low-voltage side maintained indefinitely will not destroy the transformer. This type is approved by the Underwriters' Laboratories, Inc., and listed as a National Electrical Code standard. The heavy-duty types for apartments, school houses, factories are 50-watt capacity with 6-12 and 18 volts on the bell side. This lends a flexibility to this type for operating both short and long bell circuits from the same instrument. This condition is frequently met in this class of service, but never on residence bell circuits. Formerly, this type was made with a cast iron case which has now been replaced with a blue glazed porcelain cover. The company claims the porcelain clad types have advantages over the iron box or metal case types as the porcelain will not rust or corrode, is an excellent insulator, non-resilient, hence muffles the hum or buzz inherent to alternating current devices, and as applied to its transformer is pleasing in appearance, light in weight and mechanically rugged. The cores on both the residence and heavy-duty sizes are made of silicon-alloy steel, the coils are thoroughly impregnated and the cases are compound filled which makes the transformers weatherproof, hence are not injured by being installed in a damp basement or other places where they may be exposed to moisture.

Compartment Condenser Permits Cleaning in Service.

A new and valuable development in steam surface condensers is announced by the Wheeler Condenser & Engrg. Co., Carteret, N. J. It is a patented "compartment condenser" that can be cleaned while in service without shutting down the turbine.

This is a timely development in view of the persistent claims made by well known fuel authorities that the price of fuel is not likely to go down for some time if at all. This condenser will enable the chief engineer to constantly maintain clean condensers, hence a constantly high



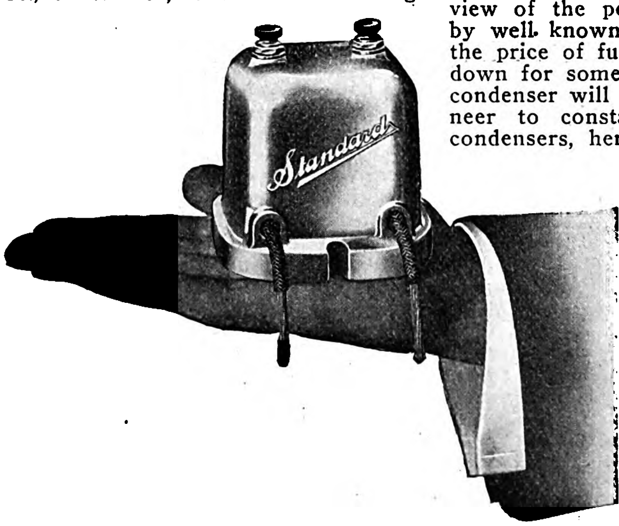
New Type of Wheeler Surface Condenser That Permits of Sectionalization for Cleaning Purposes.

vacuum. All engineers of experience know that in addition to increasing output a high vacuum means low fuel consumption and a considerable saving in money year in and year out.

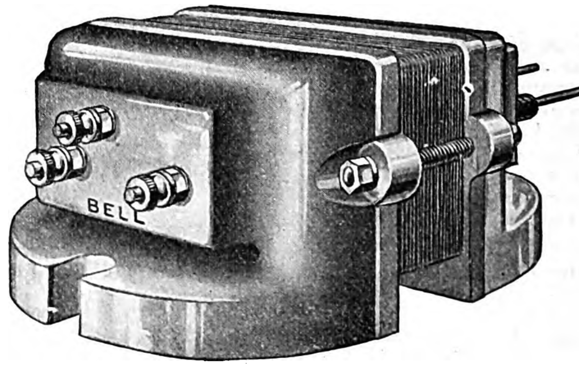
Also upon installation of this condenser there need be no interference with the operation of the turbine. At the present time, in many important power stations, even where water conditions are regarded as good, it is necessary to occasionally shut down the turbine for a period sufficiently long to clean the condenser.

To clean the average condenser is not a difficult task, but it is time-consuming, and for that reason the engineer is tempted to put cleaning off.

The illustration shows clearly how the compartments are arranged. The condenser shown is divided into four compartments, each compartment being equipped with a set of valves to control the circulating water. To clean the condenser while the turbine is delivering full power, the operator simply shuts off the water from one compartment, removes the cover, cleans the tubes, replaces the cover, turns on the water again, and then passes on to the next compartment repeating the operation until the four compartments of the entire condenser are clean. Thus, while one compartment is being cleaned, the other compartments are in full operation, temporarily taking over the entire turbine load.



Household Size of Standard Bell Ringer, Showing Compactness and Light Weight.



Heavy-Duty Type Bell-Ringing Transformer with Three Secondary Voltages.

Trade Activities

E. C. Atkins & Co. to Be Represented in Australia — Standard Transformer Incorporates — Special Literature

Sullivan Machinery Co. announces the appointment of R. S. Weiner as district manager of El Paso, Tex., succeeding Don M. Sutor. Mr. Sutor has been transferred to the St. Louis office of the company as district manager for Missouri, eastern Texas, Oklahoma, Kansas, western Kentucky and western Tennessee.

Celite Products Co., New York City, has appointed Charles P. Derleth to represent its interests in order that the increasing demands for Celite products (Sil-O-Cel for heat insulation and Filter-Cel for filtration) may be properly cared for. Previous to his enlistment 14 months ago in the Chemical Warfare Service, Mr. Derleth was affiliated with the J. B. Ford Co., Wyandotte, Mich., as sales representative. He is a graduate of the University of Illinois.

The American Steam Conveyor Corp., Chicago, announces the appointment of Morton McI. Dukehart & Co., as its representative in Baltimore, and the surrounding territory, which includes all of Maryland, and the District of Columbia, and a few counties in Pennsylvania, Delaware, West Virginia and Virginia. This concern consists of Mr. Dukehart, and E. S. Denise—both power plant engineers of long standing, and sales engineers of considerable ability. They have an enviable reputation and their service undoubtedly will considerably strengthen the sales force of the American Steam Conveyor Corp.

The Bleadon-Dun Co., Chicago, has issued a book of 52 pages dealing with violet rays as applied with the Violetta. The book first reviews the development of electricity as a curative agent and the discovery of the violet ray machine, or as it is known technically, the high frequency generator by Nikola Tesla, and also presents the phenomena produced by violet rays. This high frequency generator is generally recognized as one of the most amazing developments of electricity and many startling results have been secured by its application to almost every known ailment. The application of violet rays with the Violetta to many ailments is depicted and various types of Violetta outfits, electrodes and supplies are illustrated and described. Some ten pages are devoted to testimonial letters from sanitariums, physicians, beauty specialists, home users, and others who have used this device with complete satisfaction.

Cutler-Hammer Manufacturing Co., Milwaukee, Wis., has recently issued a new descriptive leaflet on the C-H hospital call switch, which shows the method of installing this device in the wall adjacent to the patient's bed. The switch is made for use on silent call and other systems such as used in the modern hospitals. Another of the new leaflets illustrates the Cutler-Hammer 7720 duplex receptacle, which provides two outlets in the space required for one. The principal illustration on this leaflet shows a typical ironing scene with the iron cord attached to one outlet, while an electric fan is connected to the other. The small blueprint which accompanies the duplex receptacle leaflet indicates the location of a number of duplex receptacles in the floor plan of a typical modern home and suggests the many electrical appliances which may be used when sufficient convenient outlet receptacles are provided.

E. C. Atkins & Co., Indianapolis, Ind., manufacturer of Atkins silver steel saws, which in the last three years have enjoyed a steady growth in Australia amounting to over 50%, have appointed James N. Mackin to represent their interests in that country. He is superintendent of the Australian division and has established headquarters at 5 Australasia Chambers, Martin Place, Sydney, N. S. W., Australia. During the war Mr. Mackin represented the Atkins company at Washington, D. C., and made hosts of friends both for himself and for this firm. His thorough knowledge of every detail concerning saws, as well as his wide experience in selling and his pleasing personality, make him popular with everyone who is in the least acquainted with the Atkins service. Before becoming associated with the Atkins company, Mr. Mackin traveled extensively throughout the world, becoming thoroughly conversant with business conditions in foreign lands.

James N. Mackin.

Standard Transformer Co., Warren, Ohio, has been incorporated under the state laws of Ohio for the purpose of manufacturing a complete line of bell ringing transformers. It has consummated an agreement with the Packard Electric Co., of Warren, Ohio, whereby it will in the future manufacture the bell transformers placed on the market by the Packard company about six years ago. These transformers, which embody new improvements in construction, are described in detail in another section of this issue.

Diamond Power Specialty Co. literature has always been distinguished by its direct appeal to the engineering knowledge and sound business judgment of its readers. This is particularly true of bulletin No. 132, "Profits that Get Away Through Your Boiler Room," just issued by the company. This bulletin, which is an attractive, well written book of 24 pages, deals first with the importance of exercising business-like supervision over the boiler room; the effect of soot on boiler efficiency; and in its concluding pages describes Diamond soot blowers for horizontal return tubular boilers. The book is well illustrated with charts, graphs and ledger sheets showing actual improvements affected, and should be in the hands of every operator of horizontal return tubular boilers. Copies may be had on application to the Detroit office of the company.

South Bend Current Control Co., South Bend, Ind., has issued an engineers' reference book on the R. C. O. C. system of remote control. This book gives not only a description of the company's oil switches for remote control of lighting and other circuits, by means of any convenient circuit that is used as a control circuit operated from the power house, but also gives the results of several years of experience in solving the problems of remote control that distribution engineers are confronted with in operating outdoor lighting and similar systems. This is shown in 17 of some 60 circuit diagrams, showing various problems that formerly were inclined to be impossible of solution. These circuits are shown by means of large blueprint diagrams. A list is given of a very large number of users of these switches as well as typical letters from such users and a number of installation views of the switches in use and of lighting circuits controlled thereby.

Current News

Weekly Record of Construction Activities—Conventions

EASTERN STATES.

Laconia, N. H.—Scott & Williams have commenced the erection of a new boiler plant at their works to cost about $20,000. Lockwood, Greene & Co., 60 Federal street, Boston, Mass., are engineers.

Portsmouth, N. H.—The Bureau of Yards and Docks, Navy Department, Washington, D. C., plans the installation of a 1000-kw. turbogenerator at the local navy yard to cost about $17,000. (Specification 4017).

Cambridge, Mass.—Electrical and mechanical equipment will be installed in the new seven-story and basement cold storage plant to be erected by John P. Squire & Co., 165 Gore street. The structure is estimated to cost about $200,000.

Southwick, Mass.—An election will soon be held to vote on $15,000 for the establishment of an electric plant to furnish electricity for lighting, power and heat.

Worcester, Mass.—In connection with the erection of an addition to their plant for increased output, James Smith & Sons, 99 Hope street, will build a new boiler plant for factory operation.

Worcester, Mass.—American Steel & Wire Co. will erect a building, 24x440 ft. at the North Works, and will install new electric galvanizing equipment.

Hartford, Conn.—Hartford Electric Co. is having plans prepared by Stone & Webster, Boston, Mass., for its proposed electric generating plant in the Colt Meadows district. The plant will have an initial capacity of about 100,000 kw.; it will be designed for oil fuel operation. The company is now operating a plant at Dutch Point.

Middletown, Conn.—In connection with a new factory addition for increased capacity, the Russell Manufacturing Co., manufacturer of webbing, etc., will build a complete new power plant for works operation. The plant will include turbine department, engine room, pumping chamber and boiler plant.

Binghamton, N. Y.—Binghamton Light, Heat & Power Co. has commenced the installation of a new 2500-kw. generator at its power plant, with auxiliary operating apparatus. The company has commenced the construction of a new power line to the shoe manufacturing plant of the Endicott-Johnson Corp., Endicott, N. Y. A load of about 1500 to 2000 kw. will be carried at the plant, in addition to the present power supply. The new lines will be tied in with the system running to the company's plant at Johnson City, allowing for an interchange of service as desired.

Buffalo, N. Y.—Donner-Union Coke Corp., Abbott Road, has filed plans for the erection of a new electric substation at its plant to cost about $11,400. The company will also build a number of other structures in which mechanical and electrical equipment will be used to cost about $85,000.

Canandaigua, N. Y.—Lisk Manufacturing Co. is having plans prepared for the construction of a one-story plant, 63x87 ft., to be used for works operation.

New York, N. Y.—Transit Construction Commissioner John H. Delaney has received and opened bids for the construction of tracks in the section of the Culver Rapid Transit Railroad extending along Shell road and West 6th street from Avenue X to Sheepshead Bay road, Coney Island, N. Y. The lowest bid was that of the Slattery Engineering & Contracting Co., at $58,513.70. It is expected that an award will be made in the near future. The time for completion is four months.

New York, N. Y.—Long Island Electric Railway is arranging to institute proceedings for a dissolution of the corporation, and the appointment of a receiver. The company operates a system from Grant street, Brooklyn, to Belmont Park, and in the Jamaica and Far Rockaway sections. It was organized about 25 years ago, and has a capitalization of $600,000. W. O. Wood is vice-president and general manager.

Oswego, N. Y.—The water service commission will establish a new municipal light plant. Address town clerk.

Rochester, N. Y.—North East Electric Co., 348 Whitney street, manufacturer of electrical specialties, has awarded a contract to C. W. Hoffman, 120 Railroad street, for the erection of its proposed two-story plant, 86x198 ft., on Lyell avenue, to cost about $60,000.

Rochester, N. Y.—The Municipal hospital is having plans prepared for the construction of a new boiler plant at the institution. The Board of Contract and Supply is in charge of the work. Gordon & Kaelber, Sibley building, are architects.

Syracuse, N. Y. — Considerable electrical and mechanical equipment will be installed in the new five-story cold storage plant to be erected by the Merrell-Soule Co. The structure will be 61x90 ft., and is estimated to cost $90,000. The Turner Construction Co., 241 Madison avenue, New York, has the building contract.

Bloomfield, N. J.—Sprague Electric Works of the General Electric Co., have awarded a contract to Salmond Brothers, 568 Elm street, Arlington, N. J., for the erection of an addition to its plant on Lawrence street to cost about $15,000.

Bloomingdale, N. J.—The Borough Council has authorized the installation of new arc lights on the Carmonton Road. The service will be furnished by the municipal electric plant at Butler.

Newark, N. J.—New York Telephone Co., 15 Dey street, New York, is planning for a total expenditure of about $3,270,000 for line improvements and extensions in the Northern New Jersey district during the present year. Edmund W. Wollmuth is district manager.

Newark, N. J.—Lux Manufacturing Co., 121-33 East Kinney street, manufacturer of high-grade tungsten lamps, has arranged for a stock issue of $100,000 for proposed expansion. The company has acquired property adjoining its works and plans for the construction of an addition for increased capacity at a later date. A. T. Baldwin is treasurer.

Newark, N. J.—Economic Electric Co. has filed notice of organization to operate a works at 232 West Kinney street, for the manufacture of electrical supplies. Isidor Eglowstein, 140 West Kinney street, heads the company.

Newark, N. J.—A large power plant for works operation will be erected by the Cocoanut Oil Co., in connection with the construction of its new plant at Passaic avenue, near Chapel street. The entire project is estimated to cost about $300,000. John Lowry, Jr., 8 West 40th street, New York, has the building contract.

Newark, N. J.—Stengle & Rothchild, Main street, have awarded a building contract to the Becker Construction Co., 361 Grove street, for the construction of the proposed new one-story boiler plant at their leather works to cost about $16,000.

Newark, N. J.—Rainbow Electric Co. has filed notice of organization to operate a plant for electrical work at 258 Chadwick avenue. Samuel Rubinstein heads the company.

Phillipsburg, N. J.—Electrical and mechanical equipment will be installed in the proposed sewerage disposal plant to be constructed by the city officials. The plant will be of three unit size, each unit with capacity of 1,000,000 gallons, and is estimated to cost $125,000. City Engineer Tilton will prepare plans and specifications.

Beaver Falls, Pa.—Electric Service Co., manufacturer of electrical equipment, and operating a local repair works, has commenced the removal of its plant to 700 Third avenue, to provide for increased capacity. C. J. Freund is president.

Allentown, Pa.—Electric Bond & Share Co., 71 Broadway, New York, has inaugurated construction work on new transmission lines and power plant extensions in the Lehigh Valley section to cost about $500,000.

Bethlehem, Pa.—A one-story power plant for works operation will be erected by the Traveler Tire & Rubber Co., 819 North Broad street, Philadelphia, in connection with its new manufacturing plant at Traveler avenue and Auburn street, Bethlehem. The entire works will cost about $125,000. J. Osborne Hunt, 114 North Montgomery street, Trenton, N. J., is architect.

Chester, Pa.—A large power plant will be erected by the Chester Hospital in connection with the construction of a new surgical pavilion at the institution. The project is estimated to cost about $250,000.

Easton, Pa.—Pennsylvania Utilities Co. is planning for the immediate installation of three new boilers at its Dock street plant, to increase the present capacity.

Emaus, Pa.—The contract with the Lehigh Valley Light & Power Co., for street lighting and local power service expires on April 1, 1920, and during the remaining period, the Borough Council will investigate the possibilities of the operation of a municipal electric power plant in conjunction with the present city owned waterworks. The present service charges for lighting for the municipality aggregate about $4200.

Harrisburg, Pa.—Public Service Commission has inaugurated work on its proposed investigation of the existing telephone rates throughout the state. The financial condition and cost of operation of the Bell Telephone system will be ascertained. The company is continuing the increase in rates as arranged under Government control pending the outcome of the investigation, allowed for a period of four months by the commission.

Northumberland, Pa.—Northumberland County Gas & Electric Co. has filed notice with the Public Service Commission for an increase in light and power rates, effective Sept. 15.

Philadelphia, Pa.—A boiler plant for works service will be erected by the A. Schoenhut Co., Amber and Venango streets, in connection with the construction of an addition to its woodworking plant to cost about $44,000.

Philadelphia, Pa.—Wirt Co., Armat and Lena streets, manufacturer of electrical products, has filed plans for the erection of a new two-story plant, 62x158 ft., at Greene street and Queen Lane, to cost about $60,000. Charles Wirt is president.

Baltimore, Md.—Chesapeake & Potomac Telephone Co. has made application to the city for permission to install a new underground conduit system under the Harford Road, from a point near Montebello Terrace to its Hamilton Exchange.

Crownsville, Md. — Crownsville State Hospital is having plans prepared for the erection of a new power plant at the institution, with initial capacity of about 6000 hp. C. L. Reeder, Park avenue and Saratoga street, Baltimore, is construction engineer.

DATES AHEAD.

Pennsylvania Electric Association. Annual convention, Bedford Springs, Pa., Sept. 3-6. Secretary, H. M. Stine, 211 Locust street, Harrisburg.

Washington State Association of Electrical Contractors and Dealers. Annual convention, Seattle, Sept. 11. Secretary, Forrest E. Smith, 205 Boston Block, Seattle.

Association of Edison Illuminating Companies. Annual meeting, New London, Conn., Sept. 16-18. Secretary, H. T. Edgar, Stone & Webster, Boston, Mass.

Southeastern Section, N. E. L. A. Annual convention, Asheville, N. C., Sept. 17-19. Secretary-treasurer, T. W. Peters, Columbus, Ga.

Iowa State Association of Electrical Contractors and Dealers. Annual convention, Sioux City, Iowa, Sept. 22 and 23. Secretary, F. Bernick, Jr., Oskaloosa, Iowa.

New England Section, N. E. L. A. Annual convention, New London, Conn., Sept. 22-24. Headquarters, Hotel Griswold. Secretary, Miss O. A. Bursiel, Boston, Mass.

Association of Iron and Steel Electrical Engineers. Annual convention, St. Louis, Mo., Sept. 22-26. Secretary, John F. Kelly, Empire building, Pittsburgh, Pa.

American Electrochemical Society. Fall meeting, Chicago, Sept. 23-26. Headquarters, Congress Hotel. Secretary, Prof. Joseph W. Richards, Lehigh University, Bethlehem, Pa.

International Association of Municipal Electricians. Annual convention, Chicago, Sept. 23-26. Secretary, Clarence R. George, Houston, Tex.

Empire State Gas and Electric Association. Annual meeting, New York City, Oct. 9. Secretary, Charles H. B. Chapin, 29 West 38th street, New York City.

National Association of Electrical Inspectors. Annual meeting, Springfield, Mass., Oct. 13 and 14. Secretary, W. L. Smith, Concord, Mass.

Illuminating Engineering Society. Annual convention, Chicago, Ill., Oct. 20-23. General secretary, Clarence L. Law, 29 West 39th street, New York City.

Illinois State Electric Association. Annual convention, Chicago, Oct. 22 and 23. Secretary-treasurer, R. V. Prather, Springfield, Ill.

Warren, Md.—Warren Manufacturing Co. has under consideration the building of a new power plant in connection with the proposed addition to its work, which is estimated to cost about $250,000. The cost of the power plant is to be $35,000.

Elkton, Va.—The Janney & Burroughs tannery which supplied electric light was destroyed by fire.

Clarksburg, W. Va.—Baltimore & Ohio Railroad is said to be planning for the electrification of its lines in the vicinity of Keyser in Mineral county. The road has a 17-mile grade in this section, and proposes to haul freight trains over the grade under motor operation.

New Cumberland, W. Va.—West Virginia-Pittsburgh Coal Co., Pittsburgh, Pa., is planning for the erection of a new electric power plant at its LaBelle mine. With extensions of rail system at the properties, the plant is estimated to cost about $100,000.

Wellsburg, W. Va. — Wellsburg Electric Light Co. is planning for the erection of a new local two-story electric substation. J. S. Jenks is vice-president.

Riversville, W. Va.—Monongahela Valley Traction Co. is in the market and will purchase and install immediately two more 10,000-kw. turbines which will double the present capacity and assure plenty of power for the next few years. Address E. B. Moore, general manager, Fairmont, W. Va.

Sumter, S. C.—City Council is planning for extensions and improvements in the municipal electric lighting plant to cost about $90,000. The work will include the installation of a new 1000-kw. turbogenerator, surface condenser, with new water-tube boiler, boiler-feed pumps and other operating equipment.

Arlington, Ga. — Baker County Power Co. is planning for a new hydroelectric power plant on a site in Baker county, to cost with electric transmission system about $640,000. W. E. Saunders is president.

Pensacola, Fla.—A series of about 20 electrically operated centrifugal pumps will be installed by the Bruce Dry Dock Co., in connection with its proposed dry dock and ship repair plant. The plant is estimated to cost $450,000. Address secretary of Bruce Dock Co.

Perry, Fla.—Perry & Gulf Coast Traction Co. will build a railway between Perry and Warrior Beach, distance of 15 miles. Ellis Bartholomew, Palm Grove, Fla.

West Palm Beach, Fla.—Bell Telephone & Telegraph Co., has purchased the system of the West Palm Beach Telephone Co., and will rebuild at a cost of about $200,000.

NORTH CENTRAL STATES.

Cincinnati, Ohio.—Improved street car facilities for both the new courthouse and the Central Union Railway station are to be provided. Address W. C. Culkins.

Lima, Ohio.—A new lighting system will be placed in the Central Church of Christ on West North street. Rev. J. A. Canby, pastor.

Lima, Ohio.—Ohio Steel Foundry Co. will erect an additional building, estimated cost $200,000. The plans call for the installation of a machine-charged furnace which will increase the output of the plant 15%. An overhead crane, electrically operated with a span of 100 ft. and a traveling range of 2600 ft. is to be included in the new improvements.

Fort Wayne, Ind. — Fort Wayne Builders' Supply Co. has begun the erection of a brick and stone storage house for the Rub-No-More Co., to cost $4000.

Fort Wayne, Ind.—General Electric Co. plans to increase its working force by approximately 1000 employes. During recent months business has constantly increased until now the company is deeply feeling the need of more men.

Indianapolis, Ind.—Robert H. Hassler Co. will build one-story factory, brick, steel and glass, 100x120 ft., to cost $30,000.

Indianapolis, Ind.—United States Corrugated Fiber Box Co. will erect a new building, two stories high, 100 x160 ft., fireproof. The company will build a second story to one of the older buildings, 83x160 ft.

Muncie, Ind.—Big Four Railway Co. will erect a modern freight house to cost $30,000. The company will also build a belt line around the city of Muncie.

Warsaw, Ind.—The Indiana Public Service Commission has issued an order for the Winona Electric Light & Water Co. to construct a new pumping station and to lay new mains.

Carbondale, Ill.—Surveyors for the proposed electric railway from Davenport, Iowa, to Metropolis, Ill., are making surveys near this city. The company will make a specialty of transporting coal from the extensive coal fields of Southern Illinois.

Carbondale, Ill.—Peroxide Chemical Co., St. Louis and Chicago, will erect a $20,000 factory building, 90 x100 ft., brick, one-story, containing 9000 sq. ft. of floor space. Charles B. Gautheir, a chemical engineer with the company, will be in charge of the plant. The plan will be to manufacture chemicals used for bleaching purposes in practically every phase of the bleaching business.

Champaign, Ill.—Cushman Auto Tool Co. has purchased the plant and equipment of the D. F. Boyer Handle Co., and the Danville Handle Co., at Danville, Ill., and will operate them as branches of the Champaign plant.

Galesburg, Ill.—An ordinance for the installation of an ornamental lighting system on Chambers, Losey, Willard and Bateman streets, at an estimated cost of $20,279.29, for the pavement of Mathews street at an estimated cost of $5,972.99, was passed by the city council.

Rock Island, Ill.—Root & VanDevoort Engineering Co. will install a complete electrical dynamometer testing laboratory, under the supervision of Charles P. Grimes, development engineer. This will be the fourth laboratory of this type to be installed by Mr. Grimes. It is expected that the information made available in the new laboratory in the Root & Van-Dervoort Engineering Co.'s plant will enable engineers in charge of motor and automobile designing to make much progress in the development of the company's products.

Springfield, Ill. — Davenport, Springfield & Southern Railway Co. has applied to the Illinois Public Utilities Commission for a certificate of convenience and necessity to construct and operate an electric interurban railroad from Davenport, Iowa, to Metropolis. The company also plans to build a branch line from Pinckneyville, Ill., to East St. Louis, Ill., and to construct other spurs as well, such as from Pinckneyville to Coulterville; Belleville to East St. Louis; Decatur to Litchfield and Edwardsville, and Benton to Marion. The company expects to do a heavy railroad business especially, making a special business of handling coal from the Southern Illinois coal fields.

Urbana, Ill.—Board of local improvements has awarded contract for ornamental lighting system to Freeman Sweet Co., Chicago, for $5850.

Benton Harbor, Mich.—Austin & Shamblain, 731 J. M. S. building, South Bend, have prepared plans for two-story box factory for George E. Thayer. The specifications call for motors and electrical equipment.

St. Paul, Minn.—Northern States Power Co. has closed a contract with the new Union Depot for its electric light and power requirements, the connected load amounting to about 1500 kw. Steam for heating will also be furnished under this contract. When completed the depot will be one of the most modern in the United States, costing, with its accompanying yards and track rearrangement, about $11,000,000.

Albany, Wis. — Engineer W. G. Kirchoffer, Vroman Block, Madison, Wis., has prepared plans for improving the power dam.

Black River Falls, Wis.—Plans have been prepared for municipal electric light plant for city. Architects Meade & Seastone have prepared plans. Address Albert Knutson, city clerk.

Chippewa Falls, Wis. — E. S. Schneider, president of Apple River Milling Co., has planned construction of dam, power house and canal near the quarry at Colfax.

Janesville, Wis.—Architect F. D. Chase, 645 North Michigan avenue, Chicago, has prepared plans and will let contracts for $40,000 power house for the General Motor Co. Specifications include motors.

Davenport, Iowa. — First unit of new four-story factory building of the Linograph Co. has been commenced. The building will cost $105,000.

Davenport, Iowa.—Voss Manufacturing Co. will build four-story addition 50x150 ft. to its plant. It will be connected to the main factory by an overhead "L" and tunnel. The company has booked one order alone for 10 carloads of washing machines from a Pittsburgh concern.

Terrill, Iowa.—The extension and improvements of improving electric lighting is under consideration. Address town clerk.

Independence, Mo.—A special election will be held Sept. 16, to vote on the proposal to issue $65,000 in bonds to add a new unit to the municipal electric light plant.

Mountain Grove, Mo.—J. Fred Ellis, J. A. Chase and L. H. Williams, of Mountain Grove, are organizing a company for the purpose of erecting an electric light and power plant at the Double Grove Springs in Ozark county, 34 miles from Mountain Grove. A dam and power plant will be erected. Engineers have estimated that the spring can furnish 1000 hp.

Versailles, Mo. — The municipal light plant at Versailles has been bought by Henry Moser, who will overhaul the plant and add $15,000 of new equipment.

Arlington, Kans.—Election carried for electric lights, bonds for $20,000 having been voted. At the same time election was held to vote the same amount of bonds for lights at Partridge. Both towns will get their light from Hutchinson.

Bendena, Kans. — Electric lights are soon to be installed here.

Chanute, Kans.—The election to vote on the proposition of issuing $75,000 in bonds for enlargement and improvement to the electric light plant, carried.

Courtland, Kans.—A special election will be held Sept. 16 to vote on the issuing of $45,000 bonds for the installation of a modern waterworks system.

Eldorado, Kans.—The contract between the city of Eldorado and the Kansas Gas & Electric Co., has been formally signed, 100 candle power lights will be installed for all street lighting as well as the ornamental lamps for the white way.

Erie, Kans.—A new electric light plant is contemplated.

Guide Rock, Kans.—Plans are being made for an electric light system.

Hiawatha, Kans. — Transmission lines will probably be established from Hiawatha to Willis and Bendena.

Kinsley, Kans.—Plans are being made for the installation of a white way.

Larned, Kans.—Plans are being made to bring electric current from the Hutchinson power plant through high-power transmission lines.

Willis, Kans.—Plans are being made to determine the cost of a high power transmission line from Horton to Willis. As soon as the price is determined, an election will be called to vote bonds for the line.

Mulvane, Kans.—Bonds have been voted for taking over the electric light plant.

Omaha, Neb.—Union Power & Light Co. has been given authority to issue $119,000 on preferred stock.

Oshkosh, Neb.—The election for $9750 bonds for electric lighting system carried. Address town clerk.

Watertown, S. D.—Engineer Lewis C. Larson, 18 Hendon avenue, St. Paul, Minn., is preparing plans for an electric light and power plant, estimated cost $175,000. Brown Mathier, city auditor.

SOUTH CENTRAL STATES.

Louisville, Ky.—Commercial department of the Louisville Gas & Electric Co., during the week ended Aug. 9, secured 51 new electric light and power customers with 37 kw. for lighting and 603 hp. in motors, and accepted contracts for wiring 11 already built houses. New business connected to the company's lines includes 30 customers with 23 kw. of lighting. There was a temporary loss of 42 hp. in motors. Electric energy output shows a gain of 11% over the corresponding week a year ago.

Delight, Ark.—J. F. Rhyne, Delight, is planning for the erection of an electric power plant at Okolona, Ark., for local light and power service. A similar station will also be erected in the vicinity of Delight.

Fargo, Okla.—Election was held

Aug. 11 to vote $26,000 in bonds for the construction and equipment of an electric light plant and waterworks system. A. C. Brauch, city clerk.

Hobart, Okla.—Engineers C. V. Long & Co., 1300 Colcord building, have prepared plans for $135,000 electric light plant to be erected here. Address J. J. Hunt, mayor.

Hooker, Okla.—Plans are being made for a new light plant to cost $40,000.

Albany, Tex.—The Common Council is considering a bond issue of $40,000 for the erection of a municipal electric power plant and ice plant.

Brownwood, Tex.—Further extension of the high-power lines from the Texas Power & Light Co., from this point is to be made in the near future. A line will be built from Dublin to De Leon and Gorman and a line from Dublin to Stephenville.

Denton, Tex.—E. P. Turner of Dallas, and associates, are promoting the construction of an interurban electric railway between Fort Worth and Denton and between Fort Worth and Irving. Each line will be about thirty miles long. The commissioners' court of Tarrant county, of which Fort Worth is the county seat, has granted a franchise for the construction of the proposed roads across and over the county roads. It is stated by Mr. Turner that financial arrangements for the fulfilment of the project have been made. He is also at the head of the Dallas & Southwestern Interurban Railway Co., and the Dallas & Northwestern Interurban Railway Co. The former plans to construct an interurban line from Dallas to Glen Rose, and the latter from Dallas to Denton. Mr. Turner and associates also hold franchises for the construction of an interurban railway between Fort Worth and Abilene, via Mineral Wells and Brackenridge.

Mexia, Tex.—City Council is planning for the establishment of a municipal electric light and power plant to cost $100,000. Address mayor.

Ripley, Tex.—Citizens have approved a bond issue of $150,000 for the establishment of a municipal power plant, with ice manufacturing department.

Wichita Falls, Tex.—Preliminary work looking toward construction of an interurban electric railway between Wichita Falls and Dallas is making rapid progress. Men of large financial means of both Wichita Falls and Dallas are behind the project and its fulfilment is said to be assured. Two routes into Dallas have been surveyed and the selection of the one to be followed will be made soon, it is announced by Fred A. Jones of Dallas, who is in charge of the work. The line will be about 150 miles long. It will pass through a number of thriving towns and give a new transportation outlet to one of the most populous sections of Texas. Electric power stations will be built at Dallas and Wichita Falls. There will not be a crossing at grade on the line and a maximum grade of one per cent will be obtained, according to Mr. Jones.

Wichita Falls, Tex.—Within a short time practically all of the oil well and pipe line pumping plants in the Burkburnett oil field, including the Northwest extension pool, will be operated by electric power. Already the new transmission line which the Wichita Falls Electric Co. constructed from its central station here to the Burkburnett field is providing power for a number of oil well pumps. The capacity of the company's plant is being greatly enlarged by the installation of a turbine engine of 5000 hp. and other equipment. When the improvements that are now being made are finished the plant will be more than double its present capacity, it is stated. It is asserted by oil operators that the use of electric power for operating the pumping plants will lessen the cost of production considerably. Fuel is high in price and difficult to obtain, on account of the congested traffic conditions upon the railroads.

WESTERN STATES.

Phoenix, Ariz.—The Water Users' Association plans to construct a $500,000 electric power plant to furnish power to every ranch of the valley. Project manager, W. R. Elliott.

Buhl, Idaho.—R. B. King, district manager of the Idaho Power Co., announces that his company will increase the generating power of the plant at Thousand Springs from 6000 to 8000 hp.

Uncon, Idaho.—Utah Power & Light Co. is extending its distribution system to the eastern part of this town to take care of customers in that section.

Libby, Mont.—About $240,000 will be spent for the construction of a 200-ton concentrator and power plant and other buildings by the Lukens-Hazel Mining Co., Libby. A pipe line will be installed from Granite, which will develop about 500 hp.

Seattle, Wash.—A large quantity of electrical equipment will be required in connection with the construction of the proposed 18,000,000-ton dry dock at the plant of the Ames shipbuilding & Dry Dock Co., including complete electrically operated pumping apparatus, motors, etc.

Seattle, Wash.—The Board of Public Works was directed by the city council to prepare plans for the Gorge Creek plant of the Skagit River power project. Bids are to be called for as soon as the plans are ready. This action was taken by the Utilities committee after consideration of a report from the City Engineer, A. H. Dimock, showing the construction of a high dam in the vicinity of Ruby Creek.

Marshfield, Ore.—Mountain States Power Co. will supply electric energy amounting to 40 hp. for the operation of a refrigerating machine for the Coos Bay Ice & Cold Storage Co. Negotiations are under way for the electric requirements of a veneer plant recently completed and a new sawmill at Marshfield.

Silverton, Ore. — Portland-Southeastern Electric Railway was granted a franchise at the meeting of the city council for a 50 year period. Address general manager.

Pittsburgh, Cal.—Several bonding propositions are to be submitted. Among these will be the installation of an electrolier lighting system.

FOREIGN TRADE

[*Addresses of firms referred to in these trade opportunities may be obtained by writing to the Bureau of Foreign and Domestic Commerce, Washington, D. C., or its branch and local co-operative offices. Request for each opportunity should be on a separate sheet and the file number given.*]

Electrical Supplies (30,206).—An American firm whose South American manager is leaving shortly for Brazil and Argentina desires to secure agencies for the sale in those countries of hardware and electrical supplies. References.

Motors, Dynamos, Transformers (30,212).—A commercial agent in Belgium desires to secure an agency on commission for the sale of complete equipment for electrical illuminating motors and dynamos, alternators, 25 and 50 cycles usual, transformers, and complete equipment for transformers of electric current. Correspondence should be in French. Reference.

Copper Wire, Cable, Lamp Cord, Motors (30,366). — Catalogs, price lists, and samples of all sorts of bare and insulated copper wire, stranded cable, all sorts of lamp cord, marine motors and equipment, and automobiles and accessories, are desired by a firm in Norway. Reference.

Iron Plates for Electrical Machinery, Wire (30,361).—Iron plates for electrical machinery, asbestos, asbestos cardboard, insulating bands, tinned steel wire, oiled gauze, mica, tubular soldering or welding, string, etc., are required by a company in Belgium. Quotations should be given c. i. f. Antwerp. Correspondence may be in English. References.

Wire (30,394).—An agency is desired by a man in Italy for the sale of agricultural machinery and parts, iron and steel products, rails, tubing, electric wire railroad material (narrow gauge), coal, and writing materials. Correspondence may be in English. References.

Lighting Systems (30,395).—The director of agriculture of a Government of Europe desires to have manufacturers forward catalogs and other information relative to meteorological instruments, hydrometric instruments, leveling and surveying instruments, agricultural instruments, flour-milling machinery, dairying equipment, sanitary water-supply and sewage systems, hydraulic motors, town and village lighting systems, sounding and boring machinery; and lumbermen's machinery. He also requests the names of standard books on rural engineering and hydraulics.

Electrical Apparatus and Equipment (30,399).—A merchant in France desires to secure an agency for the sale of electrical apparatus and equipment, such as bells, electric light accessories, telephone equipment, and switchboards. Correspondence should be in French. References.

Lighting Plants, Fans, Turbines

(30,404).—Iron and steel sheets (plain black, corrugated black, plain galvanized, corrugated galvanized); hydraulic tobacco baling presses suitable for baling tobacco for export; electric lighting plants, electric fans (table, wall and ceiling), especially single-phase, 3-cycle, 115-volt ceiling fans; and hydraulic turbines, are required by a firm in India. Quotations should be given f. o. b. New York. Payment, telegraphic transfer on New York with order. Reference.

Condensers and Coolers, Pumps (30,410).—An engineer in Belgium desires to secure the representation of firms exporting absorption towers, air compressors, autoclaves, beet-sugar machinery, blowers, centrifugal separators, and grain separators, centrifugal nitrators, surface condensers and coolers, jaw crushers; roll, ball, and tube crushers and grinders; rotary cutters, driers (especially vacuum driers); vacuum separators, filters and filter presses; rotary heating furnaces; pumps of all types for industrial purposes; belts, chains, and other conveyors; and hoists and cranes. Correspondence may be in English.

Electric Tools, Etc. (30,411). — A firm in Spain desires to purchase screw-cutting engine lathes, back geared power feed milling machines, machine tools of every description, small engineering tools, steel split pulleys, balata and leather belting, wood split pulleys, shafts for transmission of power, electric and pneumatic tools, and grease cups and valves of every description. Correspondence may be in English. References.

Motors (30,425).—A company in Belgium seeks the representation of a firm manufacturing electrical installations, electric motors, and accessories. Correspondence should be in French. References.

Electrical Equipment (30,430). — A merchant in Algeria wishes to secure an agency for the sale of electrical equipment, motors and accessories, and dynamos. Quotations should be given c. i. f. Algeria. Correspondence should be in French. Reference.

Electrical Appliances (30,444). — A Scandinavian firm desires to secure an agency for the sale of tools, motors, motor boats, electrical appliances, glass and construction materials. Correspondence may be in English. Reference.

Electrical Appliances (30,448).—A firm in New Zealand desires to secure an agency for the sale of hardware, novelties, fancy goods, electrical appliances, telephone (manual and automatic) accessories, etc. Quotations should be given c. i. f. New Zealand or f. o. b. some port of shipment. Terms, cash against documents. References.

PROPOSALS

Electrical Fixtures.—Bids will be received by R. L. Brown, 605 Union Trust building, Parkersburg, W. Va., to install electrical fixtures in $60,000 moving picture theatre.

Street Lighting Equipment.—Bids will be received Sept. 2 at Cloquet, Minn., for installing street lighting equipment. Address J. A. Parks, city clerk.

Street Lighting System.—Bids will be received at Dell Rapids, S. D., on Sept. 9, for installing a street lighting system.

Electric Light Plant.—The Department of Interior Office of Indian Affairs, Washington, D. C., will receive bids Sept. 18 for an electric lighting plant at the Standing Rock School, N. D. Address Commissioner Cato Sells, Department of the Interior Office of Indian Affairs, Washington, D. C.

Electric Passenger Elevator.—Bids will be received at Chicago Sept. 12 for remodeling an electric passenger elevator in the United States Marine Hospital in accordance with plans at the office of the custodian, Chicago. Address James A. Wetmore, Washington, D. C.

Generators, Lighting Fixtures, Etc.—Bids will be received until 8 p. m., Sept. 4, at Hollandale, Miss., for furnishing materials, equipment and supplies and constructing certain water and light plant improvements for the town, in accordance with plans and specifications on file at the office of the board of aldermen, Hollandale, Miss. The work includes furnishing cast-iron and galvanized pipe and fittings, fire hydrants, valves and boxes, oil engine and deep well pumping set, electric generators, switchboard and street lighting fixtures. J. A. McAlpin, mayor; Xavier A. Kramer, consulting engineer, Magnolia, Miss.

Pump.—The Treasury Department, supervising architect's office, Washington, D. C., will receive bids until Sept. 12, for motor-driven triplex pump in the United States Postoffice at New Haven, Conn. Specifications are on file in the office of the architect and of custodian at New Haven.

Boiler and Transmission Equipment.—Bids will be received by the Consolidated Creamery Co., Fultonville, N. Y., for replacing engine, boiler and transmission equipment which was recently destroyed by fire.

Generator and Equipment.—Bids will be received by the city of Ashtabula, Ohio, until Sept. 10, for installing a 1000-kw. generator and equipment in the electric light plant, at an estimated cost of $50,000. Morris-Knowles, Jones Law building, Pittsburgh, engineer.

INCORPORATIONS

New York, N. Y.—J. S. Lawson & Co., Inc. Capital, $10,000. To manufacture electrical devices. Incorporators: John A. Potter, Allen D. Stanton and John S. Lawson, Briarcliff Manor, N. Y.

New York, N. Y.—Monroe Electric Supply Co. Capital, $10,000. To manufacture flashlights and electrical novelties. Incorporators: Samuel Feiner, Joseph A. Herman and Jacob Weiner, 5521 56th street, Brooklyn.

New York, N. Y. — L. Sence & Sons, Inc. Capital, $20,000. To manufacture electrical specialties. Incorporators: A. L. Naze, A. E. Bringle and A. McMahon, 1400 Broadway.

Hoboken, N. J.—Hudson Electrical Supply & Equipment Co. Capital, $50,000. To operate as electrical engineers, manufacture electrical equipment, etc. Incorporators: A. T. Pupke, Hoboken; W. E. Stanton and W. J. Coleman, Jersey City.

Jersey City, N. J.—British-American Rotary Valve Co. Incorporated in Delaware with capital of $1,500,000. To manufacture engines, etc. Incorporators: Edward Eriksen, Sr., and Jr., and Harry Eriksen, all of Jersey City.

Delray, Fla.—Delray Utility Co. Capital, $10,000. To operate a local electric light and power system. D. K. Carter, principal incorporator.

Wilmington, N. C.—J. W. Blake Electrical Co. Capital, $50,000. To manufacture electrical supplies. Incorporators: J. W. Blake and C. F. Jones.

Elkhart, Ind.—Mann Electric Co. has been incorporated with capital of $10,000 by Vernon V. Mann, Fred Lemon and W. W. Long.

Evansville, Ind.—Gilmore M. Haynie & Co. has been incorporated with capital of $20,000 to manufacture and install motor driven power and lights plants and systems. The directors are Gilmore M. Haynie, Isidor Kahn and M. S. Haynie.

Leopolis, Wis.—Leopolis Electric Light & Power Co. has incorporated with a capital of $5000. Incorporators: Rudolph Kucksdorf, James Cervey and others.

Middlesboro, Ky.—Davis Electrical Repair & Sales Co. Capital, $10,000. To operate a local plant for the repair of electrical appliances, etc. J. H. Martin is the principal incorporator.

St. Louis, Mo.—Western Battery & Manufacturing Co. Capital, $5,000. To manufacture electric batteries and kindred specialties. Fred A. Andreas is the principal incorporator.

New York, N. Y.—A. S. Elliott Co., Inc. Capital, $40,000. To manufacture electric and gas fixtures, etc. Incorporators: S. Elliott and A. G. and S. Lichtenstein, 138 East 11th street.

Sisterville, W. Va.—West Virginia Light, Heat & Power Co. Capital, $75,000. To operate a local light, heat and power plant. Incorporators: T. C. Davidson, A. R. Ten Broeck, and A. D. Lord, New York.

Loretto, Mich.—Loretto Light & Power Co. has incorporated with a capital of $10,000, producing and supplying electricity for light, power. Incorporators, C. H. Baxter, A. R. Parkett and others.

Detroit, Mich.—Detroit Transmission Co. Incorporated under Delaware laws with a capital of $10,500,000. Incorporators: Charles L. Marshall, Charles W. Kuehl, and James I. Butcher, Detroit.

East Liberty, Ohio—Peoples' Light & Power Co. has incorporated with a capital of $20,000. L. E. Traul.

Personal

H. M. Giles New Superintendent of South Philadelphia Works, Westinghouse Co. — D. R. Smith Promoted

A. H. Nickerson, formerly connected with the Adapti Co., has been appointed representative of the Pierce Fuse Corp., with offices located at 310 Lennox building, Cleveland, Ohio.

C. B. Lord, has resigned as general superintendent of the Wagner Electric Mfg. Co., St. Louis, to become consulting mechanical engineer for the company.

E. B. Smith, auditor of the Muskogee Gas & Electric Co., Muskogee, Okla., has been transferred to the Oklahoma City office of the Oklahoma Gas & Electric Co., and will be succeeded by George H. Richardson of the Oklahoma company.

R. Timmerman, formerly division manager for the Utah Power & Light Co., Bingham, Utah, has returned after two years' service as a lieutenant in the Navy, and will have charge of the Provo Division of the company, succeeding A. P. Merrill, who has been transferred to the Ogden Division.

James R. Kearney, for the past 14 years connected with W. N. Matthews & Brother, is now western manager of the line material division of that company, with headquarters at Chicago. He will cover all of the territory west of Pittsburgh, and Canada from Winnipeg west, supervising the line-material division sales and take charge of all salesmen covering that territory.

C. H. Grove, who was recently discharged from the Navy, has been appointed Toledo representative for the Commercial Electric Supply Co., Detroit, Mich. Mr. Grove is a graduate of the 1911 class of the University of Illinois, and has been employed by the Westinghouse Electric & Manufacturing Co. on its apprenticeship course and in its sales department at Chicago.

J. E. Davidson, vice-president and manager of the Nebraska Power Co., Omaha, Neb., is retiring from the office of president of the Nebraska Section of the National Electric Light Association, and will be succeeded by T. H. Fritts, of Grand Island, Neb. Mr. Davidson was formerly vice-president and general manager of the Pacific Power & Light Co., and well known to the men of the electrical industry in the West.

Edward N. Lake, recently elected president of the Lake Engineering Co., was formerly manager of the Krehbiel Co., consulting engineer, Chicago, and prior to that time was resident engineer with Stone & Webster. During the war Mr Lake was in service with the United States Army as a major in the construction division, Quartermaster's Corps. The major portion of his time in the army was devoted to the work of the construction division at the Scituate Proving Grounds, Scituate, Mass.

Leo Valentine, formerly chief electrician of the Oklahoma Gas & Electric Co., Oklahoma City, has been placed in charge of the electric department.

H. L. Coleman, formerly general manager of the Empire Gas & Electric Company, Geneva, N. Y., has resigned to become general manager of the Bloss Vein Coal Co., recently organized.

Louis E. Strothman, manager of the steam turbine and pumping engine department of the Allis-Chalmers Manufacturing Co., Milwaukee, has resigned to become associated with the Richardson-Phenix Co., Milwaukee, as vice-president and general manager.

Maj. J. R. Worth, Construction Division, U. S. A., is now stationed at Pittsburgh, Pa., % West Penn Power Co., Beedeedum Trees building, as Government constructing quartermaster for three steam-electric plants. He will probably remain about a year.

R. L. Peterman, superintendent of the Pennsylvania Utilities Co., a property under the management of the W. S. Barstow Management Association, has been appointed general manager of the Binghamton Light, Heat & Power Co., succeeding Robert N. Hodgson.

R. O. Bentley, formerly in charge of the Newark district of the Public Service Electric Co., Newark, N. J., has been appointed division superintendent of the Essex Division, formed by a combination of the Newark and Orange districts. Rudolph Burkhalter, formerly superintendent of the Orange district, has been made division superintendent of the Southern Division, succeeding J. Howard Sturge, who becomes Division Superintendent of the Bergen Division. William B. Hartshorne, heretofore in charge of the Bergen Division, has been appointed to a like position in the Central Division, succeeding Jacob T. Barron, who has recently been appointed superintendent of production, with office at Newark.

Dorsey R. Smith, for more than 15 years associated with the Consolidated Gas, Electric Light & Power Co., Baltimore, Md., has been appointed to head its merchandise and domestic sales department. Since entering the employ of the company he has successfully held various positions, the first being that of an outside salesman selling gas-consuming appliances. Upon the merger of the gas and electric companies Mr. Smith was placed in charge of the incandescent lamp department of the electric division. Six years ago when the company inaugurated a merchandising business of gas and electric appliances, table lamps and kindred products, he was appointed assistant to the manager of the merchandise department.

Robert N. Hodgson, general manager of the Binghamton (N. Y.) Light, Heat & Power Co., has tendered his resignation to accept the position of sales manager of the W. S. Barstow Management Association, which controls the Binghamton Light, Heat & Power Co. and 22 similar companies. Mr. Hodgson will make his headquarters in New York and will have charge of the commercial end of the association's business.

Harry M. Giles has been appointed general superintendent of the South Philadelphia Works of the Westinghouse Electric & Manufacturing Co. Mr. Giles, who succeeds the late Oscar Otto, has risen from the ranks in the Westinghouse organization. For a number of years past, he has been superintendent of marine erection, a position to which he was appointed by H. T. Herr, when the electric company absorbed the machine company. Mr. Giles was born in Boothby, Maine, March 23, 1869, and when a small boy his parents moved to Providence, R. I., where he received his education. Leaving high school, he went to work at an early age in the shops of the Corliss Steam Engine Co. While working he took a night course in the Rhode Island School of Design and later received private instruction in mechanics, kinematics and mathematics. His close application to work in the Corliss shops won him rapid promotion as a draughtsman but he irked to get into the actual work of machine construction. He accordingly apprenticed himself in the mechanical department. During his apprenticeship he worked on the very lathe on which had been turned the turret rings of the "Monitor," that tiny Federal mosquito that whipped the Confederate cruiser "Merrimac" at Hampton Roads during the Civil war. Upon the expiration of his apprenticeship, he began to forge ahead in machine construction until in 1900 he became superintendent of Corliss engines with the Westinghouse Machine Co., a position he held until the company became a part of the present organization.

Obituary.

Henry A. Reed, who was operator in the first telegraph office opened on the Harlem Railroad in 1850, died at the age of 90, Saturday, August 23, in his home at Newark, N. J. He was overcome by the heat on the Fourth of July and had been ill ever since. Mr. Reed was president of the Bishop Gutta Percha Co. of New York. When he was 18 years old Mr. Reed took up what was then the new science of electricity and was one of the earliest telegraph operators in this section of the country and a pioneer manufacturer of insulated wires and cables. He was an organizer of the Electric Club and of the Electric Trade Society of New York.

For the Readjustment Period—What?

L.

Stimulating Production Essential

Following the stressful times of war, many people are inclined to underestimate the difficulties of post-war problems and to desire a cessation of government interference with business. Serious-minded people think official control, based upon economically sound legislation, seems imperative until more normal conditions have been reached. The general checking of exports does not necessarily bring about reduced cost of living. Our supply of various staple products and manufactured goods is sufficient to serve the legitimate needs of consumers here and abroad. In case of inadequate supplies, export embargoes—total or in part—should be promptly considered for the protection of the American consumer.

Above all, co-operation between labor and capital is necessary to bring about deflation. The problem cannot be solved by labor accusing capital of universal profiteering or by capital, in turn, decrying the demands of labor for higher wages. Stimulation of production is essential. Strikes only hamper the nation's power to produce, with disastrous consequences for all concerned. Investigations now being made by authorities will tend to establish a clear distinction between real and so-called profiteering; and, to put a stop to the hoarding of supplies, severe measures are predicted to reduce prices from levels arbitrarily maintained by speculation.

The reduction of most commodity prices will have to be gradual, as sudden reductions by the establishment of official maximum prices might cause undeserved losses to capital, which can only result in capital being withdrawn to the detriment of production.

NATIONAL PARK BANK OF NEW YORK

This essentially fair and clear-cut statement by one of the most progressive—yet conservative—banks of the country, is one which summarizes present needs better than any that has thus far come to our attention. For the electrical industries it has special significance.

C. A. TUPPER *Presiden*
INTERNATIONAL TRADE PRESS, INC., CHICAGO

Financial News

Foreign Credit Plan Vital.

Charges in a letter from Senator Owen of Oklahoma, member of the senate banking committee, that the New York banks have opposed bills pending in congress intended to relieve the drop in the foreign exchange market and to promote the extension of foreign credits, because their passage would deprive the banks of the opportunity to speculate in foreign exchange, were denied by local bankers. "The statement in Senator Owen's letter to the President is unfair," said E. D. Hulbert, president of the Merchant's Loan & Trust Co. "Bills now pending on the subject," continued Mr. Hulbert, "might, if enacted, take away from the banks their foreign exchange business and vest it in some one or more of the various organizations or governmental agencies proposed in the bills. It is for this reason that pending bills are generally opposed by bankers."

There was a general concurrence of opinion among bankers in Senator Owen's statement in the letter to the President, that unless immediate steps are taken to extend credits to cover European purchases in this country a serious business reaction will take place here, cutting off a large part of our foreign market.

"We are in the unique position of having nearly all of the world's money, as well as large stores of goods that are absolutely necessary to Europe," said Mr. Hulbert, "and the only way we can aid Europe is to extend credit for the purchase of our goods. Such action on our part would be beneficial to us in that it would aid us in getting rid of surplus manufactures and would unquestionably stabilize foreign exchange. The Davidson plan, a practical, workable plan that would have accomplished this result, was submitted before the situation developed its present acute form, and since it has been rejected by the administration no adequate substitute has been offered therefor."

Standard Gas & Electric Liquidates Back Dividend.

Directors of Standard Gas & Electric Co. in meeting yesterday declared the regular quarterly 2% cash dividend on the preferred stock payable Sept. 15 to stockholders of record Aug. 30, and passed a resolution providing for the payment of 13% cumulated dividends on the preferred payable in common stock of the company at par.

The operating statement for the first six months of 1919 shows the full 4% for the preferred and 3.52% on the common shares, including the increased common stock due to payment of the accumulated dividends on the preferred. This is at a yearly rate of 8% for the preferred and over 7% for the common, without taking into consideration any earnings from the Shaffer Oil & Refining Co., which company, the directors state, is progressing most satisfactorily.

Earnings statement of Standard Gas & Electric Co. for the first six months of 1919 is as follows:

Earnings after deduction of operating expenses and estimated Federal taxes	$1,377,011.04
Interest charges	486,645.73
Balance	$ 890,365.31
Preferred dividends	443,961.12
Balance for 6 months of 1919	$ 446,404.19

Oklahoma Company Redeems Bonds.

The Oklahoma Gas & Electric Co., through the Continental & Commercial Trust & Savings Bank, trustee, has called for all of its 6% debenture bonds, dated Oct. 1, 1912, outstanding. In accordance with the provisions of the trust deed, par and accrued interest as of Oct. 1, 1919, and a premium of 1% will be paid. Bonds and all interest coupons attached are to be presented at Continental & Commercial Trust & Savings Bank, Chicago, by Oct. 1, 1919, after which date interest on the bonds ceases. Of the original issue of $228,500 bonds, $102,000 are now outstanding.

Electric Companies in Big Merger.

W. S. Barstow & Co., New York, state that the Potomac Edison Co. has been incorporated to take over and to develop various properties in West Virginia and Maryland. This company will have a capitalization of $4,000,000 first mortgage bonds, $1,700,000 second mortgage bonds, $1,000,000 preferred stock and $3,500,000 common stock. It will take over the present properties of the Edison Electric Illuminating Co. of Cumberland, Cumberland Electric Railway Co., West Virginia Central Gas Co., West Virginia & Maryland Gas Co. of Maryland, West Virginia and Maryland Gas Co. of West Virginia, Maryland Gas Co., Hartland Power Co. and all of the electric light and power companies doing business in Grafton and vicinity.

Increased Valuation for West Virginia Utilities.

The State Board of Public Works, Charleston, W. Va., has issued a statement showing an increase of $3,802,989.77 in assessments of all public utility corporations in the state over the total of 1918. The aggregate assessments for the present year are $349,558,319.97. In the case of electric light and power interests, large increases have been made in the case of a number of prominent companies, as follows: Appalachian Power Co., from $1,450,000 to $2,500,000; Consolidated Light, Heat & Power Co., $800,000 to $1,100,000; Logan County Light & Power Co., $750,000 to $1,250,000; and the Virginian Power Co., from $2,000,000 to $2,250,000.

The Asia Banking Corp. announces the appointment of W. G. Avery as general manager of its Far Eastern branches, with headquarters at Shanghai. Mr. Avery, who was formerly assistant treasurer of the Guaranty Trust Co. of New York, left New York Aug. 19, and will sail from Vancouver on Sept. 4.

Southern California Edison Offers Stock.

The Southern California Edison Co. is offering to its stockholders 25,000 shares of common stock at $90 cash, or $91 payable $6 with subscription and $5 a month. Stock not subscribed will be offered publicly after Sept. 1. The company plans to expend $20,000,000 in hydroelectric developments in the next three years.

Dividends.

American Telephone & Telegraph Co. has declared a quarterly dividend of $2 a share, payable Oct. 15 to stock of record Sept. 20.

American Power & Light Co. has declared the quarterly dividend of 1%, payable Sept. 1 to stock of record Aug. 21.

El Paso Electric Co. has declared a quarterly dividend of $2.50 a share, payable Sept. 15 to stock of record Sept. 2.

A dividend of 1¾% on preferred stock has been declared by the Nebraska Power Co., payable Sept. 1 to stock of record Aug. 20.

Northern Texas Electric Co. has declared a quarterly dividend on common stock of 2%, also a dividend on preferred stock of 3%, payable Sept. 2 to stock of record Aug. 18.

Philadelphia Electric Co. has declared a quarterly dividend of 43¾ cents per share, payable Sept. 15 to stockholders of record Aug. 20.

The board of directors of the Rochester Railway & Light Co. has declared a quarterly dividend of 1¼% on preferred stock, also a quarterly dividend of 1¾% on series B preferred stock, both payable Sept. 2 to stock of record Aug. 25.

WEEKLY COMPARISON OF CLOSING-BID PRICES OF SECURITIES OF LEADING ELECTRICAL COMPANIES.

Quotatons furnished by F. M. Zeiler & Co., Rookery Bldg., Chicago.

Public Utilities.	Div. rate. Per cent.	Bid Aug. 19.	Bid Aug. 26.
Adirondack Electric Power of Glens Falls, common	6	12	13
Adirondack Electric Power of Glens Falls, preferred	6	75	78
American Gas & Electric of New York, common	10+extra	122	120
American Gas & Electric of New York, preferred	6	41	41
American Light & Traction of New York, common	..	228	220
American Light & Traction of New York, preferred	6	95	95
American Power & Light of New York, common	4	60	62
American Power & Light of New York, preferred	6	69	68
American Public Utilities of Grand Rapids, common	..	10	10
American Public Utilities of Grand Rapids, preferred	7	30	30
American Telephone & Telegraph of New York	..	101	102
American Water Works & Elec. of New York, common	..	5½	5¾
American Water Works & Elec. of New York, particip	7	10	10
American Water Works & Elec. of New York, first preferred	..	58	58
Appalachian Power, common	..	5	5
Appalachian Power, preferred	7	22	22
Cities Service of New York, common	+extra	434	438
Cities Service of New York, preferred	6	76¼	75½
Commonwealth Edison of Chicago	8	107	107
Comm. Power, Railway & Light of Jackson, common	..	25	23
Comm. Power, Railway & Light of Jackson, preferred	6	57	56
Federal Light & Traction of New York, common	..	10	10
Federal Light & Traction of New York, preferred	..	46	47
Illinois Northern Utilities of Dixon	6	75	75
Middle West Utilities of Chicago, common	2+extra	30	30
Middle West Utilities of Chicago, preferred	6	53	53
Northern States Power of Chicago, common	..	65	67
Northern States Power of Chicago, preferred	ex.div.7	89	90
Pacific Gas & Electric of San Francisco, common	..	66¾	66¾
Pacific Gas & Electric of San Francisco, preferred	6	88	88
Public Service of Northern Illinois, Chicago, common	7	86	86
Public Service of Northern Illinois, Chicago, preferred	6	94	94
Republic Railway & Light of Youngstown, common	4	15	13½
Republic Railway & Light of Youngstown, preferred	6	50	50
Standard Gas & Electric of Chicago, common	..	31	31
Standard Gas & Electric of Chicago, preferred	8	45	45½
Tennessee Railway, Light & Power of Chattanooga, common	..	5	3½
Tennessee Railway, Light & Power of Chattanooga, preferred	6	15	15
United Light & Railways of Grand Rapids, common	4	45	43
United Light & Railways of Grand Rapids, preferred	6	72	68
Western Power of San Francisco, common	..	24½	24½
Western Union Telegraph of New York	extra	85½	86¾
Industries.			
Electric Storage of Philadelphia, common	4	83	94
General Electric of Schenectady	8	162¾	162¼
Westinghouse Electric & Mfg. of Pittsburgh, common	7	52	52¾

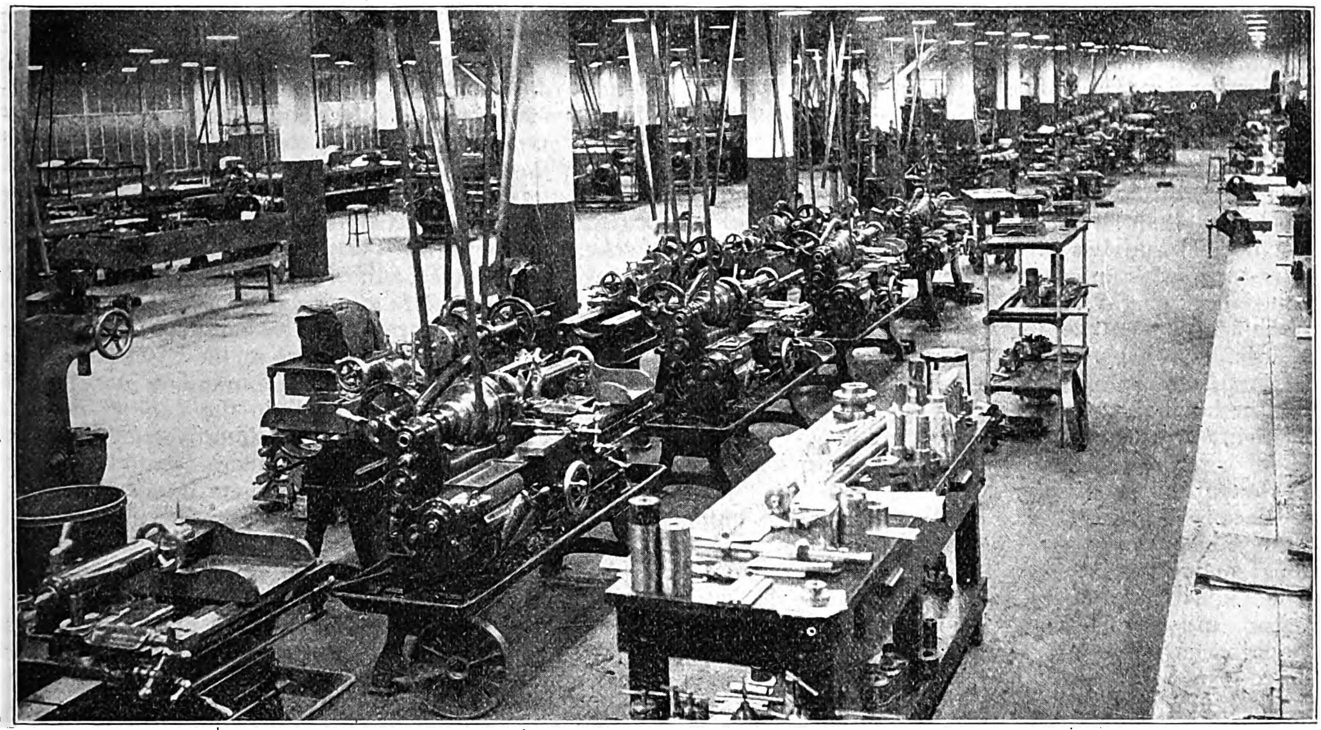
Electrical Review

l. 75. No. 10. CHICAGO, SEPTEMBER 6, 1919 Three Dollars a Year

Electrical Review

WITH WHICH IS CONSOLIDATED WESTERN ELECTRICIAN AND ELECTROCRAFT.

VOL. 75—NO. 10. CHICAGO, SATURDAY, SEPTEMBER 6, 1919. PAGE 381.



Night View in Machine Shop of an Automobile Manufacturing Plant—A Splendid Example of General Shop Lighting That Stimulates Efficiency of Employes and Increases Production.

What Better Industrial Lighting Can Do to Stimulate Production

Fight on High Cost of Living Calls for Increased and More Efficient Production—Modern Factory Lighting Was Important Aid to War Production and Can Materially Help Present and Impending Conditions

By F. H. BERNHARD

ONE of the most serious of the many economic, political and social problems of the readjustment period is the fight on the high cost of living. The latter is generally recognized as a principal cause of the prevailing labor unrest, while the strikes and lockouts developed therefrom are in turn responsible for further increases in the cost of living. Thus has resulted a vicious cycle of successive price increases of labor and commodities, these conditions having called for most careful consideration by national, state and local authorities.

NEED FOR INCREASED AND MORE EFFICIENT PRODUCTION.

The findings of the Council of National Defense in a special report on the subject indicate "that the high cost of living is primarily due to curtailment in the production of nearly all commodities except raw food products, to hoarding of storage food products, to profiteering, conscious and unconscious, and to inflation of circulating credit; and *that the situation may be most advantageously met by stimulated production,* the repression of hoarding and profiteering, the improvement and standardization of methods and facilities for distributing and marketing goods, and the perfecting of means of keeping the nation informed regarding probable national requirements and current production and stocks."

President Wilson in a recent statement said: "Only by keeping the cost of production on its present level, *by increasing production,* by rigid economy and saving on the part of the people can we hope for large decreases in the burdensome cost of living which now weighs us down."

All other authorities that have studied the question likewise are agreed that increase of production will in very large measure solve the situation and every group of remedies proposed includes it. Many careful students of the subject place it as the most essential and effective remedy, the other measures being in the nature of expedients to relieve the high costs temporarily.

When it is remembered that in nearly every country on the earth there has been disturbance of normal production for two to five years—underproduction of peace-time commodities almost everywhere, in so many countries aggravated by concentration of production upon war supplies and wholesale destruction of homes and factories and devastation of fields, forests, etc.—it is difficult to conceive how anything like normal supplies and prices of commodities can be restored without greatly stimulated production continued for several years at least. Nor does it seem probable or even possible for prices to come down rapidly. Even with special efforts to accelerate and facilitate production, the increased burden of taxation and the high wages will retard return to prewar prices for many years and such low prices may never return. There is, therefore, no legitimate cause for hesitancy on the part of producers.

Because of many uncertainties since the signing of the armistice much of the production has been at low economy because plants have been run on part time and in small sections, thus giving poor load-factor and low efficiency; intensified production should permit continuous and complete operation of entire plants and therefore result in some decrease of production cost. Corresponding decreases in prices should mean greater sales and these in turn permit further increase of production.

Increase of production will furnish greater relief if it is definitely accompanied by greater efficiency of production. As a rule, improved efficiency usually results from full-time operation with continuous processes and large-quantity production, as just mentioned. The wage increases of the last few years and the tendency to shorten working hours call for still further efficiency, if possible, to offset the higher production costs caused thereby. In other words, if greater output per employe can be obtained, either through more extended use of machinery and improved processes or greater individual efficiency of the employe, the wage increase can be partly or wholly absorbed and the price may be brought back substantially to what it was before wages went up. In many cases this increased efficiency is possible and every effort should be made to realize it so that costs and prices, if not actually reduced, should at least be kept from rising further.

Efficiency in production is always desirable in every industry on the score of general economy, but at no time is it more essential than during periods of keen competition and during great emergencies, like the recent war and the present troublesome readjustment period. At present inefficiency is more inexcusable than ever before because it is a direct upholder of high costs and prices. Whatever is done to increase production efficiency now will not only be of great value in the present crisis but will prepare for the intense international competition that is bound to grow as the countries most actively engaged in the late war gradually get back on their feet, when every source of waste and low efficiency will have to be eliminated unless dependence is placed on uncertain artificial restraints on foreign trade.

How Lighting Affects the Efficiency and Amount of Production.

The writer believes that no facts can be presented to controvert the foregoing brief statement of the present and future need for increased and more efficient production. The question then arises, upon what factors does such production depend or how can it be attained? It may be briefly answered that the quantity of production depends primarily (1) on the extent of the facilities available in the way of buildings, machinery, and other equipment, and the number of employes, that is, on the size of the plant, and (2) on the joint efficiency of the entire plant, including that of the processes, machinery and equipment used, that of the management, and that of the employes in general.

As an outcome of the foregoing, it is obvious that the output of a plant can be increased by increasing its effective size, or by increasing its efficiency, or both, but the most economical method is that which secures the output increase at minimum increase of capital and minimum increase in the number of employes. This means that any improvement in efficiency of the men or of any other essential element of the plant is much more remunerative than a plant extension and the increased output thus obtained is probably secured at the lowest unit cost. At the present time the abnormal costs of building materials as well as the numerous strikes in the building trade make it doubly undesirable to make plant extensions if any alternative can be resorted to. The remainder of this article will attempt to show that improvement of lighting is one of these alternatives, that it makes for higher efficiency of the men and of the plant as a whole, and that it stimulates production, thus yielding beneficent results greatly beyond its modest cost.

During the war every effort was bent to making the so-called essential or war industries as productive and efficient as possible. The results are well known. If it had not been that American industry aroused itself and backed up the fighting men with munitions and supplies, the war might still be on.

Old plants were in many cases rehabilitated as to their lighting and other facilities so as to make it possible to double or triple the output at almost no additional capital expense by operating with two or three shifts per 24 hours. This is the most extraordinary way to increase output quickly and at almost no investment outlay. It practically doubles or even triples the return on the investment. Even if night work in some cases has involved slightly higher rates of pay to the employes, the greater continuity of processes and other economies to be mentioned below have offset this as well as the fixed charges, operating cost and maintenance of the lighting system. These total lighting costs amount to only a very small fraction of the entire labor cost. It must be remembered that a good, modern general lighting system can be installed at nearly the same, or in some cases at even less, cost than the inefficient system still so commonly in use.

Definite economies are commonly obtained by continued operation that eliminates the cooling down of furnaces, kilns, and in winter even of the buildings themselves between shifts; in many cases the quality of the product is improved by continuous processes, as in those involving chemical changes. The main fact in this connection that was demonstrated in many cases during the war was that a scientifically designed and efficient lighting system could permit ready increase of the output to two or three times through multiple-shift operation and could also permit utilizing intensively parts of the plant whose inadequacy of daylight or other lighting made them practically worthless, all at very little increase in the invested capital.

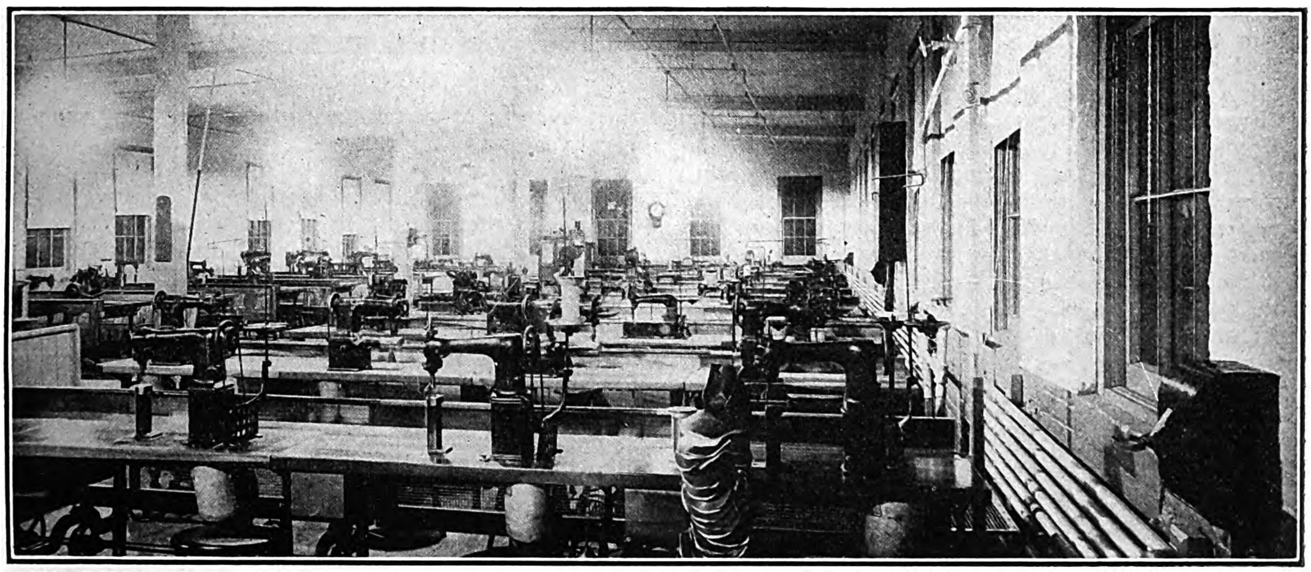
The great attention almost invariably given to lighting of the new plants built during the war also showed that generous windows and skylights, well placed or equipped so as to obviate the sun's glare, paid in the excellence of the daylight secured, and the similar generous, well placed and properly equipped electric lighting units installed also paid handsomely in the excellence of the artificial lighting that was ready at a moment to replace any deficiencies of the natural lighting and permit operation at any hour of the day with an efficiency equal to that of broad daylight. It was found that it was neither difficult nor costly to secure such lighting equipment as would enable this unimpaired efficiency to be maintained regardless of cloudy days, storms or other weather conditions, and of the darkness of the morning, evening or night hours. Thus in both old and new war plants lighting received probably the most extended recognition of its importance and value that has yet been accorded it. This importance was merited because of the very substantial increase it made possible in the general efficiency of the entire plant and in the personal efficiency of the employes.

Turning now to this question of personal efficiency we find in every poorly lighted plant that considerable time is lost by the employes' inability to see their work properly on cloudy days, during storms, and during the inadequate daylight of the early morning and late afternoon hours of fall and winter days, so that the output per employe for each of these dark hours is considerably lower than when daylight is plentiful. Several causes contribute to this, chiefly the impaired efficiency of the eye under inadequate or poor light, which causes one to take more time to do work requiring perception of detail than when the light is suitable; eye strain is a usual accompaniment of attempts to work under improper light and results in further loss of visual efficiency and time. Even where the resulting loss of time is only a few seconds or a fraction of a minute per operation, the total time lost for scores or hundreds of operations effected during the hours of inadequate lighting may amount to from half an hour to one or even more hours per day—an outright loss of useful time for which the employe is paid but is unable, through no fault of his, to render effective service.

Where the lighting is unsatisfactory the visual strain of attempted work leads most employes to let up on their usual pace or else do their work in a slipshod fashion that means much spoilage and work that must be done over. Moreover, poor lighting makes supervision of workrooms difficult so that lazy employes are apt to spend as much as an hour at a time in some obscure part of the plant merely "killing" time, if not actually asleep. In a well managed and properly lighted plant this could not happen, but it is surprising to what extent it does happen in poorly lighted factories.

All the various losses of time aggregate a considerable amount in the average ill lighted plant, as has been shown not only by direct observation but by the indirect proof of substantially increased output after the lighting has been rehabilitated to modern scientific standards. Increases of output from 2 to 25% or even more have been proven after the lighting was modernized, 10 to 15% being a common average. These increased outputs are the result chiefly of the improved visual efficiency, but another source of higher personal efficiency is the psychologically stimulating effect of bright and cheerful workrooms which produce alertness and keener application to duty, as well as dispel the depressing effect of gloomy surroundings.

Emphasis has been given in the foregoing only to those ways in which good lighting has a direct influence in increasing production, either through more intensive utilization of the plant or through improved efficiency of the workmen. It is known to have other beneficial effects also, most of which help indirectly to stimulate production. Thus it improves the quality of the product and reduces spoilage, it promotes order and neatness in the plant, it reduces accidents, lessens eye strain, makes more cheerful working environment, and promotes contentment of the employes. The four latter features have an immediate bearing upon the working conditions and thus also influence



Night View in Sewing Room of a Shoe Factory, Showing That Even the Exacting Work of Sewing Can Be Done Successfully Where Suitable and Yet Highly Efficient General Lighting Is Provided.

the personal efficiency of the men, while at the same time they tend to reduce labor turnover and diminish the likelihood of labor troubles.

Aside from the increase of production, which has been the subject of numerous tests and has been conclusively proven to average from 10 to 20% after putting in an up-to-date lighting system, the other benefits of good industrial lighting are somewhat intangible because so difficult to segregate and demonstrate quantitatively, or on a dollar-and-cents basis. They are not less real, however, nor to be ignored. In fact, in some industries they are of almost more importance than production increase alone. But they are such close accompaniments of the latter that their benefit is almost invariably added to that of stimulated production and therefore makes a modern lighting installation that much more valuable, so that in view of its low cost any obsolete lighting is entirely inexcusable.

Big Field for Further Factory Lighting Betterment.

It has been mentioned that considerable improvement in factory lighting was effected in the last two years in plants engaged upon war work where it was recognized that good lighting was an important means of stimulating production. The importance of improved factory lighting has also been recognized by the fact that in the last few years the number of states that have industrial lighting codes has been practically doubled. It must not be concluded from this, however, that a majority or even large percentage of factories really have lighting systems that meet the illuminating engineering requirements of the present day.

The truth is far from this. Most factories are still very poorly lighted. As a rule, natural lighting facilities (windows and skylights) are inadequate, poorly located and equipped, and poorly maintained. In some cases, artificial lighting is entirely unprovided for, thus making a very hazardous plant and one whose production is dependent largely on the weather and season. Where lighting systems are installed, they are in very many cases provided with obsolete and inefficient equipment, improperly placed and improperly maintained, so that the resultant illumination is inadequate, very poorly distributed and very often extremely glaring at many points while other places are in deep gloom. It is the common prevalence of such lighting conditions that has given rise to the factory lighting codes referred to.

Even in factories that have installed fairly modern equipment, it is not uncommon to find poor maintenance thereof. As an example, there was recently observed an installation of well built enameled-steel bowl reflectors designed for 100-watt vacuum type Mazda lamps; these were not kept clean and the lighting became inadequate, so the lamps were replaced with 200-watt gas-filled Mazda lamps. Since the reflectors were not designed for the latter lamps, there was a great deal of glare and uneven distribution. The higher efficiency of the new lamps merited discarding the reflectors and re-equipment of the units with reflectors of the latest type designed for these lamps. The progress of lighting developments is so rapid that it pays to overhaul the entire system at intervals of 3 to 5 years in order to take advantage of the advances of the art in making the lighting more effective and efficient, which means more productive.

Meanwhile there is the great mass of factory owners and managers who still have to be shown that the equipment that was thought to be satisfactory 10 to 15 or more years ago, because none other was then available, comes far from meeting present-day lighting requirements. On the other hand, modern ideas of factory management call for making the plant facilities conducive to the highest production efficiency and they recognize in the most up-to-date lighting equipment a most valuable and economical means for stimulating the production.

Supplementing the present article, the author has in preparation one on "What Better Industrial Lighting Can Do to Improve Working Conditions," in which it will be shown that it should aid in ameliorating the present industrial unrest. This article will appear in the issue of Sept. 20.

INTER-RELATION OF SCIENTIFIC LIGHTING AND INDUSTRIAL EFFICIENCY.

Leon Gaster, Honorary Secretary of British Illuminating Engineering Society, Lectures on Value of Good Shop Lighting.

In a lecture on "Scientific Lighting and Industrial Efficiency," at the British Scientific Products Exhibition, Central Hall, Westminster, London, Leon Gaster referred to the close relation existing between good industrial lighting and the health of workers, and gave many instances of accidents due to insufficient or badly arranged conditions of illumination. Light, he said, was a "tool," and it was absurd to install expensive machinery, and to pay highly skilled workmen, and then to neglect the relatively small expenditure on illumination necessary to the efficient performance of work. Instances were quoted showing that, as a result of improved lighting conditions, increases in output of 8 to 27% had been recorded. When the need to increase production was so great, and when the necessity of saving fuel was so evident, the application of scientific methods to factory lighting was of special importance. The Illuminating Engineering Society was in a good position, he said, to render assistance in making clear the essentials of good industrial lighting, by means of lectures and demonstrations.

INSPECTION AND LIFE TESTS OF INCANDESCENT LAMPS.

The total number of lamps offered for delivery to the Government purchasing authorities during the past fiscal year was over 5,000,000, of which about 600,000, or 12%, were rejected on the initial inspection at the factory, which covers the mechanical qualities of the lamps and their rating in regard to power consumption and efficiency. In this initial inspection samples are selected for the burning or so-called life tests. During the year nearly 3500 lamps were subjected to this life test; and with few exceptions the tungsten lamps, both vacuum and gas-filled, supplied under Government contracts, had a life considerably in excess of the 1000 hours of burning required by the standard specifications.

At the request of the General Supply Committee, tests were made in connection with bids of various manufacturers for the contract for the next fiscal year, and a considerable range in quality among the lamps submitted was indicated. It is probable that the information obtained by these tests alone repays the total cost of the lamp work for the year.

Electric Cooking Load as Developed by Detroit Edison Company

Local Factors Involved—City and Rural Business—Range Troubles and Voltage Regulation—Revenue Derived—Paper Before Michigan Section N.E.L.A.

By R. F. HOTTON
Detroit Edison Co.

THE Detroit Edison Co. has not encouraged the electric cooking business in its metropolitan district and has not sought the business in the rural communities which it serves. The reason for not developing this field are:

Its metropolitan district has a good and cheap gas supply, and electricity for cooking is not an actual need.

During the development stage of the cooking equipment, the high first cost and the heavy repair charges put this equipment out of competition with the well developed and cheap gas equipment.

Under the general living conditions of the metropolitan community, the heavy cooking is for the evening meal, and a cooking load, if such a load were developed, would be superimposed on the lighting load, and in accordance with the rate methods of the company, such business should be taxed for its share of fixed charges, and the consequent rate would be too high to secure business.

Except for the cost of repair on equipment, these conditions are modified in rural communities. Few rural communities have a gas supply, and there is a need for electricity for cooking. The important meal is generally cooked in the middle of the day, and the late afternoon demand is for a short period. These differences of use permitted the establishing of a cooking rate for the rural districts and the need for electric cooking was evidenced by an immediate demand for the service, which is constantly growing. The rate established was 3 cts. per kw-hr., and has been effective since 1916.

This paper deals with the cooking business as it has developed in one of The Detroit Edison Co. districts, serving a rural territory of sixteen communities, ranging in population from 200 to 10,000. There is a gas supply in only one city—that of Mt. Clemens, having a population of 10,000. The number of farm customers is about 650, approximately 10% of the customers in the district; and the number of ranges installed and used by farm customers is 10% of the 314 ranges installed, so that this data is representative of town and small city business, rather than farming districts.

An important fact forced to our attention in the early stages of this development was the changes necessary in our regular lighting distribution to take care of the load created by the connection of ranges to these circuits, but we did not begin immediately to keep track of the cost of these changes. To date we have records of cost on 31 installations, which we are quoting. Changes represented by these costs will accommodate many more stove connections if we sell stoves to customers in the vicinity, so that as the business increases, the average cost per stove should show a lower figure than the ones quoted. These figures do not include the cost of superintendence and engineering. On 23 installations changes were required in primary or secondary distribution or transformers—in some cases all three factors were affected. The average costs on these 23 installations were as follows:

Labor	$ 25.00
Material other than transformers	17.20
Transformers	61.40
Total	$103.60

On eight installations the only change required was increasing the service loop, at an average cost of $10.50, making the average cost on the 31 installations $93.11. These figures do not include any salvage on material returned, and it is doubtful that anything but junk value could be placed on it.

We have from the first and are continuing to furnish free repairs for stoves and have replaced units, standing the expense of renewals when the manufacturer did not do so. This service is an expensive one, and record of the cost has not been kept. Our greatest difficulties have arisen from mechanical rather than electrical defects, although each type of element developed different troubles with use.

Opinions on Range Troubles.

The first enclosed type does not stand line disturbances of a lightning storm, the construction of the oven unit making it even more susceptible than the surface unit to these disturbances. The surface units buckle and warp with use. The difficulties have been fairly well eliminated, but the light mechanical structure of the terminals continues to cause trouble with this type of unit. In the next type, the open coil type, the element difficulties were overcome, but the terminal connection is not much improved—the terminals having insufficient protection from the heat of the unit burn off at the junction point. The wiring used in the stoves is not heavy enough for the wattage of the units This latter trouble may be overcome by rewiring the stove with larger wire, which we do when trouble develops. Repeated reports of these defects to the manufacturer have not resulted in improvements. However, most of the ranges on our lines are of a later type having the molded block open coil. On a few of the first ranges, we discovered that the range wiring was unbalanced having approximately 75% of the load on one side. This condition caused a drop in pressure on a small transformer when only the heavy side was in use.

Another source of trouble with this range was the crystallizing of the oven terminals—this defect has been overcome by making the terminal connection on outside of the oven.

During 1917 and the early part of 1918, several customers in different locations in the district complained of the length of time it took to do their cooking on the electric range. When we would receive a complaint of this nature our first step would be to take a voltage test at the entrance point of the service and then at the range terminals with stove on and off. If the voltage at the terminals was below 2% of the rated voltage, we would try to increase this by means of moving the transformer closer to the entrance point and in some cases it was even necessary to boost the voltage on our primaries. In one particular installation something over $300.00 was spent without giving the customer satisfactory service. Finally, we installed a set of 105 volt units, this has proven successful in every case. We now specify 105 volt units with every range order.

In order to determine the terminal voltages at rated wattage and the actual wattage inputs of the electric range units, a series of tests were made May 12, 1919, by our research department. Because of general similarity of construction, all surface units now in use may be classified into two types, enclosed and open coil; the open coil can be subdivided into molded block and reflector. The following method of testing was used; two runs were made on each unit. First, the units of each type were numbered 1, 2 and 3. Each unit was tested at a time, starting with the unit at room temperature. The a-c. voltage was kept constant at 110 volts. The current flowing through the unit and the input in watts were observed every minute for five minutes and every five minutes thereafter until two successive observations were identical. If the data for the three units of each type agreed closely, the one nearest the average was used in the table. If the units showed a variation of 5% or more, the extreme high and low test was used.

A sheet metal frame was made up which held the surface units, bringing them as near actual range conditions as possible. The efficiency of the units was obtained in a simple manner as follows: Two quarts of distilled water at a temperature of 60° F. was placed in a cast aluminum kettle (with cover) upon a unit. Current at a constant potential of 110 volts was turned on the unit (beginning cold) until the water reached the boiling point, as registered by an open scale chemical thermometer. At the same time the energy consumption was recorded. The terminal voltage at rated wattage will be found in Table No. 1. On the average they keep within 5% above or below 110 volts, but with the enclosed type of unit they varied as much as 9% below 110 volts and 11% below 110 volts with the open coil reflector unit. Cases were found where the elements were improperly marked. Out of 13, 1500-watt enclosed units, 31% were found to have but a 1000-watt capacity at 110 volts. One out of three of the open coil (molded block) was marked 880 watts but actually had 1100-watt capacity at 110 volts.

TABLE I.

Type.	Size.	Watts.	Volts for rated wattage.		Wattage at rated voltage of 110.	
Enclosed	8½"	1,500	107.2	113.5	1,576	1,403
Enclosed	8½"	1,000	106.4		1,060	
Enclosed	6 "	1,000	100.8	106.7	1,182	1,059
Enclosed	Oven	1,500	109.1		1,520	
Open coil reflector...	8½"	1,500	109.6		1,515	
Open coil reflector...	7½"	1,200	110.2		1,200	
Open coil reflector...	6½"	800	99.8	112.4	958	764
Open coil reflector...	Oven	1,200	110.9		1,183	
Open coil reflector...	Oven	1,000	108.7		1,020	
Open coil molded block	8½"	1,500	110.7		1,485	
Open coil molded block	6½"	1,100	109.3	113.2	1,110	1,145
Open coil molded block	6½"	880	107.1		924	
Open coil molded block	4 "	440	110.8		434	
Open coil molded block	Oven	1,100	106.8		1,154	
Open coil molded block	Oven	880	102.2	109.2	1,012	890
105 Volts—						
Open coil molded block	10 "	2,000	108		1,900	
Open coil molded block	8 "	1,000	104.3		1,015	
Open coil molded block	Oven	1,000	103		1,032	

The most important factor in the electric cooking service is to give good pressure and quick repairs. We make no charge for repairs unless it is apparent that trouble is result of carelessness on part of users of the stove. During 1918, we had 128 range trouble calls, which were as follows:

TABLE II.

Surface Units 1500 W.	Surface Units 880 W.	Surface Units 440 W.	Oven Units 1100 W.	Oven Units 1000 W.	Gridiron	Misc.
26	15	9	32	4	6	36

CHARACTERISTICS OF COOKING LOAD.

For the characteristics of the cooking load the following test was made during the period from December 25, 1918, to January 2, 1919, on a group of five ranges that are connected to one 25-kw. transformer. In addition to the ranges there are 15 lighting circuits connected to the transformer, which load could not be separated from the cooking load. Range services are all taken directly off the transformer pole, and all of the connections are within two sections of the transformer.

The load was recorded on two Bristol recording ampere meters, one located on each side of the neutral wire. The sum of the two readings at any time thus gives the total current output of the transformer at that time.

The readings for the six days December 25, 26, 27, 29 and January 1 and 2, were selected and the total load on the transformer for each hour of the day was obtained by adding the readings of the two meters. The curves shown were thus obtained, giving the characteristic average loads during the day and the maximum loads recorded during the period from each hour of the day, also the loads on the maximum day, that is the day on which the total kilowatt-hours consumed was the greatest.

It will be seen that the curves have similar characteristics at all essential points. They all show well defined peaks as might be expected, indicating the time of breakfast preparation, morning baking, dinner preparation, afternoon baking, supper preparation, etc. The fact that there is considerable lighting load in addition to range load probably affects the shape of the curves somewhat—especially in the early morning and in the evening. Also the fact that most of the residences have some other appliances such as vacuum cleaners, washing machines, etc., would affect the slope of the curve. Since the range load is large in comparison to the other devices, the curves may be considered fairly characteristic of range services.

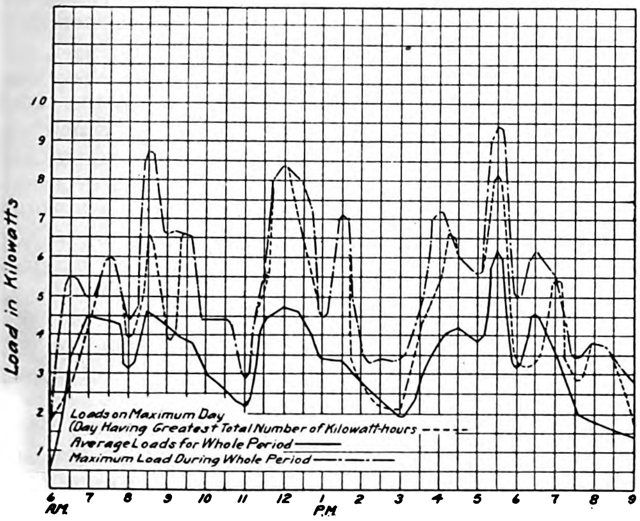
It is interesting to note how closely the curve for the maximum day follows that of maximum for the period, showing that, for the most part, the maximum for the period occurred on the maximum day. The average curve had most of the sharp peaks smoothed out and since its shape agrees closely with that of both the other curves, this is probably very nearly the typical variation throughout a day which we might expect to find under any similar condition, i. e. range load combined with lighting and appliance load.

The diversity factor of such loads is also illustrated. The maximum load for the whole period was less than

10 kw. The transformer installed, 25 kw., was sufficient to care for all five ranges together, but due to the diversity in use the actual load was never greater than 40%. A 10-kw. transformer would be sufficient. This diversity will vary with the number of ranges on one transformer. With a less number of connections, a greater proportion of the connected load must be provided in transformer capacity.

The following tabulation shows the average net revenue from a varying number of range customers for the year 1918. The reason for the higher average during the summer months may be attributed to the summer homes, which are closed in September for the winter. Another reason is that some customers use coal or wood ranges in the kitchen during the cold months for heating as well as for cooking.

1918 Month	Number of Customers	Total Kw-hr.	Total Revenue	Average Net Bills
January	119	12,161	$346.64	$2.91
February	127	11,325	323.44	2.54
March	128	10,957	317.04	2.31
April	128	15,117	412.80	3.22
May	133	16,397	467.31	3.55
June	148	19,862	543.77	3.67
July	178	29,747	807.24	4.53
August	195	32,665	889.08	4.55
September	204	31,305	856.65	4.19
October	202	23,882	659.19	3.26
November	202	22,002	611.18	3.02
December	201	18,669	513.88	2.55



Curves Showing Characteristics of Average Daily Load and Maximum Loads.

There is one point at least that should be emphatically stated; that is, that electric cooking is strictly scientific, and, therefore, possesses a great advantage over all others. The scientific feature associated with electric cooking is its exactitude. Electric heat provides a fixed temperature for each particular type of cooking and thus illustrates the main feature of the new system. It is exact, and therefore, the products of it are more reliable than by other means. This is what is meant by its being more scientific. Since there is no flame in an electric range, there is no combustion and consequently no possibility of poisonous fumes escaping to contaminate the atmosphere and the food which is kept in the kitchen or pantry. The air in the kitchen will remain so pure that even delicate flowers may be kept near the stove without fear of withering. The elimination of matches and the fact that there is no flame which means absolute protection from fire, no danger of explosions, no smoke, fumes or discolored walls. All of this is done away with. The electric range is especially desirable in the warm summer months, there being no radiation of heat in the room. These features have undoubtedly helped the more extensive sale of ranges. Electric lighting was accepted by the public years ago because it has advantages that other systems of lighting did not have, therefore, if one system of cooking has an advantage over others, there is every reason to expect its final acceptance by the public.

Looking over this paper, the question arises in our minds: "Do the earnings warrant this investment?" However we cannot stop a landslide. Cooking by wire has come to stay. The best and only solution will be to build up the business to the point where we can serve several customers from one transformer. In conclusion, we might add that the electric range business ties our customers more securely to us than the electric lighting and in this way makes them more dependent and more appreciative of our service.

THE ELECTRICIAN'S TABLE OF ELECTRICITY UNDERTAKINGS.

The latest issue of the "*Electrician's* Tables of Electricity Undertakings" has just been received in this country. This is published annually by Benn Bros., Ltd., London, also publishers of *The Electrician*. It contains a list of the central stations operating in the United Kingdom, the British colonies and some foreign countries, and also considerable information concerning them. Among the latter are the engineer's name, a brief description of the systems of generating and distribution, number and types of public lamps served, total motor load, maximum recorded load, maximum traction load, capacity, the number and size of generating sets, fuel used, prices charged for service, number of showrooms, and the names of the purchasers of current for traction purposes, also the prices paid for such service. The list and information contained pertaining to the British and colonial undertakings is very complete but that of the foreign countries is limited to the larger concerns.

ENGINEERING SOCIETIES ADOPT RESOLUTIONS ON CARNEGIE.

Andrew Carnegie's death August 11, 1919, at Lenox, Mass., brought to its close a career which greatly advanced all the engineering arts and sciences. By the introduction into the United States of the Bessemer process for the production of steel and by the establishment and development of steel plants, which became the greatest in the world, he made available for engineers the most useful modern material for engineering construction. His munificence provided large funds for the building of a home for the great national engineering societies in New York and many associate societies. He was an honorary member of the American Institute of Mining and Metallurgical Engineers and American Society of Mechanical Engineers. In view of these facts, the following resolution was recently adopted:

Resolved, That the American Societies of Civil, Mining, Metallurgical, Mechanical and Electrical Engineers, the United Engineering Society and the Engineers' Club, herein express to the family of Mr. Carnegie and record their sincere appreciation of the great contributions of Andrew Carnegie to the advancement of engineering, and of his friendly assistance in making possible beautiful homes for the Engineering Societies and the Engineers' Club, thus fostering the spirit of unity in the profession.

Central-Station Rates in Theory and Practice

Ninth Article—Comparison of Cost-of-Service and Value-of-Service Principles in Rate Making — Price Splitting — Analysis of Relations Between Selling Price and Earnings

By H. E. EISENMENGER

This is the ninth article of this series. A general outline of the series was published in the issue of July 5, and the first article in the issue of July 12. The first seven articles discussed the cost of rendering central-station service, a knowledge of the cost being necessary before rates can be intelligently considered. Last week's article introduced the subject of prices or rates and treated especially of the three general principles on which the amount of profit may be based. This subject is continued in the present article and a mathematical analysis of it is begun in Insert IX. On account of the length of this Insert, the next two articles will be devoted to it exclusively, the main text being resumed in the twelfth article (Sept. 27) and continued throughout practically the remainder of the volume.

PART II—THE PRICE OF ELECTRIC SERVICE—Continued.

III. THE VALUE-OF-SERVICE PRINCIPLE.

SECTION 78. In comparing the value-of-service principle with the two others previously mentioned as to their merits we could dismiss the "what-the-traffic-will-bear" principle (maximum earnings) from the outset as unethical and unfit for public service corporations. We would confine ourselves to a comparison between the cost-of-service principle and the value-of-service principle, but since the latter is nothing but an evolution of the maximum-earnings principle, we will have to pay attention to the latter principle also.

In order to determine the relative advantages of the cost-of-service and the value-of-service principle, both to the consumer and the producer, it is convenient to assume that we have been making our charges first on the cost-of-service basis, that is, we have been charging the same percentage of profit to every customer and for every particle of service. We assume further that the price has been regulated so that the earnings derived from that system of charging are just what is considered fair, neither more nor less.

Then we change over to charging on the value-of-service basis, in such a manner that the earnings (gross income, net income or net rate of return) of the producer remain unchanged, or at least are not reduced below what has been recognized as fair. The producer will therefore experience at least no damage as a consequence of the change-over. We will first investigate under what conditions it is possible to make such a change-over to the value-of-service principle in such a manner that the price is not increased to any consumer[1]. This means that we will begin our investigation with that part of the value-of-service principle which requires only a lowering of the price (namely, for those parts of the service for which the respective consumers are not willing or able to pay the original price), but we will leave out of consideration, for the beginning, an advance of the price for those parts of the service for which the customers would be willing and able to pay more than the original price. The value-of-service principle will then be of indisputable advantage to some of the parties concerned and of disadvantage to nobody. Then we will extend our investigation to the introduction of raised prices, where necessary.

79. The change from the cost-of-service principle to the value-of-service principle means that we will charge no longer one uniform price[2] throughout, but a number of prices in accordance with the valuation of the respective service or part of service by the respective customer, that is, in accordance with the customer's power and willingness to pay for the respective service. This process of judiciously raising or lowering the prices according to the valuation of the service will be called *"price splitting."* If price splitting comprises only price reduction and no increases it will be called *"price splitting downwards"* in contradistinction to *"price splitting upwards."* Of course, price splitting downwards and upwards can be combined, so that some prices are reduced, others raised with respect to the original price.

80. In Insert IX is given an analysis of the relations between prices and earnings, including an investigation of the conditions which bring about the possibility of increasing the earnings by splitting the prices downwards only, that is by lowering the prices of at least some parts of the service and to at least some customers, but raising them to nobody.

[Since the next Sections refer to Insert IX, their publication is deferred until Insert IX is completed.]

[1]If the prices are made lower to some customers than to others, the latter are liable to complain that they are "discriminated against" and to demand that the same prices be charged to every customer. This demand is prompted by a hazy feeling that in that case the resulting price will be the average between the prices charged previously to the various customers, or at any rate lower than the prices charged to the complaining customers, because, it is stated, "the minus of profit from the favored customers must be covered by a plus from the others."

In a well designed rate system this assumption is not justified. The price reduction to certain customers increases the aggregate consumption and therefore the production. A larger production results in a lower unit cost so that the central station can, as a next step, reduce the prices, for instance, to all customers alike by a certain constant percentage, without reducing its own profits below what they were originally. (In fact the profit of the central station may even be left higher than it had been before the first price reduction to the "favored" customers had been made.)

Thus the customer who is grumbling that he has to pay more than some other customer is actually paying less than he would have to pay if he were not "discriminated against."

This problem is treated in detail in the following Sections.

[2]Or, more accurately speaking, prices with a uniform percentage of profit.

Insert IX—Appendix to Section 80 et Seq.—Relations Between Selling Prices and Earnings.

(For readers who are familiar with mathematics.)

I. Prices Independent of the Customer's Valuation of the Commodity (Cost-of-Service Principle).

A. THE FOUR FUNDAMENTAL FACTS.

1. The deductions in this Insert are based on four facts which are partly so self-evident and partly so generally known that they need no proof and can be accepted as axioms. These four facts are:

Fact No. 1.—Although we do not know just how the quantity m sold of a certain commodity varies with varying unit prices, it is obvious that with increasing prices the quantity sold will steadily decrease—other conditions remaining equal—and vice versa.

Fact No. 2.—If the price p per unit is zero, the quantity m will not be infinity, and with rising prices the quantity m will become zero at a finite value of p.

From Nos. 1 and 2 follows: If we plot the unit prices p as abscissae and the quantities m as ordinates (heavy curve in Fig. A, compare also Fig. 2 of the main text) we will get a curve which will steadily fall from the left to the right, whatever its shape may be otherwise, and it will intersect the axes at finite distances from the origin O. This curve will be called hereafter the "sales curve."

Fact No. 3.—Let s designate the total cost of producing a certain quantity of the commodity per year including those capital charges which are, theoretically at least, independent of the earnings (bond interest, depreciation, etc.) but excluding the net return of the capital invested (dividend). Then s is a function—$f(m)$—of the quantity m produced; it is in general not simply proportional to m, but consists of a constant part and of a part which is approximately proportional to m, so that the increment cost per unit produced is approximately constant and $f(m)$ is a straight line. Stating the law of cost in more accurate terms, we will have to recognize that a large manufacturing enterprise (central station), on account of larger and more economical machinery and for other reasons, will be able to produce an incremental unit more cheaply than a small enterprise. The increment cost per unit is therefore not independent of the amount produced m, but it decreases continually with increasing m, from a maximum value for $m=0$ to a minimum value for $m=\infty$, this minimum being still positive. The curve of cost $s=f(m)$ plotted against m will therefore start from the axis of ordinates $(m=0)$ at a certain distance OS_0 from the origin O (see Fig. A[1]) so that OS_0 is the constant part of the cost and then the curve will steadily rise with increasing abscissae m, displaying a certain concavity towards the axis of m. If we want to go into further details, we can even say that the curvature of the line will decrease (radius of curvature increase) with increasing m because the increment of cost per unit produced converges towards a certain limit for $m=\infty$. The curve will asymptotically approach from below a straight line which is slanting upwards.

It is not essential for the investigations of this Insert to assume that the curve of cost $s=f(m)$, whether it be a straight line or a curved line with the concave side pointing downwards, intersects the axis of ordinates at a certain distance above the origin. The curve of cost may also pass through the origin, which is only a special case $(OS_0=0)$; it may, for instance, be a parabolic function of the amount m, of the form $s=\gamma m^n$.

From the left part of Fig. A we get the following two relations.

$$\text{Average cost per unit} = \frac{s}{m} = \frac{f(m)}{m} = \tan\sigma_0 \ldots\ldots\ldots (1)$$

$$\text{Increment cost per unit} = \frac{ds}{dm} = \frac{df(m)}{dm} = \tan\sigma \ldots\ldots (2)$$

Fact No. 4.—The curve $k=F(m)$ of the capital invested k plotted against the quantity sold (or rather produced) m, in the same manner as has just been shown for the cost s, has the same character as the curve $f(m)$ and everything said about the characteristics of the curve of cost applies to the curve of the capital also. See Fig. A curve $F(m)$, which is drawn to another scale than $f(m)$, that is a dollar per year in the s-curve is not represented by the same length as a dollar in the capital curve.

[1]As the quantity m is stepped off in Fig. A on the vertical axis of co-ordinates, the cost $f(m)$ must be stepped off in horizontal direction so that this axis of $f(m)$ coincides with the axis of p (except that in order to keep the diagram free from confusion it has been stepped off to the left of O whereas the axis of p runs to the right).

B. THE THREE SPECIES OF EARNINGS.

1. Gross Income.

2. We now assume first that we have only one product (no by-products) and a system of charging according to the cost-of-service principle, which means every unit is sold at the same price p as every other unit. The number of units sold is then m and the total gross income b is given by the product of the unit price and the quantity sold:

$$b = mp = \text{area } OMLP \text{ (Fig. A)} \ldots\ldots\ldots\ldots\ldots\ldots (3)$$

A certain gross income b will belong to every price p and if we step off the gross incomes b as ordinates over the abscissae p we get the curve b, which will intersect the axis of abscissae (p) in the origin of the system of co-ordinates because there one factor of the product mp is zero; on the other hand, for $p=p_{max}$, that is if the price has become so high that the last sales have just dropped out, the gross income will also become zero because then nothing will be sold $(m=0)$. The curve b must therefore necessarily have at least one maximum between these two points[2]. This maximum is b_{max} with the corresponding price* p_b as abscissa[3].

2. Net Income.

3. As regards the net income we have to deduct the cost s from the gross income b and in order to do this we have to transform the curve $s=f(m)$ (see left-hand portion of Fig. A) from the abscissae m to the abscissae p (right-hand portion of Fig. A) so that $s=\phi(p)$. A definite value

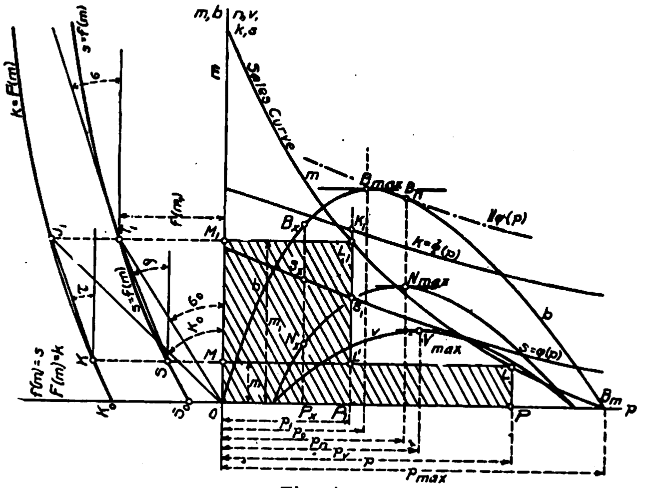


Fig. A.

of s corresponds to every price p. We can therefore construct the curve $s=\phi(p)$ with p as abscissa, as is done in the right-hand portion of Fig. A. For instance, for the abscissa $p_1=OP_1$, we find m_1 from the sales curve $=P_1L_1$ and read from the $f(m)$ curve the corresponding value $s_1=f(m_1)=M_1T_1$. If we step this off vertically upwards from the point P_1 we get the point S_1 as a point of the curve $s=\phi(p)$.

Deducting now the ordinates of the curve $s=\phi(p)$ from those of the curve b leaves the ordinates of the curve of the net income n. The ordinates of the area between the curves b and $s=\phi(p)$ (for instance S_xB_x) indicate by their length the net income n in dollars per year. These ordinates are also stepped off in Fig. A from the axis of abscissae upwards, as $P_xN_x=S_xB_x$, thus furnishing the curve of net income n. If we shift the curve $s=\phi(p)$ parallel to itself upwards until it just touches the curve b (at point B_n) the abscissa p_n of the tangential point gives the price for which the net income is a maximum; the corresponding ordinate of the area between the b and $\phi(p)$ curves gives the amount of this maximum N_{max} of the net income. Now curve $\phi(p)$ necessarily shows a steady decline with increasing abscissae[4]. The

[2]Whether we have one or more maxima depends on the shape of the sales curve. The footnote of Section 22 of this Insert gives a condition for this shape under which condition the gross-income curve can have only one maximum.

*Erratum: In Fig. A designated by mistake as p_0.

[3]The case that the income curve has more than one maximum is treated later in this Insert, Section 22 et seq.

[4]The slope of the curve $s=\phi(p)$ is given by the derivative ds/dp and this can be written in the form $ds/dm\ dm/dp$. Owing to fact No. 3 of Section 1 of this Insert, ds/dm is always positive, and owing to fact No. 1 the term dm/dp is always negative. Consequently ds/dp, being the product of the two, must always be negative; this means that the curve $s=\phi(p)$ must be continually sloping downwards with increasing abscissae p.

The same can be proven in exactly the same manner for the curve $k=\Phi(p)$, see Sections 4 and 6 of this Insert.

price p_n which furnishes a maximum of net income is therefore greater than that which furnishes a maximum of gross income because, owing to the slope of the $\phi(p)$ curve, the tangential point just mentioned must lie to the right of the point B_{max} which indicates the maximum of b-curve.

3. *Rate of Return.*

4. Proceeding to the rate of return (interest, dividend), we first enter the values of the capital invested as a function of the prices in the same manner as this has been shown above for the net income and thus get a curve $k=\Phi(p)$ which has a similar character as the $\phi(p)$ curve[5].

By entering for every single abscissa p the ratio n/k in per cent we get the curve of the rate of return v in Fig. A. This curve again has a maximum because its ordinates must be zero where the ordinates of n are zero. This maximum occurs at the point V_{max} and the abscissa p_v belonging to that point is the price which brings about the best rate of return under the assumed conditions.

By placing equal to zero the first derivative with respect to p of the term $v=\frac{n}{k}$ we arrive at the result that v becomes a maximum if $\frac{dn}{dk}=\frac{n}{k}$, that is, if $\frac{dn}{dp}=\frac{n}{k}\frac{dk}{dp}$. On the right side of this equation n and k are essentially positive values and dk/dp is essentially negative (see footnote to Section 3 of this Insert). If therefore v becomes a maximum, dn/dp is negative. This means that at that point the n-curve is already declining; it has gone through its maximum. *The price p_v which furnishes a maximum of the rate of return is therefore higher than that which furnishes a maximum of net income and the latter price,* as has been shown above, *is higher than the price which furnishes a maximum of gross income;* that is

$$p_v > p_n > p_b$$

4. *Summary.*

5. Each one of the three curves of "earnings" (gross income, net income and rate of return, see Section 70 of the main text) will therefore rise from zero value with increasing prices to at least one maximum and then drop to zero again. We thus have two branches of each curve, a rising left-hand one and a falling right-hand one. Consequently we can attain the same amount of earnings with at least two different prices, one on the left and the other one on the right branch. The former price is smaller than the price at which a maximum of the respective earnings is obtained and the latter larger. As long as we are on the left-hand branch an increase of the price will result in an increase of the earnings, whereas on the right side every increase of the price will reduce the earnings. If we cannot hit the price where the maximum earnings are obtained, we will of course generally prefer the price on the left branch of the curve to the corresponding price on the descending right-hand branch.

C. THE FINANCIAL EFFECT ON THE PRODUCER AND THE CONSUMER OF AN INCREASE (OR DECREASE) OF THE COST OF PRODUCTION.

6. The above methods of representing sales, cost and earnings give a good insight into the problem of finding to what extent the producer and the consumer relatively are the losers in case the cost of production is increased, for instance by taxation, a rise of the cost of labor or material, etc. The producer complains at such times about the high cost of production, whereas the consumer is liable to retort more or less hotly that the producer anyway simply loads the burden of increased cost on the consumer's shoulders, thus leaving his own profit unimpaired, if he does not use the increase of cost as a pretext for even raising the prices so high that his profit is increased. A little investigation into the situation may therefore be of interest.

If the unit cost is increased by a certain fixed amount, the total cost $s=f(m)$ is raised by an amount which is proportional to the quantity m; in other words, the curve s in the right-hand part of Fig. A will not only move higher up but it will also become steeper. The net income will become smaller than it was before for every price and consequently the maximum net income will also be reduced from its original value. Moreover, the maximum of the net income will take place at a higher price than before the cost was raised, because the point at which the s-curve, if shifted upwards parallel to itself (see Section 3 of this Insert), just touches the gross income curve, will lie more to the right than before on account of the greater slope of the s-curve.

The price we have to charge in order to obtain the maximum of the rate of return will also be higher than it was originally, as can be shown in the following way. If c_0 is the amount by which the unit cost has been raised, the total cost will be increased to $s+c_0m$ and the net income $b-s$ reduced to $b-s-c_0m$. The rate of return $v=\frac{b-s}{k}$ is reduced to $v_m=\frac{b-s-c_0m}{k}$. The slope of the curves v and v_m referred to the axis of abscissae p is determined by the first derivatives of v and v_m with respect to p:

$$\frac{dv}{dp}=\frac{k\left[\frac{db}{dp}-\frac{ds}{dp}\right]-\left[b-s\right]\frac{dk}{dp}}{k^2}$$

$$\frac{dv_m}{dp}=\frac{k\left[\frac{db}{dp}-\frac{ds}{dp}-c_0\frac{dm}{dp}\right]-\left[b-s-c_0m\right]\frac{dk}{dp}}{k^2}$$

If now we let $dv/dp=0$, that is, if we choose the abscissa p so that v becomes a maximum, we find, by substituting dv/dp from the first one of these two equations into the second one, the following special value for

$$\left(\frac{dv_m}{dp}\right)_{v=max}=\frac{-kc_0\frac{dm}{dp}+c_0m\frac{dk}{dp}}{k^2}=-c_0\frac{k\frac{dm}{dp}-m\frac{dk}{dp}}{k^2}$$

$$=-c_0\frac{d\left(\frac{m}{k}\right)}{dp}$$

$$=-c_0\frac{d\left(\frac{m}{k}\right)}{dm}\cdot\frac{dm}{dp}$$

Now k is a function $[F(m)]$ of m and m/k is the cotangent of the angle k_0 between the axis of abscissae and a straight line drawn from the origin of co-ordinates to a point on the curve $k=F(m)$, see left-hand portion of Fig. A. From the properties of the $F(m)$ curve (see fact No. 4 of Section 1 of this Insert) it follows that this angle k_0 is continuously decreasing for increasing m and therefore the cotangent of the angle $=m/k$ is continuously increasing. This means $\frac{d(m/k)}{dm}$ is necessarily always positive; dm/dp, on the other hand, owing to fact No. 1 of Section 1 of this Insert, is always negative so that $\left(\frac{dv_m}{dp}\right)_{v=max}=-c_0\frac{d\left(\frac{m}{k}\right)}{dm}\cdot\frac{dm}{dp}$ has necessarily the same sign as c_0. If c_0 is positive, that is, if the cost of manufacturing increases, then the term $\left(\frac{dv_m}{dp}\right)_{v=max}$ is also positive, which means that where v is a maximum the v_m-curve (plotted over the abscissae p) is sloping upwards, and it reaches its maximum at a higher price than v does.[6]

We see from this—using the term "profit" to include both net income and rate of return—the following to be true:

An increase in the cost of production will raise the price which produces a maximum of profit (and conversely a reduction will lower it). On the other hand, the value of the maximum itself is reduced by an increase in the cost of production (and conversely increased by a reduction), as can be easily understood from Fig. A.

A. Supposing now first that the producer have no other considerations to follow in determining his prices than to always obtain a maximum of profit, and supposing further that he had a full knowledge of the sales, cost, and capital-curves as given in Fig. A, then he will as a consequence of

[5]The capital invested depends on the selling price. If the selling price is lowered, a larger amount of the commodity (for instance, electrical energy) will be sold, therefore a larger amount must be manufactured. The manufacturing plant (central station, also transmission lines, etc.) must be extended and this requires in its turn an enlargement of the capital invested.

[6]A decrease of the quantity produced does not release any portion of the capital k tied up in the enterprise. The rate of return will therefore in this case change theoretically the same as the net return, since the capital will be constant. We can assume, however, at least in the central-station business with which we are chiefly concerned here, that the natural growth of the business will take up the decrease of the necessary capacity; in other words, that the effect of the increase of the cost of production, as far as the capacity is concerned, is simply a retardation of the growth of the capacity. If c_0 is negative, that is, if the cost of production is reduced, the above formulas for the rate of return apply without any restricting assumptions.

an increase of cost raise his unit price from the amount which resulted in a maximum profit under the original conditions of cost to the price which results in a maximum of profit under the new conditions of cost. The unpleasant effect of the advance of the cost of production will therefore be divided between the producer and the consumer in some ratio; the consumer will have to pay a higher price and the producer will get a lower profit. It is impossible for the producer to shift the entire burden of the increase of the cost onto the shoulders of the consumer. Moreover, the producer sees his chances reduced of investing new capital in his growing business. Conversely, if the cost of production is reduced, the producer cannot reap all the benefit alone, it is to his best interest to let the consumer participate by reducing the prices.

B. In practice the details of the shapes of the sales, cost, and capital-curves as represented in Fig. A are not known and we can make only rough guesses at the course these curves take. This and other reasons make it possible or even probable that the vendor (producer) has fixed the price not just at that amount which would yield him a maximum profit. Generally, as pointed out in the preceding section (5) the tendency will be to keep the price below that optimum value rather than above it. In that case it will be possible to shift a larger portion of the cost increase onto the shoulders of the consumer than under *A* above, and if the price has been sufficiently below the amount which resulted in a maximum it will be even possible for the producer to maintain his profit at the original level. It may even happen that the result is an increase of the profits. Owing to our ignorance of the details of the curves it will obviously always be a matter of chance which one of these three contingencies will take place.

C. If the price should have been higher than that which results in a maximum of profit from the beginning, it is possible that even after an increase of cost a price reduction remains advisable from the producer's standpoint so that both the producer and the consumer would be benefited by an intelligent downward revision of the price. But it should not be overlooked that this is the case not *on account of* the raise of the cost but *in spite of* it and that the benefit would have been greater to both parties if the increase of the cost of production had not occurred. Moreover, the raise of the cost of production will in no way reveal the fact that the price has been (and still is) too high. The remedy for the decrease of profit will be sought in an increase of the prices instead of in a reduction.

(To be continued.)

COMPLETE SAFETY EXHIBIT DURING SAFETY CONGRESS AT CLEVELAND.

Demonstration of Approved Shop Lighting to Be Made Among Exhibits of Safety Devices, Guards, Appliances, Etc., from October 1 to 4.

The most complete collection of commercial and non-commercial safety guards, appliances, devices and accident-prevention data ever arranged in the history of the National Safety Council will be shown at the exhibit to be held at Grays' Armory in Cleveland, Ohio, Oct. 1 to 4, inclusive, in conjunction with the eighth annual Safety Congress of the National Safety Council.

Every foot of space at the armory has been contracted for. There will be 70 booths in which will be shown types of safety equipment applicable to every industry. The exhibit will be given under the auspices of the National Safety Council and the Safety Institute of America, and 350,000 cards of admission to the exhibit will be distributed among the delegates to the Safety Congress and workmen of the plants in and around Cleveland.

An unusual shop-lighting exhibit will be conducted by the National Lamp Works, Nela Park, Cleveland, to which has been assigned the entire stage of the armory. This company will show a shop in operation, with three lighting installations, one poor, one mediocre and one ideal from the point of view of safety engineering. The light will be flashed on and off alternately, while the advantages and defects of the different systems will be explained. This exhibitor will also show a model office and model drafting room with indirect lighting installations.

There will be several safe clothing exhibits, including a special live model display of safe clothing for women and girls in industry. Sanitation and recreational facilities at industrial plants also will be shown. The round table and sectional meeting discussions at the last annual congress of the National Safety Council at St. Louis disclosed the need for a complete collection of the mechanical aids to safety work as an adjunct to the Safety Congress.

Gray's Armory at which the safety exhibit will be held in Cleveland is about two blocks from the Hotel Statler where the sessions of the congress will be held. The exhibit will be open from 11 o'clock in the morning to 11 o'clock at night, to make it possible for men and women who come to the Safety Congress to visit the exhibit without missing any of the sessions.

Among the other features to be shown for the first time in connection with a Safety Congress will be an Americanization exhibit, an industrial housing exhibit and a women in industry exhibit supplied by the United States Department of Labor, Women in Industry Service. The exhibit of the eighth annual Safety Congress will also be unique in the extensive display of non-patented or so-called home-made mechanical safety guards.

DETECTION OF OIL SOURCES CLAIMED BY ELECTRICAL MEANS.

Locating crude petroleum by means of an electrical device, no matter how far beneath the earth's surface the product may be, has been successfully done in the shallow field near Corsicana, Texas, during the last few weeks, according to reports, and Eugene Elkins, the inventor of the instrument, has gone to the outlying district around Burkburnett to make further practical tests of what is claimed to be a very remarkable invention. The oil industry may be revolutionized if oil pools can be located by means of so simple an instrument. The principle upon which it works is described by Mr. Elkins as follows:

"The system consists in forming an electrical circuit through the earth by dropping an insulated wire to the bottom of a dry water hole, valley or indentation and placing a series of batteries on top of the earth, to the positive pole of which is attached a land wire. This land wire is then taken out over the field in any direction and for any distance and all of the intermediate territory is combed thoroughly with electric currents flowing from the anode or positive pole to the cathode or negative pole. The earth being simply a huge inverted magnet, the electric currents travel from one to the other of the charged poles by the path of least resistance, much as does the return current of the telegraph system through its ground wires to the point of origin. That system also proves that the principle of earth conductivity of electricity is absolutely correct.

"Oil and its constituent components being the only minerals in the earth through which electricity cannot pass, it therefore follows that an oil pool in the path of the electric currents mentioned will offer a great resistance to the said currents, forcing them to go around the pool and also resulting in an appreciable loss of current through electrolysis, both of these factors registering these resistances on an extremely delicate meter in the hands of the operator on the surface of the earth."

Delivery of High-Tension Service to Large Consumers

General Considerations Involved—Relation of Cost to Station Capacity and Revenue—Choice of Equipment—Metering

By RAWSON COLLIER

Operating and Sales Manager, Georgia Railway & Power Co.

IT IS often difficult to decide whether the ideas of the sales department or the operating or engineering department should prevail when it comes to the delivery of certain types of service to the customers. Until recent years, the majority of the large consumers on the lines of our central stations were located in the congested districts of our cities, where they were supplied either from underground alternating-current or direct-current feeders, at low voltage, or from semi-high-tension distributing lines, through manhole or vault-type transformers. In these cases, the construction details were practically standard, following closely the rules for such service prescribed by the insurance underwriters. Usually, standard manhole type transformers were used, and the only engineering details that sometimes called for special study were those covering ventilation and drainage in the manhole or vault.

Metering was generally done at low voltage, and the practice generally was for the central station to furnish, install and maintain the necessary transformers, the rates quoted being supposed to cover all the various items entering into this type of service.

When the utilities began to build out from the cities, with their high-tension transmission lines, and delivery at the customers' premises was often made at from 6000 to 44,000 volts, new problems at once presented themselves to the sales manager as well as to the engineer.

In the case of large consumers, it was almost always the case that central-station energy had to compete with isolated steam plants, in production cost, and, as the larger the consumer the lower his isolated plant generating cost per kilowatt-hour, so the unit price of central-station energy had to be lowered and every inducement had to be offered to the prospective customer in order to get this business. It is certain that a careful study of many existing large contracts between manufacturers and central stations will show that the customer is buying current at less than its actual delivery cost to the central station, simply because the central station was too eager to obtain "big business" and failed to take into consideration the fact that the unit cost per kilowatt-hour on long distance transmission lines and step-down substations and the current loss in such transmissions and transformations should play an important part in deciding whether or not the rate obtained from the consumer was a profitable one.

I know of no case where current is delivered to ordinary wholesale commercial customers at a voltage exceeding 44,000 where the reduction to usable voltage is handled by the consumer. This is doubtless the limiting delivery voltage at present, as it is about the highest voltage for which standard high tension customers' transformers are being built in moderate sizes and it is practically the limiting voltage for standard moderately priced oilbreak and disconnecting switches and for customers' primary watt-hour metering outfits.

Generally, in serving a manufacturing center, if remote from the generating station, the central station finds it advisable to transmit at high voltage to a central point, where a line distributing bank of transformers is installed, from which the district is served through high tension customers' feeders, operating at voltages ranging from 19,000 to 44,000. Some companies operating in moderately populated territories have found it advantageous to operate lines at 38,000 to 44,000 volts of as much as 60 miles in length, the service being perfectly satisfactory for total connected loads as high as 6000 kv-a., with momentary demands of 4000 kv-a. Over such a line under ordinary circumstances, there will be delivered during the year approximately 10,000,000 kw-hr. The data from such a line in actual operation shows that the total cost of transformers and stations installed is approximately $100,000. Interest, depreciation and upkeep on these transformers represents approximately $20,000 per year. If the company had to own and operate these transformers, its delivery cost per kilowatt-hour to the customer, due to overhead and maintenance charges on transformer stations, would be increased approximately two cents.

The customer in figuring his isolated plant construction and operation cost should start with his coal bunkers and his coal pile, and figure the cost of his finished power from this point through to the point where it is used. Is it not correct, therefore, that in figuring the cost of purchased electric power to the same consumer, that he be expected to pay for and maintain everything from the high tension line (the crude power) to the point where the power is used? This would place the delivery to all wholesale customers, on the same basis and the customer would bear the expense of changing the current as received to any voltage that he might desire for his operation. The objection might be advanced that the average customer is not prepared to maintain and keep in repair a high tension transformer station, but this can easily be handled by the company furnishing free periodic inspection service on the customers' station, and the customer paying for all necessary work that the company does on the station, in order to keep it in first class condition.

At this time, I have been able to obtain the ruling of only one Public Service Commission on the subject of who should furnish the high tension station. It is in general, as follows: "In the opinion of the commission, a company attempting to serve the public with a particular kind or class of service should furnish all the instrumentalities for so doing. However, in view of the fact that the customer has it in his hands en-

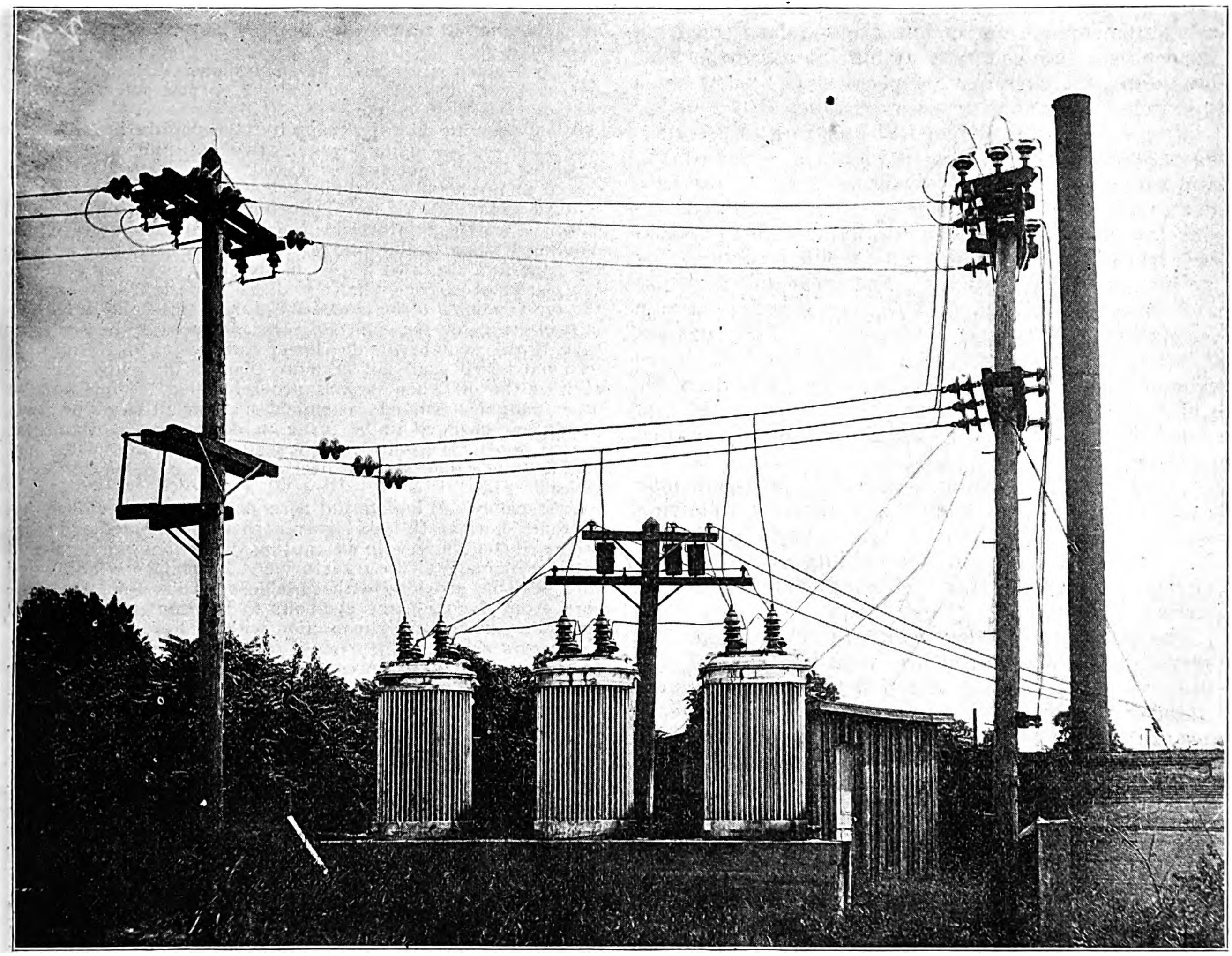


Fig. 1.—Early Type of Pole Structure for 600-Kv-a. Transformers, Transforming from 22,000 to 2300 Volts. Metering on 2300-Volt Side.

tirely as to the length of time that he (the customer) shall use the service of the company, and in order to protect the public from the company's making an unwise expenditure of money in furnishing a particular type of transformer to meet the peculiar needs of any individual customer, and such particular customers later deciding after a short trial to go back to isolated plant operation, the commission therefore holds that the customer should provide the transformers."

Fortunately for the sales department, where the customer is a large one and where the current sales rate of necessity must be low in order to obtain the business, it is found that the cost per kilovolt-ampere of transformer capacity, rapidly diminishes as the station grows larger, and the load-factor is generally higher for large than for small consumers. These two facts, therefore, tend to reduce the increase in the cost per kilowatt-hour to the large consumer where he owns the step-down transformer station and where he actually adds to the rate paid for electricity, the overhead and operating costs of his step-down transformer station. The following table illustrates the point.

Size of station.	Transformer cost.	Transformer cost per kv-a.	Total station cost per kv-a.	Yearly expense, station maintenance.	Yearly kw-hr.	Yearly maintenance expense per kw-hr.
45	$1215	$27.00	$36.00	$ 324	74,000	0.43c
150	1920	12.80	18.00	540	200,000	0.27c
1000	5100	5.10	14.76	2561	3,200,000	0.08c
2000	8200	4.10	12.50	4000	6,000,000	0.07c

If, therefore, the customer is to be expected to furnish the substation and if the upkeep and overhead costs of the station are to be charged by the customer against his power cost, the closest co-operation between the sales department and the engineering and operating departments will be needed, both in the design and in the operation of the station, as the yearly station overhead and maintenance expense must be kept down if the business is to be obtained and retained.

The best design for a customers' transformer station has been carefully studied by a number of the larger companies, during the past few years, the idea being to build the cheapest station possible consistent with first-class engineering practice. Early designs of stations show a leaning towards wooden pole structures, but it was soon found that this was unsatisfactory except for small unimportant stations. Repairs and upkeep on the wooden structures were frequent and it often became necessary to interrupt the customers' service in order to replace burned off pins or crossarms, or to replace poles. Naturally, therefore, the design drifted to a steel or iron structure and immediately the installation cost per kilovolt-ampere and consequently the unit kilowatt-hour cost covering interest and upkeep increased greatly. No standard substation design of moderate cost and of substantial and flexible construction has been brought out. There are several designs of "ready built" structures on the market, but as a general proposition they are comparatively expensive, and in many cases their design and equipment will not fit into the standard construction details of the company wishing to use them. This necessitates the carrying of special repair parts, such as switches, lightning arresters, etc., etc.

The photographs shown will illustrate to a certain degree the practice as carried out in some of the wholesaling companies. It will be seen from these photographs that the general practice is to build stations for installations up to 100 kv-a. with a wooden pole structure, using angle iron or pipe structures for stations above that capacity. The great difficulty that has been encountered is in designing a flexible station —a station that can be used for a medium size installation but later expanded cheaply and easily to accommodate additional capacity. Also it is desirable to have the steel work and bus work so designed that it need not be scrapped in case the station is enlarged or discarded.

The ideal high tension customers' substation may be said to be that substation that fulfills the following requirements: Low first cost, low upkeep cost, flexibility, safety in operation, accessibility of meters and switches, ability to adjust delivered voltage between commercial variations.

The main construction details of the average customers' station will be touched upon in a general way with a view of drawing attention to the three points that have a bearing, in so far as customers' substations are concerned, on the delivery of continuous and satisfactory service.

Transformers.

For moderate sized stations, oil-insulated, self-cooled transformers will prove most satisfactory. Such transformers may be specified to meet the standard A. I. E. E. specifications; some companies, however, are requiring special taps, special voltage tests, etc., etc. I quote as follows from a report made by one large company regarding their specifications: "We follow fairly closely the A. I. E. E. specifications except that the temperatures are based on 35° instead of 50° rise; voltage tests practically the same except on the secondary test, where we demand a higher voltage test. On the 110,000-volt transformers we have 2½% taps in steps from 110,000 to 74,000; on the 44,000-volt transformers we step down to 36,000 volts in drops of 1000 volts."

The specifications covering transformers of another wholesaling company are in part as follows:

General.

Use.—Transformers to be used on 38,000-volt "Y" grounded neutral, 22,000-volt and 11,000-volt circuits from substations connected to 110,000-volt transmission lines. Transformer will not be used in connection with choke coils. Transformer to be oil insulated, self cooled.

Tanks.

Fittings.—Shall consist of gauge glass, drain valve (located on nameplate side), sampling valve (located at bottom of tank and brought out opposite drain valve, size ½ in.), filtering valve (located at top of tank on side opposite drain valve, size ¾ in.). Globe valves to be used throughout, equipped with nickel steel seats and removable hand wheels.

Design.—Shall be such as will permit of convenient handling with jacks and rollers when transformer is assembled in case and case filled with oil. Base of tank shall be provided with lugs or recesses to permit the use of jack or pinch bar without requiring the use of wedges. Shall be provided with eye-bolts or other device for use in fastening slings or hooks with which to facilitate handling fully assembled transformers filled with oil by the use of hoisting or other equipment of like character. These devices shall have ample factor of safety. Base of tank shall be drilled and tapped for ⅝-in. cap screw on nameplate side to provide for ground connection.

Dry Air.—Shall be maintained by the use of anhydrous calcium chloride in proper container which shall be installed at factory on all transformers of 250 kv-a. and over.

Windings.

Over-potentials.—Shall be so designed that they may be operated continuously at 20% above normal potential rating with normal kv-a. output.

Taps.—Four 2.5% full capacity taps shall be provided for the 22,000-volt winding, making two 5% full-capacity taps available when connected for 11,000 volts. Taps shall not be placed in line ends of windings.

End-turn insulation.—The high-tension winding shall have a heavily reinforced insulation on each end of the winding leading to the line, this reinforced insulation extending back to a depth of 5% of the total turns of the winding.

Terminal board.—Shall be of such design as to permit the tap terminals to be placed in straight lines, the outer terminals being for the high voltages and moving the straps in toward the center for the lower voltages. All fittings on terminal board shall not be more than 12 in. below the surface of the oil when tank is properly filled. Wing nuts or other suitable terminal fastenings shall in all cases be used, permitting changes to be made in connections without the use of tools. Terminal board shall be provided with fiber edging strip which shall project above the edge of the board at least ½ in.

Assembly.—Winding and core shall be so assembled that 20 times normal full-load current may be momentarily impressed upon them without causing distortions which would result in damage to the transformer. Assembled winding and core shall be provided with suitable eye-bolts for lifting the core from the tank, the eye-bolts to be near enough the oil surface to be found by inspection without lowering the oil.

Temperatures.

Operating temperatures shall be determined in accordance with A. I. E. E. Standardization Rules, edition October, 1916.

Factory Tests.

Shall be made in accordance with A. I. E. E. requirements for this class of apparatus.

Oil.

Assembled transformers shall be filled with the proper amount of the best grade of transformer oil, this oil to be placed in the transformer case at a time in the assembly or final test of the transformer which is found to be productive of the best results in securing the maximum insulating value.

Transportation.

Transformer shall be shipped from factory with full amount of oil in transformer tank; equipped with calcium chloride container connected properly and filled with proper amount of calcium chloride; all necessary valves, thermometers and oil gauges installed and ready for service; with or without bushings as conditions may require; with proper protection from damage from handling during transit.

The manufacturer must guarantee the following condition of transformer upon its arrival at destination: Mechanical and electrical condition perfect, the oil to be free from moisture and of a dielectric strength equal to a test of 40,000 volts, frequency 60 cycles, between two ½-in. smooth disks with a separation of 0.2 in.

Purchaser agrees to draw ½ pint sample of oil from the bottom of each transformer tank as soon as it arrived at destination and forward to the manufacturer for test.

Foundations.

(For all except pole-type stations.)

Concrete foundations to extend well above any possible high water line. It is much cheaper to handle, test, change or filter a transformer if it is kept near the ground, therefore the placing of large transformer on steel or wooden structures high above the ground is to be discouraged.

Switches.

Disconnecting switches should be installed on the high-tension side of the transformers. Preferably these switches should be operated from the ground by suitable lever, which can be kept locked, if customer desires. By the use of these switches the customer can disconnect the station from the line when the station is not in use or when there is work to be done on it. The low-tension side should be equipped with suitable oil-break switch, equipped with overload and no-voltage release coils.

Lightning Arresters.

This item is extremely difficult to handle, especially if the station is placed in an isolated locality where competent help can not be obtained. Electrolytic lightning arresters are expensive and need daily attention, therefore are used on only the large and expensive stations. Horn-gap arresters, while of some assistance, do not afford perfect protection. There are a number of other types of arresters on the market but all seem to have faults, and trouble from lightning coming into the station from the line side seems to be always with us. To illustrate the different ideas now followed out by various stations, I will quote from several letters received by me.

A report from one operating company says: "Our lightning protection is left to the ground wire on the transmission system and choke coils at the substations." Another company reports: "We no longer place faith in fused horn-gap lightning arresters on 11,000 to 38,000-volt lines. We have bridged our fuse gaps with heavy copper wire and now treat the customers' substation as a part of the semi-high-tension distributing system. We find that we have fewer interruptions to the customers' service."

On the low-tension side, if necessary, lightning protection can be obtained by a number of well-known low-tension arresters.

Metering Equipments.

Metering seems to be almost universally done on the low-tension side of the transformers. Some companies established the rule of metering on the high-tension side at voltages ranging from 11,000 to 38,000 but later a few of those companies decided to stand the transformer losses and meter on the low-tension side of the transformers rather than pay the large difference in the cost of the high-tension metering outfits and chance the increase in maintenance cost, due to the high-tension outfit being destroyed by lightning.

The accompanying table shows the difference in cost to one operating company in high-tension and low-tension metering, the data covering four years' operating:

Kv-a. capacity of transformers.	Cost of meter installation, high-tension voltage. 11,000/22,000	Cost of meter installation, low-tension voltage. 550	Maintenance per yr., high tension.	Maintenance per yr., low tension.
100	$762	$225	$60	$3
500	762	225	60	3
1000	762	225	60	3
3000	762	225	60	3
3000*	1600	225	$400	$3

*22,000/38,000 volts.

Transformer Loss to Central Station by Metering on Low Side (Approximate).

11,000/22,000 volts.	Kw-hr. per year.
100	17,000
500	86,000
1000	173,000
3000	520,000
3000*	520,000

*22,000/38,000 volts.

Maximum Demand Meters.

A large number of companies now make a rate consisting of a charge per kilowatt of maximum demand, plus a charge per kilowatt-hour. To obtain the

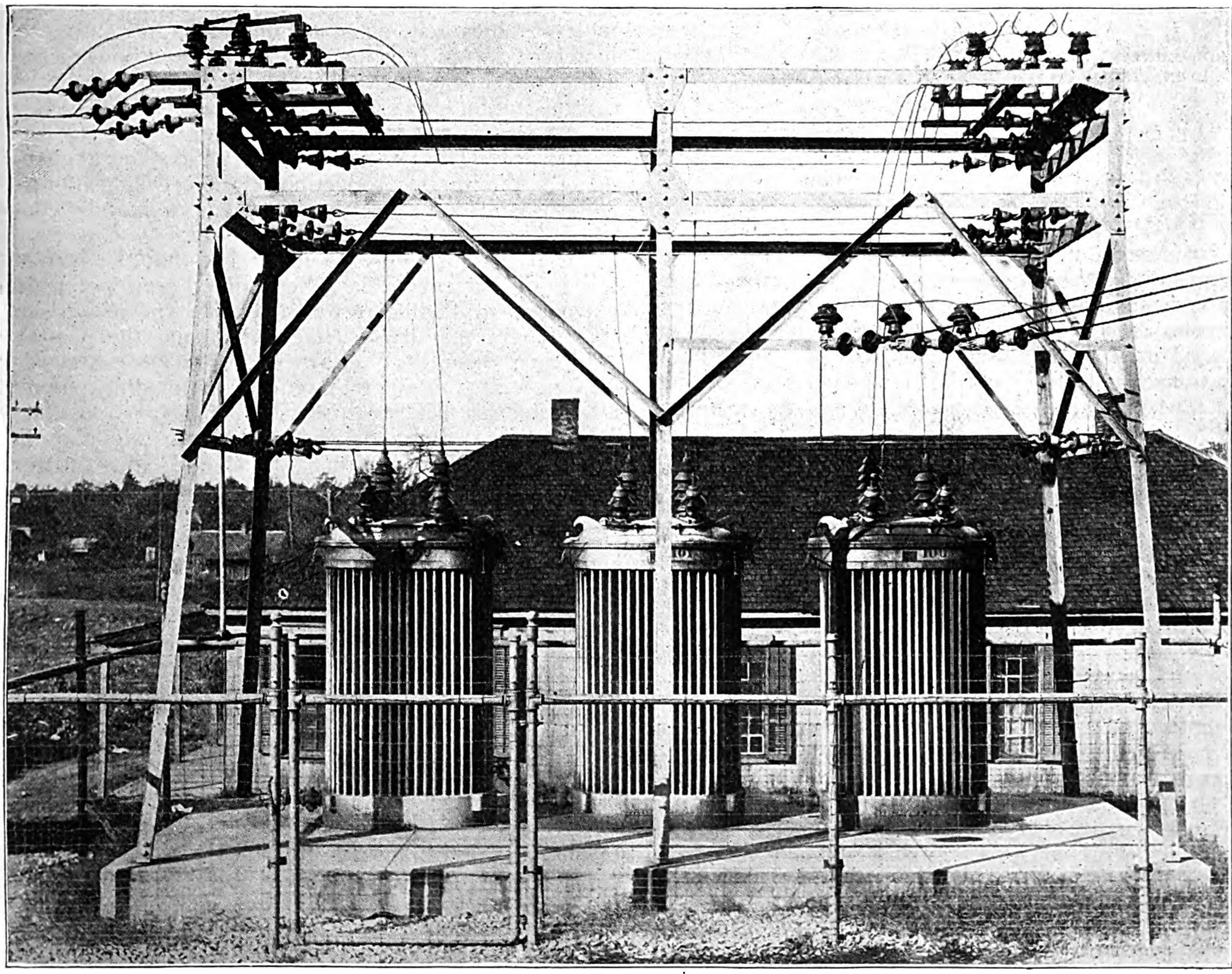


Fig. 2.—Modern Type of Outdoor Installation, Showing Three 150-Kv-a. Transformers With 2300-Volt Metering.

data for the maximum demand charge, a number of types of instruments are available. Curve-drawing instruments and those of the curve-drawing type are suitable only for mounting indoors and can therefore only be used where an indoor type station is used or where the instrument is mounted on the buss bars on the customers switch board. There are several types of indicating maximum demand instruments suitable for mounting out of doors in a weatherproof box and connected directly to the watthour instrument. These instruments are low in first cost and upkeep, and commercially accurate.

From time to time the question has been agitated by the customer and by rate experts, as to the effect of the varying lengths of time that should be allowed for registering the maximum demand. To determine the actual effect of the varying maximum demand time limit, tests were made on a number of customers, operating various types of manufacturing plants, the results being based upon observations taken from graphic recording wattmeter charts, comparing the result of the average of four 5-minute demands during any four days in the month, with one 15-minute demand, one 30-minute demand and one 60-minute demand. The results obtained, were as follows:

Type of industry	Number of customers	15-minute demand	30-minute demand	60-minute demand
		In percentage of four 5-minute demands		
Abbatoir	2	107	103	99
Barytes and Ochre Mines ..	5	101	98.5	96
Bed Mfgrs.	1	114	111	105
Chair Factory ..	1	107	101.5	97
Cotton Mills	4	102	101	99
Cotton Linters ..	1	110	107	100
Fertilizer Plants.	3	104.2	101.2	93.4
Iron Foundries..	2	99	95	85.5
Municipal Plants	5	107	104.5	100
Oil Mills	3	118	110	106
Oil Refinery	1	102	100	100
Stone Crushing..	3	110	104.2	101.5
Average	31	106.8	103.1	98.5

In passing, it may be mentioned that if metering is done at the transformer frame in weatherproof box, windows should be placed in the box so that the customer can read his watthour instrument and maximum demand instrument whenever he wishes. This allows him to keep accurate record of his power consumption, and tends to increase his confidence in the metering outfit.

In General.

The following suggestions are made with a view of calling attention to points that may aid in giving continuous and satisfactory service to your high-tension customers.

(a) Insist that transformers, lighting protection, and switches on the station, installed by the customer, shall conform to standard specifications as prescribed by your company. By so doing you will tend to eliminate any undue weakness in the station, that might cause a short circuit or ground and thus shut down your transmission line and cut off service to other customers.

(b) Standardize on one or two voltages for your power consumers, and insist that transformers and other apparatus conform to these voltages. In case of trouble to the customers' apparatus, you will then be in a position to make quicker repairs, or you can lend from your stock, transformers, motors, switches, etc., until the damaged apparatus can be repaired.

(c) Demand that the customer maintain as high power-factor as is consistent with first-class engineering and operating. If his type of machinery, or his operating methods tend to reduce the power-factor below that allowable for first-class operation, require the customer to install necessary machinery to rectify the trouble.

(d) Make periodic inspections, free, of the customers' transformer station and if trouble is found, notify him immediately and make repairs promptly, at his expense.

(e) Generally, the customer will desire that his transformer station be erected by your company. If so, design and build him the most economical station possible, taking into consideration, first class engineering and operating.

(f) If possible, do all work on your customer's station without interfering with his operation. If your company does not do live line work, try to make repairs or changes on Sundays, nights or holidays, first always getting permission from the customer in writing before taking the current off his station.

(g) Generally large manufacturing plants desire to know their power costs for each month. Try, therefore, to read the meter on the last day of each month, so that the bills rendered, will cover an actual month's service.

(h) Insist that your customer is furnished the correct voltage for his apparatus, and that the regulation is within commercial limits. Much of your wholesale business is obtained because of the fact that the amount of manufactured product is increased, due to the fact that electrical drive is steadier than the drive obtained from reciprocating engines or even most turbines. In some cotton mills, the output is increased as much as 10% with the same power consumption, due to the change from isolated plants to central-station power. If the voltage or frequency is low or the regulation is poor, this saving quickly disappears. If momentary interruptions occur, frequently, the loss in production or the breaking of machinery will soon cause the advantages gained by central-station electric drive, to disappear.

There is absolutely no doubt but that the wholesaling of current to large consumers can be made extremely profitable, if we give that type of service the thought that has been given during the past to your retail business. Let us therefore try to standardize our service to our high-tension customers, striving at all times to make such service as nearly as possible, free from interruptions and variations. No man in the central-station organization should know better than the sales manager what is necessary in the way of service and equipment, in order to have a satisfied customer. Therefore, only by the closest co-operation between engineering and operating departments and the sales department, can we hope eventually to work out and perfect a standard plan for properly and economically serving our high-tension customers.

The above paper was presented by Rawson Collier before the Sales Managers' Convention, held at Association Island, August 4, 5 and 6.

AIRPLANES PATROL PANAMA POLE LINES.

Airplanes are now being employed for hunting trouble and patrolling pole lines in the Panama Canal zone, according to advices from the Air Service. In one recent case a seaplane went from Balboa to San Carlos, repaired a line and returned in one hour and fifty minutes, whereas the trip through the jungle trail by horseback would have occupied not less than three days.

DEVELOPMENTS OF POULSEN WIRELESS SYSTEM SHOWN.

Expert Evidence for and Against the System Given at the British Marconi Inquiry.

During the hearing of the claim of the British Marconi Co. against the British Government for $35,000,000, some very interesting evidence, new to English minds probably owing to war-time restrictions on the circulation of wireless technical developments, was given respecting the Poulsen system.

Wm. Elwell, in the course of a detailed statement, said that he was employed by some San Francisco millionaires to investigate all the existing wireless systems and in 1909 he came to the conclusion that the most promising system was the Poulsen. After ascertaining that the rights were for sale, he went to Denmark and had the system demonstrated to him between Lyngby and Copenhagen. He made a contract with the owners to purchase the patent rights for America, and on returning to America he organized the Poulsen Wireless Telephone & Telegraph Co. with a capital of $5,000,000. This company in 1911 was merged into another company known as the Poulsen Wireless Corporation. It was a large company, and to avoid taxation in different states it was reorganized and operated under the name of the Federal Telegraph Co. with a nominal capital. The Federal company built many stations, starting from 5 and 12 kw. which he purchased in Denmark to demonstrate the system. After that date he manufactured arcs of increasing power—15, 30 and 60 kw. In 1912 he built a station in San Francisco and one in Honolulu, which he constructed with 30-kw. arcs, and inaugurated the system which had been spoken of in Lord Parker's report. Towards the end of 1912 he took a 30-kw. arc to Arlington, where he demonstrated to the American Navy that it was superior to the 100-kw. Fessenden spark. He was asked by the American Navy what he would recommend at a station, and his proposition was to put up three 600-ft. towers and install a 100-kw. arc. This contract was signed in April, 1913. That was at Darien, on the Panama Canal. During the demonstrations he showed that with an arc of 100 kw. reliable communication could be given over a distance of 2000 miles. In 1913 he became chief engineer of the Universal Radio Syndicate, who were then building the Danish design stations at Ballybunion and Newcastle, New Brunswick. These were destined for Transatlantic commercial work. He did not design these stations, but he was called in towards the end of 1914 with a view to making them work. He modified the design of the generator and satisfactory communication was carried out. In 1915 he was invited to Paris and for the French Government put up an arc on the Eiffel Tower. In 1916 he put up an arc generator at the Lyons station for the French Army, which has been in work with America, or about 4000 miles, for over two years. In 1917 he went to Rome and designed a plan for communicating direct from Rome to America, a distance of some 4200 miles. In 1918 he installed a still larger arc in the Lyons station. The largest arc he had worked was 405 kw., the communication being over some 3000 miles. He had no hesitation in saying he considered the Poulsen system the best wireless system in use today.

E. H. Shaughnessy, staff engineer to the British Post Office Engineering Department, and in charge of the wireless section, expressed the opinion that the Poulsen arc was at present the best known working system for wireless transmission. It became so at the middle of 1918. He said that the development of the Poulsen arc had been pretty rapid, and larger power arcs had been built in various parts of the world. The plan of the alternative receiving system which had been put in on behalf of the Post Office was perfectly free from any existing Marconi patent. It was quite as efficient as any other receiving system. The Poulsen arc generator for transmitting which was shown on the same plan was fully covered by expired Poulsen patents. An efficient working Poulsen generator could be made to deal with the requirements of the Imperial wireless chain without infringing.

Another witness, H. A. Madge, technical wireless expert to the British Admiralty, said he had been responsible for the general technical planning of over 500 Poulsen installations, mostly for small power, though a dozen were capable of communicating over 1000 to 1500 miles. He held that a Poulsen installation, if properly designed, was more efficient than any wireless spark known to or heard of by him. The largest Poulsen arc installation he had seen working was that at Nantes, of 200 kw. He could design a 200-kw. arc which would be a perfectly practical proposition and thoroughly satisfactory for long distance commercial wireless.

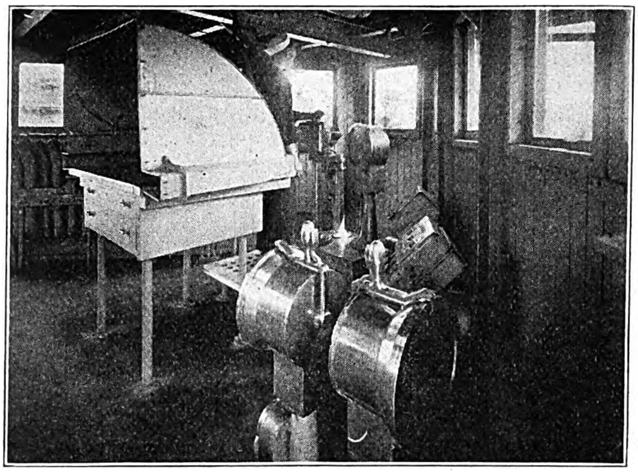
Other evidence was given by Capt. C. R. Payne, R. N., concerning satisfactory experience with the Poulsen system while on British battleships. He said that day and night communication was better by the Poulsen system than by the spark system. Commander J. F. Commerville, R. N., testified to very satisfactory accuracy of transmission and small interference, during practical experience in the war.

The Marconi company followed up the foregoing statements by calling evidence of a different kind from Emile Girardeau, radio officer engineer to the French Government, who said that the Poulsen arc system had not been a success in French stations and very little was left of the original design. He said that neither the French War Office nor the French Navy had been satisfied with the working of the system. He said further that none of the French stations was capable of conducting a regular commercial service, even with the improvements made.

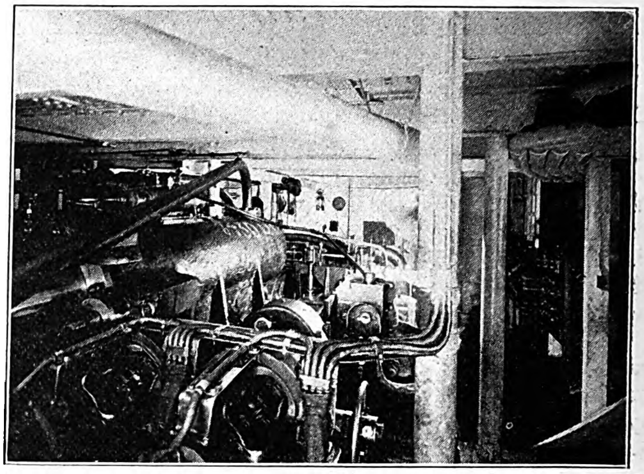
UNITED STATES COAL PRODUCTION IN 1918.

The final figures of coal production for 1918, compiled from reports from all operators in the country, have just been completed by the Geological Survey. These official figures show for the year 1918 a total output of 579,386,000 net tons of bituminous coal, a figure less by 1.1% than the estimate published 8 months ago. The total production of coal, anthracite, bituminous and lignite, in 1918, was 678,212,000 net tons. Pennsylvania ranked first in output, with West Virginia second and Illinois a close third. The number of men employed in the production of bituminous coal in 1918 was 615,300, compared with 603,143 in 1917. The average number of days worked, the highest recorded, was 294, compared with 243 in 1917.

The total value of the production of the bituminous coal mined in 1918 was nearly $1,500,000,000 and of both bituminous and anthracite coal, $1,828,423,000. The average value per ton realized for bituminous coal was $2.58, compared with $2.56, the estimated weighted average of the established Government prices in effect throughout the year.



Navigating Bridge with Steering Control and Electric Apparatus for Transmitting Signals to Engine Rooms.



View of Steering Apparatus (Chiefly Electrical) Looking Forward—Note Two Motors in Foreground.

INTERESTING ELECTRICAL FEATURES OF THE BATTLESHIP NEW MEXICO.

Superdreadnought Flagship of the New Pacific Fleet Has Most Complete Electrical Equipment of Any Ship Afloat.

It is fitting that the superdreadnought *New Mexico,* probably the most modern of all battleships and the first capital ship of any nation to be operated entirely by electricity, should have been selected as the flagship of our new Pacific fleet now on our Pacific coast.

By many the *New Mexico* has been referred to as the only 100% electric ship, for there is hardly a device on board which does not operate electrically. The special features of her electrical propelling equipment were described in our issue of April 12, 1919. A very brief summary of this feature and some of the other interesting electrical features is given below:

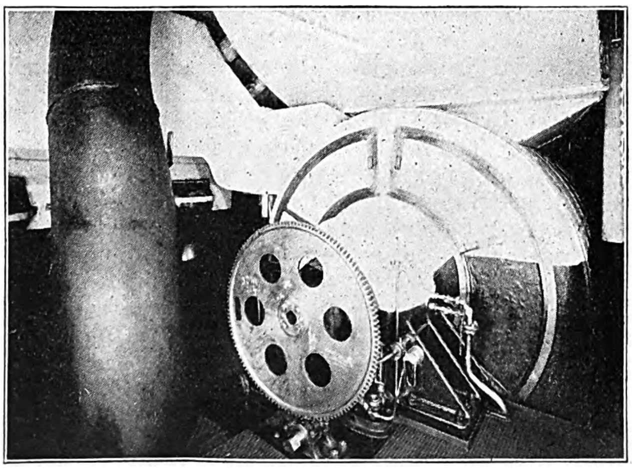
The *New Mexico* is propelled by four 7000-hp. polyphase induction motors each direct connected to a separate propeller shaft. Each motor is 12 ft. in diameter and can operate efficiently at several speeds. These four motors are supplied with current obtained from two special turbogenerators used only for this purpose. The propelling equipment is the product of the General Electric Co., Schenectady, N. Y., which developed it in conjunction with the Bureau of Steam Engineering of the Navy. A view of one of these big motors is shown on page 400.

There are six auxiliary turbogenerator sets located in different parts of the ship which produce the electricity that operates all of the many electrical devices, outside of the propulsion equipment, including power, lighting, heating and signaling apparatus.

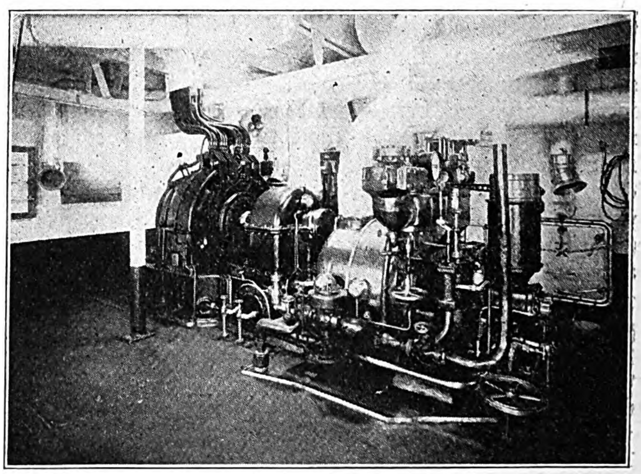
Some of the Motor Uses.

It has been estimated that there are about 300 motors on the *New Mexico,* and here is a partial list of some of the uses to which they are put:

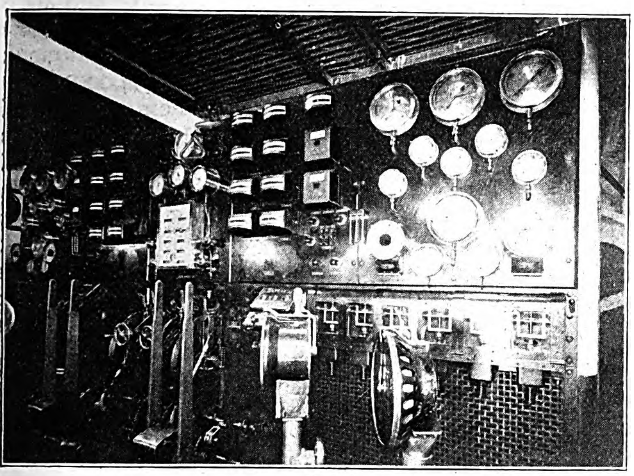
4 motors for steering gear;
2 motors for anchor windlass;
4 motors for boat cranes;
4 motors for deck winches;
1 motor for capstan;
8 turret-turning motors;
12 gun-elevating motors;
4 motors for ramming charges in turret guns;
24 ammunition-hoist motors;
4 smoke-ejector air-compressor motors;
2 torpedo air-compressor motors;
14 motors for operating sanitary, fresh water and drainage pumps;
4 motors for oil pumps;
4 shaft-turning motors;
2 motors for refrigerating system;
80 motors for ventilation fans;
8 motors in kitchen for potato peelers, dough mixers, meat grinders, dish washers, ice cream freezers, etc.
20 motor-generator sets for interior communication, telephone, gun firing, etc.;
6 motors in carpenter shop;
10 motors in machine shop;
7 portable motor-driven drills;



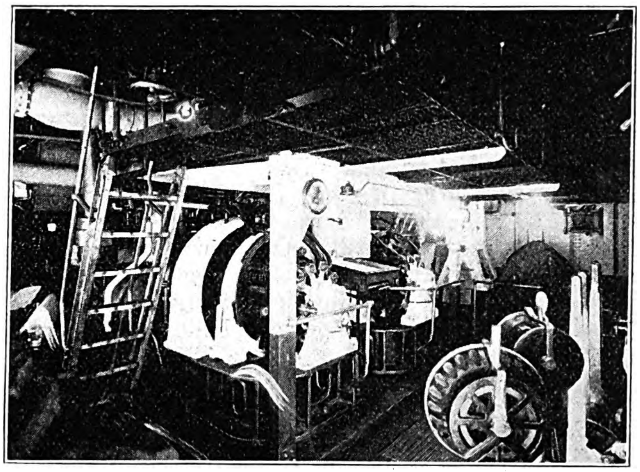
One of the Two Main Turbogenerators for Producing the Polyphase Current for the Propeller Motors.



One of Six Turbogenerator Sets for Supplying Lights, Fans, Cranes, Wireless, and Scores of Auxiliary Motors.



Main Switchboard and Control Apparatus Through Which Current Passes to the Propeller Motors.



Two Main Exciter Sets for Turbogenerators that Supply Current to the Propeller Motors.

6 motors in laundry;
4 motors in print shop.

It is interesting to note that most of the electric lights of the *New Mexico* are dependent on two sources of supply, first, the auxiliary turbogenerators already mentioned and, second, a set of storage batteries which are designed to be brought into service if for any reason the main source should fail.

Two electrically driven boat cranes used in hoisting and lowering the boats and loading supplies aboard the ship have a capacity of 4000 lb. each. The large-calibre guns are fired by electricity; ammunition is hoisted from the magazines by electric motors and some of the big guns are loaded by electricity.

The ponderous rudder is moved into any desired position by the simple turn of a controller on the navigating bridge, which sets in motion machinery in the hold of the vessel for this purpose. There are several steering stations located in various parts of the ship where this operation may be performed in case one station should be disabled. In all, there are five different ways of steering the *New Mexico,* one of which is the hand method, which requires the exertions of six men.

There is a complete equipment of motor-driven machines in the carpenter shop, machine shop, foundry, laundry, bakery and kitchen. In the bakery bread is baked in electrically heated ovens; in the laundry five electric dryers are used, and in the hospital quarters are several electrically heated sterilizers.

Space does not permit detailing all of the marvelous electrical devices of this ship, but among these are the following:

22 radiotelegraph sets;
12 searchlights;
2 Sperry master gyroscope compasses with numerous repeater compasses;
104 loud-speaking telephones;
176 ship service telephones;
170 fire-control telephones;
50 electric air heaters or radiators for warming exposed positions that cannot be economically heated by steam;
6 electric toasters;
15 electric flatirons;
6 electric soldering irons;
2 electric glue pots.

Other interesting facts about this powerful vessel are the following:

The *New Mexico* was built at the Brooklyn Navy Yard and launched in the summer of 1917.

She is 624 ft. over-all.

She has a 97 ft. 4½ in. beam.

She displaces 32,000 tons.

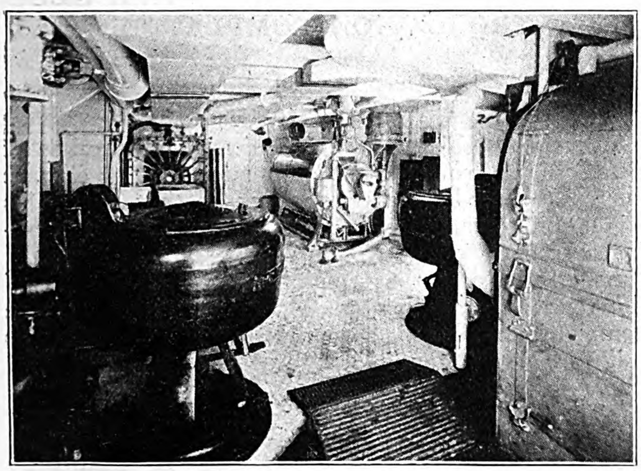
She draws 30 ft. of water.

At full speed she can make slightly in excess of 21 knots.

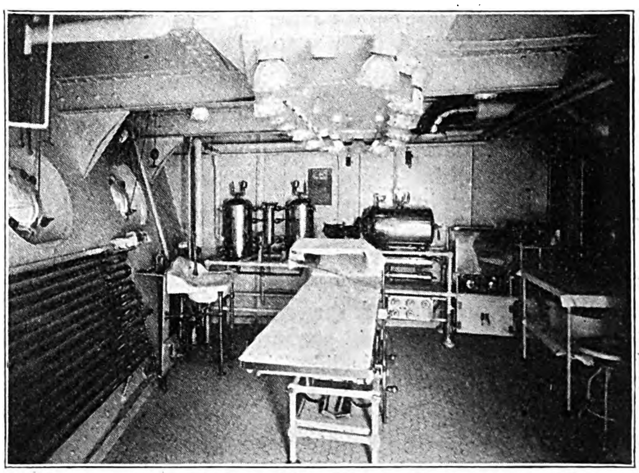
She can generate 28,000 hp. for propulsion.

Her crew numbers nearly 1200 men.

She burns oil instead of coal as fuel and has a total fuel capacity of 3400 tons, or about one million gallons.



View in Laundry, Showing Motor-Driven Washing Machines, Electric Dryer and Electric Sterilizer.

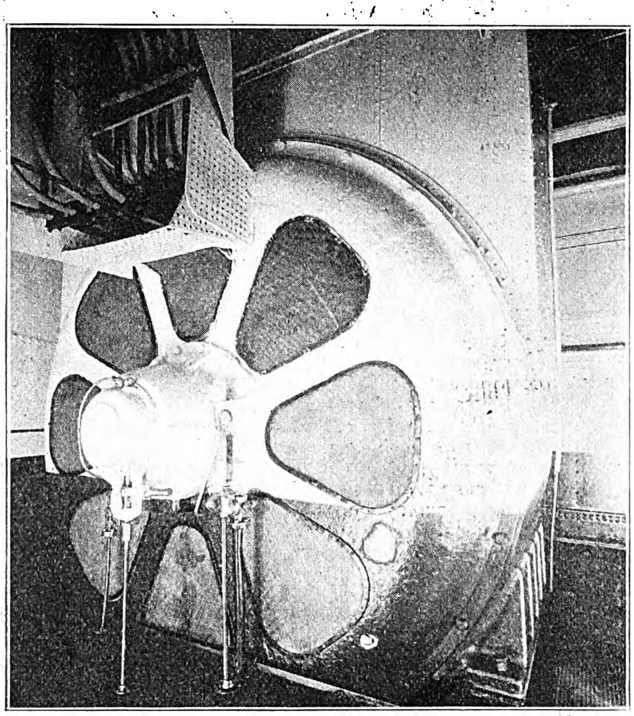


Operating Room in Hospital Quarters, Showing Electric Heating Apparatus and Special Lighting for Operating Table.

NEW JERSEY UTILITY BOARD ABROGATES ELECTRIC SURCHARGE.

War Surcharge of 25% Removed from Power Consumers, Except Wholesale Customers.

The Board of Public Utility Commissioners of New Jersey has handed down a decision abrogating the war surcharge of 25% for electric service furnished by the Public Service Electric Co. to customers under a uniform retail power rate and the elevator rate, effective Sept. 1. The surcharge will continue in force for the time being as applies to the charges for wholesale power. Unless the company



Forward End of One of the Four 7000-hp. Propeller Motors of Battleship New Mexico. Diameter of Motor is 12 ft.

accepts this modification of the surcharge order, the entire surcharge will be set aside pending further decision of the Board.

Following investigations, the Board finds that the war surcharge, excepting in the case of wholesale power, has produced a revenue in excess of that expected when the application was granted, and due largely to the great increase in business resulting from war activities rather than to any error in computation. In the company's application for increased rates, the added revenue was estimated at $1,800,000, whereas the actual business done was far in excess. In the case of wholesale power, the Commission finds that the rates are somewhat proportionately lower than for other classes of service, and less than the charges existing in other eastern metropolitan areas for the same classes of consumers.

The abrogating of the surcharge will affect about 10,000 consumers, or approximately 95% of the power-using patrons of the company, the other 5% comprising the wholesale consumers of the company. In connection with its decision in this case, the Board says:

"It is apparent that had the surcharge not been allowed, the company would have sustained a deficit of from $800,000 to $900,000, even taking into account the unanticipated increase in the business. The result to the company for the year 1918, over and above the amount needed to maintain its usual dividend rate and to lay aside for depreciation an amount deemed necessary, was a net gain of $594,000.

"It is generally recognized that the extent to which the industries, particularly those engaged in war work, will continue at the speed of operation under which they were maintained during the last year is problematical. How far this will affect the use of power is doubtful. It thus becomes a matter for the Board to determine a sound public policy rather than a determination of the accuracy of financial estimates in making modifications of existing rates. The prices for labor and supplies are still uncertain and will probably remain so for some time to come.

"In a period of readjustment, public policy requires that the greatest care be exercised: First, that the utility be not made the victim of too optimistic a forecast and its revenues so curtailed that, in the event of unforeseen conditions, it shall be so crippled as to preclude the performance of its proper functions; second, on the other hand, in a period of readjustment, the public should be protected against prohibitive war rates, particularly where it is disclosed that, from the results of operation thereunder, an excess amount has been earned by the utility.

"From the Board's analysis, based upon the results of operation under the rates now in effect, and consideration of the estimates of the company, due regard being had to possible contingencies during the period of readjustment, both as to cost of labor and materials as well as to the extent to which industries in the territory served by the company will continue operations, the Board is of the opinion that a readjustment of the rates should be made at this time. The surcharge heretofore allowed cannot be removed entirely, as to do so would result in an actual deficit of several hundred thousand dollars, dependent upon the readjustments now taking place in the industries.

"The Board is of the opinion that the removal of the surcharge entirely from the bills charged to the customers under the uniform retail power rate and the rate for elevator service, and the continuance thereof on the rates of the wholesale power customers, refrigerator rate and kilowatt-hour rate will result in a sufficient net revenue to the company to assure the continuation of safe, adequate and proper service to the public, and to enable it to properly market its securities and thereby finance the necessary extensions required by the growth of the business."

ANOTHER STRETCH OF ST. PAUL ELECTRIFICATION COMPLETED.

Harlowton-Seattle Line, Electrification, 885 Miles Long, to Be Completed Jan. 1.

President Calkins of the Chicago, Milwaukee & St. Paul Railroad recently announced that electric current would be turned on over another 110 miles of main line from Othello to Cle Elum, Wash., including a crossing of the Columbia river, in a very short time. By Jan. 1 the remaining 135-mile stretch of the road from Harlowton, Mont., to Seattle, will be completely electrified, 885 miles in all, or within 200 miles of half the entire length of the St. Paul-Seattle line.

The last stretch from Cle Elum to Seattle, 130 miles, will cost about $9,000,000, or 25% to 40% more, relatively, than preceding units, on account of higher prices of labor and material.

Editorial Comment

Stimulating Production by Up-to-Date Industrial Lighting

RAPIDLY shortening days again arouse general interest in lighting. This is the psychological time to put lighting campaigns into effect because now is commonly considered to be the most opportune time to rehabilitate lighting systems in offices, stores, factories and homes in readiness for long hours of usefulness during the autumn and winter. Lighting interests must decide on what lines of activity to give special emphasis without neglecting any. While this question will be decided differently in different localities, we believe that the nation as a whole will be most benefited by special attention to factory lighting in all industrial communities.

In an article in this issue is pointed out the peculiar timeliness of taking advantage of the stimulating effect on production resulting from improved industrial lighting. Of the various measures for combating the high cost of living, the most widely accepted and probably the most effective is increase of production. Much needed as it is, it has been retarded by the many economic and social uncertainties since signing of the armistice, but prospects of ratification of the peace treaties and truce in the relations of labor and capital, together with recognition of the unlikelihood that prices will fall very rapidly, should remove the principal uncertainties and permit replenishing of the world's supply of all useful commodities. Lighting is only one means of increasing production, but a potent one, as shown in the article. It is an essential factor in all production and when applied with intelligence has a marked stimulating effect upon production.

Aside from the stimulating effect of an up-to-date lighting system, there are special reasons why improvement in industrial lighting should be strongly advocated now. There are very many old plants that have reached the limit of their capacity as now arranged because large sections of the floor space cannot be effectively used due to the meagerness of their lighting. Provision of suitable lighting makes these areas useful and saves additional construction.

Moreover, an up-to-date lighting system makes it possible to operate with two or even three shifts per day, thus increasing the output two or three times at practically no investment expense. This possibility is especially valuable where real estate values, and therefore rents, are high and where there is a heavy investment in plant machinery and equipment. We believe there will be an undoubted tendency to utilize plant investment more intensively when manufacturers come to realize that multiple-shift operation is entirely practical with a good lighting system, and that it decreases the fixed charges per unit of output and offsets the higher wages and shorter hours that are now the order of the day.

Association of Iron and Steel Electrical Engineers

OF THE industries employing electricity, the steel industry is the largest single industrial consumer. Year by year the kilowatt-hours consumed in the steel industry have increased as the tonnage increased and as electric power supplanted hydraulic, steam and pneumatic power in divers ways. And then the electric furnace, that has made such healthy headway in steel mill and foundry, is also responsible for its quota of energy consumption, a form of load that will increase, the more so as preheating, annealing and tempering come to be carried out electrically.

The problems of electrification in the steel industry, while being basically similar to electrification in any other industry, have many peculiarities of their own. The applications of electric power are many, giving rise to an urgent demand for standardization. Reliability is paramount, because cessation of some one detail in the production of steel may cripple the day's output and ruin large masses of metal. Low cost is fundamental, which means efficiency of application of electricity. Having many problems of its own, and in view of the fact that electricity enters in so many different ways it is but natural that electrical engineers concerned with the application of electricity in the steel industry should tend to come more and more closely together and share their experiences for mutual gain. To do this is the function of the Association of Iron and Steel Electrical Engineers.

This young and growing association will hold its thirteenth annual convention in St. Louis the latter part of September, and the tentative program of papers indicates that the convention will be a very interesting one for the electrical industry in general. In addition to the various reports on such foremost matters as standardization, safety, education and electric furnaces, a series of joint papers on "Organization of the Electrical Department in the Steel Industry" should be found instructive to many other industries where electric drive is a prime factor in production. Electric welding will come in for its quota of discussion in seven papers by representative manufacturers. "Meter Equipments in Steel Mills," "High Temperature Furnaces," "Recent Improvements in Industrial Control," and a general discussion on the design and operation of electric cranes and lifting magnets are other topics that are to come up at the meeting.

The steel industry is an industry unto itself. And yet all of us are vitally concerned in its progress in some way or another; and the more we know about it and its problems the better it is for us and for the steel industry. Meanwhile the engineers in the iron and steel industry are tackling their problems with a vim deserving of success. To what extent they are responsible for the rapid development of electrical apparatus and its evolution in the steel industry we do not know. But that much credit is theirs must surely be a conservative statement and stinted praise.

Making Utility Strikes Oboslete

WE HAVE on numerous occasions pointed out the serious inconvenience and sometimes danger to the public of the recently frequent strikes of street-railway, telephone, railroad and other public utility employes, and we have advocated that such strikes be prohibited without curtailing the rights of the employes to have their desires heard and fairly considered. At a recent hearing before a Congressional committee Mr. Charles Piez, well known as a manufacturer and for his recent connection with the United States Shipping Board, laid special emphasis on the question of doing away with railroad strikes. Mr. Piez advocated the creation of a board of arbitration by the Interstate Commerce Commission to deal with all labor disputes, and he would give the public representation on that board. With the formation of this agency to investigate and give disinterested decisions, railroad workers would be required to waive the privilege of striking and the railroad managers would have to exercise similar self-restraint in the matter of lockouts.

In a bill dealing with the railroad question that was introduced in the United States Senate this week somewhat similar provisions are included. In an editorial, the *Chicago Daily News* says: "The soundness of the basic idea—that railroad strikes and lockouts should be prevented by law, which at the same time should effectively protect railroad workers from every form of injustice by careful scrutiny and timely revision of the wage scales and other conditions of service—is not open to serious question. Much confused thinking has been done on the subject and many wild assertions have been made in defense of the strike, but the fact remains that the public's interests are paramount, provided the public takes ample precautions to prevent injustice to those who serve it faithfully."

All these are good indications of rational consideration and solution of the subject and we hope that this provision of the railroad bill will be enacted and that similar measures will be passed with respect to other public utility employes.

Electric Cooking and A Large Utility

COOKING by wire is coming apace. In many instances electric cooking is gaining although the central station concerned does not energetically encourage it. In some instances the utility interested in supplying electric light and power also supplies gas, and effort is made to encourage cooking by gas. In other instances a low rate by a competing gas company is looked upon by the utility as a powerful deterrent and one the electric utility does not feel justified in seriously competing with when it comes to developing the electric cooking load. The fact that there may be a tendency for the cooking load peak to overlap with the evening winter peak is also an influencing factor no doubt. But there are many more utilities that have realized the possibilities of electric cooking load and are going after it seriously with good results.

The frank statements as to the policy of the Detroit Edison Co. toward electric cooking, as outlined in an article by Mr. R. F. Hotton appearing elsewhere in this issue, are of exceptional interest. In brief, one judges from Mr. Hotton's article, that the Detroit Edison Co. has allowed the electric cooking load to come to it in the city, but has not gone after it. In the rural communities this type of load has been encouraged.

In the largest cities, like New York, Chicago and a few more, it is true that the cooking load occurs during the time when the daily winter peak occurs, since cooking, lighting and power exist simultaneously. However, while in the largest cities it is a fact that the heaviest meal of the day occurs at night, it is also a fact that in the smaller cities, of 200,000 population and below, the heaviest meal occurs at noon. The reason for this is, of course, that in the largest cities, there is an exodus at evening to the suburbs where the family reunion is held over the dinner table, whereas in the smaller cities, people are able to go home to midday lunch.

The possibilities of the farmer and rural communities as markets for the electric range—and all electrical appliances—are probably not yet realized. What the Detroit Edison Co. has done, and it has probably as yet merely scraped the surface, can be done elsewhere. One fact brought out in Mr. Hotton's paper is that when one electric range is installed, it is particularly desirable to obtain similar installations in close proximity. It means more efficient utilization of investment, with an equitable gain to the consumer.

The importance of voltage regulation deserves special mention. Voltage drop interferes with the performance of the electric range—of any electrical appurtenance so far as that goes—lengthening the time required to cook, tending to injure the culinary achievement and sometimes jeopardizing the flavor of the product cooked. Even more serious is the effect of poor voltage regulation upon revenue, a fact that has been realized, but not perhaps appreciated to the full.

Current Events

Pennsylvania Meeting Opens—New England Section's Convention Program—Export Record—N.E.L.A. Activities

PENNSYLVANIA ELECTRIC CONVENTION OPENS AUSPICIOUSLY.

Large Attendance and Attractive Program Marks Opening of Twelfth Annual Convention of Pennsylvania Electric Association.

With delightful weather and an initial registration of 211, the twelfth annual convention of the Pennsylvania Electric Association opened at Bedford Springs, Pa., on Wednesday evening, Sept. 3, with a brilliant reception to the president of the association, Thomas Sproule, of Philadelphia, and Mrs. Sproule. It was followed by dancing. Every indication points to the convention being the largest in the history of the association. Large numbers of members and guests were expected to come on Thursday morning when the first business session was to open. An attractive exhibition is being made by a considerable number of manufacturers, the displays being arranged in a large tent adjacent to the hotel. A fine collection of prizes has been donated by various manufacturers and jobbers for the card games, golf, swimming and other contests on the entertainment program. Telegraphic advices at the time of going to press seem to bear out a close following of the technical program that was published in our last issue, but Gov. William C. Sproul of Pennsylvania will be present on Friday instead of Thursday. A report of the meeting will be given in our next issue.

NEW ENGLAND SECTION N. E. L. A. TO CONVENE.

Outline of Important Topics to Be Discussed at Annual Convention to Be Held at New London, Conn.

The eleventh annual convention of the New England Section of the National Electric Light Association will be held at the Hotel Griswold, New London, Conn., Sept. 22, 23 and 24. Plans have been made for seven interesting and helpful sessions, and it is expected that a large number will be in attendance. The afternoon session on Monday, Sept. 22, will be in charge of and assisted by members under forty years of age. F. A. Belden, Portsmouth, N. H., will be chairman of the meeting, assisted by Leavitt L. Edgar, of Boston. On Wednesday forenoon there will be an informal meeting for the discussion of subjects of general interest to accountants. The convention program may be summarized as follows:

Monday, Morning Session.—Address of the president George B. Leland, Stamford, Conn.; report of the treasurer, Bowen Tufts, Boston; report of the secretary, Miss O. A. Bursiel, Boston; reports of standing committees as follows: Advertising and Publicity, L. D. Gibbs, Boston, chairman; Accident Prevention, H. W. Moses, Boston, chairman; and Membership, Merle R. Griffeth, Boston, chairman. A paper will be presented by Perry Barker, fuel engineer, Boston, on "The Purchase of Coal." Also a paper entitled "High-Power Switching Apparatus Used in Connection with Large Systems," by Fred L. Hunt, Greenfield, Mass.

Monday, Afternoon Session.—The presentation of the following papers will be the feature of the afternoon session: "Courtesy and Goodwill," by Leavitt L. Edgar, Boston; "What a Manager Should Find in His Monthly Report," by H. A. Gidney, Boston; "Meter and Engineering Department Systems from the Standpoint of Service," by Frank W. Randall, Portsmouth, N. H. "The Cost of Serving the Small Lighting Customer," by Bowen Tufts, Boston; a talk on thrift and saving by Major William A. Atkinson, War Loan Organization, Boston, will be given.

Tuesday, Morning Session.—Report of Commercial Section Committee, of which C. E. Greenwood, of Boston, is chairman, will be presented.

Tuesday, Afternoon Session.—The commercial session will be continued in the afternoon and the following papers given: "Co-operative Features of a Central-Station Accounting Organization," by H. M. Edwards, New York City; "The Use of the Electric Range in a Small City," by E. F. Putnam, Greenwich, Conn., and "Electric Ranges and Water Heating," by M. C. Osborn, New Britain, Conn.

Tuesday, Evening Session.—The dinner will be held at 7 o'clock and will be followed by the Public Policy Session. Addresses will be made by R. H. Ballard, president of the National Electric Light Association, Los Angeles, Cal.; and F. G. R. Gordon, Boston, on "Municipal Ownership and Socialism."

Wednesday, Morning Session.—Following the presentation of papers by Wallace S. Clark, Schenectady, N. Y., on "High Tension Cables," and Nicholas Stahl, Providence, R. I., on "The Control and Improvement of Power Factor," discussions of these subjects by operating men will be engaged in. This will be ensued by a paper entitled "Planning for Power as Applied to New England," by Prof. Charles F. Scott, Sheffield Scientific School, New Haven, Conn.

Wednesday, Afternoon Session.—Reports of the following committees will be presented: Accounting Section Committee, Frederick E. Webster, Haverhill. Mass., chairman; Electric Vehicle Committee, Day Baker, Boston, chairman, and Heating Research Committee, G. F. Parsons, Boston, chairman. This part of the program will be succeeded by the annual meeting of Class A members and the election of officers.

A number of entertainment features have been provided for the convention, one of which is the dancing party on Monday evening in charge of Lieut.-Col. H. A. Gidney. This will immediately follow the reception and will be held in the ballroom of the Hotel Griswold. Attractive sports in the way of golf and tennis at the Country Club, adjoining the hotel, are offered to convention delegates, and prize contests in golf, as well as a tennis tournament, will be held during the three days of the convention.

NEW AND EXTRAORDINARY RECORDS IN ELECTRICAL EXPORTS.

Figures for June Over Double Those of a Year Ago—Fiscal Year Nearly 48% Better Than Last.

Astounding figures on the growth of our electrical export trade are disclosed in the monthly summary of the foreign commerce of the United States for last June, just issued by the Bureau of Foreign and Domestic Commerce, Washington, D. C. Electrical shipments for that month totaled over 100% above those of the corresponding month last year, and nearly 40% over the preceding monthly record established last March. The figures for June also complete the data for the fiscal year ended June 30, for which the extraordinary sum of over $80,700,000 was reported, this being nearly 48% over the preceding fiscal year and more than 34% above the highest twelve-month—the calendar year 1918, whose total was $59,982,526. All these figures would be still higher if they included electric locomotives; the latter are separately listed in the government reports; during the fiscal year these were shipped to the value of $327,947.

In the following table are given the comparative figures for last June, for June of 1918, and for the fiscal years ended June 30, 1919, and June 30, 1918:

Articles.	June 1919.	June 1918.	Fiscal year 1919.	Fiscal year 1918.
Batteries	$ 787,748	$ 272,316	$ 4,800,668	$ 3,351,838
Carbons	173,582	117,995	1,672,106	1,525,128
Dynamos or generators	760,546	133,549	4,269,103	2,688,169
Fans	130,817	164,486	1,297,017	818,338
Heating and cooking apparatus	192,551	49,185	1,222,886	533,988
Insulated wire and cables	1,420,699	340,138	8,683,304	5,730,766
Interior wiring supplies, including fixtures	280,631	138,805	1,926,177	1,532,309
Lamps—				
Arc	173	90	14,555	13,308
Carbon-filament	5,276	3,985	166,294	144,761
Metal-filament	530,085	475,768	4,465,075	3,182,516
Magnetos, spark plugs, etc.	219,826	167,710	3,020,610	3,167,325
Meters and measuring instruments	319,336	208,294	2,618,405	1,592,195
Motors	1,562,521	521,442	10,677,354	6,598,664
Rheostats and controllers	65,384	24,170	434,413	212,059
Switches and accessories	593,975	188,408	2,663,327	2,229,023
Telegraph apparatus, including wireless	92,220	11,659	765,011	294,297
Telephones	377,395	274,809	3,135,851	2,566,929
Transformers	438,483	464,195	4,423,007	2,343,968
All other	3,039,569	1,462,515	24,457,147	16,021,380
Total	$10,990,717	$5,019,519	$80,712,310	$54,546,961

In the following table are given the monthly totals of electrical shipments from the United States during the 12 months of the fiscal year ended June 30, 1919. This table shows that November, January, February, March and June in turn broke all preceding monthly records. These monthly figures also show that the extraordinary total for the fiscal year is due chiefly to the decided impetus to the foreign electrical trade since the signing of the armistice on Nov. 11, 1918.

Month.	Electrical exports.	Month.	Electrical exports.
July, 1918	$5,393,949	January, 1919	$6,722,524
August, 1918	5,340,110	February, 1919	7,566,089
September, 1918	5,146,077	March, 1919	7,876,353
October, 1918	4,860,392	April, 1919	7,709,138
November, 1918	6,177,252	May, 1919	7,717,518
December, 1918	5,187,931	June, 1919	10,990,717

The following table gives the totals for the last seven fiscal years.

Fiscal year.	Electrical exports.	Fiscal year.	Electrical exports.
1912-13	$26,772,816	1916-17	$51,903,823
1913-14	25,060,844	1917-18	54,546,961
1914-15	19,771,757	1918-19	80,712,310
1915-16	30,254,020		

This last table shows the effect of the world-wide depression just before breaking out of the World War, followed by the worse depression during its first year up to about the beginning of 1916 when both neutrals and belligerents began turning to the United States for their electrical supplies, since which time there has been steady growth of our foreign electrical shipment, especially since active fighting ceased last November.

CONCLUDING SESSIONS OF MICHIGAN SECTION N. E. L. A. TACKLE COMMERCIAL PROBLEMS.

Commercial Papers and Election of Officers Concludes Successful Meet.

The concluding session of the convention of the Michigan Section of the N. E. L. A., held Thursday morning, Aug. 28, was devoted to matters pertaining to electrical merchandising, electric ranges and cooking and fire insurance.

Three papers were presented, namely, "Electrical Merchandising" by A. H. Touscany, Detroit Edison Co.; "Electrical Ranges" by R. F. Hotton, Detroit Edison Co., and "Notes on Fire Insurance," by J. H. Lobben. In the absence of Mr. Lobben, his paper was read by S. L. Ferguson.

On the first two papers presented there was a general discussion, the main points being brought out on the paper dealing with electric ranges.

Mr. Johnson of the Consumers Power Co. opened this discussion in which he recommended making tests for the diversity factor; in this way an idea of the relation between the lighting load and that of the ranges can be readily obtained.

Mr. Cavanaugh of Benton Harbor spoke briefly as to his experience with electric ranges, covering 10 years experience. He pointed out that there was a big diversity factor in the electric range load so that the connected load could be far in excess of the transformer capacity serving electric range customers.

Following the open meeting of the morning, there was an executive session at which the following officers and Executive Committee were elected. The meeting then adjourned until the annual meeting next year.

W. M. Lewis, Muskegon, president.

Geo. E. Lewis, Ann Arbor, first vice-president.

John Swanson, Jackson, second vice-president.

Herbert Silvester, Ann Arbor, secretary-treasurer.

Executive Committee: Thos. Chandler, Sault Ste Marie; H. A. Fee, Adrian; John A. Cavanaugh, Benton Harbor; R. E. Keller, Kalamazoo; Earle L. Milliken, Houghton.

TWO NEW N. E. L. A. COMMITTEE CHAIRMEN ANNOUNCED.

J. F. Gilchrist and F. T. Griffith to Head Water-Power Development and Public Information Committees.

President R. H. Ballard, of the National Electric Light Association, announces the acceptance of John F. Gilchrist, vice-president of the Commonwealth Edison Co., of Chicago, Ill., as chairman of the Committee on Public Information, and also of Franklin T. Griffith, president of the Portland Railway, Light & Power Co., of Portland, Ore., as chairman of the Committee on Water Power Development. These important committees will have valuable and instructive reports to submit to the National convention of 1920, which will be held in Southern California.

The Committee on Public Information is a new committee and Mr. Gilchrist will organize it by establishing in each state or geographical section a local committee which will finance itself and furnish news bulletins to the press through member companies. Recommendations for appointment as members of the general committee, of men selected as chairmen of committees in various states, will be made by Mr. Gilchrist and will be submitted for approval to the president and to be acted upon by the Executive Committee.

This will be a very large committee but as its work will be largely devoted to states and geographical sections, it is unlikely that its entire membership will ever be called to meet. Thus its proportions will not be objectionable. Mr. Gilchrist was instrumental in starting a movement along these lines in Illinois which proved very successful. It is believed that to extend it to every state in which company members may desire assistance, will accelerate its effectiveness.

The work of the Committee on Water Power Development, which will be under the direction of Mr. Griffith and with which he will associate with himself prominent executives from all of the Pacific Coast companies and also some of the executives from eastern companies, has before it an enormous scope for its activities. The purpose of its organization is to investigate and encourage water-power development and it is the first general committee of the association to take up this most important feature of the electrical industry.

Both the Department of the Interior and the War Industry Board and other bodies have collected an enormous amount of data in relation to the problems of water-power development. Mr. Griffith's committee will not only collect and codify the information gathered by these bodies, putting it into workable shape for the use of geographical and central states, but will pursue when there seems to be necessity a line of original investigation. The necessity for conservation of the natural resources of the Nation, the impending shortage of both coal and fuel and the probability of large increases in the demand for electric energy by partial railroad electrification, make the work of this committee of paramount importance and its report will be of the greatest assistance in the large financing which extensive water development will involve.

EXECUTIVE COMMITTEE OF COMMERCIAL SECTION, N. E. L. A., HOLDS MEETING.

Plans for Work During Ensuing Year Presented and Approved at Recent Meeting.

The Executive Committee of the Commercial Section, National Electric Light Association, held a meeting recently at Association Island, N. Y. At this meeting the plans for the section work during the coming year were presented and discussed. John G. Learned, chairman of the section, presided at the meeting. The following officers and members were also in attendance: M. S. Seelman, Vice-Chairman; R. H. Tillman, Secretary; M. O. Dellplain, E. A. Edkins, F. H. Gale, L. D. Gibbs, R. S. Hale, O. R. Hogue, S. M. Kennedy, F. A. Ketcham, R. H. Knowlton, L. H. Lamont, C. L. Law, I. Lundgaard, F. D. Pembleton, A. A. Pope, Charles J. Russell and A. Jackson Marshall, Executive Representative; and by invitation Fred R. Jenkins, Walter Neumuller, C. K. Nichols and J. M. Wakeman.

At the first session Chairman Learned submitted a list of bureaus and committees, together with respective chairmen selected, as follows:

Bureaus.—Advertising and Publicity Service Bureau: L. D. Gibbs, Boston, chairman; Lighting Sales Bureau, Clarence L. Law, New York, chairman; Merchandise Sales Bureau, E. A. Edkins, Chicago, chairman; Power Sales Bureau, R. H. Knowlton, Philadelphia, chairman.

Committees.—Commercial Service and Relations with Customers Committee, R. F. Bonsall, Baltimore, chairman; Committee on Education, Fred R. Jenkins, Chicago, chairman; Committee on Relations with Contractors, Dealers and Jobbers, M. S. Seelman, Brooklyn, chairman; Committee on Compensation of Salesmen, Adolph Hertz, New York, chairman; Electrical Salesman's Handbook Committee, I. Lundgaard, Rochester, chairman; Finance Committee, M. S. Seelman, Brooklyn, chairman; Committee on the Sale of Company Securities to Customers and Resident Citizens, A. F. Hockenbeamer, San Francisco, chairman; Wiring Committee, R. S. Hale, Boston, chairman.

The appointment of A. Jackson Marshall as Executive Representative of the Commercial Section was confirmed.

In reporting for the Lighting Sales Bureau, Chairman Law presented a chart showing the organization of the bureau under which it is proposed to operate during the present year. The Executive Committee of the Lighting Sales Bureau will consist of representatives of the various geographic sections and company sections, appointed by the chairmen of these various sections; representative of the National Council of Lighting Fixture Manufacturers, a representative of National Association of Electrical Contractors and Dealers and the chairmen of the various divisions of the bureau. The chart also showed the channels through which the information collected by the various divisions of the bureau will be distributed. Through this organization it is proposed to keep closely in touch with all commercial subjects having reference to work of lighting sales.

The activities of the Lighting Sales Bureau will be substantially the same as in the past, with the addition, however, of activities necessary in co-operating with the various geographic sections, the company sections, and associations which will be affiliated with the bureau because of their relation to the general subject of lighting and its commercial aspects. Relative to the activities of the Lighting Sales Bureau at the 1920 convention, Mr. Law proposed to have a presentation of reports accompanied by demonstrations in all cases where possible. This is considered a good plan in view of the fact that it not only promotes interest in the report, but gives an opportunity to demonstrate practically the recommendations made by the committee.

In the discussion that followed it was the consensus of opinion that the organization plan evolved by Mr. Law would effectively connect the Commercial Section with the geographic sections, state organizations and company sections.

Consideration was then given to the matter of meetings of bureaus and committees and the Executive Committee of the Section during the administrative year.

Chairman R. H. Knowlton of the Power Sales Bureau made preliminary recommendations regarding divisional organization as follows: General power, industrial electric heating, electro chemical, isolated plant, electric steel furnace, current rate practices, special addresses for convention, and geographic sections. The recommendations were approved.

Chairman Edkins of the Merchandise Sales Bureau reported that this bureau was to be organized along two lines, dealing with "Research" and "Service," indicating that in his judgment the most important work which the bureau could undertake would be a thorough investigation as to the best methods of organizing merchandising activities, including how to improve present methods and how to secure more business. A tentative divisional organization outline of the Merchandise Sales Bureau was presented as follows: Household electric ranges, electrically equipped furniture, electric shop merchandise, merchandising service to central stations, merchandising statistics and economics and standardization and national testing. Some or all of these divisions will be further subdivided into groups.

Mr. Edkins also spoke of the desirability of representation of this bureau on the Advertising and Publicity Service Bureau, the Lighting Sales Bureau and the Power Sales Bureau, and any committees whose work may in any way be related to the development and sale of electric shop merchandise.

Chairman L. D. Gibbs of the Advertising and Publicity Service Bureau suggested that the bureau's work this year should be considerably broadened to the end that advertising and publicity service could be rendered the electrical industry, and that it should be the function of the bureau to impart information pertaining to Commercial Section activities to all branches of the industry and obtain the co-operation of all concerned. Chairman Gibbs recommended that the bureau be organized with two divisions and four groups: First, a Publications Division which would have charge of all booklets, circulars, etc., and a General Advertising Division with four groups: (a) co-ordinate advertising and sales campaign work; (b) illuminating engineering, co-operating with the Illuminating Engineering Society, Lighting Sales Bureau and other related activities; (c) co-operation with manufacturers of nationally advertised commodities; (d) more service outlets. There will be included in the personnel of this bureau at least one member from each state and liberal cross-membership with bureaus and committees of the Commercial Section.

Chairman R. S. Hale of the Wiring Committee recommended that the committee be permitted to prepare a lecture treating with wiring methods for the benefit of the contractors, etc., and advised that a sub-committee had been appointed to prepare a table of contents on the subjects which such lecture should cover. He also advised that it seemed desirable to prepare a lecture on wiring methods for the benefit of the householder, and that a subcommittee had been appointed to suggest a synopsis for this. Mr. Hale reported as to tests which the committee is conducting in the matter of wiring, which it is calculated will continue for a number of years with a view to ascertaining the behavior of different kinds of wire when employed under different conditions in actual practice.

Chairman I. Lundgaard of the Electrical Salesman's Handbook Committee reported that the supply of handbooks was entirely exhausted, and it would therefore be necessary to consider the publication of a new edition. A very extended discussion ensued regarding the form (loose leaf or bound volume) which the handbook should assume. The consensus of opinion favored the development of small bound volumes covering grouped subjects.

Chairman Fred R. Jenkins of the Committee on Education of Salesmen advised that he would attempt to organize this committee further along the general lines employed by the Lighting Sales Bureau. He emphasized the importance of educational courses, particularly at this time when central-station companies are rehabilitating their forces, depleted on account of the war, and asked the earnest co-operation of central-station commercial managers in this work, which would be emphasized this fall by an advertising campaign calculated to cause increased enrollment. In connection with the report consideration was given to the idea advanced by Chairman Jenkins that the committee be authorized to make available educational courses to other than N. E. L. A. members, and after discussion, Chairman Learned was requested to take this up with the National Executive Committee.

Chairman M. S. Seelman of the Committee on Relations with Contractors, Dealers and Jobbers advised that as this committee had been decided upon but recently, there had not been sufficient time to suggest personnel and to define its scope of activities. Mr. Seelman pointed out the desirability of close co-operation with other branches of the electrical industry, and suggested that the personnel of the committee might be formed of representatives of the jobbers association, contractor-dealers association, manufacturers association and representatives of the N. E. L. A.

S. M. Kennedy urged that the Committee on the Sales of Company Securities to Customers and Resident Citizens be continued, pointing out the growing tendency, at least in certain sections of the country, to sell central-station securities to the public, and stated that if such practice were continued the commercial men of central-station organizations were by temperament, experience and ability best qualified to merchandise them. A. H. Hockenbeamer, Pacific Gas & Electric Co., who has had considerable experience in the sale of securities to the public was appointed chairman of this committee.

L. A. McArthur, general manager of the Pacific Light & Power Co., Portland, Ore., was elected to fill the vacancy on the Executive Committee caused by the resignation of W. H. Hodge.

TRACTION LINES FORCED TO SHUT DOWN BECAUSE OF COST.

Two Lines in New York City Fail to Meet Operating Expenses for Years and Will Cease Operations.

The Public Service Commission for the First District, New York, has been informed that the Long Island Electric Railway Co., which operates as a trolley road from Jamaica to Far Rockaway, is ready to ask the courts, through a receivership, to discontinue operation, wind up its affairs and sell its rails and other property to the highest bidder. The company is owned jointly by the Interborough Rapid Transit Co. and by the Long Island Railroad Co., which have advanced numerous sums in recent years to provide its running expenses. The company has not paid interest on its bonds for many years and never has paid dividends on its stock. The parent company refused longer to advance moneys for maintenance and operation, and officials of the road declare they must shut down.

Commercial Practice

Merchandising Electrical Appliances—Economic Side of Central-Station Advertising—Continuous Service Ruling

OPPORTUNITIES AND DEVELOPMENTS IN ELECTRICAL MERCHANDISING.

Many Suggestions Contained in Paper Presented Before Sales Managers by Earnest A. Edkins.

At the recent meeting of central-station sales managers, a very interesting paper entitled "Merchandising Electrical Appliances" was presented by Earnest A. Edkins, general manager of the Electric Shops of the Commonwealth Edison Co., Chicago. In this paper Mr. Edkins gave many valuable suggestions on merchandising and building up sales which are of special interest to central-station men but are equally applicable and effective for any electrical retailing establishment and pointed out some of the present and impending opportunities and developments in the electrical merchandising field.

The basic principles and general methods of merchandising which have been pretty well thrashed out and standardized in other lines of retailing are just as applicable to the sale of electrical appliances. As these principles and methods have proven very successful in these other lines and also because the general public is accustomed to them they should be carefully studied by electrical merchants and applied to their business if the best results are to be obtained.

One of the most essential obligations laid upon the public service company is to render the very best possible service and this applies to merchandising by these firms as well as their other service. Real service, however, means giving the customer what he wants and in electrical merchandising it includes the selling of all goods associated with electricity. For example, a flashlight does not add any load to the central-station company's lines, but it should nevertheless be handled by the central-station retail shop as a mark of service. For to the average customer it is electrical and if he can not secure it at the electric shop he will go elsewhere for it and when in need of other electrical goods will go to the second place also. Under the heading of kindred merchandise comes such accessories as trays, creamers, sugar bowls, vacuum bottles, chafing dish sets, silk for lamp shades, parchment, automobile accessories, small electrical devices, etc. Such stock also averages up very profitably and is a big factor in increasing attendance, while without it the appeal of the electric shop is sharply limited.

Three plans for stimulating merchandise sales were also described in the paper—premiums, coupons and deferred payments. All these plans have proved satisfactory in many other lines and are employed with great success by Mr. Edkins in the Electric Shops.

The premium plan is looked upon in some quarters with considerable disfavor. However, it is based upon human nature and appeals to a universal weakness—the desire to get something for nothing, and as long as human nature remains what it is it will be an effective means of increasing sales.

The coupon plan has been tested by Mr. Edkins in the Electric Shops for three years and he has found that it increases attendance, multiplies good will and builds up all classes of sales. The coupons used by the electric shops are purchased from the Federal Profit Sharing Co. and are given to customers, one for each five-cent purchase. They are redeemable at the rate of 1000 coupons for each dollar of retail price for all sorts of electrical merchandise. The Electric Shops are reimbursed by the coupon company for the value of the merchandise so redeemed. These coupons are also sold by the Electric Shops to other merchants for distribution among their trade. During the first six months of this year 73,753,750 such coupons have been put out in the city of Chicago. Each of these coupons is an advertisement for the Electric Shops and every customer who becomes a collector also becomes a booster.

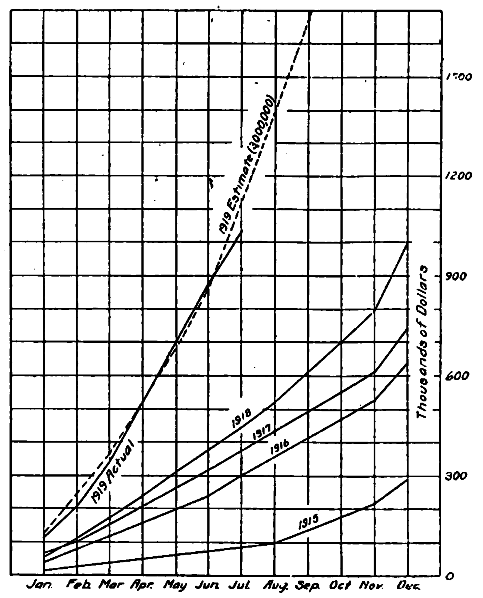


Chart Showing Increases in Merchandise Sales of Electric Shops of Commonwealth Edison Co., Chicago.

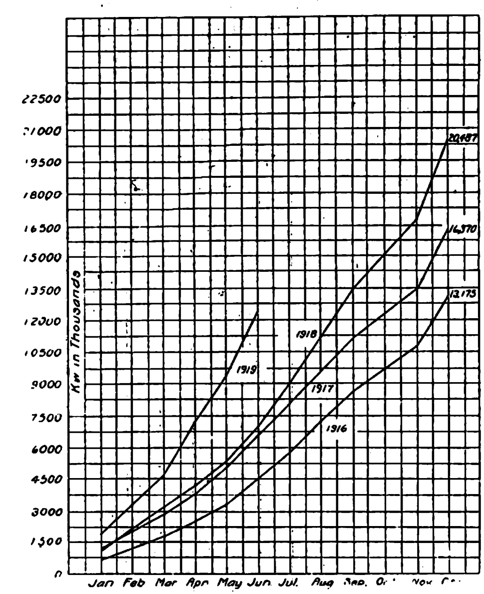
The tremendous value of the deferred-payment plan as a business builder is now recognized by the majority of central stations selling electrical merchandise. This plan is only another form of service and whether or not it is appreciated is perhaps best shown by the following figures. The success of this plan in other lines is shown by the following data compiled by the Chicago Association of Commerce covering a few of the articles sold in this city during 1918:

	Percentage of total sales sold on deferred payments.
Pianos	75%
Talking machines	90%
Refrigerators (over $50 each)	75%
Electric washers	80%

The following figures show the percentage in the Electric Shops on sales under different terms during the past five years during which the gross annual sales (not including lamps) have increased from $250,000, to approximately $3,000,000:

	Deferred payment.	Charge.	Cash.
1915	35%	40%	25%
1916	34%	30%	36%
1917	37%	27%	36%
1918 } 1919 }	47%	19%	34%

The specific opportunities for sales promotion offered by electric ironing machines, sewing machines, washers, suction sweepers, portable lamps and silk shades, seasonal sales, syndicating the sale of portable lamps and electric household conveniences were also fully described. Each of these appliances or methods offers a great field for activity which is especially favorable at the present time. The field for electric ironing machines, for example, has barely been touched yet it has been cultivated for many years by



Total Load Represented by Electrical Merchandise Sold by Electric Shops.

the sale of electric washing machines. The electric sewing machine is also especially desirable now for use in the small apartments in large cities.

The value of electrical appliances as load builders is now generally recognized. During the past few years when many central stations practically abandoned all efforts to secure new business that involved plant investment or line extensions this feature was especially desirable. The extent of the load thus secured by the Commonwealth Edison Co. through the appliance sales in its Electric Shops is shown by an accompanying chart.

It should also be remembered that the sale of appliances, backed up by painstaking service, constitutes one of the most valuable and effective means of creating good will toward the central station. So much comfort, convenience and labor-saving efficiency cannot be carried into the homes of its customers without inevitably causing them to feel kindly towards it in return.

The paper also called attention to the growing interest in and appreciation of the importance of style merchandise in electric shops. There is considerable room for improvement in the design of portable lamps, shades, electric appliances for table use, etc., but the manufacturers are now developing devices along this line and these developments should be watched with interest and be given practical support and encouragement.

Regarding the sales opportunities of electric ranges the paper included a number of figures showing the tremendous possibilities of this apparatus. In 100 towns now actively engaged in promoting ranges it was shown that only 0.22% of the population or 1% of the homes are now using electric ranges.

Another device that is just now beginning to appear on the market but offers a great opportunity for the electrical merchant is the electrically operated talking machine. The recent development of expensive cabinet types and period designs has made the projecting crank a very undesirable feature and the manufacturers are now squarely up against the necessity of producing electrically operated machines. When it is considered that about 4,500,000 of these machines are now produced every year the possibilities of this development for the electrical trade may readily be appreciated.

THE ECONOMICS OF CENTRAL-STATION ADVERTISING.

Abstract of Discussion Supplementing Paper by L. D. Gibbs at Recent Sales Managers' Convention.

By R. S. HALE,

Superintendent, Special Research Department, The Edison Electric Illuminating Co., Boston.

One great difficulty in analyzing advertising is that many things which are really advertising are not charged to advertising accounts, and also that the advertising department often does work and performs services which would have to be done anyway. There is no distinct line between the advertising account and many of the other accounts on the books.

In advertising, however, we may make a general division into:

1. Advertising that is a service for carrying on the business.
2. Advertising that is a promotion for increasing the business.

Though no sharp line can be drawn, yet, in the first class can be clearly placed such things as railway time-tables, or the sign over the door that directs people where to enter. The difference is that some advertising, like the railway time-table, really reduces the cost to the purchaser, while other advertising, such as advertising in the magazines, helps reduce the cost only if it increases the seller's output enough to enable him finally to reduce his price. This distinction becomes clearer if it is remembered that the purchaser of goods includes in his real costs not only the money he pays the seller, but his other expenses in making the purchase, such as freight and delivery charges, and also his own time, or the time of his purchasing agent in making the purchase. Anything, like a catalog, that saves the time of the purchasing agent really reduces the total cost to the purchaser, and, therefore, warrants the purchaser in paying a higher price to the seller, a price usually enough higher to pay for publishing the catalog. The catalog is then service rather than promotion. But, on the other hand, a beautiful large catalog sent out broadcast would be promotion advertising rather than service advertising.

This distinction between service advertising and promotion advertising is an important one. There is also another line of distinction which is a little different, and also very important. It depends on looking at the problem not only from a different angle, but from an entirely different viewpoint, and then this viewpoint brings out the reasons why advertising sometimes pays and sometimes does not pay.

The problem of advertising, as in all other problems, starts with some definite set of conditions, which may be described as the budget or plan for the next year and future years. Such a budget always exists in the mind of the executive, even if it is not put on paper.

When he considers the advertising problem, he considers what will be the effect if he spends, say, $10,000, for advertising in the daily newspapers. He figures that this will mean so many more kilowatt-hours sold, so much more coal, so much more labor, so much more expenditure for new service or plant, so much more interest or dividends on the new money, so much more income, and he finally decides what he had better do, as between the present budget based on no change in his orders, or the new budget based on a $10,000 expenditure.

He will also consider whether the particular advertising will stimulate existing customers or not, attract new ones, and so on. If on a central station each customer doubles the use, it is one thing. If on the other hand, the central station doubles the number of its customers, putting in no new lines, but only new services, it is another thing, while if a central station doubles by going into virgin territory, the case is still different.

It is true that ordinarily the increases in the business of a central station in different years are usually of much the same nature, and they usually involve a much greater increase in income than the increase in expenses. This is because a large portion of the increase in business comes on lines already built, and therefore, does not necessitate an extension. But this is not always true. An increase in business may involve a long line to reach a distant customer, or may just overload a turbine station and involve building a new station which will not be loaded for several years.

In the ordinary case the executive estimates that any increase in business will bring an increase in net profits, hence, he is willing to spend money in promotion advertising to get that business quicker. Even if he knows that the business will come anyway, say in five years, he may figure that spending one year's profits to get it all on his books in anything less than four years may show a profit.

On the other hand, in the case that is not ordinary, the reverse may happen. When it is a question of a long expensive line and a small increase in income, the net profits will probably be greater if the long line is postponed instead of hastened. In such cases advertising to increase the business would do harm. During the war, budgets without promotion advertising showed better results than the budgets that included promotion advertising, since the latter at that time involved a much greater investment than the expected increase in income.

The result of this analysis clearly points to the importance of directed advertising, that is, to the importance of advertising strenuously in some cases, and not advertising or promoting at all in other cases. As the matter is gone into further, the importance of directed advertising comes out even more clearly.

For example, in the electric business there is the off-peak business. We can usually afford to stimulate fan business, heating business and power business, since on the whole each kilowatt-hour thus used increases expenses less than kilowatt-hours used for lighting. Even if lower rates are made for this off-peak business, they are a form of promotion advertising, and the question is, will such advertising increase the net profits enough to warrant the expenditure? Off-peak rates might even be made so low that it would pay to stimulate peak business by advertising. Conditions differ in each case, but the problem always is:

What will happen if we go along without change?

What will happen if we make some change?

Finally, which is best of all the possibilities considered?

In central-station advertising a case might be made out for directing the advertising solely at customers adjacent to existing lines. This is seductive since a new customer who requires only a service is much more profitable than if an extension is required. If, however, the extension of lines goes along a street with many prospects, the general budget should include an allowance for the advertising power of the new line and customer. In my opinion 90% of the growth of the ordinary central station is the result of the talk of its existing customers. Therefore every customer, even if he is individually unprofitable, helps to get other profitable customers.

However, the fact that the new line may be worth while because of its effect in getting still more business does not lessen the importance of considering each case, and of directing the advertising. General advertising, it must be remembered, is also directed advertising in the sense that it is directed generally, and not at some particular feature. Obtaining the good will of the public, for example, is general advertising which is directed at the whole business. Such work is one job of the advertising department, though other departments should also obtain good will. The important point is the comparison of budgets and basing the final decision on a comparison that includes all the things that effect net profits.

Any advertising man who merely tries to increase the gross business of the company by advertising is neglectful of the company's interests and his own. He must consider the net results of each possible budget, campaign or plan. The advertising man should always be able to judge, approximately at least, the probable effect of his advertising on the gross business of the company; but that is not enough for the executive. He is concerned in the effect on the net profits. It is the probable final result that guides the executive in his decision as to which of several plans will be best. The executive will decide, but if the advertising man gets a clear idea of how his proposition will be judged, he will be able to present to the executive the propositions that will be the most attractive and most likely of acceptance.

MISSOURI COMMISSION RULES REGARDING CONTINUOUS SERVICE.

An interesting decision was made by the Public Service Commission of Missouri in the matter of the application of the Vandalia Electric Light Co., Vandalia, Mo., to discontinue service between 11 p. m. and 5 a. m. each day or increase its charges. The company had recently lost a large customer through the shutting down of the plant which prevented its rendering continuous service at a profit. The people of the town however were desirous of retaining such service but were of the opinion that the company should receive a fair rate for its services. The commission therefore ruled that the company should exact a surcharge of 10% on all bills except municipal accounts but that continuous service must be maintained.

Operating Practice

Metering Hydroelectric Auxiliaries—Transmission Line Practices and Precautions — Steam Operating Problems

METERING OF AUXILIARIES AIDS ECONOMY OF HYDROELECTRIC PLANT.

Conservation of Water Power Follows Regular or Periodic Use of Instruments.

By Marcus A. Stillson.

When the war created an unprecedented demand for power and fuel, the hydroelectric plants of industrial concerns and public utilities were forced to take steps to utilize all available energy by reducing wastes and eliminating needless uses. And it is surprising what a large amount of water may be needlessly wasted through carelessness and lack of appreciation of its magnitude.

One instance where water is frequently allowed to be wasted is in driving the auxiliaries, exciters and pumps, etc. The most economical distribution of a given excitation and the auxiliary loads of any hydroelectric plant between motor drive and water-wheel drive is obtained only after output-discharge curves have been plotted and it is then known when the auxiliaries should be driven direct by water power or by motor obtaining its energy from the generators.

The auxiliaries of hydroelectric plants consume about 1% of the high-flow station output, excluding the power required for generator excitation. Notwithstanding this, it is usually possible to bring about a measurable economy of water power by a careful study of the load requirements of each individual piece of apparatus without financial expenditure. During times of extreme low flow stages the 1% mentioned above may easily become 2, 3 and even 4%, since certain of the station auxiliaries are required irrespective of the energy output of the station.

In many hydroelectric power houses no provision is made in the original installation to permit measuring the electrical input to motor-driven auxiliaries. This is a pity, because it is well to know just what are the power requirements of each motor-driven auxiliary and to what extent this demand varies from time to time with the station output. Such data enables economies to be made by modifying the mode of operating as already outlined. However, if permanent installations of watthour meters is not feasible, because of cost, it is usually quite feasible to furnish a means by which such instruments can be quickly inserted in circuit for periodic investigations. This proposal can be carried out quite inexpensively by installing small panels beside each motor-driven unit, upon which jumpers are mounted so as to permit connecting measuring instruments in circuit at any time without interrupting the flow of current to the motor. In this way the initial investment can be kept down with very little loss in flexibility.

It might be stated that the readiness with which operating engineers carry out tests to improve the water economy of their stations depends very largely upon the case with which the tests may be made.

PRACTICES AND PRECAUTIONS IN WORKING ON LIVE TRANSMISSION LINES.

Linework Experiences and Policies of Consumers Power Company.

Several different methods are used by the Consumers Power Co. to test and change the insulators on their high-tension lines, the fundamental principle of them being that there is always a long insulating rod or other appliance between the man and the live part that is to be worked upon. In testing insulators on live lines advantage is taken of the fact that a difference of potential exists between the cap and pin of a disk insulator. A healthy, static spark is obtained if the insulator is good. If the insulator is poor, a weak spark or no spark at all results. The presence or absence of static on insulators can be readily determined and with proper tools an experienced man has no difficulty in picking out defective insulators. A line foreman standing on the ground 50 to 100 ft. from the pole or tower where the work is going on can clearly distinguish between a good and bad insulator by the noise made by the static spark.

The following is a brief description of one of the methods used to change defective insulators on high tension lines. The insulators are first tested and the defective ones are noted, a record being kept of the pole or tower and the position of the insulators. A crew, generally consisting of six men and the foreman, do the work of changing the insulators. Long insulating rods are first attached to the wire and the line is secured in position and held so it can not swing into the poles or towers. By means of rope blocks handled by men on the ground, the rods force the wire upward and outward from its regular position. This relieves the strain on the insulators and also holds the wire securely. The defective insulator is then removed and replaced with a good one. With proper tools it is not necessary for any of the workers to approach or place their hands or any part of their body within dangerous proximity of any live conductor.

Special Precautions to be Observed in Case of Line Trouble.

Noise and static on telephone lines, discharging lighting arresters or an unusual amount of static on or around lines and insulators indicates trouble and it may be due to defective insulators or to an "arcing ground," on the high-tension lines. Foremen should instruct their men to work with extreme caution at such times. It is generally advisable to stop the regular work of changing insulators until the cause of the trouble has been located. This precaution should always be heeded on system with a grounded neutral.

Before any work on high tension transmission lines is undertaken for the first time, a careful analysis is always made of the job. Each operation should be considered and men should be selected and trained for the different operations they have to perform.

It is interesting to note that linemen who have tried both methods of changing insulators would rather work on live lines with insulating rods between them and the line, than on "dead" lines without this protection. The dangers incident to the accidental energizing of lines that are supposed to be "dead" are eliminated. Emergency or rush work which always adds to hazard is to an extent avoided and the work can generally be done in the day time when the light is good.

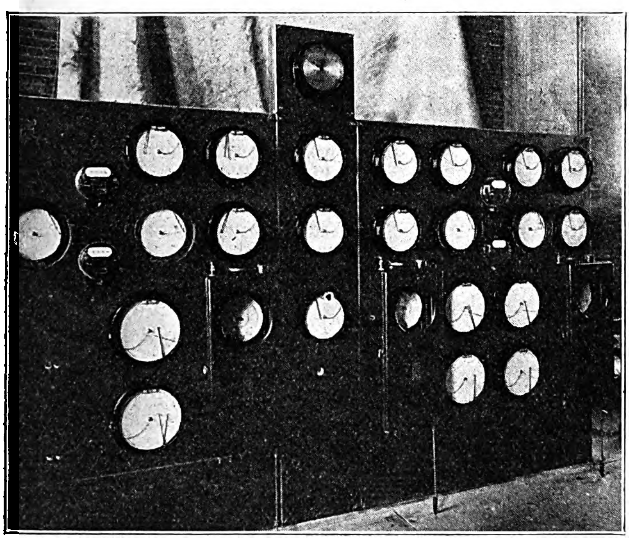
Telephone, telegraph, signal and other lines that parallel high-tension lines are always liable to be more or less energized and dangerous to handle. This fact should not be overlooked in instructions given to linemen.

The above is abstracted from a paper by H. J. Burton, before the Michigan Section of the N. E. L. A. In summing up Mr. Burton said: "The prime requisites for safe working on high-tension lines are: safe construction, a good foreman, competent workmen, equipped with proper tools and insulating appliances."

DETECTING THE PRIMING OF BOILERS.

Thermometers and Leaks in Pipes May Be Used as Tell-tales.

The priming of boilers is often most troublesome and frequently very persistent. As a matter of fact, it often happens that boilers are priming without the knowledge of the firemen or water tenders or whoever it may be that should be conversant with the situation. Evidence of priming may be entirely lacking



Board Containing Full Equipment of Instruments by Which Priming Could be Detected.

in the glass, and the attendants may make the assertion that the boilers are not priming while they actually are doing so.

The real test lies in the quality of the steam leaving a boiler, of course. That means the temperature of the steam leaving the superheater, and this fact may be utilized as a check on a boiler that is suspected of priming, by the very simple expedient of installing a recording thermometer on the steam outlet from the superheater. Priming will be indicated, obviously, by sharp fluctuations in the superheat temperature curve and thus bring to light priming that might otherwise occur and persist without knowledge. The accompanying illustration is that of boiler-room instruments installed in the power house of the Oshkosh Gas Light Co. Fixture recording thermometers are installed in a convenient location so as to indicate priming.

Superheated steam is invisible whereas wet steam is visible, and this fact may also be utilized as a tale-tell of bad priming. A small leak in the steam line between superheater and the main steam header or line does not make itself visible so long as superheated steam escapes, but dirctly the boiler primes and wet steam passes through the leak, the leak becomes visible and indicates that priming of the boilers is occurring.

SEALING OF TURBO LABYRINTHS IN 9400-KW. STATION.

By Mark Meredith.

In a steam plant there were one 4000-kw., two 2000-kw. and 750-kw. turbines, two of which have water-sealed pressure, and a comparison of these two methods of sealing, from an operating point of view, can therefore be readily made. The load curve for a 24-hour run of the small central station is a very erratic one, as there are continual small variations occurring in the load and also high peaks. This entails constant vigilance on the part of the turbine attendant, as the exhaust pressure on a turbine varies with each variation of the load, and the steam pressure on the high and low-pressure glands has to be adjusted accordingly. Any neglect or oversight on the part of the attendant in this matter, if the load drops considerably, results in a decrease in vacuum and a corresponding increase in steam consumption for the turbine. As this will probably occur a considerable number of times during a 24-hour run, it will be realized that it has a tendency to cause the steam consumption to be excessive.

The load connected to this station includes a 600-kw. electric furnace, which causes widely-varying and continual fluctuations in the load, and this aggravates the troubles, especially when it is run from one of the 2000-kw. turbines which has steam-sealed glands. The steam for sealing the glands on the 2000-kw. turbines has to be adjusted very closely as an even slight excessive amount of steam causes overheating of the thrusts bearings.

For the two turbogenerators having water-sealed glands the arrangement is as follows: A water storage tank is fixed to the engine room wall at a height considerably above the turbine level, and this is supplied from the city water supply. A ball valve is inserted in the tank to regulate the water level, and the water falls by gravity through pipes to the turbine glands. The water pressure on the glands is therefore a few pounds above atmospheric pressure, say 20 to 25 lb. per sq. in., hence it will be obvious that when a turbine is started up and water is put on the glands, no further adjustment is necessary, as the glands are continually sealed, irrespective of the variations in load and vacuum. This eliminates the reliance placed on the turbine attendant when steam pressure is used, and tends to reduce the steam consumption of the turbine, as the vacuum is maintained during the whole time the turbines are on load, unless condenser troubles occur.

Contractor-Dealer

Getting After the Outlet Business—Value of National Publicity — Successful Advertising — One Jobber's Policies

FOLLOW-UP APPLIANCE SALES FOR OUTLET BUSINESS.

Proper Service Requires Dealer to Assist Customer in Using Appliances.

A great deal has been said recently about laxity of the electrical contractor who when he wires a home makes no attempt to sell the customer electrical appliances at the same time or to follow up the opportunity thus presented and sell the prospect at some future date. But how about the dealer who sells an electrical device without attempting to find out how the customer is going to use it. Isn't he also passing up a great opportunity? He surely is, and not only that, but he cannot consider that his service is even good unless he makes it convenient for his customer to use the device as well as to purchase it.

No reputable dealer would think of selling a customer a bell-ringing transformer to use in a building where the service was direct current. Yet they will sell a customer a washing machine or a vacuum cleaner and give the customer an extra extension cord without even suggesting the convenience of a suitable outlet.

The advantage of following up such sales is shown in a recent article in the *Monthly Sales Service* of the Society for Electrical Development. According to this article, one small contractor-dealer makes it a practice when he has sold a fan or other electric appliance to try to deliver it himself. Very often he calls with the fan on his way home in the evening. He goes into the home, supposedly simply to connect the fan and see that it runs properly, but the real reason is to see what wiring work he can find to be done.

In a great many cases he finds that it is necessary to unscrew a lamp in order to connect a fan. Sometimes there is but one light in the room, as in a bedroom. This gives him an excellent chance to suggest the installation of convenient outlets. By guiding the conversation along the right lines he has in several cases made other suggestions which have resulted in improving the customer's wiring—and in business for himself.

This plan can easily be modified so that a salesman delivers the appliance and makes the suggestions. It is a peculiar fact that many people, once having made a purchase, are in a very receptive mood for other sales suggestions.

HOW CONTRACTOR-DEALERS CAN TIE-IN WITH NATIONAL ADVERTISING.

National Lamp Works Offers Opportunity for Dealers to Cash In on "The Great Discovery."

Many manufacturers of electrical devices and appliances are now conducting national advertising campaigns which both in total amount and attractiveness surpass the advertising of practically every other industry. This advertising is securing a great deal of valuable publicity and creating a desire for these appliances from the public. However in order to get the proper results the electrical contractor-dealer must grasp the opportunity thus presented by tying-in with this advertising and letting the public know where they can get the merchandise advertised.

In order to assist its dealers to tie-in with the intensive national advertising campaign which it will conduct from now until the end of this year, the National Lamp Works of the General Electric Co., Cleveland, is distributing a pamphlet describing its advertising plans and the methods by which the local dealer can co-operate and reap the benefits.

The story of the campaign is hinged upon the phrase "The Great Discovery." In every branch of lighting, people need to make the discovery that lighting is of real importance to their comfort and convenience. The factory man, the merchant, and the home maker, all will come to realize it through the medium of the advertisements. It remains for the dealer to come out in front of this advertising, let the people know where they can get good lighting and who can help them secure it. This can only be done by accepting and using the helps offered the dealer by the company.

The first advertisement of the campaign appeared in the Aug. 30 issue of the *Saturday Evening Post.* To accompany this the company sent out to each one of its agents an attractive window trim similar to the advertisement for display at that time. The other advertisements of the series will appear shortly in prominent publications.

In addition to these tie-up trims the company offers the lamp agent 13 other ways to cash in directly on the national advertising. Among these other ways are plan books covering store lighting, window lighting, industrial lighting, refixturing and relamping electric signs, sales plans, and also a salesmen's contest plan book. There are also seasonable trims. litho cut-out displays, counter displays, an ad book to assist the dealer in preparing newspaper copy, monthly advertisements for newspapers, the regular tie-up theater slides and a special monthly slide.

THE ESSENTIAL FEATURES OF SUCCESSFUL ADVERTISING.

Quality Goods and Good Service Must Back Up the Dealer's Advertising.

By Chester A. Gauss.

A great many people consider advertising a mysterious force which can sell goods and services of all kinds regardless of the value given in return. Nothing is further from the truth. Advertising is something that is intimately associated with the commodity or services on sale. It cannot be applied successfully to a proposition unless it is founded on principles and qualities dug out from the goods or services themselves.

Advertising can make the first sale of a commodity or services but after that the commodity or services must largely help to sell themselves. Advertising will bring a customer into your store but it will not give him courteous and pleasing service. It will not take an interest in seeing that he secures what is best fitted for his purposes nor that he is satisfied with his purchase. Advertising cannot make goods operate satisfactorily. It cannot say "thank you." All this the electrical contractor-dealer must do himself.

Successful advertising is that which is founded on two things—quality goods and good service. No amount of advertising can counteract the adverse advertising created through the selling of unreliable goods in a poor way.

Advertising in the broader sense of the word does not merely mean the use of printer's ink. It means getting one's goods and services impressed as reliable and inviting upon the minds of a community. Printed advertising will aid in doing this. It is cheaper than making a call on every inhabitant of a city and having a heart to heart talk with him about one's goods and services and consumes less time. It is quicker than waiting for people to become acquainted with the quality of the goods and services through satisfied customers. It is, hence, advisable to use printer's ink but, where used, it should be devoted to telling and convincing people that dealers' goods are of the best quality and that the dealer aims to give the most courteous and satisfactory service in town.

But such advertising must have all its statements backed up. The goods must be of the best value. The store show-windows must be attractively dressed, the exterior of the store pleasingly painted and the interior made attractive and inviting. In addition to this courteous and satisfactory service must be given all who enter.

Printed advertising cannot build up business unless it is backed by goods, store and service. But one's store, goods and services can build up trade without the use of printer's ink more slowly, of course, than with the aid of printed advertising, but upon a firm foundation. Make your goods, services and store an advertisement for you before expecting printers' ink to build up your business.

MOHAWK JOBBING COMPANY EXPLAINS POLICY TOWARD DEALERS.

Value of New Self-Selling Box Label Line Also Described to Company's Dealers.

The laudable attitude of the Mohawk Electrical Supply Co. of Syracuse, N. Y., toward its dealers was explained very clearly in a recent issue of *The Mohawk Trail,* the house organ of the company. In this it was stated that no inquiry that comes from any town or city where there is a Mohawk dealer is ever handled by the company except for the account and profit of the local dealer.

It is the company's aim to build up 100% dealers in every town, selling the full household appliance line so that all the appliances sold there may clear through that dealer and bring him income. For this reason a good strong sales letter is sent in reply to every inquiry from towns where there is a dealer asking the prospect to buy from the dealer. A copy of the reply is sent to the dealer also. If the customer insists on purchasing from the company, the dealer is still taken care of, for the sale is made to his account and he is credited with the retail profit.

In the same issue is an article describing the many advantages of new General Electric self-selling box label line and how it opens an opportunity for the contractor-dealer. For many years dealers have realized that they were badly handicapped from the nature of electrical goods, being for the most part mysterious "electrical things" that did not appeal, for few people knew what they were for. In the new line of packages these devices are changed into appealing household merchandise, for each package is covered with a carefully prepared label illustrating its use. It is the little things like this that count the most in merchandising and they should prove a big help to the dealer in increasing sales.

BUY ELECTRICAL GOODS AT ELECTRICAL STORES.

Amusing Incident That Demonstrates Inability of Other Merchants to Sell Electrical Devices.

An amusing incident occurred in a large department store some time ago that clearly demonstrated the desirability of buying electrical goods from an electrical shop. It happened in the toy department where a large collection of toy motors and other electrically operated toys were attracting a great deal of attention.

A prosperous looking customer approached the saleslady, evidently taken from some other department to fill in during the temporary rush, with the question, "Are all those electrical motors?" Upon receiving a reply in the affirmative he asked to be shown a neat appearing device from the display to which was connected several feet of lamp cord and a plug and a tag announcing the price, $2. He explained that his boy had wanted a motor for some time but appeared doubtful as to whether or not this particular device would fill the bill. The girl readily assured him with the statement that "all you have to do is screw this into any light socket" and the sale was made.

The observer was sorely tempted to interfere in the bargain but did not, feeling that the customer will hereafter patronize electrical stores when shopping for electrical goods—after he has tried to make that bell transformer run.

SEPTEMBER IS ELECTRIC WASHING MACHINE MONTH.

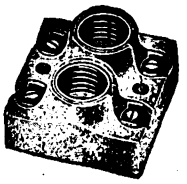
September has been designated on the electrical merchandising calendar or schedule as "washing machine month." During this month electrical contractor-dealers should concentrate their efforts on this particular device, tie-in with the manufacturers' national advertising, the central-station, jobbers and other dealers in local advertising and publicity, display washers, demonstrate washers, talk washers and sell washers. The short, cold, tempestuous winter days will soon be here when washing by hand is more disagreeable and arduous than ever and drying clothes is next to impossible. The use of an electric washer will shorten the washing time and lengthen the drying time and will enable the housewife to take advantage of the first good day and get her wash out to dry early.

New Appliances

Porcelain Cutouts—Improved Type Current Tap—Cleaner with Motor-Driven Brushes — Automatic Compensator

Arrow Porcelain Plug Cutouts.

To its extensive line of sockets, receptacles, switches, etc., the Arrow Electric Co., Hartford, Conn., has added a line of porcelain plug-fuse cutouts, of which the one shown is rated

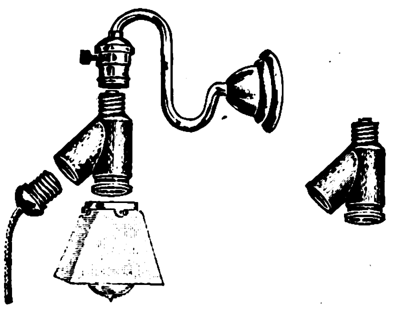


Arrow Plug-Fuse Cutout for 30 Amperes, 125 Volts.

at 30 amperes, 125 volts. They are made in single, double and triple-pole plain types and also in standard double-pole branches from two or three-wire mains. They are all made of the highest grade materials and meet all requirements.

Ajax Plural Socket Plug.

A new attachment plug especially designed to meet the needs for a two-way plug for the use of a lamp and an appliance at the same time has recently been placed on the market by the Ajax Electric Specialty Co., 1011 Market street, St. Louis, Mo. It is called the Ajax plural socket plug and offers many advantages over many of the older types of such plugs that were pri-



Ajax Plural Socket Plug Showing Design Which Does Not Change Position of Lamp. At Right, Plural Plug Only, Showing One-Piece Construction.

marily intended for the use of two lamps rather than a lamp and appliance. On this account such plugs can not be used in modern lighting arrangement without disturbing the original lighting effect.

In the Ajax plug, as shown by the accompanying illustration, the lighting socket remains directly in line with the fixture socket, the appliance socket being set at an angle to this. The lighting socket terminal is also provided with a groove for attaching shade holders and which will accommodate any ordinary holder. Both sockets are designed to accommodate an Edison base lamp or extension plug. In order to insure a good contact with all such plugs, however, a spring center contact has been placed in both sockets.

The plug is made in one piece, eliminating poor contacts, loss of parts or extra terminals. It is covered with Bakelite insulation, which adds greatly to its ruggedness.

New Premier Combination Electric Vacuum Cleaner.

The Electric Vacuum Cleaner Co. Inc., of Cleveland, Ohio, has just announced an addition to its line of cleaners to be called the new "Premier." This is styled the complete cleaner and combines three methods—the bristle brush, the rubber-fingered brush and the vacuum. A tufted bristle brush and a pliable rubber-fingered brush, both motor driven and interchangeable, are furnished. Either can be instantly removed and the cleaning done by the machine's extra powerful suction alone.

The rubber-fingered brush is the special feature of this cleaner it being the only machine so equipped. The rubber fingers pick up the dirt in a manner closely akin to that of a human hand performing the same task. The bristle brush is said to be the most effective yet put on the market.

The machine is equipped with a universal-type, air-cooled General Electric motor and rubber-tired wheels to make it easy running and prevent marring the floor. The power control is an integral part of the pistol grip handle—a handle so arranged that it will stand rigidly upright at will. The ingenious nozzle mechanism makes adjustments unnecessary. Because of this improvement the Premier is automatically adjusted to get all the dirt regardless of the depth of the nap.

This machine will retail at a higher price than the present model Premier so that dealers handling the Premier line will have a low and a medium priced cleaner to meet all demands.

Automatic Compensator for Squirrel-Cage Induction Motors.

The new automatic compensator which has recently been placed on the market by the Industrial Controller Co., Milwaukee, Wis., is a device which is considerably different from anything than has heretofore been offered for the purpose.

This compensator is intended for starting and stopping automatically, or at remote points, squirrel-cage induction motors of practically any size. The entire stopping and starting of the motor is accomplished by means of remote-control stations, one or more of which can be situated at convenient points, while the compensator itself may be located on the ceiling near to the motor, or at any other out-of-the-way location.

The compensator mechanism consists of magnetic contactors operated under oil and which may be easily removed from the oil (revolving around an operating shaft) for convenient inspection or replacement of the contacts. In addition to the magnetic contactors the device contains a suitable autotransformer and two time-limit overload relays, and the entire compensator, including the relays, is enclosed in a single dustproof steel casing.

Under-voltage protection is provided as the magnetic contactors open upon failure of the voltage, and inverse-time-

New Automatic Compensator for Control of Induction Motors from Remote Points.

element relays are provided as standard for overload protection.

A novel feature of this compensator is the fact that the period of acceleration may be at any time changed at the remote-control station without the necessity of disturbing or in any way changing the compensator itself. With this compensator the motor, when so desired, may be "inched," as this in many installations is desired on some types of machinery or when replacing belts.

A suitable lock is provided at each control station, so that when it is desired that the motor be stopped and kept stopped for any reason whatever, it may be locked into the "off" position at the remote-control station so that it cannot be started from the station at which it is locked out or at any other control station operating the compensator.

The makers claim considerable saving in the installation of this type of compensator is due to the fact that it may be conveniently located near to the motor, eliminating long conduit runs for heavy cable which might be required were the hand compensator used.

Trade Activities

Edison Electric Appliance Establishes Central District Office—Godfrey Conveyor Co. Incorporates—Literature

Edison Electric Appliance Co., Hotpoint Division, Chicago, has issued price list No. 16 on Hotpoint appliances, effective Aug. 18 and supersedes all previous issues. A supplementary parts price list on Hotpoint devices is also being distributed.

The Republic Engineers, Inc., consulting and constructing engineer, 60 Broadway, New York City, has been engaged by the Pennsylvania Cement Co. in connection with the proposed installation of waste heat boiler and power plant at its cement mill at Bath, Pa.

Electrical Engineers Equipment Co., Chicago, designer and builder of power plant appliances, has appointed F. H. Boyer as a sales representative. Mr. Boyer, who was formerly connected with the Chicago office, has opened an office in the Hubbell building, Des Moines, Iowa, and will represent the company in the states of Iowa and Nebraska.

E. L. M. Engineering Co., Prescott, Ariz., has been organized by W. C. Ellis, L. H. Lockwood, and E. R. McCartney. The new company will handle civil, electric and mechanical work as designers and supervisors throughout the northern part of Arizona. For the past year these gentlemen have been on the engineering staff at Whipple Barracks, General Hospital No. 20, U. S. A., Prescott, Arizona.

The Wellman-Seaver-Morgan Co., Cleveland, Ohio, is distributing Bulletin No. 27, which has for its subject W-S-M automatic ore unloaders. This publication comprises 12 pages and describes at length the successful use of its ore unloaders on the Great Lakes. Excellent illustrations of typical installations of the equipment are given, which give some idea of what may be accomplished by the use of W-S-M ore unloaders. Copies of the bulletin will be furnished free upon request to the company.

Edison Electric Appliance Co., Inc., 5660 West Taylor street, Chicago, announces the establishment of its central district office at its general offices, Chicago, with Walter M. Fagan, district sales manager, in charge. This district comprises the following states: Michigan, Ohio, Kentucky, west half of West Virginia, Wisconsin, Illinois, Indiana, Iowa, Kansas, Nebraska, Colorado, Wyoming, New Mexico, Oklahoma, North Dakota, South Dakota, Minnesota, Arkansas, Texas, Missouri and eastern part of Montana. With the establishment of the central district, all correspondence pertaining to sales matters, covering all lines of apparatus, should be addressed to the attention of the district sales manager. All salesmen of the company will call on customers whether they are selling Hotpoint, Edison, Hughes or General Electric type appliances.

T. W. Price Engineering Co., New York, announces the appointment of J. L. Dixon as metallurgist and electric furnace engineer. Mr. Dixon was instrumental in the development of the Gronwall-Dixon furnace and has had an extensive experience in the design, installation and operation of electric furnaces, covering a period of 11 years. The company will construct and install an electric furnace to be known as the Price-Dixon electric furnace; and in addition will continue to practice consulting engineering, specializing in the design of foundries, rolling mills and also machinery and processes. The Price company has just recently completed the design and purchased equipment for a rolling mill to be installed in Japan.

Green Engineering Co., with main offices and shops at East Chicago, Ind., announces the appointment of E. L. Sullivan as its representative in the Pittsburgh district, including western Pennsylvania, eastern Ohio and western West Virginia. Mr. Sullivan has been a special representative for the McDonough Regulator Co. for the past ten years, six years in Chicago and four in Pittsburgh. He has devoted all of his time to special investigations pertaining to the securing of more efficient boiler and furnace operation. He has had a long intensive experience in matters pertaining to boiler and furnace operation, and the company is to be congratulated on securing such excellent representation for Green chain grate stokers, Sealflex arches, steam jet ash conveyors, cast iron ash tanks, and replacements for the same. Mr. Sullivan will maintain the present offices at 2545 Oliver building, Pittsburgh.

Allis-Chalmers Manufacturing Co., Milwaukee, Wis., manufacturer of concentrating machinery and equipment, is distributing illustrated catalog No. 107, comprising 112 pages. This bulletin describes the latest types and designs of machinery that have been developed to meet the demands of modern practice in the concentration and dressing of ores. Some ten pages are devoted to a discussion of the subject of concentration following which are detailed descriptions of concentrating equipment. Much data are included covering individual machines, devoting particular attention to those machines which have shown the great progress and which are recognized as standard. The bulletin is profusely illustrated, showing views of typical installations of concentrator equipment and of the various types of machines. It contains considerable data which will be of value and assistance in the selection of suitable and properly balanced units for concentration work.

The Driver-Harris Co., Harrison, N. J., is now selling its wire rope products direct to the trade instead of through its former selling agents. These products include sash cord and tiller rope in plain iron, galvanized iron, phosphor bronze, special bronze, monel metal, and all special grades. In addition to this, the company has increased its facilities to include all grades of rope in 6x7, 6x12 and 6x19 construction, such as drilling cable, elevator rope, haulage rope, sand lines, etc., in all sizes up to ¾ in. The other products of the company are resistance materials of nickel alloys in the form of wire, strip and sheet for electric heating controllers, rheostats and resistance elements, wire for spark plugs and weaving; rods and sheets of pure nickel and its alloys; cold rolled strip steel, nichrome castings such as annealing boxes, carbonizing boxes, pots, tubes, rotary and stationary retorts, dipping baskets, pyrometer protection tubes, etc., flexible heater cord and thermostrip.

Godfrey Conveyor Co., Elkart, Ind., has just completed its incorporation, which will enable this firm to manufacture on a much larger scale the Godfrey coal conveyor in order to meet the wide demand for this device. Ever since the first announcement by John F. Godfrey several years ago of a simple and practical conveyor system that would handle all sizes of coal and similar materials mechanically, there has been a steadily increasing interest in Godfrey conveyors on the part of those firms seeking greater economy and efficiency. Although its facilities for delivering the Godfrey conveyor have been increased during the past few months, the sales have far exceeded production and orders have been delayed from fifty to sixty days. The organization is headed by John F. Godfrey, originator, inventor and manufacturer of the conveyors, who has been chosen president of the board of directors. With 15 years' experience in the business of handling coal he is in a position to guide the company along lines required by the needs of industrial plants and dealers. The engineering department, with a staff of capable engineers of extensive experience, is headed by J. Sumner Kirk, under whose guidance special plans are made for every installation of Godfrey conveyors. I. D. Landis is sales manager.

Current News

Weekly Record of Construction Activities—Conventions

EASTERN STATES.

Rutland, Vt. — Temple Brothers, operating granite and marble works, have arranged for the electrification of their plant. Electric power will be furnished by the Rutland Railway, Light & Power Co.

New Bedford, Mass.—A new power plant will be erected by the Beacon Manufacturing Co. in connection with the erection of an addition to the weave works at its cotton mill.

Bridgeport, Conn.—Work has commenced on the erection of a one-story addition to the plant of Harvey Hubbell, Inc. The structure will be 82x140 ft. and cost about $18,000.

Hartford, Conn. — Hartford Electric Light Co. has completed plans for the erection of a new power plant at Colt's Meadows. The present plans are for a station with a capacity of 100,000 kw., or 125,000 hp., with oil as the fuel to be used. Construction will be by Stone & Webster.

Middletown, Conn.—In connection with the erection of an addition to its webbing works, the Russell Manufacturing Co. plans to erect an extension to its power plant, to include one-story turbine department, 20x20 ft. Plans include a two-story engine and pump house and one-story boiler plant.

Woonsocket, R. I.—A new boiler plant and pumping works will be erected by the French Worsted Co., 50x50 ft. on Hamlet avenue, for increased capacity.

Bath, N. Y.—Judd Gunderman has been given an option on his mill property with its water rights located between this village and Kanona to the Lamoka Power Co. The Lamoka Power Co. proposes to make extensive improvements.

Lockport, N. Y.—The city has under consideration the erection of a municipal light plant.

New York, N. Y.—Charles Cory & Son, 290 Hudson street, manufacturers of electrical apparatus, are having plans prepared for a six-story concrete addition, 140x175 ft. to cost about $200,000. Russell G. Cory, 39 Cortlandt street, engineer.

New York, N. Y.—New York Edison Co. has awarded a contract to the George Sykes Co., 70 East 45th street, for the construction of a new two-story building, 25x75 ft. at Hester and Norfolk streets.

New York, N. Y.—A boiler plant, 35x45 ft. will be erected by Fraser, Brace & Co., 1328 Broadway, in connection with their new shipbuilding and repair plant at Clifton, Staten Island. The entire plant will cost about $3,000,000, and considerable electrical equipment will be required for the different works departments, including machine shop, plate and angle shop, forge and pipe shop, tinsmith and carpenter shop and other works buildings. It is proposed to inaugurate immediate construction.

New York, N. Y.—American Radio & Research Corp., 21 Park Row, a Delaware corporation, has increased its capital from $125,000 to $500,000.

New York, N. Y.—Electrical and mechanical equipment will be installed by the Bronx Consumers Ice Co., Devoe avenue and 180th street, in connection with alterations and improvements in its one and two-story refrigerating plant to cost about $60,000.

New York, N. Y.—Rector Electric Co. has removed its main office from 81 Washington street, New York, to 327 Atlantic avenue, Brooklyn. The former New York office will be retained as a branch.

New York, N. Y.—New York Telephone Co. has arranged for immediate extensions and improvements in a number of its local exchange buildings, with the erection of new structures as required. The work includes a new four-story telephone building at Liberty avenue and Milford place, Brooklyn, 60x120 ft. to cost about $200,000, with equipment; alterations and additions to its two-story exchange at West New Brighton, S. I.; and alterations and extensions to its telephone building at Buffalo, N. Y.

New York, N. Y.—Plans have been filed in the building department for alterations and extensions in the boiler plant used for the building at 29 East 35th street, property of Q. S. Morgan, to cost about $9000.

Syracuse, N. Y.—Dyneto Electric Co., Wolf and Park streets, is planning for the erection of a new one-story plant, 70x200 ft., on Wolf street, to cost about $50,000.

Brielle, N. J. — Following a controversy with the Lakewood Coast Electric Co. relative to furnishing service for the Brielle fire house, the borough officials are negotiating with the Atlantic Coast Electric Co., Asbury Park, to extend its lines to this district and enter the field on a competitive basis. The street lighting contract with the Lakewood company has expired, and it is proposed to give a new contract to the Atlantic Coast organization.

Dover, N. J.—New Jersey Power & Light Co. is now building a new line to Newton, and expects to have construction completed for service at an early date. Both lighting and power service will be furnished by the company in the Newton district, including domestic and industrial consumption; the initial load is estimated at about 300-kw. The company has secured a power contract with C. Kleiner & Co., who are establishing a cigar manufacturing plant at Dover.

Garwood, N. J.—The plant of the C. & C. Electric Manufacturing Co., recently offered for sale at a receiver's sale, has been purchased by Paul E. Ryan, New York, through Joseph P. Day, agent, 31 Nassau street. The plant will be used by the new owner for manufacturing, with large department for the production of aluminum and other castings.

Keyport, N. J.—Common Council is arranging a new contract with the Monmouth Lighting Co. for street lighting and service for other municipal work during the coming year.

Newark, N. J. — New York Telephone Co., 15 Dey street, New York, is planning for the construction of two new central exchange stations in northern New Jersey, and extension to 40 present switchboards in this territory. The work will provide for an increase of about 11,000 subscribers and is estimated to cost nearly $2,000,000.

Newark, N. J.—American Can Co. will build a new boiler plant in connection with its proposed three-story factory, 50x130 ft., at Oliver street, and New Jersey Railroad avenue.

Newark, N. J.—A one-story boiler plant, 25x42 ft. will be erected by the American Platinum Works, New Jersey Railroad avenue, in connection with the construction of a factory addition, and alterations and improvements in the present plant to cost about $100,000.

Newark, N. J.—Donavan & Erlach Co., 64 Forest street, Kearney, has filed notice of organization to operate an electrical engineering business. Andrew Donavan and James C. Erlach head the company.

Nutley, N. J.—A one-story boiler plant addition, 40x53 ft. will be erected by L. Sonneborn & Sons, in connection with the erection of an addition to their local chemical works.

South Amboy, N. J.—Monmouth Lighting Co. is planning for improvements in its service in this district. A communication to this effect has been sent to the Common Council.

Allentown, Pa. — Lehigh Valley Light & Power Co. and the Lehigh Navigation Electric Co. have filed application with the Public Service Commission for permission to merge under the name of the first mentioned company.

Carlisle, Pa.—C. H. Masland &

Sons, Amber street, Philadelphia, are taking bids for a power plant to be erected at Carlisle, in connection with a new carpet manufacturing plant at this place.

Easton, Pa.—Pennsylvania Utilities Co. has constructed an additional power line from its Dock street power station to its substation at Ferry street, for increased service.

Erie, Pa.—Erie County Electric Co. has commenced the erection of a one-story addition to its turbine plant for increased capacity. The structure will be 60x110 ft., and is estimated to cost $43,000.

Greencastle, Pa.—The Town Council is considering plans for the establishment of a municipal electric light and power plant. Plans are under way for co-operation in the erection of a plant with the borough of Waynesboro, which is also planning for a similar station.

Harrisburg, Pa. — Application has been made to the Public Service Commission for a merger of a number of power companies in the vicinity of Mauch Chunk, and in Carbon county, under the name of the Industrial Power Co. The new organization plans to operate a large electric generating plant in the anthracite coal fields.

Morrisville, Pa.—Considerable electrical and mechanical equipment will be required for the new local sewerage disposal plant to be constructed by the Borough Council. The plant with sewerage system is estimated to cost about $265,000. Thomas F. Bovie, engineer, has prepared plans and specifications.

Philadelphia, Pa. — William B. Grimshaw Co., Drexel building, is in the market for a single drum mine type electric hoisting engine, 2300 volts, 3-phase, 60-cycle, a. c. and haul 6 tons up 66% grade at speed of from 2 to 300 ft. per minute.

Philadelphia, Pa.—Plans have been filed by the Wirt Co. for a new two-story plant, 62x158 ft. at Green street and Queen Lane, to cost $60,000. Charles Wirt is president.

Philadelphia, Pa.—Bell Telephone Co. of Pennsylvania has leased the eight-story building, 47½x120 ft., at 263-65 Broad street, for a new local establishment. The structure has been used heretofore by the Emergency Fleet Corp.

Philadelphia, Pa.—Plans are being prepared by Architect M. H. Dickinson, 1785 Chestnut street, for a new boiler plant to be erected in connection with a new local dye and textile works.

Philadelphia, Pa.—A boiler and engine plant will be erected by the Rockland Hosiery Co., Kensington avenue, in connection with its proposed hosiery mills at Kensington avenue, near O street.

Pittsburgh, Pa. — Maitland-Rago Co., manufacturer of electrical fixtures, has leased the three-story brick building, 20x110 ft., at 1029 Liberty street, for a new establishment.

Pittsburgh, Pa.—Susquehanna Collieries Co., operating coal properties in Dauphin, Schuylkill, Northumberland and Luzerne counties, is planning the complete electrification of its works at Williamstown and Lykens, with construction of a new shaft at Big Lick, between Lykens and Wiconisco. The work is estimated to cost about $2,000,000. The company has arranged for a mortgage aggregating $11,000,000, to be used in part for expansion and betterments.

Pittsburgh, Pa.—The Government has commenced the construction of a new concrete power plant at Lock No. 3, on the Monongahela river. The structure will be operated by water power and will furnish electric power for the operation of the local lock. Lieut.-Col. Wistar M. Chubb, local United States engineer, is in charge.

Reading, Pa. — During the past month the Metropolitan Edison Co. has secured about 913 additional contracts for furnishing electric power. A number of plants in this section are closing down their steam-operated stations, and using central-station service, including the Quaker Silk Mills, which have recently arranged for power supply for works operation.

DATES AHEAD.

Washington State Association of Electrical Contractors and Dealers. Annual convention, Seattle, Sept. 11. Secretary, Forrest E. Smith, 205 Boston Block, Seattle.

Indiana Electric Light Association. Annual convention, French Lick Springs, Ind., Sept. 11 and 12. Secretary, Thomas Donohue, Lafayette, Ind.

Association of Edison Illuminating Companies. Annual meeting, New London, Conn., Sept. 16-18. Secretary, H. T. Edgar, Stone & Webster, Boston, Mass.

Southeastern Section, N. E. L. A. Annual convention, Asheville, N. C., Sept. 17-19. Secretary-treasurer, T. W. Peters, Columbus, Ga.

Iowa State Association of Electrical Contractors and Dealers. Annual convention, Sioux City, Iowa, Sept. 22 and 23. Secretary, F. Bernick, Jr., Oskaloosa, Iowa.

New England Section, N. E. L. A. Annual convention, New London, Conn., Sept. 22-24. Headquarters, Hotel Griswold. Secretary, Miss O. A. Burgiel, Boston, Mass.

Association of Iron and Steel Electrical Engineers. Annual convention, St. Louis, Mo., Sept. 22-26. Secretary, John F. Kelly, Empire building, Pittsburgh, Pa.

American Electrochemical Society. Fall meeting, Chicago, Sept. 23-26. Headquarters, Congress Hotel. Secretary, Prof. Joseph W. Richards, Lehigh University, Bethlehem, Pa.

International Association of Municipal Electricians. Annual convention, Chicago, Sept. 23-26. Secretary, Clarence R. George, Houston, Tex.

Empire State Gas and Electric Association. Annual meeting, New York City, Oct. 9. Secretary, Charles H. B. Chapin, 29 West 38th street, New York City.

National Association of Electrical Inspectors. Annual meeting, Springfield, Mass., Oct. 13 and 14. Secretary, W. L. Smith, Concord, Mass.

Illuminating Engineering Society. Annual convention, Chicago, Ill., Oct. 20-23. General secretary, Clarence L. Law, 29 West 39th street, New York City.

Illinois State Electric Association. Annual convention, Chicago, Oct. 22 and 23. Secretary-treasurer, R. V. Prather, Springfield, Ill.

Ellendale, Del. — Plans are under way to inaugurate operations at the new municipal electric power plant at an early date. The construction of local distributing lines is now under way.

Baltimore, Md.—In connection with its proposed group of buildings at Roland Park, the Maryland Casualty Co. is planning for the construction of a large central power plant to furnish electric service to the administration, clubhouse, printing plant and other structures. The entire project is estimated to cost about $2,000,000.

Baltimore, Md. — Bethlehem Shipbuilding Co. is planning for the construction of a new drydock, 400x80 ft., at its Sparrows Point plant, to be operated by electric power. Sufficient power capacity will be developed to raise the structure in ten minutes.

Cumberland, Md.—Western Union Telegraph Co. and the Baltimore & Ohio Railroad Co. will build a new underground conduit system between the viaduct and Queen City building. The system is estimated to cost $50,000. J. H. Hays, Western Union Telegraph Co., Baltimore, is in charge.

Sparrows Point, Md. — The construction of an additional floating drydock, 400 ft. long, 80 ft. wide and 20 ft. deep, equipped with electric power is contemplated by the Bethlehem Shipbuilding Corp.

Bristol, Va.—Virginia Tub Co. is in the market for an electric welding machine for round iron tub and bucket hoops.

Cambria, Va.—James Rigby & Son are in the market for a 25-30 hp. a. c. motor, 3 phase, 60 cycle, 2300 volts.

Clarksburg, W. Va.—A syndicate is being organized to purchase and operate the Grafton Power & Light Co., and the Grafton Traction Co., operating at Grafton and vicinity, and now in bankruptcy. O. E. Wyckoff is referee in bankruptcy for the companies.

Fairmont, W. Va. — Monongahela Valley Traction Co. is planning for the erection of a large addition to its electric power plant at Rivesville, to double the present capacity. A new turbogenerator will be installed, with auxiliary operating equipment. The company is also planning for the construction of a new 60,000-volt transmission line from this plant to Grafton and Clarksburg, with a number of distributing branches. A new high tension transmission system will also be built in Barbour county.

Grafton, W. Va.—Potomac Edison Co., recently incorporated with a capital of $4,000,000 to take over electrical properties in this district, plans for a new power plant in the mining section to furnish electric power for coal mines operation.

Belmont, N. C. — Electrically operated machinery and equipment will be installed in the proposed cotton mill to be established by the Sterling Spinning Co., recently organized with capital of $800,000. R. L. Stowe is president.

Winston-Salem, N. C.—J. S. Kuykendall, Winston-Salem, is planning for the establishment of an electric power plant at Black Mountain, to furnish local light and power service.

Gaffney, S. C. — Piedmont Telephone Co. will erect a two-story building. Sam Gaulet, mayor.

Summerville, S. C. — Summerville Public Service Co. has purchased electric light plant and ice plant and will improve them. M. Barshay, president.

Bainbridge, Ga.—Southwest Georgia Power Co. has published its application for charter for the purpose of placing a power plant on Spring Creek. Address I. F. Murphy, or E. J. Perry.

Fort Pierce, Fla. — East Coast Lumber & Supply Co. is in the market for 20 electric motors, 5 to 20 hp. W. E. Tylander, general manager.

Kissimmee, Fla. — Mach Brothers, Oxford, Fla., will build a mill and install electric motors.

Daytona, Fla.—The Daytona Beach Council has granted an electric light and power franchise to Nelson Mounts, who plans to install and operate a local system.

Stuart, Fla.—Stuart Public Service Co. recently incorporated with a capital of $50,000, will operate a light and power plant for local electric service. George R. Hilty is president.

NORTH CENTRAL STATES.

Fremont, Ohio.—The plant of the Ohio State Power Co. (on the Sandusky river, six miles from Fremont), was damaged by explosion. The plant valued at $3,000,000 was erected along the Sandusky river a mile south of Fremont, six years ago. The company supplies power to many neighboring towns and in addition furnishes power to the Lake Shore electric lines and the Fostoria and Fremont interurban railway.

Minerva, Ohio. — Engineers Froelich & Emery, 412 Second National Bank building, Toledo, are preparing plans for a $50,000 power house and distributing station. R. A. Penweth, mayor.

Evansville, Ind.—Ohio Valley Seed Co. will build a five-story mill and grain elevator. The company has increased its capital stock from $25,000 to $100,000.

Fort Wayne, Ind.—Thieme Brothers Co., manufacturer of silk hose, will erect a $185,000 factory building.

Indianapolis, Ind.—J. D. Adams & Co., manufacturers of road building machinery, will build a new one-story storage house, 162x175 ft., with balcony containing 4100 sq. ft. of floor space, at cost of about $60,000.

Indianapolis, Ind.—Henry L. Dithmer, secretary of the Polar Ice & Fuel Co., announces plans in the enlargement of the company's manufacturing and storage capacities which will double its facilities. Additions will be built to three different plants in the city of Indianapolis at an expenditure of $150,000.

LaFayette, Ind. — Numerous improvements on building and grounds of Purdue University are being rushed to completion. Throughout the summer a large force of workmen has been at work in the mechanical, civil and electrical buildings, constructing concrete laboratories, testing devices and installing new equipment. A new tractor testing laboratory has been completed.

Portland, Ind. — The Detamore plant of the Union Traction Co. of Indiana, has been offered to the city of Portland for $18,000, and a transfer of the property will soon be made. This move has been approved by the citizens of Portland and the factory owners who have been demanding more light and power current.

Warsaw, Ind. — A new auditorium will be erected at Winona Lake to cost between $100,000 and $150,000.

Elgin, Ill.—A municipal lighting and electric power plant is the expectation of the city commission. A $200,000 bond issue to cover the original cost of the plant is planned and it is stated that a special election to vote upon this question will be held soon.

Herrin, Ill. — U. S. Reduction & Atomizing Co. is erecting a $100,000 factory building. The new plant will handle the by-products of the mines around Herrin.

Rock Island, Ill.—The plant of the Universal Tractor Works, the property of the Moline Plow Co. will be rebuilt, following a fire which destroyed the machine shops with loss of $150,000.

Mt. Clement, Mich.—Henry Ford of Detroit, has petitioned the council for franchise to develop power house from the Clinton river. It is proposed to establish a motor factory here to employ 300 persons.

Appleton, Wis.—Langstadt & Meyer Co., manufacturer of farm lighting systems and other electrical equipment, will erect a two-story addition to its plant to cost $25,000. New tools and other equipment will be purchased. Herman Wildhagen is architect.

Minneapolis, Minn.—Sales department of the Minneapolis General Electric Co. during the week ended Aug. 15, secured 456 new electric light and power customers with 266 kw. of lighting and 674 hp. in motors. New power business includes contract for 400 hp. in motors with the Schreiber Milling Co., and 90 hp. with the Victoria Elevator Co. New business connected to the company's lines shows an increase of 185 new customers with 135 kw. of lighting and 673 hp. in motors, which includes the two contracts mentioned above as well as 130 hp. for the city of Minneapolis for the construction of the Franklin avenue bridge. An increase of 26.5% is shown in the output of electric energy during the week as compared with the corresponding week last week.

St. Louis, Mo. — Wagner Electric Co. is preparing plans for a five-story plant, 160x400 ft.

Lincoln, Neb.—Wakefield Electric Co. has applied to the Nebraska Railroad Commission for a certificate of convenience and necessity.

Mullen, Neb. — The city contemplates a bond issue for electric light improvements.

SOUTH CENTRAL STATES.

Louisville, Ky. — United Casket Co., will erect a fireproof factory, 100x440 ft., also dry kilns and power house. Planers, molders, sanders, saws, etc., will be installed.

Louisville, Ky.—Commercial department of the Louisville Gas & Electric Co. during the week ended Aug. 16, secured 56 new electric light and power customers with 35 kw. of lighting and 158 hp. in motors, and accepted contracts for wiring 11 already built houses. New business connected to the company's lines shows a gain of 57 customers with 20 kw. of lighting and 36 hp. in motors. The output of electric energy was 10.5% greater than during the corresponding week last year.

Maysville, Ky. — The council will take up at once the construction of a municipal electric light plant.

Piedmont, Ala. — Coosa Manufacturing Co. will erect a $100,000 addition to its mill. Electrical equipment will be purchased.

De Riddie, La.—$100,000 in bonds have been voted for building a light and power plant and water works. Address mayor.

New Orleans, La.—Plans are being prepared by the Interstate Electric Co. for the erection of three large buildings in New Orleans, to cost about $1,500,000. The company deals in electrical appliances and automobile appliances. Percival Stern is president of the company.

New Orleans, La.—The Navy Department will install a power plant here, and purchase equipment to cost $115,000.

Lexington, Miss.—Common Council is planning for improvements in the local electric system to cost about $20,000. Bonds for this amount will be voted. W. L. Jordan is city clerk.

Natchez, Miss.—National Box Co. will improve its plant. Electrical equipment will be purchased.

Centreville, Tenn.—Common Council is planning for the immediate construction of a municipal electric plant to cost about $15,000. Owen L. Bates is mayor.

Little Rock, Ark.—Dixie Power Co. has perfected plans for the erection of its proposed hydroelectric power plant near Cotter, on the White river. The station will have an initial capacity of about 100,000 hp., and with machinery and equipment installation is estimated to cost about $4,000,000. A dam about 1500 ft. long and 100 ft. high will be constructed. An extensive high-tension transmission system will be constructed. H. A. Allen, Chicago, is engineer.

Pine Bluff, Ark.—Missouri & Southeastern Utilities Co., affiliated with the Arkansas Light & Power Co. is planning for the construction of a new steam operated electric power plant in this section. A transmission system, with local distributing lines, will also be erected. O. P. Moss is manager.

Perry, Okla.—$260,000 light and water bonds have been authorized. Address city clerk.

Canton, Tex.—Hercules Power Co. recently incorporated with a capital of $10,000,000, is planning for the erection of a large electric power plant with transmission system thorughout this district. A. B. Saling is manager.

WESTERN STATES.

Bonners Ferry, Idaho.—Washington Electric & Supply Co. of Spokane, is considering the matter of installing a street lighting system here, to include 14 post lamps.

Sandpoint, Idaho. — Contract has been closed with the Calispell Light & Power Co., Dalkena, Wash., which purchases electric current from the Sandpoint division of Mountain States Power Co. covering 40 hp. in motors for the Dalkena Lumber Co., with prospects of an additional 100 hp.

Libby, Mont.—It is reported that the Lukens-Hazel Mining Co. will expend $240,000 for a 200-ton concentrator, and power plant. A pipe line will be installed from Granite Creek which will develop 600 hp.

Albuquerque, N. M. — Rio Grande Light, Heat & Power Co. has had specifications prepared for $4,000,000 electric light plant to be erected at White Rock Canyon on the Rio Grande, 40 miles north of Albuquerque. The power company will maintain its general offices in Philadelphia, with a branch office here.

Portland, Ore.—Application for an increase in rates which will enable the company to realize a return of seven per cent on its investment has been filed with the city auditor by the Portland, Railway Light & Power Co. has a necessary formality to the hearing to be held soon before the Public Service Commission. The application gives the city ten days in which to prepare and file its answer as one of the affected parties.

Colfax, Wash.—Washington Water Power Co., Spokane, is planning to spend about $28,000 this fall in putting in a heavier line to the city.

Hoquiam, Wash.—Plans and specifications have been completed by the Commercial Club for a curb lighting system on 8th and 9th streets.

Morton, Wash. — Morton Electric Co.'s plant has been sold to J. P. Haggerty of Tacoma, for $10,000.

Seattle, Wash.—Ordinance has been passed by the city council authorizing the Board of Public Works to continue work of investigation to determine proper location for dams and reservoirs in the vicinity of Ruby, Gorge Creek and Diablo Canyon.

Seattle, Wash.—J. Bechler, Mayflower Dairy, 917 Virginia street, will erect a brick power house at a cost of $24,000.

Spokane, Wash.—Universal Electric Co. will erect a building at 1218 Second street, at a cost of $10,000.

CANADA.

Thorold, Ontario.—Ontario Power Co. is planning for the erection of an addition to its local substation to double the present capacity. A new bank of transformers will be installed, and other operating equipment. Apparatus now at the Welland substation will be utilized, in part in the new addition.

Winnipeg, Manitoba. — Winnipeg River Power Co. has commenced the construction of its proposed hydroelectric power plant at Little Du Bonnet Falls, on the Winnipeg river. The structure will be one of the largest plants of its kind in the world; it will have an initial capacity of about 160,000 hp., and is estimated to cost $5,000,000.

PROPOSALS

Generator and Equipment. — Bids will be received Sept. 23, at Saskatoon, Sask., for a steam turbine, alternating current, generator, surface condenser and condenser auxiliaries. C. J. Yorath, city commissioner.

Power Plant Extensions.—Bids will be received until 3 p. m., Sept. 10, for extensions and improvements in the power plant and power system at the State Hospital, Binghamton, N. Y. Address State Hospital Commission, Capitol building, Albany.

Pumps.—The purchasing agent of Kansas City, Mo., will receive bids until Sept. 17, for a pumping station, centrifugal type pump driven by steam turbine through reduction gears, centrifugal type pump driven by vertical cross-compound Corliss engine. Plans are on file with W. C. Goodwin, chief engineer.

FOREIGN TRADE

[*Addresses of firms referred to in these trade opportunities may be obtained by writing to the Bureau of Foreign and Domestic Commerce, Washington, D. C., or its branch and local co-operative offices. Request for each opportunity should be on a separate sheet and the file number given.*]

Lighting Fixtures (30,461). A firm in Australia wishes to purchase from manufacturers opalescent glass for use in indirect and semi-direct electric fixtures.

Electrical Supplies (30,462). A firm of important merchants in India desires to connect with selling agents of American manufacturers of hardware, mill, gin, and railway stores, machinery, electrical supplies, chemicals, dyes, general sundries, etc. Quotations with samples where necessary are requested. Reference.

Incandescent Lighting Glass (30,466). The purchase of large quantities of incandescent gas mantles and incandescent lighting glass is desired by a company in England. Quotations should be given c. i. f. London. References.

Electrical Conductors and Machinery (30,475). An agency is desired by a firm in Spain for the sale of electric conductors, electrical machinery, material for central generating stations, small electrical material, pumps, turbines, internal combustion motors, and lamps. References.

Motors (30,498). The president of a Spanish mining company is in the United States and is soon to return to Spain. He desires to purchase mining machinery, gasoline and kerosene engines, electric motors and equipment, and agricultural machinery. References.

Wireless Equipment (30,504). An American firm desires to obtain for one of its clients in Spain all classes of apparatus used by manufacturers of wireless equipment. References.

INCORPORATIONS

New Berlin, N. Y.—Berholme Power Co. Capital, $25,000. To operate a light and power system at South New Berlin. Incorporators: T. B. Parker, F. Van Valkenburg, and E. W. Hovey, all of South New Berlin.

Rochester, N. Y.—Rochester Storage Battery Co. Capital, $40,000. To manufacture storage batteries, etc. Incorporators: W. W. Armstrong, E. F. and A. C. Dyver, Rochester.

New York, N. Y.—Electric Keyless Lock Co. Capital, $10,000. To manufacture special locking devices. Incorporators: H. Gottesman, S. Greene and A. M. Block, Woolworth building.

Buffalo, N. Y. — Milner Flower Electric Co. Active capital, $30,000. To manufacture electrical machinery. Incorporators: C. B. McBride, M. W. Bense and A. E. Moore, 37 Wall street, New York.

Wilmington, Del.—Phix Light Co. Capital, $100,000. To manufacture electrical and power machinery. Incorporators: T. L. Croteau, H. E. Knox and S. E. Dill.

Huntington, W. Va.—Electric Unit Corp. Capital, $50,000. To furnish light and power service. Incorporators: C. C. Hatzell and E. F. Kincaid, Huntington.

Fairview, N. C.—Cane Creek Telephone & Light Co. Capital $10,000. To furnish local electric light and power, and telephone service. Principal incorporator: R. B. Williams.

Varnville, S. C.—Twin City Light & Power Co. Capital, $30,000. To operate a local light and power system, with lines to Hampton, S. C. Principal incorporator: R. H. Gibson.

Indianapolis, Ind.—Wheeler Automatic Transmission Co. has been incorporated with capital of $500,000 for the manufacture of an automatic transmission which is said to do away with the shifting of gears in automobiles. George W. Ray is the president, and J. M. Milner, secretary-treasurer.

Personal

Captain Porter to Take Charge of Railroad Department, Western Electric—F. D. Egan Promoted—Other Changes

JOSEPH D. WHITTEMORE and FRANCIS R. HARBISON have been appointed ancillary receivers for the West Virginia Traction & Electric Co., Morgantown, W. Va., by Judge Orr, United States District Court.

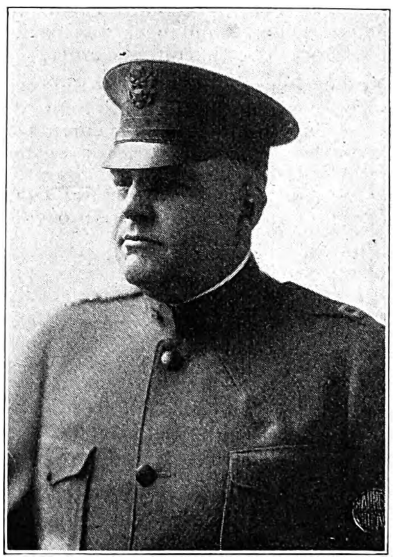
GEORGE R. JONES has been elected assistant to the vice-president of the Public Service Co. of Northern Illinois. Mr. Jones has been connected with the company for more than ten years, most of this time as purchasing agent.

RAYMOND D. SHERMAN, superintendent of the Deerfield River Power Co., Watertown, N. Y., has been promoted to the position of superintendent of the Connecticut River Power Co., both companies being under the management of the New England Power Co.

L. H. STRATFORD, for about two years assistant manager of the W. A. Baehr Co., Great Falls, Mont., is now manager of the Pocatello Gas & Power Co., with headquarters at Pocatello, Idaho. Mr. Stratford is well known in that section, having held important positions with the Utah Power & Light Co., Ogden, and with the Portland Gas & Coke Co., Portland, Ore.

W. H. TIMBIE, who is well known for his teaching in vocational subjects and for his important list of books relating to electrical engineering and applied electricity, has been appointed associate professor of electrical engineering in the Massachusetts Institute of Technology. Mr. Timbie was graduated from Williams College in 1901 with honors, being high in the list of Phi Beta Kappa. During his college course he prepared for teaching and shortly after graduation became a teacher of applied science at the Pratt Institute in Brooklyn. Upon the establishment of the Wentworth Institute in Boston he became head of the Department of Applied Science in that institute. During the past year he has been editor-in-chief of the Committee on Education and Special Training in the United States War Department at Washington. He is joint author with Professor Higbie, of the University of Michigan, of a well known book on alternating currents and himself is author of a book on practical electricity and other books relating to electrical engineering, which are known and used throughout the world. Certain of these books have been translated into foreign languages. Mr. Timbie is a member of the American Institute of Electrical Engineers, the American Society of Mechanical Engineers. He has been active in the National Educational Association and has memberships in other engineering and educational societies. At the Massachusetts Institute of Technology his principal duty will be the supervision of the co-operative course in electrical engineering which is carried on in association with the General Electric Co. This course is arranged so that the students receive a scientific training of very high order in electrical engineering at the institute and associate with this a training in manufacturing methods and shop management and industrial research at the works of the General Electric Co. Mr. Timbie's marked success as a teacher and his enthusiasm in such work assure great success in his new position.

CAPT. GEORGE HULL PORTER has just been appointed manager of the railroad department of the Western Electric Co., in charge of the railroad business for the Western Electric Co.'s 53 houses extending from coast to coast. This well merited promotion comes after an experience covering a number of years as railway salesman in Chicago territory. Captain Porter is well and favorably known in railroad circles as well as in the electrical field, having served as president of several railroad associations as well as chairman of various committees. He is also a past president of the Illinois Athletic Club, Chicago. Captain Porter saw service in the army during the war, being attached to the signal corps.



Capt. George Hull Porter.

F. D. EGAN, former works manager of the Pittsburgh Iron & Steel Foundries Co., has accepted a position in the General Engineering Department of the Westinghouse Electric & Manufacturing Co. at East Pittsburgh, Pa., where he will devote his entire time to the development of electrical apparatus for steel mill application. Mr. Egan's experience with electrical apparatus as applied to steel mills has extended over a period of a score of years, all of which time was spent in mills in the Pittsburgh district. In 1899 he entered the electrical department of the Carnegie Steel Co.'s Homestead Plant, working under the direction of Alva C. Dinkey, then superintendent of the electrical department. He resigned this position in 1903 to enter Grove City College, where he completed his college course. After graduating from school, he went to work in the inspection department of the Westinghouse Electric & Manufacturing Co., remaining a little over one year, leaving there to accept a position with the Carnegie Steel Co., where he served as assistant chief electrician during the construction of its Nos. 6 and 7 blast furnaces. When this work was completed he joined the electrical engineering force of the National Tube Co.

While working for the tube company Mr. Egan devised a plan whereby he could attend the Engineering School of the University of Pittsburgh and at the same time devote a major portion of his time to his work. After successfully laying his plans before the management, the aspiring engineer entered the university where he studied for two years, when he found it necessary to give up his course for the time being in order that he might enter the electrical superintendent's office. As a result of considerable study and hard work, he was later promoted to the position of assistant superintendent of the electrical department. In 1911, at the end of the construction period that lasted for four years, he left the tube company, accepting a position as electrical engineer with the Pittsburgh Crucible Steel Co. during the construction and operation of its Midland Works. In the latter part of 1917 he left the Crucible Steel Co. to enter the employ of the Pittsburgh Iron & Steel Foundries Co., of Pittsburgh, Pa., as works manager to have charge of all war work done by that company. Serving in that capacity until just recently when he joined the general engineering department of the Westinghouse company. Mr. Egan is a member of the Iron and Steel Committee of the American Institute of Electrical Engineers, a member and past president of the Association of Iron and Steel Electrical Engineers, a member of the Iron and Steel Institute, the Delta Tau Delta Fraternity and the Pittsburgh Athletic Association.

Obituary.

HENRY A. REED, 88 North 9th street, Newark, N. J., a pioneer in telegraphy, died at his home in that city, Aug. 23, at the age of 90 years. As an operator, Mr. Reed opened in 1850 the first telegraph office on the Harlem Railroad, New York. He was one of the organizers of the Electric Club and Electric Trade Society in New York.

Institutional Advertising Combined With Specialization

New Sherwin-Williams Campaign Takes Advantage of Changed Conditions of Property-Owner Demand and Increased Building Activities

By C. L. LEMPERLY, *Advertising Manager, The Sherwin-Williams Company.*

HOW to give sudden point and direction to advertising that had been wholly institutional, says the above named writer in Printers' Ink, was a question with which The Sherwin-Williams Company was recently called on to deal.

Institutional advertising might be compared to a club. It is intended to gain large ends, to cover big space, to carry great weight. But a club is usually not flexible. It cannot be readily bent, nor is it easily adapted to specific ends.

The Sherwin-Williams Company wanted to retain the momentum and larger benefits of its institutional campaign, and at the same time utilize its force in specific directions. The solution lay, it found, in putting spikes on the club, so to speak. It retained the institutional idea of advertising its products as a whole, and at the same time, by featuring certain products in response to changing demands in the market, it lost no ground.

Prior to the war, the company had been advertising its leading lines through national advertising, alternating the schedule by seasons.

Last year, while some advertisers were holding back, Sherwin-Williams decided it was an opportune time to launch a larger campaign than ever, even though its plants were overtaxed with large bulk business, mostly from big manufacturers. Consequently it opened its Products campaign.

This was entirely institutional, telling in double spreads of some particular achievement of the company as an institution. No mention was made of individual products by trade name. The campaign was not designed to bring inquiries.

During the time when this campaign was running there was little or no demand for the household products formerly purchased in large quantities by property owners. This was due to several reasons. Price had gone up, which naturally restricted the demand, as people figured that painting was something which they could put off. Then came the building restrictions. There was not a great deal of activity in the dealer lines while there was tremendous activity in the larger bulk lines.

The large advertising campaign was decided upon, as it had always been a policy of the company to strike out boldly when others were holding back. There was very little paint advertising competition in the publications at the time, which gave this campaign particular prominence and brought about the desired result of making the name and the scope of the institution better known. It presented an opportunity to tell the public about many of the new activities of the company, such as the manufacture of dyes, chemicals, disinfectants, coal-tar products, etc., in addition to the old-established lines of paints, varnishes and insecticides.

THE PRESENT NEED.

Then came peace which brought a heavy demand for the old dealer lines of paints and varnishes from property and building owners. Painting had been put off for two or three years. Building had been restricted. Now the people were realizing that on account of the high replacement cost of building materials, painting could not be put off much longer. With the taking off of building restrictions great activity followed along these lines.

This meant that there would be specific demand for the company's leading specialties by trade name, a factor that could not be overlooked. The institutional plan had made a decided impression and should be retained.

The solution, therefore, was to retain the "Sherwin-Williams Products" with a touch of institutional copy and to incorporate by groups into the new campaign the leading specialties which the company wanted featured.

This was worked out by retaining practically the same general treatment of the double spreads as in the last campaign, and by adding illustrations in circles showing the use of various specialties.

Groupings were arranged according to seasons, with reference to demand for exteriors or interiors, from home-owners or from manufacturers, etc.

By keeping before the public the institutional thought, and at the same time featuring the leaders, like SWP House Paint, Flat-Tone Wall Paint, Mar-Not Floor Varnish, Rexpar Outside Varnish, etc., it is logical to assume that the question has been met in a satisfactory way. The campaign retains the bigness of the former idea and adds an effective means of acquainting the public with the specific trade names of the articles manufactured.

The company's new plan comprehends an extension of its direct-mail and dealer display service, built around the intention of continuing to make its retail agency as attractive as possible to the old agent and to the prospective agent.

The company's sales for its fiscal year closing August 31, 1919, indicate a realization of the "Million A Month Gain" campaign launched a year ago. The sales reflect directly a condition shown by an investigation among the company's agents and dealers. In this investigation the market situation was reported satisfactory, with brisk demand. Eighty-one per cent of the dealers reported good sales conditions, in spite of the price situation.

The price advances have been due to unprecedented linseed oil, turpentine, and other raw material costs. Only a small percentage of the dealers reported that there was a deferring of purchases on account of the price, and even these stated that the smaller lines were selling well and that only big orders were being held up.

The situation appears to be somewhat similar to that in the automobile field where it is a question, as Ned Jordan says, whether there will be enough automobiles to go around. It is evident that there will not be enough paint and varnish to go around.

Manufacturers who have been operating on a big bulk production have been forced to switch to a peace-time property-owner production without a long preparation period. Many manufacturers advised the retail trade to get orders in early, but orders were smaller than usual. When spring came, dealers deluged the manufacturers with orders, and there appears to be a genuine realization on the part of the public that paint primarily preserves property, whereas the old concept used to be that paint primarily beautified property. As a matter of fact it does both, and painting cannot be put off without genuine economic loss.

I am giving up my Readjustment Period page this week to the reprint of an article which I think has extraordinary suggestive value. Read it carefully.

C. A. TUPPER *President*
INTERNATIONAL TRADE PRESS, INC., CHICAGO

Financial News

Business Uncertainty Temporary.

The business uncertainty which has been occasioned by general industrial unrest and by the focusing of attention on the prevailing level of prices is described as temporary by the National Bank of Commerce in New York in its monthly discussion of the money market.

"In this respect," the bank says, "there would not seem to be grounds for undue apprehension. The business activity of the country is based on fundamentally sound and essential production. With due consideration given to producing costs, the price-level agitation does not threaten general business activity, and losses resulting therefrom should fall mainly on speculative profiteers. Furthermore, as the Federal Reserve Board has pointed out, the existing level of prices has not resulted from an undue inflation of currency.

"There is another aspect of the situation, however, which is receiving too little consideration—namely, the importance which our foreign trade has assumed in relation to our total trade. During the war, production was expanded to meet a good share of the needs of the world. Our industries have been committed to an output greater in many respects than domestic markets can now absorb, so that the continuance of domestic prosperity is involved with our foreign trade. For the fiscal year ending June 30, 1919, the balance of exports to Europe over imports totaled about $4,250,000,000. During the same period, credits extended by the Government to the allied nations amounted approximately to $3,250,000,000. In a word, our exports were financed by ourselves, through the Government, on a long term credit basis. In the present year, however, sums available for such financing are negligible.

"The permanent maintenance of the high level of war exports is not desired, but our own continued prosperity demands that readjustments be effected gradually. The needs of the countries of Europe are common knowledge. Their inability to pay for supplies at once in either gold or goods requires no reiteration. What must be appreciated is that under existing circumstances we cannot afford not to sell to Europe; and that consequently the problem of financing our exports is most urgent.

"Bills are pending in Congress which would provide the legal basis for the formation of financing corporations. There is an unfortunate tendency to hope for salvation by legislation—to delay action pending the enactment of a law. The situation calls for the direction and leadership of men who will work out plans, enlist the co-operative efforts of industry, build up an organization, and go at the matter in hand. Such elements of leadership, which would give meaning to whatever laws may be passed, and would make such measures a success, are not now distinctly in evidence."

Westinghouse Earnings Show Large Gain.

The business of the Westinghouse Electric & Manufacturing Co. has shown splendid recovery from the falling off incident to the slackening of structural activity following the signing of the armistice.

Bookings are now running at the annual rate of $100,000,000 and billings at $120,000,000, against actual billings of $160,379,943 in the year to March 31, 1919. For a number of months, after the cessation of hostilities, bookings fell considerably below a $100,000,000 rate.

The Essington plant is still busy on government turbine contracts. When this work is completed it is planned to move the turbine business from the East Pittsburgh plant and concentrate all the work of this character at Essington, located on the Delaware river outside of Philadelphia. The facilities thus released at East Pittsburgh will be devoted to the construction of electric locomotives. Contracts have recently been signed with the New Haven railroad for a number of these and with the growth of railway electrification equipment orders are expected to reach substantial proportions.

The company made a manufacturing profit of $31,108,387 on its $160,379,943 of gross in the 1919 year, or 19.3%. At the same rate in the present fiscal year the manufacturing profit on $120,000,000 gross would be approximately $24,000,000. After allowance of $10,000,000 for federal taxes, against $15,000,000 last year, a balance of $14,000,000 would be left for dividends, equal to $9.30 a share on the $74,812,650 preferred and common stocks.

General Electric to Bid for Foreign Trade.

That the General Electric Co. through its new $20,000,000 subsidiary, the International General Electric Co., plans to make a strenuous bid for foreign business, is the statement of one of its directors. The departure of President Swope for Europe lends color to the belief that announcement of interest to the electrical trade may be expected within a short time. The General Electric Co. has grouped all of its foreign possessions into one corporation, the International General Electric, of which $10,000,000 is 7% cumulative preferred and $10,000,000 common. All of this stock is reported to be in the treasury of the company.

Foreign Credit Corporation Formed.

Announcement is made of the incorporation of the Foreign Credit Corp., with capital of $5,000,000 and a paid-in surplus of $1,000,000, and with the following officers: President, Grayson M.-P. Murphy, vice-president of the Guaranty Trust Co. of New York; vice-presidents, G. M. Dahl and D. Raymond Noyes. The directors, of whom President E. V. R. Thayer of the Chase National Bank is chairman, will represent the banks in New York and elsewhere that are stockholders of the corporation. The corporation, organized under New York laws, is believed to be the first company formed in this state to do primarily an acceptance business. It will be interested chiefly in the financing of exports, though it will have other broad powers and will accept drafts of both foreign and domestic clients. The manager of the company will be Mr. Noyes. Albert Breton, vice-president of the Guaranty Trust Co. of New York will be the chairman of the executive committee.

Duquesne Light Issues Bonds.

The Public Service Commission has granted permission to the Duquesne Light Co. to issue bonds for $25,000,000 and notes for $2,000,000, to be used in part for the construction of its proposed new power plant at Cheswick, Pa. Initial construction work on this plant is well under way; the structure with machinery and equipment is estimated to cost about $15,000,000.

Dividends.

General Electric Co. has declared a dividend of $2 per share, payable Oct. 15 to stock of record Sept. 15.

The board of directors of the Canadian General Electric Co. has declared a quarterly dividend of 2%, also a semi-annual dividend of 3½% on preferred stock, payable Oct. 1 to stock of record Sept. 13.

New York Edison Co. has declared a quarterly dividend of 1¾%, payable Sept. 14.

Galveston-Houston Electric Co. has declared a semi-annual dividend of 3% on preferred stock, payable Sept. 15 to stock of record Sept. 3.

Arkansas Valley Railway, Light & Power Co. has declared a quarterly dividend of 1¾% on preferred stock, payable Sept. 15 to stock of record Aug. 30.

Muskogee Gas & Electric Co. has declared a quarterly dividend of 1¾% on preferred stock, payable Sept. 15 to stock of record Aug. 30.

WEEKLY COMPARISON OF CLOSING-BID PRICES OF SECURITIES OF LEADING ELECTRICAL COMPANIES

Quotations furnished by F. M. Zeller & Co., Rookery Bldg., Chicago.

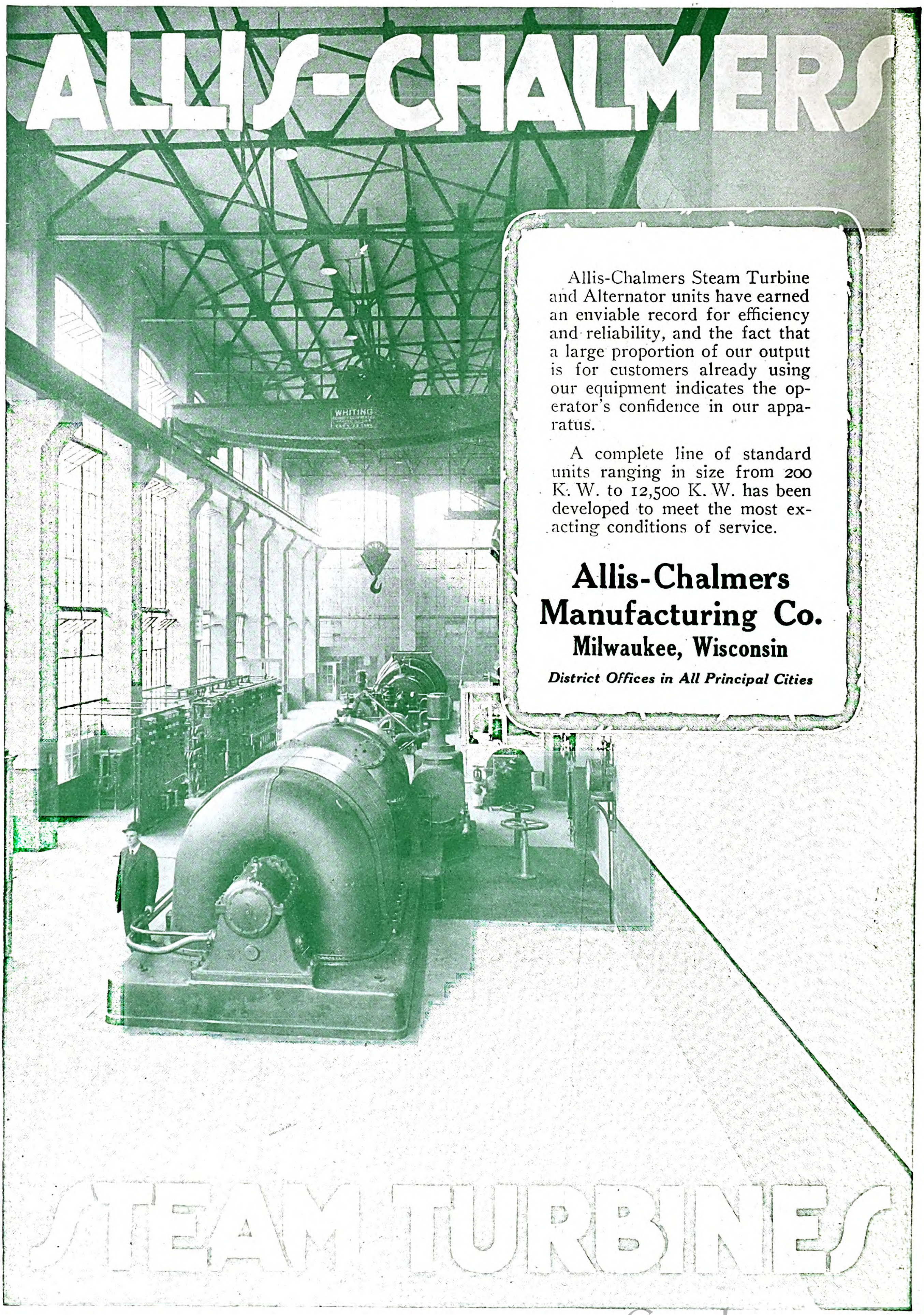
Public Utilities.	Div. rate. Per cent.	Bid Aug. 26.	Bid Sept. 2.
Adirondack Electric Power of Glens Falls, common	6	13	14
Adirondack Electric Power of Glens Falls, preferred	6	78	76
American Gas & Electric of New York, common	10+extra	120	122
American Gas & Electric of New York, preferred	6	41	40½
American Light & Traction of New York, common	..	220	220
American Light & Traction of New York, preferred	6	95	95
American Power & Light of New York, common	4	62	63
American Power & Light of New York, preferred	6	68	68
American Public Utilities of Grand Rapids, common	..	10	10
American Public Utilities of Grand Rapids, preferred	7	30	30
American Telephone & Telegraph of New York	..	102	102
American Water Works & Elec. of New York, common	..	5¾	5½
American Water Works & Elec. of New York, particip	7	10	10
American Water Works & Elec. of New York, first preferred	..	58	58
Appalachian Power, common	..	5	5
Appalachian Power, preferred	7	22	22
Cities Service of New York, common	+extra	438	445
Cities Service of New York, preferred	6	75½	75¾
Commonwealth Edison of Chicago	8	107	108
Comm. Power, Railway & Light of Jackson, common	..	23	23
Comm. Power, Railway & Light of Jackson, preferred	6	56	56
Federal Light & Traction of New York, common	..	10	10
Federal Light & Traction of New York, preferred	..	47	47
Illinois Northern Utilities of Dixon	6	75	75
Middle West Utilities of Chicago, common	2+extra	30	30
Middle West Utilities of Chicago, preferred	6	53	54
Northern States Power of Chicago, common	..	67	67
Northern States Power of Chicago, preferred	ex.div.7	90	91
Pacific Gas & Electric of San Francisco, common	..	66¾	63
Pacific Gas & Electric of San Francisco, preferred	6	88	88
Public Service of Northern Illinois, Chicago, common	7	86	85
Public Service of Northern Illinois, Chicago, preferred	6	94	95
Republic Railway & Light of Youngstown, common	4	13½	13
Republic Railway & Light of Youngstown, preferred	6	50	50
Standard Gas & Electric of Chicago, common	..	31	32
Standard Gas & Electric of Chicago, preferred	8	45½	*43
Tennessee Railway, Light & Power of Chattanooga, common	..	3½	5
Tennessee Railway, Light & Power of Chattanooga, preferred	6	15	15
United Light & Railways of Grand Rapids, common	4	43	45
United Light & Railways of Grand Rapids, preferred	6	68	70
Western Power of San Francisco, common	..	24½	24
Western Union Telegraph of New York	extra	86¾	86½
Industries.			
Electric Storage of Philadelphia, common	4	94	96½
General Electric of Schenectady	8	162¼	167
Westinghouse Electric & Mfg. of Pittsburgh, common	7	52⅜	53¾

*Ex. div.

530

Electrical Review

Vol. 75. No. 11. CHICAGO, SEPTEMBER 13, 1919 Three Dollars a Year


ALLIS-CHALMERS
WHITING
Allis-Chalmers Steam Turbine and Alternator units have earned an enviable record for efficiency and reliability, and the fact that a large proportion of our output is for customers already using our equipment indicates the operator's confidence in our apparatus.
A complete line of standard units ranging in size from 200 K. W. to 12,500 K. W. has been developed to meet the most exacting conditions of service.
Allis-Chalmers Manufacturing Co.
Milwaukee, Wisconsin
District Offices in All Principal Cities
STEAM TURBINES

Electrical Review

WITH WHICH IS CONSOLIDATED WESTERN ELECTRICIAN AND ELECTROCRAFT.

VOL. 75—No. 11. CHICAGO, SATURDAY, SEPTEMBER 13, 1919. PAGE 423.

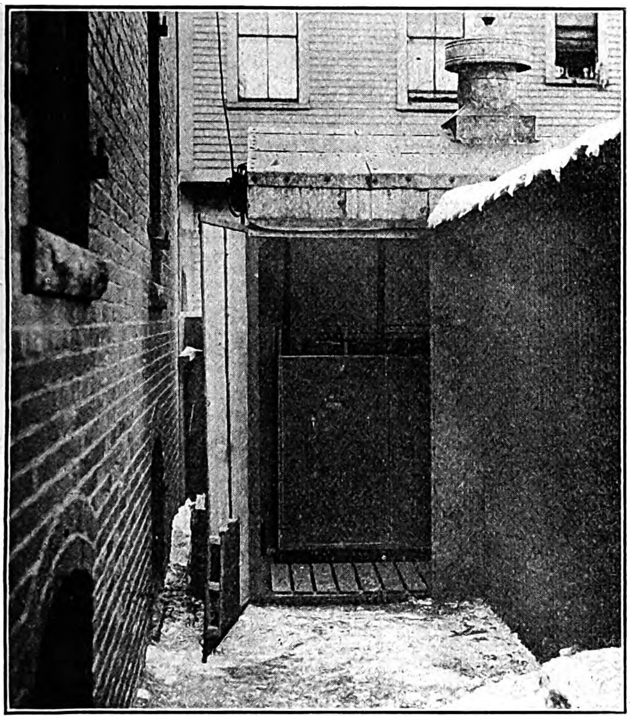


Fig. 1.—Galvanized-Iron Structure Housing Static Condenser Outdoors.

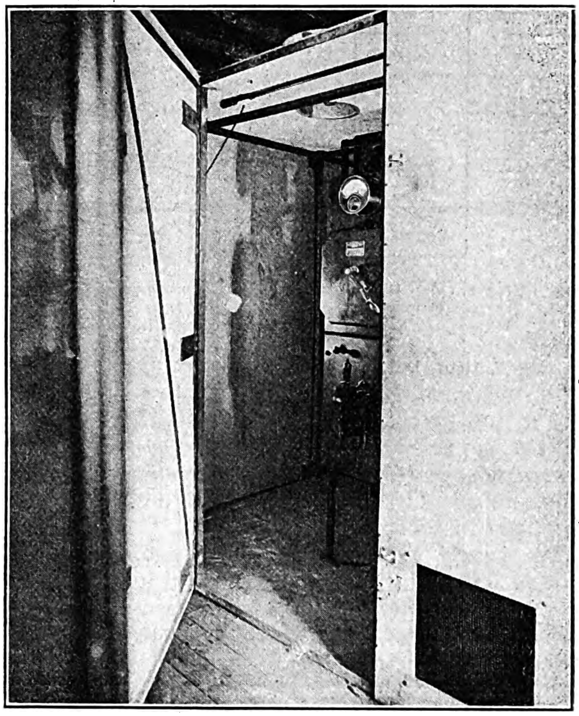


Fig. 2.—Asbestos Housing for 100-Kv-a. Static Condenser Installed Indoors.

Power-Factor Correction by Use of the Static Condenser

Characteristics of Static Condenser Installations—Causes of Low Power-Factor — Operating Costs and Purchase Price — Paper Before Pennsylvania Electric Association

By O. C. ROFF

General Electric Co.

THE importance of maintaining a high power-factor on the system is generally recognized by operating companies. Low power-factor represents a purely economic loss with a consequent reduction in efficiency. The law of conservation demands that equipment should be made to serve to the limit of its capacity, and to accomplish this it follows that alternating-current apparatus should operate at the highest possible power-factor.

The detrimental effects of low power-factor conditions are similar to an insidious disease, and often become a distinct menace before the gravity of the situation is appreciated.

While in all instances the character of the load imposed on the distribution system should be carefully scrutinized, and preventive measures taken wherever possible to avoid an undesirable power factor, it frequently happens that such precautions alone are not sufficient. It is then necessary to adopt some corrective means and the static condenser offers a solution of the problem in many such cases.

FEATURE OF STATIC CONDENSER INSTALLATION.

The static condenser, as the name implies, is devoid of any moving parts and is extremely simple in operation, requiring practically no attention aside from throwing the necessary control switches to connect or disconnect the apparatus from the system. The

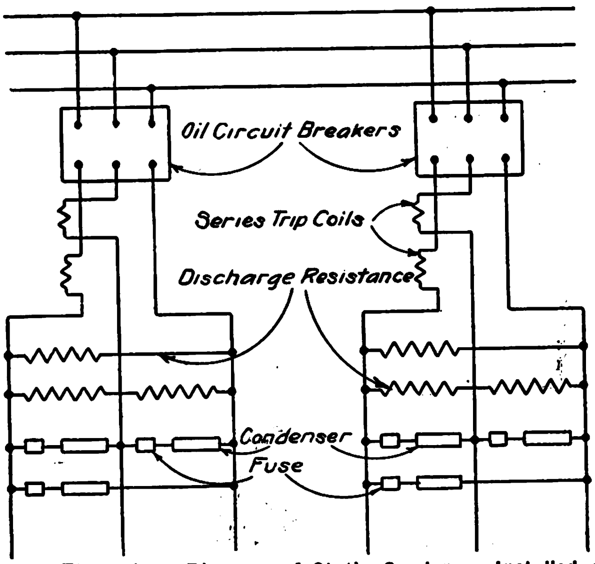


Fig. 3.—Elementary Diagram of Static Condenser Installed on Three-Phase Circuits.

condenser units are immersed in oil in hermetically sealed metal cases and mounted upon racks. The number and grouping of the units is dependent upon the kv-a. capacity and the number of phases.

A series reactance for the purpose of excluding all possibility of resonance with the higher harmonics is inserted in each phase.

The synchronous motor or converter, when over-excited, acts as a capacity for the fundamental frequency, but is dead for the higher harmonics, and the static condenser is made equivalent to the synchronous condenser by the introduction of this reactance.

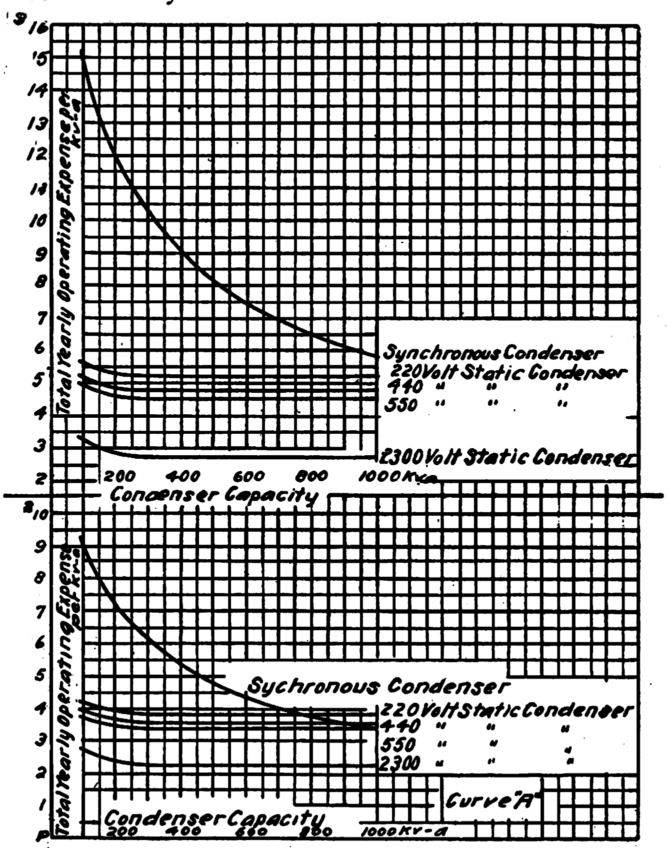


Fig. 4.—Total Yearly Operating Expense per Kv-a./Kv-a. Capacity on Basis of Full-Load Operation 7000 Hrs. per Year. Capital Charge 15% per Year of Purchase Price.

Upper Curves: Losses charged at 1½ ct. per kw-hr. Lower Curve: Losses charged at ¾ ct. per kw-hr.

Discharge rods of high resistance are arranged across each phase of the equipment, where required, so that when disconnected from the system any charge will be dissipated.

As an additional precaution for the protection of the condenser units, and to increase the reliability factor of the equipment, a fuse element is inserted in series with each unit.

On account of the active element of the condenser units being immersed in oil, the insulating properties are greatly increased, which consequently insures long life with resultant low maintenance. The equipment can easily be housed for outdoor installation along transmission lines or remote locations.

Static condensers can be arranged for mounting in tanks to provide for subway installation, or in

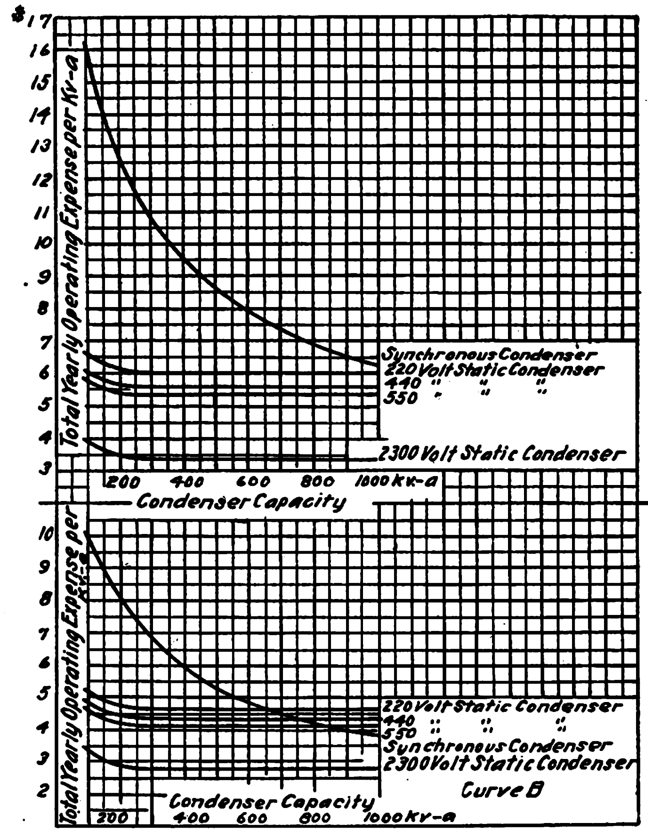


Fig. 5.—Total Yearly Operating Expense per Kv-a./Kv-a. Capacity on Basis of Full-Load Operation 7000 Hrs. per Year. Capital Charge 20% per Year of Purchase Price.

Upper Curve: Losses charged at 1½ ct. per kw-hr. Lower Curves: Losses charged at ¾ ct. per kw-hr.

capacities up to approximately 20 kv-a. for pole mounting.

The equipments have been standardized in capacities from 60 to 300 kv-a., preferably in 60 kv-a. steps, and for all commercial voltages from 220 to 2300 volts.

As it is impossible to produce an economical design for 550 volts or below for direct operation, it is necessary to utilize autotransformers for stepping up the potential for the condenser units.

The frequency of the circuit is also closely related to the characteristics of the equipment, due to the fact that the current in a condenser with a given voltage is dependent upon the frequency. By reason of this, static condenser outfits become correspondingly expensive on frequencies less than 40 cycles.

An elementary diagram of the equipment is shown in Fig. 3. The simplicity is a factor which produces a low maintenance.

The following summary of the pertinent characteristics of the static condenser render it particularly adaptable as a power-factor corrective device:

(1) Total absence of moving parts insure practically noiseless operation.

(2) Due to the simplicity of its control and operation, which amounts to merely connecting or disconnecting the apparatus from the system through the medium of an oil switch, the minimum amount of operating attendance is required.

(3) By virtue of their construction, condenser equipments can be installed in remote locations or distributed over the system in small units as the situation may demand. This puts the correction at the source of the poor power-factor, and allows the maximum advantage to be obtained, as the transmission losses of the wattless component are eliminated.

welding equipments, underloaded induction motors, and unwieldy distribution networks, composed of oversized transformers.

Naturally, lightly loaded transformers introduce considerable reactance into the system, and when low power-factor exists excessive current must be transmitted with the consequent necessity of increased transformer capacity. It follows, therefore, that such transformers under light load at off peak periods tend to still further reduce the power-factor. A large number of such oversized transformers distributed over the system are consequently productive of a greatly lowered over-all system power-factor.

While the regulation of transformers is inherently good, nevertheless it is a factor which is considerably affected by low power-factor conditions.

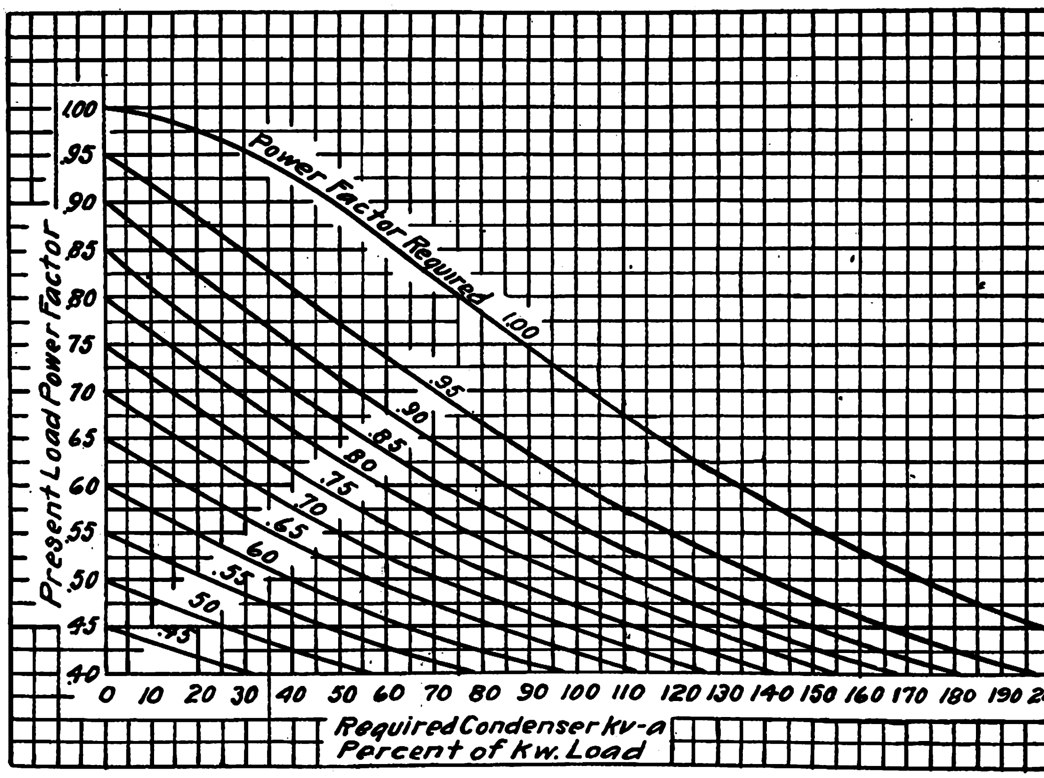


Fig. 6.—Curves Showing Condenser Kv-a. Required for Any Desired Power-Factor Correction in Per Cent of Existing Kilowatt Load.

(4) No expensive foundations are necessitated for the installation.

(5) The high efficiency of the apparatus, better than 99% for direct application, results in good operating economy which when capitalized is a valuable asset.

The location of the equipment is of paramount importance, for to secure the best results the correction should be made at the source of the wattless current and thus avoid the transmission of this component, thereby decreasing line copper losses.

It might even be found advantageous on long feeders with a large number of distribution circuits emanating therefrom, to install small condenser units with each distribution transformer, thereby obtaining a balanced corrective effect over the entire network. Such an arrangement would obviate the transmission of wattless current, and in many instances be preferable to confining the corrective apparatus at a central distribution point.

Causes of Low Power-Factor.

The conditions producing low power-factor are many and varied, such as electric furnace loads, arc

Small lighting transformers have a regulation ranging from 1½ to 2% at unity power-factor with a reduction in this characteristic of from 4 to 5% at 70% power-factor. In the case of larger units, with a regulation of 1%, this value would be lowered to 3% at 70% power-factor.

The detrimental effects of a poor power-factor are even more apparent in generators than in transformers and is productive of both a decrease in kilowatt capacity and efficiency. Not only will such a condition impair the voltage regulation, but often demands increased exciter capacity to overcome the demagnetizing tendency of the lagging power-factor current set up in the armature.

As a consequence the field heating of alternators is greatly augmented, while the increased energy input and decreased energy output considerably lowers the efficiency.

It is, therefore, evident that a relatively high leading power-factor is more efficient than a low lagging power-factor, for the voltage will be maintained at a higher value with a corresponding decrease in excitation, owing to the fact that the generator will be partially excited by the capacity current in the armature winding. The detrimental effect of low power-factor is further emphasized when it is considered that the regulation of modern alternating-current generators is approximately 14% at unity and drops to 30% at 70% power-factor.

The question of the flexibility factor of the static condenser is closely related to the foregoing, but it will be found in the majority of cases that the reduced power-factor at light load periods is offset by the comparatively high condenser capacity, so that the power-factor will improve at this point and possibly advance to a leading value.

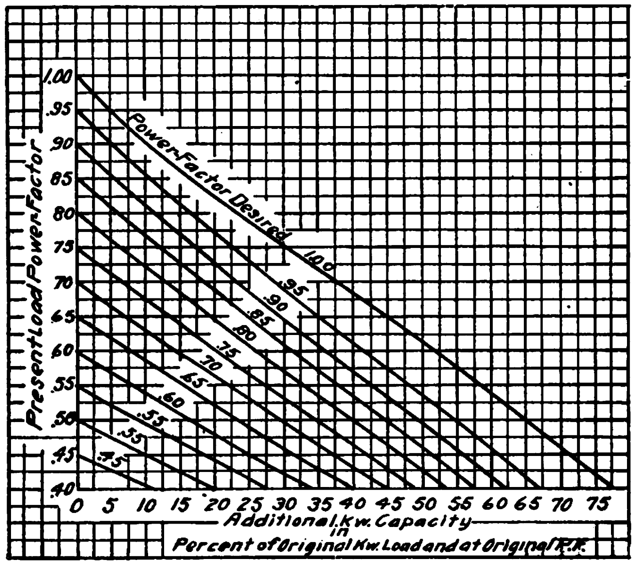


Fig. 7.—Curves Showing Additional Kilowatt Capacity Made Available by a Given Correction of Existing Power Factor.

If, in extreme situations, automatic operation is justified, it can be accomplished by the introduction of a time switch or other automatic features.

The effect of lower power-factor on the distribution circuits is even more pronounced as evidenced by the following example:

Assume that a load of 100 kw. is to be transmitted a distance of two miles at 2300 volts, three-phase, 60 cycles, with an energy loss of 10%—each conductor at unity power-factor would require an area of 25,000 c.m., at 0.9 power-factor 30,820 c.m., while at 0.60 power-factor it would necessitate the use of 69,500 c.m.

It is thus apparent that it will require 2.8 times as much copper at 60% power-factor as at unity.

If the initial cost is capitalized, it will be found that the increased copper demanded will cost somewhat less than a static condenser of sufficient size to accomplish the same result, but it is evident that the gain in the available capacity of generators, transformers and lines would justify such cost differential.

A few of the benefits derived from an improvement in power-factor may be summarized as follows:

(1) Makes possible the meeting of increased demands without the purchase of additional generating equipment, and this refers not only to the generators themselves, but to the necessary prime movers and auxiliary apparatus.

(2) Permits additional load being carried on existing distributing feeders, which might otherwise be fully loaded with the low power-factor existing.

(3) Effects a material saving in present transmission losses.

Operating Costs and Purchase Price.

The extremely moderate operating cost and approximate prices of static condenser equipments are illustrated by the curves shown in Figs. 4 and 5.

The total yearly operating expense referred to in the curves comprises two items, one a capital charge at some assumed percentage of purchase price of the equipment in question, and the other representing the cost of furnishing the losses of the equipment at an assumed number of hours per year operation at full load charged at a stated price per kilowatt-hour.

Application of the Static Condenser.

The determination of the size of a static condenser equipment required to correct the power-factor of a given load is graphically illustrated by the curves in Fig. 6.

A concrete idea of the saving made by correction of the power-factor is emphasized by the curves appearing in Fig. 7, which show with a given improvement in power-factor the amount of load in kilowatts at the original power-factor which can be added to the system. It is assumed that the circuit was carrying the maximum amperes before the correction was made.

If, however, when the correction is accomplished, only the load on the circuit at that time was considered, the addition of more load at the original power-factor will cause a consequent reduction in power-factor, and this point should be considered, if it is desired to maintain a certain power-factor and keep the line loaded to a maximum carrying capacity. Fig. 7 illustrates the resultant power-factor for different corrections, assuming that the line is again loaded to capacity. The solution of practically any power-factor problem may be developed from the use of the curves appearing in Figs. 6, 7 and 8.

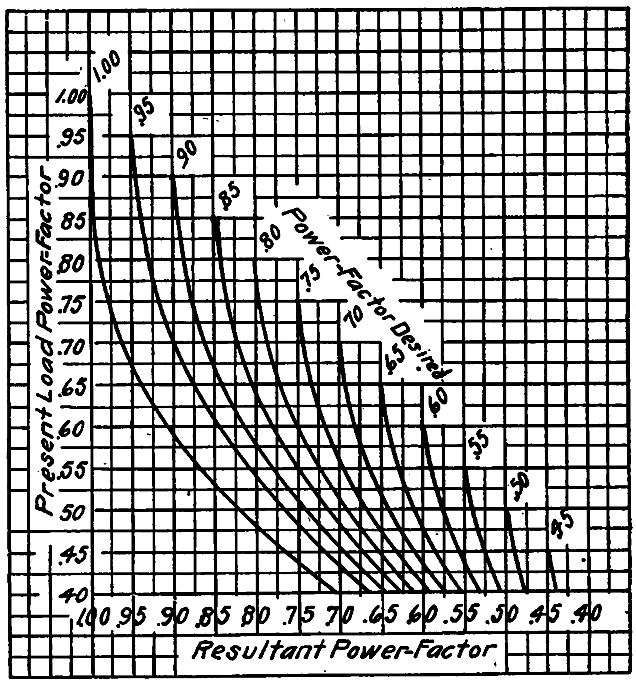


Fig. 8.—Curves Showing Resultant Power-Factor.

Determined by original load at corrected power-factor plus additional load at original power-factor so that total kilovolt-amperes of circuit is equal to original kilovolt-amperes.

The problem of power-factor improvement is at the present time closely allied with the question of rates, and numerous remedies for bettering conditions are either being utilized or are under consideration. Prominent among such corrective measures are the enforcement of power-factor penalty clauses or metering on the kilowatt-ampere basis.

The rapid growth in load so frequently encountered illustrates the necessity for a rather generous attitude on the part of the public toward the utility, so that the increase can be properly taken into account and the best interest of both the public and company conserved.

The importance of power-factor is appreciated more and more by engineers, but there is still the need for more organized co-operative effort toward the betterment of power-factor conditions in alternating current systems. This tendency is particularly apparent in many sections of the country, especially where large individual users of power are scattered over the system, and without doubt will ultimately be more seriously considered as a vital element of power distribution and transmission.

FRENCH MARKET FOR ELECTRICAL GOODS.

Report by American Chamber of Commerce in France.

In a recent report made by American Trade Commissioner Charles P. Wood during his investigations in France in regard to the possibilities of marketing American electrical goods, he stated that prior to the war a considerable amount of electrical goods was imported from Germany by French dealers in competition with other dealers handling French-made goods. It is thought that most of the inquiries in this line now come from the former class of dealers, who have lost their connections and who, naturally, have no claim on French manufacturers already represented.

American underwriters' standards are not necessary in France. French houses are more nearly fireproof than American houses and the same precautions do not have to be taken. American dealers exporting to France will have to furnish French patterns in several fittings that differ essentially from American practice. Among the more common instances will be: Bayonet sockets instead of screw sockets, tumbler switches instead of snap switches, sheet-metal tube with crimped joint and lined with treated paper instead of heavy metal conduit. This light conduit employs sleeve unions instead of screwed joints.

There have been inquiries regarding the conduit mentioned above, which is scarce in France at present. Other inquiries refer to: Multipolar snap switches, flush-type push button switches, all fittings requiring hard rubber in their manufacture, high-candlepower low-volt incandescent lamps for motion picture machines.

While there is a certain demand for the importation of electrical goods in France at present, and while it is undoubtedly worth while to solicit this business and to take orders, if possible, it is also well to bear in mind that there are French factories well equipped for making a full line of electrical goods and that their production will be on the increase. Therefore orders taken during the present emergency, should not be considered an indication of a considerable future demand, except in the case of specialties controlled in America.

NEW HYDROELECTRIC INSTALLATION FOR MADAGASCAR.

Plant of 3000-Hp. to Be Built with Fifteen-Mile Transmission Line.

The installation of a water and electric-light system for Tamatave, the principal port of Madagascar, is under consideration by the authorities and the project has the approval of the Governor General.

The electric current is to be furnished by waterfalls situated 10 to 15 miles west of Tamatave, in the Ivondronó river. In view of the capacity of these falls, estimated at 3000 hp., it is agreed that in addition to the municipality of Tamatave the colony of Madagascar and dependencies should also become interested, and that this water power should be made available in order to furnish power for the general future needs of the colony in connection with such important undertakings as the electrification of the railway from Tananarive to Tamatave, a distance of 229 miles, electrometallurgical and electrochemical industries, etc. It is proposed, therefore, that the colony undertake the harnessing of this water power, which would necessitate the building of a dam, reservoirs, canals, and a power plant. The obligation of the municipality will thus be reduced to the installation of two groups of turbines to furnish 500 kw. of alternating current, power cables, transformers, and the distribution of water in the town of Tamatave. The colony's expenses in this connection will, it is estimated, be $120,625, and those of the municipality of Tamatave $236,425.

It is being considered whether it will be better to have all of this work done under contracts to be awarded on bids or to have it undertaken by the local services. Whatever might be decided, however, it is admitted that the first part of the work—that which is to be undertaken by the colony—should be awarded only to contractors in the colony, and proposals for the second part should be submitted concurrently in the colony and in France. As a rule, all contracts for public works in Madagascar are awarded to French citizens only.

INTERESTING BOOKLET DESCRIBES CHICAGO ELECTRICAL SHOW.

Amusing Report by Well-Known "Japanese School Boy" Describes Features of Coming Exposition.

An interesting and amusing pamphlet entitled "The Japanese School Boy Learns of the Land of the Wonderful Lamp" is being distributed by the Electrical Trades Exposition Co. describing the Electrical Show to be held in Chicago Oct. 11 to 25. In this pamphlet the Japanese school boy, originated by Wallace Irwin, relates in his most amusing style an interview with E. W. Lloyd, general manager of the show. in which he describes its features and attractions, and supposedly is given the Herculean task of arranging the display before the show and of serving tea to its lady visitors.

The booklet is attractively illustrated with views of the various Chinese display booths, all of which are pleasingly decorated and designed to fit into the general decorative scheme.

Copies of this booklet can be obtained by writing E. W. Lloyd, general manager of the Chicago Electric Show, Edison building, Chicago.

Practice in Making Electric Utility Appraisals

Discussion of the Value of Unit Costs and Necessity for Care in Their Preparation — Practical Methods of Appraising the Land, Buildings and Pole Lines

By CHARLES W. McKAY

Chief Appraisal Engineer, L. V. Estes Incorporated, Chicago.

THE importance of the subject of unit costs in appraisal work can hardly be exaggerated. No matter how carefully the inventory may be prepared, nor how accurate it may be, it is worse than useless if the unit costs used in its appraisement are faulty. To illustrate:

Let us assume that a certain electric utility plant contains 1000 30-ft. 7-in. poles and that the field men in recording the inventory have observed the utmost detail in describing the condition of the poles, noting whether or not they are stepped, painted, butt-treated, etc., in short that the inventory represents an extremely accurate record of the conditions actually existent in the plant. Such an inventory should result in a splendid appraisement, if reasonable care is exercised in preparing the unit cost. Obviously, it will be necessary to derive but one unit cost and this cost will be multiplied by 1000 to obtain the total cost of the 1000 poles. Hence, even a slight error in the preparation of the unit cost may result in a grievous error in the appraisement. Assume that due to some mistake in computation, or in the basic assumptions, the unit cost is $1.50 too low. There will be a resultant appraisal error of $1500.

Methods of Determining Unit Costs.

The unit cost, it should be remembered, includes not only the cost of material used in plant construction but also the cost of the labor necessary to install such materials as a part of the operating plant.

As a prelude to a more detailed discussion of the subject of unit costs, it may be well to say that there are two prevalent methods of determining the costs used in electric utility appraisement. One of these methods is known as the "trend method" and the other as the "average method."

In the trend method curves are plotted showing the prices prevalent for the various materials used in electric utility construction; the slope of these curves is determined for the period immediately antedating the appraisal and the curves are extended, or projected, to predict future material prices. A similar process is followed with respect to labor costs. In other words, when it comes to a final determination of the unit cost, the *trend* of material and labor costs is considered.

This method has not found favor with many of the state commissions and for this reason it will only be mentioned as a factor in public utility appraisement. No attempt will be made to enter into a discussion of the merit of this method, as advanced by its defenders. The writer is of the opinion that the trend method is obsolescent and quite unsuitable for use in these days of abnormal prices.

In the average method of determining electric utility unit costs, a careful investigation is made of all material and labor costs for a period of five years or more antedating the appraisal and the results obtained by averaging these costs are used as a basis for determining the unit costs. The word "basis" is used advisedly in this connection. The exact average as obtained by the consideration of the costs prevalent over a given period is not always suitable for use in appraisal work. The individual peculiarities of every case must be considered and an effort made to so reconcile these peculiarities as to determine a *fair* cost. Such a fair cost may, or may not, be an average cost, although in applying the average method the *average* cost is a guiding factor in determining

Suggestions for Making the Appraisement Dependable.

IN previous articles of this series it has been shown that valuation of the utility's property is a usual accompaniment of rate cases in which the utility is involved. This valuation must be quite accurate and yet made with reasonable speed and at as moderate a cost as possible. The first feature in the valuation is the inventory and this Mr. McKay discussed in his last article (see August 9 issue), showing methods for systematic counting and recording of the data. In the present article he makes valuable suggestions for determining accurate unit costs to facilitate setting down the actual appraisement figures.

This article is the fifth of a series of twelve by Mr. McKay covering the subject of valuation and rates, as related especially to electric central-station companies. The first article appeared in the issue of May 17 and presented a general introductory discussion of modern ideas of utility regulation. In the second article (issue of June 7) there was a compilation of the principal terms used in this work and definitions thereof. Why reproduction cost is now used as the basis of appraisement was discussed in the third article, in the June 28 issue. The actual inventory was the topic taken up in the fourth article, August 9 issue. Several other articles dealing with appraisement will be included before other topics bearing on rate-making will be taken up.

Throughout this series it is the author's aim to present the principal features of valuation and rate-making in a simple and understandable manner that will make clear to the central-station manager and engineer, as well as others interested in the subject, the fundamental basis of modern practice in utility regulation.

what is to be taken as the actual fair cost in the particular case.

With this brief resumé of the theory of the unit cost derivation we may proceed to a consideration of the appraisement of the inventory discussed in the issue of the Electrical Review for August 9.

Land Appraisement.

It is interesting to note that several of the leading public utility commissions have taken the stand that neither the utility companies nor the engineers who represent them are competent to testify as to land values. In the writer's opinion this point is not well taken, but nevertheless it is well to bear it in mind in preparing a case for presentation before a commission that has put itself on record as holding such a prejudice. Be it understood that the foregoing statement is by no means intended as a criticism of the method of procedure of any commission—the fault may be laid at the door of several members of the engineering profession who have floundered in their testimony as to land appraisement, to the discredit of the entire profession.

Use of Land.—There has long been a difference of opinion between public utility appraisal experts as to whether or not *use* should be a factor in the determination of the value of the land occupied by electric utility companies. One faction argues that there is no real reason why land, or right of way, belonging to, say, an electric railway company, should be treated any differently from land belonging to a private individual. The other faction argues that the mere fact that the railroad is present raises the values of adjoining properties and therefore automatically raises the value of the land, or right of way, under appraisement. There is undoubtedly much to be said in favor of this argument, but one point should be carefully borne in mind and that is that if this policy be adopted in one case it must, to be consistent, be adopted in all cases, at least in the same appraisement. While the presence of an electric railway may increase surrounding property values it is equally true that the presence of a large central station using soft coal, let us say in a residential district, may cause a decrease in surrounding property values and the utility company owning the central station must suffer a depleted valuation of its land.

The attitude of the courts on this subject is evidenced by the following quotation from the case of Columbus Southern Railway *versus* Wright (151 U. S. 481):

"The value of the land depends largely upon the use to which it can be put, and the character of the improvements upon it."

Method of Appraising Land.—Two methods have been advanced for the appraisement of land in public utility rate cases, the one known as the "expert method" and the other as the "sales method."

The expert method consists in the appraisement and description of the land by one or more competent real-estate experts, or appraisal engineers, the valuation as thus determined being substantiated by expert testimony on the witness stand. Sometimes a modification of this method is adopted by having a local real-estate expert make a valuation of the land, submitting his findings to the commission, and subsequently to have the appraisal engineer make an entirely separate investigation and submit his findings to the commission. The commission's engineer, having both of these valuations before him and having cross-examined the witnesses to his entire satisfaction, may take upon himself the problem of assigning the final value of the land to be included as evidence in the rate case.

Again, it may happen that as many as three or four experts may be called upon to evaluate the same parcel of land. Subsequently their valuations may be compared and a final value assigned by the appraisal engineer as evidence to be presented to the court or commission.

The sales method of evaluating public utility land requires a careful study of land values in the territory contiguous to the land under appraisement and as a result of this study the derivation of a unit cost to be used for valuation purposes. This unit cost may consist of a cost per square foot, cost per front foot, or a cost per acre as the case may require. The value of the adjoining land is determined by examining records of sale or transfer at a time as nearly coincident as possible, to the date of appraisement. In some cases tax-assessors' valuations are used as a basis for determining the unit.

In a decision, dated March 8, 1910, the Wisconsin Railroad Commission (in the case of State Journal Printing Co. *versus* Madison Gas & Electric Co.) discussed the sales method of evaluating real estate at some length. The case is a historic one and excerpts from the Commission's decision are quoted herewith.

"The sales method of valuing real estate was used partially in the Michigan railway appraisals of 1900-01, and in the light of the experience gained in that work the method was adopted in the Wisconsin steam-road valuation made under the provisions of the ad-valorem-assessment law of 1903. It has since been extensively used in Wisconsin and elsewhere in connection with important valuations of public service properties for both rate-making and taxation purposes, and is generally accepted as a valuable aid to the judgment by experts engaged in such valuation work on a large scale.

"The sales method may be defined as a plan or process for the systematic collection and comparison of data relating to real-estate transfers for the purpose of estimating true market realty values. It consists in a study of the transfers of neighboring property having conditions or characteristics similar to the land whose value is to be determined, and is intended to duplicate, as nearly as may be, the mental or judicial processes ordinarily employed by the so-called 'local real-estate expert,' with a view to arriving at results approximating those which would be reached by such local expert acting without bias or suggestion.

"The sales method is capable of application in a variety of ways, in fact, is as flexible in its possible applications as are the varied methods employed by individual local experts. Two interpretations of the sales method have been most commonly employed. In one of these the area and consideration in each sale of similarly situated land is found, and the average unit price—per square foot, per foot frontage, per lot, per acre, etc.—ascertained, and this unit applied to the tract under investigation.

"The other application of the method introduces what, in many cases, is believed to be an additional safeguard, consisting of the use of the average assessed value of adjacent or similarly situated lands in combination with an average ratio or percentage representing the relationship of the assessed value of transferred lands to the total consideration paid for such transferred lands in the district or locality under consideration, all of these figures being based on the 'ground values' exclusive of the improvements thereon.

"Such use of assessment figures is designed to introduce, as far as may be, the results of the judicial processes of the assessor, who, at least in theory, serves on behalf of the public as an unbiased expert in the matter of relative valuations, and who attempts to make allowance for the peculiar attributes or characteristics of individual parcels of real estate in any given locality or neighborhood of a city.

"In the broader and more flexible applications of the sales method, the expert adopts one or the other of the processes just outlined, or blends the two together in such fashion as to yield the most consistent and trustworthy final result. In the process of valuing a tract of land involving conflicting data, as in the case under consideration, the expert user of the sales method on this flexible basis derives a series of tentative results similar to the results representing the judgments of individual local experts.

"The judicial function involved in the discriminating selection of data and in the derivation of final results is exercised along essentially parallel lines with the two classes of experts here compared. The further act of the judgment in selecting a final preferred valuation figure in the light of a group of preliminary or tentative results is identical in the two cases.

"In the particular valuations here considered, the similarity of the basis is further emphasized by the fact that the results by the sales method represent the composite judgment of four members of the Commission's expert staff, as against an equal number of local real-estate experts employed by the company. . . . ."

Building Appraisement.

Given the inventory data specified in the article on inventory methods (see Electrical Review for August 9) and a complete set of floor plans, the appraisement of the buildings occupied by an electric utility company is an exceedingly simple problem. There are several ways in which such an appraisement may be effected. The buildings may be appraised by making a detailed estimate of the cost of all materials entering into their construction; they may be appraised by computing the total number of cubic feet of contents and applying a unit cost per cubic foot, or they may be appraised by determining the number of square feet of floor area and applying a unit cost per square foot.

It is probable that the first mentioned method is the best—that of estimating, with a considerable degree of detail, the amounts of the various kinds of materials entering into the building construction; estimating the cost thereof, and of the attendant labor necessary to erect the building. However, this method is somewhat laborious and it is thought that accurate results may be obtained, by specially experienced building appraisers, with the aid of simpler methods.

Knowing the type of construction—and most central-station buildings may be divided into a half dozen or more standard classifications—it is a comparatively simple matter to determine a unit cost per cubic foot of contents which may be used in the building appraisement. The use of this method, however, should only be attempted by one thoroughly versed in the appraisement of central-station buildings. Great care should be exercised to see that the unit costs are representative ones—especially in these times of high material prices and high wage rates. All unit costs derived upon the volume basis (cubic foot of contents, cubic yard of concrete foundation, etc.) should be carefully checked before they are used. If a building is appraised by the cubic foot method special attention and special treatment should be given to such items as stack, stack foundation, building foundations, piers, excavation, back-filling, etc.

There is still another point which should be most carefully investigated. Most central stations, whether hydraulic or steam, are located near a waterway. It frequently happens that quicksand is encountered in excavating for foundations. This, of course, appreciably increases the cost of the building foundations and provision for such a contingency should be made in deriving the unit cost used in appraising the building. The writer recently appraised a plant in South Dakota, where the central-station building was located a few feet from a stream. It was found that the brick stack cost the company $2500. Under ordinary conditions the concrete foundation for this stack should not have cost over $500 or $600. Something in the soil conditions near the central station made the appraiser suspicious of sub-surface quicksand. After a good deal of trouble the appraiser interviewed the contractor who built the stack and found that his suspicions were well founded. As a matter of fact the actual cost of the concrete foundation—including shoring, piling, pumping, extra concrete reinforcement, etc., amounted to nearly as much as the cost of the stack itself—over $2000.

In view of the fact that, in the case under discussion, the central station was located at the only logical site for a power house, the additional cost of building on quicksand could not be avoided. An allowance, therefore, for this cost was included in the reproduction cost of the power plant. As the foregoing illustration will indicate, it is most important that an investigation be made of the construction history of a central-station building in order to provide, insofar as possible, for such unusual contingencies.

A Practical Method of Building Appraisement.—The following method has been used by the writer in appraising the central-station buildings of electric utility companies.

Assume the case of a brick and concrete building —brick walls with concrete foundations. Assume further that the concrete foundations extend about four feet above the level of the ground. Measure the length and width of the building. Determine the average thickness of the concrete foundation wall and estimate, as closely as possible, the distance the foundations extend below the ground. Knowing the average thickness of the wall and its height (below and above ground) the cross-sectional area in square feet may be determined. Multiply the result by twice the length plus twice the width (in feet) of the building; this will give the total number of cubic feet of concrete in the foundation wall. Make a deduction for door and window openings and reduce the figure above obtained to cubic yards. Apply a unit cost per cubic yard which will include the cost of material, cost of mixing concrete and cost of placing.

Determine the average height of the building above the foundation wall, multiply the figure thus obtained by the length in feet and the result by the width of the building in feet. The result will be the displacement of the building, expressed in cubic feet. Apply a unit cost per cubic foot—this unit cost being weighted to correspond with the type of building under appraisement. It is assumed that the appraiser has a large amount of data available upon which to draw and from which he can select a suitable unit cost. Buildings with different types of roofs and different types of structural steel construction will have correspondingly different unit costs.

Estimate the number of cubic yards of concrete in the stack foundation and apply a suitable unit cost to cover the foundation in place, including material cost, cost of mixing and placing concrete. In this connection it is most important, as heretofore suggested, that the sub-surface soil conditions shall be determined and adequate allowance made in the unit cost for unusual conditions.

If the stack is of brick, determine the height and the average diameter. Build up a unit cost per linear foot of height and apply this unit cost to the total height in feet.

If the stack is of metal, determine the height, diameter and the gauge of the metal. Determine the cost of the material, estimate the cost of riveting and estimate the cost of placing. Stacks of this nature will usually be delivered in cylindrical sections ready for assembly and erection. Provision in the total cost should be made for freight and cartage charges.

There are firms who make a business of building stacks and it is well to obtain all possible cost data from these firms and, where possible, to have them check the cost as determined by the appraiser.

The Pole Line Appraisement.

In the final recapitulation of the inventory of the pole lines, all of the items of inventory are divided into groups according to their individual character-

TABLE 1.—MATERIAL PRICES* FOR WESTERN AND NORTHERN CEDAR POLES.

Height (feet).	Top (ins.).	Quotation, 8-28-14, f. o. b. Indianapolis.	Quotation, 12-16-14, f. o. b. Kokomo.	Quotation, 6-28-15, f. o. b. De Kalb.	Aver'ge, 8-28-14, 12-16-14, 6-28-15.	Quotation, 10-24-16, f. o. b. Decatur.
30	5	$3.40	$3.40	$3.10	$3.30	$3.35
	6	4.05	4.05	3.70	3.93	4.75
	7	5.70	5.70	5.50	5.63	5.95
	8	6.40	....	6.30	6.25	7.00
	9	10.25	....	10.45	10.35	10.80
35	5	....	5.00	5.05	5.03	4.75[1]
	6	6.70	6.70	6.25	6.55	6.20[1]
	7	8.90	8.90	9.05	8.95	7.00[1]
	8	10.25	10.25	10.45	10.32	8.70[1]
	9	13.15	.....	.....	13.15	9.90[1]
40[1]	6	.....	.....	.....	7.92	8.55
	7	8.15	.....	.....	8.15	8.80
	8	9.55	.....	.....	9.55	9.90
	9	.....	.....	.....	11.50	12.00
45[1]	6	.....	.....	.....	10.55	11.00
	7	10.95	.....	.....	10.95	11.56
	8	12.25	.....	.....	12.25	12.75
50[1]	7	13.25	.....	.....	13.25	13.55
	8	14.40	.....	.....	14.40	14.80
	9	.....	.....	.....	16.64	17.10
55[1]	8	16.80	.....	.....	16.80	.....
60[1]	7	.....	.....	.....	17.03	17.50
	8	.....	.....	.....	18.88	19.40
	9	.....	.....	.....	22.39	23.00

*Note that these prices are obsolete and are used for illustrative purposes only.

[1]Western or red cedar.

istics. Poles are grouped according to height and top diameter; anchors according to size and type (patent anchors are separated from log anchors); guys according to size of strand and average length; crossarms according to length in feet and cross-sectional area in inches, etc. The next step in the appraisement is, therefore, the derivation of a suitable unit cost for each inventory group.

Unit costs applicable to the various classifications of poles are usually built up simultaneously, one study being made of material costs and another of labor costs. In determining the material costs, prices are obtained not only as of the date of appraisement but also for the several years preceding the appraisal. Table I presents the results of the pole-cost study made in connection with an actual appraisal. In this connection it should be noted that the appraisement under consideration was made some time ago and the prices, of course, are useless today. Prices as used in this series of articles are merely for illustrative purposes and should not be used in actual appraisal work. It is most unwise to quote prices in technical articles, or in books on the subject of appraisement, except for illustrative purposes. Prices vary so rapidly that there is always danger of misleading the reader.

In the first column of Table I the height of pole (in feet) is given; in the second column the top diameter (in inches) and in the last five columns quotations, over a two-year period, f. o. b. various points in the vicinity of the plant under appraisement. It will be noted in this particular case it was not necessary to examine prices over a five-year period. The reason for this will be apparent from the date of the price quotations. Prior to 1914 there was little change in pole prices for several years. The appraisal from which this illustration was taken was made in the latter part of 1916. Hence, the analysis of prices over a two-year period was sufficient. It proved the fairness of the unit costs used in the appraisement.

The next step in the derivation of the pole unit costs involves the determination of proper labor costs. Table 2 presents a rather complete analysis of the labor costs entering into the preparation and erection of electric light poles. The various operations are listed in the left-hand column (for pole sizes of from 25 to 35 ft., inclusive) and the corresponding costs for different diameters of poles are entered in the last six columns.

It will be noted that the item "supervision" is included in Table 2. Supervision, in this case, is limited to the direct supervision of the gang foreman, only the salary and expenses of the gang foreman and that portion of the salary and expenses of the supervising foreman which may be allocated to pole-construction work being included in the unit cost. The cost of general supervision—the supervision of general officers—falls under the collateral construction costs and will be discussed in a subsequent article.

Before preparing a study of the nature of the one illustrated in Table 2 it is necessary to ascertain the labor wage rates prevalent in the community in which the plant under appraisement is located and also to see that the labor rates used as a basis for the labor unit costs are not too high or too low, in other words, that they represent fair average prices for the four or five years antedating the appraisal.

Table 3 is in the nature of a summary of the studies presented in Tables I and 2. Fair pole prices, as determined from Table I, are shown in the third column. In the fourth column it will be noticed an allowance of 2% of the cost of the pole is added for waste and loss. Such an allowance is customary in

TABLE 2.—LABOR COSTS OF CEDAR POLES IN CITY, EXCLUSIVE OF PAINTING, STEPPING, SHAVING AND GAINING.

	Inches					
	5	5½	6	6½	7	8
25-foot—						
Unloading	$0.109	$0.123	$0.138	$0.153	$0.170	$0.206
Roofing	.032	.036	.041	.046	.050	.061
Hauling	.272	.309	.346	.381	.425	.515
Digging	.454	.516	.578	.644	.710	.860
Setting	.301	.343	.382	.426	.470	.569
Supervision, 15%	.175	.199	.223	.248	.274	.332
Total	$1.343	$1.526	$1.708	$1.898	$2.100	$2.543
30-foot—						
Unloading	$0.149	$0.168	$0.190	$0.210	$0.230	$0.275
Roofing	.036	.040	.045	.050	.055	.066
Hauling	.356	.403	.453	.500	.550	.659
Digging	.577	.655	.733	.812	.890	1.066
Setting	.402	.457	.511	.566	.620	.742
Supervision, 15%	.228	.258	.290	.321	.352	.421
Total	$1.748	$1.981	$2.222	$2.459	$2.697	$3.229
35-foot—						
Unloading	$0.200	$0.226	$0.250	$0.274	$0.300	$0.352
Roofing	.040	.045	.050	.055	.060	.066
Hauling	.466	.525	.585	.642	.700	.776
Digging	.716	.809	.902	.991	1.080	1.196
Setting	.534	.601	.668	.734	.830	.886
Supervision, 15%	293	.331	.368	.405	.441	.491
Total	$2.249	$2.537	$2.823	$3.102	$3.381	$3.766

deriving unit costs for materials used in outside plant construction. The reason will be obvious when it is remembered that no matter how carefully materials may be handled, a certain percentage will be broken or lost. Naturally the amounts represented by this percentage will not be found in taking an inventory of the plant, but nevertheless the material was paid for at the time of the plant's construction. In the case of the poles the allowance of 2% is to compensate for poles that are broken in handling. A 2% allowance for waste and loss is used in the derivation of practically all of the unit costs for outside plant construction. This percentage has been determined from observation of a large number of actual construction jobs.

The fifth column of Table 3 is determined by adding the respective figures in columns three and four, in other words, it presents the total material and its costs. The sixth column (labor cost) is taken from Table 2, and the last column presents the complete unit costs.

The unit costs as derived in Table 3 are exclusive of painting and stepping. Where the poles are painted or stepped or both, it is necessary to derive additional unit costs. The derivation of such unit costs is illustrated in Tables 4 and 5. The method will be obvious and it is thought that no explanation is necessary.

Unit Costs for Pole Attributes.—In addition to the poles themselves placed, painted and set, there are several items that must be considered in connection with the appraisement of the pole plant—the pole attributes, as they have been aptly termed by one of the large midwestern companies. The pole attributes consist of crossarms, anchors and guys. Illustrative examples will be given showing the method of deriving the unit costs used in the appraisement of the pole attributes. These illustrations, together with a brief description, should suffice to show the reader how this phase of the work is handled.

Crossarm Unit Costs.—In deriving the unit costs used in the appraisement of the crossarms, it is first necessary to tabulate all data pertaining to crossarm prices for a period of several years antedating the appraisal, in much the same manner as that suggested for the pole plant and illustrated in Table 1. In a similar manner a representative wage-rate schedule must be used in computing the labor costs. Having determined the material and labor costs on a satisfactory basis, the appraisal engineer will then proceed to build up a unit cost per crossarm installed in the manner illustrated in Table 6. It will be noted that a complete bill of material is given (priced out at average material prices) and, after the total material cost is obtained, there is added an allowance for waste and loss and a labor cost for placing the crossarms. The unit labor cost of placing the crossarms is derived by estimating the daily cost of a gang necessary for placing crossarms and determining as accurately as possible the number of crossarms that such a gang would place ordinarily in one day; the total cost per day divided by the number of arms placed a day will give the unit labor cost. The time element (number of arms placed per day) is a most important one and may only be properly determined from extensive data showing the results of actual performances.

Cost of Anchors and Guys.—A similar method is adopted for determining the unit costs used in the appraisement of the anchors and guys. Table 7 illustrates the method of building up the unit cost for anchors and Table 8 that of building up the unit cost for headguys.

We have now completed a consideration of the method of appraisement of the land, buildings and pole-line equipment of an electric utility company. It may be well to again caution the reader that all costs used in the examples are merely for illustrative purposes and should not be used in appraisal work. The practice of prescribing appraisal costs in technical articles and in books on the subject of valuation is an exceedingly dangerous one. Prices change rapidly and, furthermore, prices that are suitable for use in one locality may not be in another, due to differences in freight rates or to some local condition. In every appraisement the unit cost problem should be carefully analyzed by an expert. No attempt should be made to use costs merely because they have been used in some other appraisal, or because they have been quoted in a technical journal.

The next article in this series will deal with the derivation of the unit costs for, and the appraisement of, the remaining items of outside plant—the conduit system, the underground wire and cable, the aerial wire and cable and the transformers. The question of inventory and appraisement of the items "Tools and Supplies" will also be discussed. The appraisement of the central-station equipment will be made the subject of a separate article in which there will be incorporated, in addition to the description of standard appraisal methods, a synopsis of "short-cut" methods which may be used for rough-and-ready ap-

TABLE 3.—SUMMARY OF MATERIAL AND LABOR COSTS FOR CEDAR POLES.

Height (feet).	Top (Ins.)	Pole cost.	2% waste and loss.	Total material.	Total labor.	Cost each.
25	5	$1.08	$0.02	$1.10	$1.40	$2.50
	6	2.10	.04	2.14	1.78	3.92
	7	3.03	.06	3.09	2.19	5.28
	8	3.90	.08	3.98	2.65	6.63
30	5	3.30	.07	3.37	1.83	5.20
	6	3.93	.08	4.01	2.33	6.34
	7	5.63	.11	5.74	2.82	8.56
	8	6.35	.13	6.48	3.38	9.86
35	5	5.03	.10	5.13	2.38	7.51
	6	6.55	.13	6.68	2.98	9.66
	7	8.95	.18	9.13	3.57	12.70
	8	10.32	.21	10.53	3.95	14.48
40[1]	6	7.92	.16	8.08	3.68	11.76
	7	8.15	.16	8.31	4.41	12.72
	8	9.55	.19	9.74	5.14	14.88
45[1]	7	10.95	.22	11.17	5.36	16.58
	8	12.25	.25	12.50	6.29	18.79
50[1]	7	13.25	.27	13.52	6.41	19.98
	8	14.40	.29	14.69	7.51	22.20
55[1]	8	16.80	.34	17.14	8.73	25.87
60[1]	8	18.88	.38	19.26	10.11	29.37

[1]Western cedar.

TABLE 4.—COST OF PAINTING POLES.

Size (feet).	Material.	Labor.	Total cost.
20	$0.23	$0.19	$0.42
25	.35	.22	.57
30	.49	.24	.73
35	.57	.30	.87
40	.65	.37	1.02
45	.74	.45	1.19
50	.84	.53	1.37
55	.96	.62	1.58
60	1.07	.70	1.77

TABLE 5.—COST OF STEPPING POLES.

(Galvanized iron steps, $0.026 each; wood steps, $0.0083 each.)

Height of pole (ft.)	30	35	40	45	50	55	60
No. of iron steps	11	14	17	20	23	26	29
No. of wood steps	5	5	5	5	5	5	5
Material:							
Iron steps	$0.286	$0.364	$0.442	$0.520	$0.598	$0.676	$0.754
Wood steps	.042	.042	.042	.042	.042	.042	.042
Nails for wood steps	.020	.020	.020	.020	.020	.020	.020
Waste and breakage	.007	.009	.010	.011	.013	.015	.016
Total material	$0.355	$0.435	$0.514	$0.593	$0.673	$0.753	$0.832
Labor:							
Boring for steps	0.11	$0.14	$0.20	$0.28	$0.37	$0.48	$0.60
Attaching steps	.12	.15	.18	.21	.24	.27	.30
Supervision, 15%	.03	.04	.06	.07	.09	.11	.14
Total labor	$0.26	$0.33	$0.44	$0.56	$0.70	$0.86	$1.04
Total cost	$0.615	$0.765	$0.954	$1,153	$1.373	$1.613	$1.872

TABLE 6.—ILLUSTRATIVE OF METHOD OF DERIVING CROSSARM COSTS.

1 ten-pin standard 120-in. fir crossarm at $0.63	$0.630
10 1¼-in. by 8-in. locust pins at $0.0123	.123
2 16-d. nails at $0.0001	.001
2 22-in. crossarm braces at $0.051	.102
2 ⅜-in. by 4-in. carriage bolts at $0.015	.030
1 ½-in. by 4-in. fetter-drive screw at $0.025	.025
2 1¼-in. washers at $0.003	.006
1 ⅝-in. by 12-in. machine bolt at $0.077	.077
2 2¼-in. washers at $0.013	.026
Total material	$1.020
Waste and loss at 2%	.020
Total material, including waste and loss	$1.040
Cost of placing crossarm	.495
Unit cost	$1.54

praisal of the central-station equipment. A knowledge of such short methods is frequently an asset to the central-station manager.

The author will be very glad to answer any questions regarding this article, or any of the preceding articles, if addressed to him in care of L. V. Estes Incorporated, 202 South State street, Chicago, Ill.

TABLE 7.—UNIT COST OF LIGHT PATENT ANCHOR.

1 patent anchor, 5-in., at $0.850		$0.850
2 guy hooks at $0.059		.118
1 Crosby clip at $0.155		.155
1 2-bolt clamp at $0.176		.176
10 pole shims at $0.023		.230
1 ⅜-in. thimble at $0.0345		.035
2 fetter drive screws, ½-in. by 4-in., at $0.025		.050
20-ft. ⅜-in. S. & M. strand at $0.011		.220
20-ft. No. 6 B. B. iron wire at $0.0039		.078
Total		$1.912
Add 2% loss and waste		.038
Total material		$1.950
Labor, placing rod	$1.250	
Labor, placing guy	1.000	
Field supervision and teaming	.338	
Total labor		$2.588
Unit cost		$4.54

TABLE 8.—UNIT COST OF HEADGUY.

75-ft. 5/16-in. S. & M. strand at $0.0132		$0.990
50-ft. ⅜-in. S. & M. strand at $0.011		.550
2 guy hooks at $0.0590		.118
2 fetter-drive screws, ½-in. by 4-in., at $0.025		.050
10 pole shims at $0.023		.230
2 Crosby clips at $0.155		.310
2 2-bolt clamps at $0.176		.352
Total		$2.600
Add 2% loss and waste		.052
Total material		$2.652
Labor, placing guy	$2.500	
Field supervision and teaming	.300	
Total labor		$2.800
Unit cost		$5.45

PRIVATE OWNERSHIP SUPERIORITY DEMONSTRATED IN WORLD WAR.

E. N. Hurley, Former Shipping Board Head, Says Lesson Taught Is to Be One of Greatest Benefit to Country.

E. N. Hurley, formerly chairman of the United States Shipping Board, who has resigned after serving throughout the war, was asked if he would tell, as a sort of valedictory to the American people, what in his job had impressed him most. Mr. Hurley's opinion is valuable in that he knows both phases of industry, having risen from a railroad fireman to the head of one of the largest machinery concerns in Chicago.

"The efficiency of private ownership and operation as compared with public ownership and operation," was the answer, "and I believe this lesson, as it is brought home more emphatically to the American people, is to prove one of the greatest benefits we derived from the war.

"As new facts about the conduct of the war come out, as our experience in many fields of production is appraised, they will point, I predict, more unerringly to this same conclusion—the superior efficiency of private ownership. *All production centers on the cost*—you can't get away from that. Shift responsibility for the cost, for the best possible result under a given set of circumstances, and you shift the responsibility for efficiency. That is what we did on the Shipping Board, under the pressure of war's necessity, when the question of cost was forced into second place. We shifted the responsibility of the cost from private shipbuilding concerns to the Government.

"With the shifting of responsibility of cost to the Government, that keen interest in results which follows private initiative was gone. There you have the whole problem as between public ownership and private ownership stated. No way has been found to instill in public ownership the incentive that possesses private ownership to improve conditions of production.

"The cost-plus-percentage system was a great mistake, and from the start had a bad effect on the workmen and the management. No private concerns could have operated and paid their way on the wages paid under that system. On the basis of cost they could not have borrowed money from the banks. The whole proposition of government ownership is fine in theory; in practice the push of individual energy is missing.

"I don't know of a government-owned plant that produces more than two-thirds efficiency. When the manager has no dividend to strive for when the toll is paid, the slowing up is sure to follow. In the years to come some way may be found to keep incentive to best endeavor in men under government ownership, but until that is discovered that system may be classed as a failure."

ANOTHER MARITIME APPLICATION OF ELECTRICITY DEVELOPED.

Earl C. Hanson Devises Practical Method of Guiding Ships in Harbors by Electricity.

If a new electrical device now being perfected meets with expectations, much delay in ocean travel due to weather conditions will be eliminated in the near future. This has already been accomplished to a certain degree by the development of the radio compass. The new device, however, carries the electrical guiding idea further by enabling a vessel to enter and leave a harbor in all sorts of weather with comparative safety.

It was invented by Earl C. Hanson, of Los Angeles, Cal., and has already been turned over to the Navy Department where it will be put into practical application as soon as all its details are perfected. Tests are to be made at once at the naval base at New London, Conn., and later it is intended to give it a further trial in Ambrose channel in New York harbor using some of the large ocean liners for the test.

The device and the methods of application are comparatively simple. A suitable cable is laid in the ship channel through which is sent a low-frequency electric current. The current in this cable actuates devices on the ship which in turn set up a peculiar sound. This sound indicates when the vessel is directly over the cable. Any variation in the course away from the cable is indicated by visible indicators that show in feet the distance away from the cable. Several of the indicators and sounding devices may be located in the various parts of the ship.

By following these indications the ship can follow the cable line from the harbor line to the dock. Two such cables will be installed, one for ships entering the harbor and the other for those going out. The sound on each cable is different and there can be no confusion which greatly lessens the possibilities of a collision.

Along the cable at certain intervals a short section is insulated with lead. Through such sections no sound can come and therefore the man on listening duty can tell instantly how far the ship has progressed and by referring to the cable chart ascertain where the cable turns and dangerous places are and in which direction the ship must be steered to follow the channel.

Central-Station Rates in Theory and Practice

Tenth Article—Continuation of the Mathematical Analysis of Price Splitting When Value-of-Service Principle Is Followed—Conditions Under Which Price Reductions Are Desirable as Regards Earnings

By H. E. EISENMENGER

This is the tenth article of this series. A general outline of the entire series appeared in the July 5 issue and the first of the articles in the July 12 issue. The first seven articles discussed the cost of electric service, which must be taken into account in any system of rates. In the last two articles a comparison has been made of the cost-of-service and value-of-service policies in rate making, it being shown that the latter permits an extension of the service to such groups of customers as could not be reached if a uniform percentage of profit were expected from all groups. The conditions under which price reductions are possible without curtailed earnings are studied mathematically in Insert IX, which will be concluded next week, and then the main text will be resumed for practically the remainder of the volume.

PART II—THE PRICE OF ELECTRIC SERVICE—Continued.

Insert IX—Appendix to Section 80 et Seq.—Relations Between Selling Prices and Earnings—Continued.

II. PRICES DEPENDING ON THE CUSTOMER'S VALUATION (VALUE-OF-SERVICE PRINCIPLE).

A. EVERY PARTICLE OF THE SERVICE IS CHARGED IN ACCORDANCE WITH ITS VALUATION.

SECTION 7. We change over now from the cost-of-service principle to the value-of-service principle in such a way that, starting with the unit price p, we add one or more other prices *lower than* p, for instance first the unit price p_1, in such a manner that this lower price applies to those parts of the commodity (service) *only* for which the respective customers are not able or willing to pay the original price p, whereas we continue to charge the original price p for all those parts of the commodity which had been sold heretofore under the original system of charging. We will in practice, of course, not be able to fulfill this theoretical requirement entirely, but there are several ways of approaching it with a reasonable degree of accuracy (see Sections 94-102 of the main text and Section 14 of this Insert).

This operation of applying two or more different prices to the same commodity according to the valuation by the purchaser will be called *"price splitting"* and the prices formed in this manner will be called *"conjugated prices"* or a *"price combination."* If the prices split off in this manner are all lower than the original price (as has been assumed so far), the operation will be called *"price splitting downwards"* and the prices split off are *"lower conjugated prices."* If prices are added higher than the original price p in such a manner that they apply only for such parts of the commodity for which the customers would be ready to pay these higher prices instead of the original lower price, the operation is called *"price splitting upwards."* Price splitting upwards and downwards can be combined with each other.

8. As a result of the splitting of the prices we will sell the same total amount of the commodity as if we would offer every unit at the lower unit price p_1, that is, we will sell the quantity m_1, which is greater than m. The gross income b_c of the price combination is composed of two parts: (1) The gross income mp of the original customers who are charged the original price p and therefore buy the original quantity m and (2) the gross income of the new customers who buy the balance, that is $m_1 - m$ at the price p_1, therefore

$$b_c = mp + (m_1 - m)p_1 \quad \text{.......................} (4)$$

$(m_1 - m)\,p_1$ is given by the rectangle MM_1L_1L' and b_c is therefore represented by the shaded area in Fig. A.* No matter how small the lower conjugated price p_1 is, it will always increase the gross income.[1]

9. The total cost of production is determined only by the quantity sold (produced) and not by the prices at which the commodity is being sold. The total cost under the combination of prices is therefore $M_1T_1 = P_1S_1 = s_1$, just as if the whole commodity were offered for sale uniformly at the lower price p_1. Likewise the capital will be $M_1J_1 = P_1K_1 = k_1$.

If the price combination applies, we will therefore have the net income given by

$$n_c = b_c - s_1 = mp + (m_1 - m)p_1 - s_1 \quad \text{..........} (5)$$

and the dividend (interest)

$$v_c = \frac{n_c}{k_1} = \frac{b_c - s_1}{k_1} \quad \text{..........} (6)$$

10. The question with which we have to deal here is the following: When is it possible to add one or more conjugated *lower* prices to the original price p in such a manner that the "earnings" (that is, the gross income b_c, the net income n_c, or the interest v_c, respectively, as the case may be) are *increased* over the original earnings b, n and v?[2]

11. As regards the gross income b we have seen from equation (4) of this Insert that it is always possible to increase it by price splitting downwards, no matter how large or small the original price p or the conjugated lower price p_1 is. There are no lower or upper limits for the prices.

12. As regards the net income we find the following: The original net income is given by

$$n = b - s = mp - s \quad \text{...........................} (7)$$

Subtracting this equation from equation (5) we get

$$n_c - n = (m_1 - m)p_1 - (s_1 - s)$$

Using the symbol Δ for differences in the customary way so that $\Delta m = m_1 - m$ (positive value) and $\Delta s = s_1 - s$ (also positive value) and $\Delta n = n_c - n$ (to be investigated whether positive or negative value) we can write the above equation in the following form:

$$\Delta n = p_1 \Delta m - \Delta s$$

Δn will be >0, that is n_c will be $>n$, if $p_1 > \dfrac{\Delta s}{\Delta m}$.

This means, the net income is necessarily increased by the addition of a lower conjugated price in all cases where that price is higher than the cost increment per unit.[3] Now the original price from which the lower conjugated price has

*See page 389 of last week's issue.

[1]It may be stated here incidentally that we can, of course, add more than one conjugated lower price, in which case the gross income will become greater and the shaded area will contain more than two steps. We can, in fact, add an infinitely large number of conjugated lower prices which will change the shaded area, representing the gross income, into the total area under the sales curve between ordinates given by the highest and lowest prices.

[2]The importance of this problem is based on the following considerations: If it is possible to add the lower prices with the result mentioned, this means that we will be able to increase the earnings by price reductions to some customers without price increases to others. Or with constant earnings we can reduce the prices to all customers as a consequence of the change from the cost-of-service system to the value-of-service system. (See Sections 78 and 88-91 of the main text). The solution of this problem is therefore at the bottom of the question of the superiority of the cost-of-service or the value-of-service system of charging.

[3]See footnote to Section 75 of the main text.

been split off must, of course, according to the definition of a *lower* conjugated price (Section 7 of this Insert) be greater than that lower price. On the other hand, the original price upon which the original cost-of-service system was based must have been greater not only than the cost increment per unit, but even greater than the average cost (see Section 2 of the main text) given by equation (1) of this Insert, otherwise the enterprise would have been a losing one from the outset. We will therefore always be able to add lower conjugated prices which increase the net income. The lower limit of such profitable conjugated prices is the cost increment per unit.

13. As regards the interest (dividend) v we have the original interest v given by

$$v = \frac{n}{k} = \frac{b-s}{k} = \frac{mp-s}{k} \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots (8)$$

Subtracting this from equation (6) we get

$$v_c - v = \frac{b_c - s_1}{k_1} - \frac{mp-s}{k}$$

or, substituting the value of b_c from (4),

$$v_c - v = \frac{mp + (m_1 - m)\,p_1 - s_1}{k_1} - \frac{mp-s}{k} \quad \ldots\ldots (9)$$

Now, again introducing the symbol Δ in the same way as in Section 12 above (also $\Delta k = k_1 - k$), we find from (9) that v_c will be $> v$ if

$$[mp + p_1\Delta m - (s + \Delta s)]k > (mp - s)\ (k + \Delta k)$$

or if $(p_1\Delta m - \Delta s)k > (mp - s)\Delta k$

$$\text{or if } \frac{p_1\Delta m - \Delta s}{\Delta k} > \frac{mp-s}{k} \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (10)$$

The fraction on the left-hand side of this relation may be called the "rate of return of the increments" or "interest of the increments," inasmuch as it is the increment net income divided by the increment capital (see Section 27 of this Insert). We can say, therefore, that the interest will always be increased by the addition of a lower conjugated price if the "interest of the increments" is *greater* than the original interest.

It remains to be shown that such a lower conjugated price can be found in all cases which are to be considered in practice. This is proved in the following way:

If we make the lower price just a trifle, a differential, smaller than the original or upper price, that is if Δp becomes dp, and if we then should find that the differential of v *must* be positive for all upper prices which would be considered under the cost-of-service system, that would mean that the adding of lower prices, at least in a certain range below the upper price, *must* increase the interest (rate of return). It will be shown in the following that this is actually the case.

Calling $v_c - v = \Delta v$, we get from equation (9)

$$\Delta v = \frac{mp + (m_1 - m)p_1 - s_1}{k_1} - \frac{mp-s}{k}$$

Substituting now $p_1 - p = -\Delta p$* or $p_1 = p - \Delta p$
and $m_1 - m = \Delta m$
and $s_1 - s = \Delta s$ or $s_1 = s + \Delta s$
and $k_1 - k = \Delta k$ or $k_1 = k + \Delta k$

we get Δv

$$= \frac{mpk + \Delta m(p - \Delta p)k - (s + \Delta s)k - mp(k + \Delta k) + s(k + \Delta k)}{k(k + \Delta k)}$$

$$= \frac{pk\Delta m - k(\Delta m\Delta p + \Delta s) - (mp - s)\Delta k}{k(k + \Delta k)}$$

If we now choose Δp smaller and smaller and let it converge towards dp with a consequent change of the other differences into differentials, magnitudes of the second order will vanish beside those of the first order and we get

$$dv = \frac{pk\,dm - k\,ds - (mp - s)dk}{k^2} \quad \ldots\ldots\ldots\ldots\ldots (11)$$

If now dv shall be > 0 the numerator of (11) has to be positive or $p(k\,dm - m\,dk)$ has to be $> k\,ds - s\,dk$ or

$$p \text{ has to be}^4 > \frac{k\,ds - s\,dk}{k\,dm - m\,dk} \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (12)$$

This is the condition for a positive dv, or in other words the condition that there is a certain range of prices in existence within which the conjugation of lower prices raises the rate of return v.

Now, from Fig. A and equation (1) of this Insert we see that the average unit output cost $s/m = \tan\sigma_0$. According to fact No. 3 of Section 1 of this Insert, $\tan\sigma_0$ must continually decrease if m increases (see Fig. A) which means that

$$\frac{d\,(s/m)}{dm} \text{ is always} < 0$$

$$\text{or } \frac{m\,ds - s\,dm}{m^2} < 0$$

$$\text{or } m\,ds \text{ is always} < s\,dm$$

Multiplying by k and then subtracting $sm\,dk$ from both sides: $m(k\,ds - s\,dk)$ is always $< s(k\,dm - m\,dk)$

We can divide both sides of this relation by $m(k\,dm - m\,dk)$ without reversing the sign of inequality because this product is essentially positive[5] and we arrive in this manner finally at the following relation for s/m:

$$\frac{s}{m} \text{ is always} > \frac{k\,ds - s\,dk}{k\,dm - m\,dk} \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots (13)$$

The right sides of (12) and (13) are identical. If therefore $p = s/m$ the condition (12) will be fulfilled and if $p > s/m$ the condition (12) must be all the more fulfilled. As we have seen in Section 12 of this Insert,[6] prices which are fit for a practical system of charges under the cost-of-service principle will always be greater than s/m and therefore there will always exist a certain range below the original price within which the conjugation of lower prices raises the rate of return.

B. THE VALUATION AFFECTS THE PRICES OF GROUPS OF SERVICE ONLY, BUT NOT OF EVERY PARTICLE.

14. The above deductions are based on the assumption that we can charge every particle of the service according to the valuation it meets from the customer, which means, not only are different services charged differently to the same customer, and different customers differently for the same service, but different units of the same service will be charged differently even though they are sold to the same customer (see Section 73 of the main text).

We can, of course, never carry out this assumption strictly in practice. We must group large numbers of units into one class of service or of customers, and then charge the whole class under a uniform rate or rate schedule. We may, for illustration, charge all kilowatt-hours for heating service at the same price and differently from the kilowatt-hours for other classes of service. The same may apply to the kilowatts demand for heating service. Or we may charge the first 500 kw-hr. of wholesale power service at a separate price, etc. We will thus select a certain limited number of unit prices and the problem is to choose these prices at such amounts as produce the maximum of earnings which is possible with the chosen number and distribution of prices. This grouping of the individual units into classes means of course a deviation from the theoretical system of charging, inasmuch as some of the units will be charged at lower prices than they could fetch at the utmost, whereas for others there will be demanded too high a price so that they cannot be sold. Therefore this grouping will reduce the earnings below the earnings of the theoretical system which charges every particle of the service individually.

As the units within each group are charged at the same price, this grouping amounts to resolving the value-of-service system into a number of cost-of-service systems. The relative prices of the various groups are determined according to the value-of-service principle. We have therefore in this *practical value-of-service system* a hybrid between the cost-of-service system and the real value-of-service system.

15. We have now a problem parallel to the problem of Section 10 et seq. of this Insert as follows: Can we increase the "earnings" in this practical system by lowering the prices of one or more of the groups without raising the prices to any

*Note that $p_1 - p$ has a negative value because the lower price p_1 is smaller than p, whereas with the values m, b, s, and k the subscript 1 indicates an increase: $m_1 - m = +\Delta m$, etc., because the amount m, etc., which belongs to the lower price p_1 is greater than the amount which belongs to the original price p.

[4] We could also arrive at the same result by direct differentiation of v, n and b and subsequent substitution of the results, but the above method seems to be both shorter and clearer.

[5] The factor m is obviously always positive and as regards $(k\,dm - m\,dk)$ this can be written as $k^2 \frac{d(m/k)}{dm}\,dm$. Now fact No. 4 of Section 1 of this Insert shows that m/k (which is given by $\cot\kappa_0$, see left-hand portion of Fig. A) increases with increasing m so that $\frac{d(m/k)}{dm}$ is essentially positive: dm is also positive because we start with a *reduction* of the price p by the differential dp, which (with reference to the shape of the sales curve Fig. A and fact No. 1 of Section 1 of this Insert) necessitates dm being positive. The product of all these factors is therefore positive.

[6] This can also be seen from equation (7) which shows that the net income (and consequently also the rate of return) is positive as long as $mp > s$, which means as long as $p > s/m$.

other group? To investigate this matter we will start with two groups of service only, called g and G (for instance, electric service for heating purposes only and for all other purposes) and the conclusions drawn from this investigation will then be extended to the case of a subdivision into more than two groups.

Each one of these groups has its own sales curve, M and m, respectively. The total-sales curve M_t is formed by the addition of the ordinates of M and m (see Fig. B). Under the original cost-of-service system both groups are charged the unit price p_0. This results in the sale of M_0 units of group G and of m_0 units of group g.

We shall now investigate the behavior of the three species of "earnings" (gross income, net income, and rate of return) if we split the prices between the two groups.

1. Gross Income.

a. Shape of the Gross Income Curve.

16. The question is: When can we lower the unit price in any one or both of the two groups, for instance in g, in such a manner that the aggregate gross income is increased thereby? We lower the price in group g from p_0 to p_1, thereby

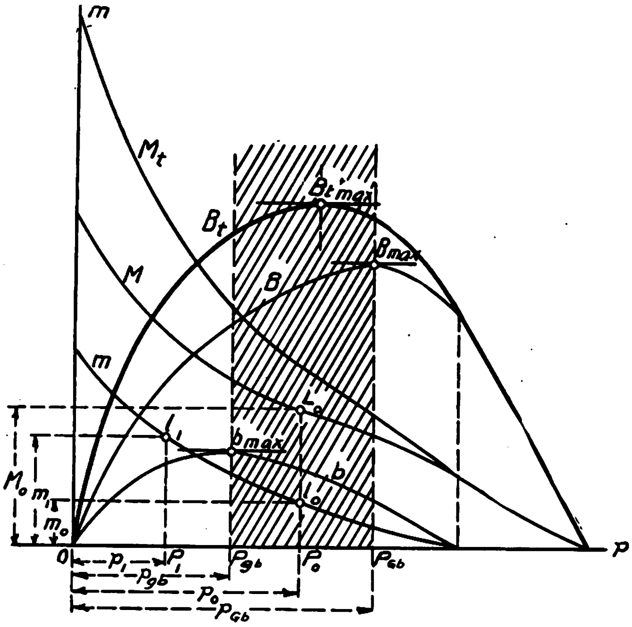


Fig. B.

increasing the number of units sold in that group from m_0 to m_1. The original aggregate gross income B_{t0}, which is given by $(M_0 + m_0)p_0$ changes into $B_{t1} = M_0p_0 + m_1p_1$. If this change shall be an increase, that is, if B_{t1} shall be $> B_{t0}$, it follows from the above equations for B_{t0} and B_{t1} that

m_1p_1 has to be $> m_0p_0$..........................(14)

Now m_1p_1 and m_0p_0 are the gross incomes from group g alone without any reference to its combination with group G and relation (14) means therefore the following: The necessary and sufficing condition for an increase of the aggregate gross income from the two groups as a result of a price reduction within one of the groups is that the income b from that group alone—group g without regard to the other group G—is *increased* by the price reduction. With reference to Fig. B, which shows the sales curves M and m, the gross income curves B and b, and their summation curves M_t and B_t, we see that this is possible only if the original price p_0 is greater than the price $p_{gb} = OP_{gb}$ which produces a maximum of gross income b from that group g alone for which the price is to be reduced; otherwise any price reduction for group g would necessarily result in a reduction of the gross income[7] b. (See Section 2 of this Insert.)

17. This condition means, in other words, that the original price must be high enough so that the corresponding point on the gross income curve b of group g is situated on the descending (right hand) branch of that curve. This wording of the condition is sometimes more convenient for application than that of the preceding paragraph.

18. We can now distinguish the following three cases:

(a) The original price is lower than the lower one of the two respective prices which make the income of one of the two groups a maximum, that is, according to the assumptions made in Fig. B, it is lower than p_{gb}. The original price lies in the range to the left of the shaded range in Fig. B.

(b) The original price is lower than the higher one of the prices which make the incomes of one of the two groups a maximum (p_{Gb}) but higher than the lower one of these prices (p_{gb}). This means it is situated in the shaded range in Fig. B.

(c) The original price is higher than either of the above named prices p_{gb} and p_{Gb}; it lies to the right of the shaded range in Fig. B.

In case (a) any price reduction in any group will always reduce the aggregate gross income.

In case (b) any price reduction in group g to a price not lower than p_{gb} will increase the aggregate gross income, any price reduction in group G will reduce it.

In case (c) any price reduction in group g to a price not lower than p_{gb} and any price reduction in group G to a price not lower than p_{Gb} will result in an increase of the gross income. Although therefore a price reduction in either one of the groups will be of advantage in this case, we will prefer an initial general reduction of all prices, as this is of greater advantage until the price p_{Gb} has been reached which results in the maximum gross income B_{max} of group G alone. After this has been done, this case necessarily reduces to case (b)[8], thus making advisable a further price reduction to one of the groups only.

It may be pointed out here that case (c) will not occur in a well designed cost-of-service system of charging. As the same gross income, and even a greater one, can in this case be obtained with a lower uniform price, case (c) would mean that the price has been chosen too high altogether from the producer's point of view and consequently also from the consumer's point of view. (Compare the closing sentence of Section 5 of this Insert.)

19. Wherever we find that a price reduction in any group is of advantage to the aggregate gross income it is obvious that, in order to obtain the best results which can be obtained by a variation of the prices in the respective group, this price reduction must be continued so long and not longer until we have reached the price which results in a maximum of the gross income of the respective group, for the following reason: If we stop reducing the price earlier there will still exist the possibility of further increasing the gross income by a continued price reduction, because in that case we are still on the descending branch of the income curve[9]. Conversely by pushing the reduction beyond the mentioned point we will come onto the ascending branch of the income curve which shows that an increase of the price would be proper in its place and that we have therefore gone too far with the reduction.

20. Relation (14) can be written

$$\frac{m_1}{m_0} > \frac{p_0}{p_1} \text{ ....(15)}$$

This means in words: A reduction of the price in a certain group or class of service *must* have the effect of increasing the gross income if the sales curve has such a shape that the number of units sold of that group rises more rapidly than the price is reduced. If, for instance, the price of a certain class of service is reduced to 3/4 of its original amount, the number of units sold would have to rise to more than 4/3 of the original amount; $\frac{p_1}{p_0} = \frac{3}{4}$, $\frac{p_0}{p_1} = \frac{4}{3}$, $\frac{m_1}{m_0} > \frac{4}{3}$.

The above is another way of expressing the law contained in Section 17 of this Insert. If the price corresponds to the descending branch of the income curve the number of units sold at a price in the immediate neighborhood of the original price increases at a more rapid rate than the price reduction indicates, and vice versa. This is demonstrated by relations (14) and (15).

21. It is easy to extend this line of reasoning to more than two groups (and to income curves with more than one

[7] This wording is based on the preliminary assumption that the curve of the gross income has only one maximum.

[8] An exception is the special case when the shapes of all the sales curves should happen to be such that the maxima of the income curves of all groups occur at the same price, in which case $\frac{dB}{dp} = \frac{db}{dp} = \ldots = 0$ for $\frac{dB_t}{dp} = 0$. The width of the range within which price splitting is of advantage becomes zero in this limiting case.

[9] If there should occur more than one maximum of the group's gross income curve in the range of prices below the original price (wavy income curve, see footnote to Section 22 of this Insert) we must obviously push the price down so far and not farther until we have reached the highest one of these maxima, because if we stop reducing earlier, that is, before reaching the maximum or on reaching a maximum which is lower than the highest one, there is still the possibility of increasing the income from that group, according to relation (14) of this Insert, by a price reduction of that group.

maximum). As a result we can express the law laid down in Section 18 of this Insert in different words and with more general validity as follows:

Where it is intended to bring about an increase of the gross income by means of price reductions to one or more groups of service without any price increase to others, this is always possible if the sales curves of these groups have such a shape that a ratio of price reduction can be found which makes the number of units sold in that group or groups rise at a more rapid rate than the rate at which the prices decrease; (if, for instance, at a reduction of the price to one-half its original value, the number of units sold would rise to more than twice their original amount). Whether this means a general reduction of the prices or a splitting off of prices for a certain number of groups only, depends on the number of groups which have the above quality. If they *all* have sales curves of the shape mentioned [Section 18—case (c)] a general lowering is the most efficient means of increasing the income, and according to Section 19 of this Insert, the price of every group will generally be lowered to a different level, which means price splitting downwards. Otherwise [case (b)], the prices will be lowered to some, but not to all, of the groups (again generally to a different level in every group, if the reduction takes place in more than one group.) This again means price splitting downwards.

b. Shape of the Sales Curve.

22. A graphical representation will make the above clearer and at the same time pave the way for the subsequent deductions. If, instead of the relation (14) $m_1p_1 > m_op_o$, which states the condition for an increase of the gross income by price splitting downwards, we write the equation

$$m_1p_1 = m_op_o \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (16)$$

this represents the limiting case of relation (14), and consequently also of (15). The graphical expression of this equation is an equilateral hyperbola with the axes of coordinates m and p as asymptotes (Fig. C). If the value of $m = P_oN_o$, which belongs to p_o, is assumed as variable (P_ox_1, P_ox_2 ..., etc., see Fig. C) a family of such hyperbolas, as indicated by the thin lines in Fig. C, will result. With sales curves having the shape as determined by facts Nos. 1 and 2 (stated at the beginning of this Insert), every sales curve must from left to right intersect higher and higher situated hyperbolas of this family until it just touches one of them from below (dash-and-dot line, point N_t) indicating that the maximum gross income has been reached and then it intersects a second time all the hyperbolas in the reverse order.[10]

Where the sales curve intersects the hyperbola in such a manner that it is lower than the hyperbola to the left of the point of intersection and higher to the right, the gross income curve is therefore in its ascending (left hand) branch, and vice versa. The two points of intersection with the same hyperbola, for instance H_1 and H_o, indicate prices which produce the same income (because mp is constant along the whole course of every hyperbola of the family).

23. From this follows another way of wording the condition that price splitting downwards will increase the gross income. We reduce the ordinates of the sales curve to percentages of the ordinates of the respective curve at the price p_o, choosing, for instance, for all curves the ordinate M_o of group G at abscissa p_o as 100%. Thus, for illustration, the sales curve M of group G has been transferred unchanged from Fig. B to Fig. C and the sales curve m of group g has been entered with ordinates increased in proportion so as to reach the percentage $M_o = 100\%$ at abscissa p_o. Consequently this curve, which has been called %m in Fig. C, will intersect the sales curve M (which now might also be called %M) at the point N_o (abscissa p_o). If we have more than two groups, the curves of the remaining groups will be treated like curve m so that the percentage curves of all the groups will pass through point N_o. A hyperbola of the family will of course also pass through the same point N_o in which all the percentage sales curves intersect. If now at least one of the percentage curves has a greater slope than the hyperbola (in other words, if the hyperbola is not the steepest one of the bundle of curves passing through the point N_o) then it *must* be possible, within a certain range of prices $< p_o$, to improve the gross income by price splitting downwards. The prices are to be lowered for that group (or those groups) which has a greater slope than the hyperbola.

It is also clear, and needs no further explanation *per longum et latum*, how far down the range reaches within which price splitting downwards is of advantage in every group and for which price the maximum of income is reached.

24. The same lines of reasoning as have been applied in the above, beginning with Section 16, for the gross income, can also be applied *mutatis mutandis* to the net income and to the rate of return (dividend) with entirely analogous re-

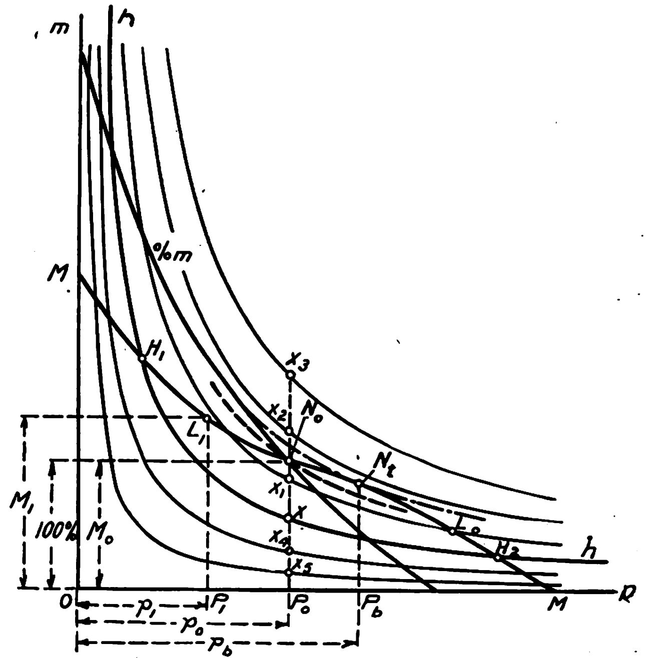


Fig. C.

sults. In the following will be shown in what respects the methods and the results of the investigation differ from those for the gross income.

(*To be continued.*)

UNITED STATES MAY BECOME WORLD'S CHIEF COAL EXPORTER.

The United States has now moved up from third to second place in the list of coal exporting countries of the world and British newspaper opinion seems to contemplate America's becoming the world's permanent chief coal exporter. According to figures in the London *Times*, reported by the American Chamber of Commerce in London, Britain's coal exports for the twelve months ended June, 1919, were approximately one-half her exports in 1913, the last pre-war year. The figures given are 37,000,000 tons and 73,400,000, respectively. Meanwhile America's exports have increased from 19,000,000 tons in the fiscal year 1914 to nearly 26,000,000 tons in the fiscal year 1918.

Even allowing for the worrisome exodus of foreign labor from the United States and the consequent falling off in coal production, it is estimated that the American output for 1919 will be three times that of Great Britain and four or five times that of any other country. The statement is made that about one-half of America's output is produced by means of machinery whereas only one-fifth of Great Britain's output is thus produced.

[10] We can see from this that if the sales curve has no point of inflection the income curve cannot have more than one maximum, because then obviously the above mentioned point at which the sales curve just touches one of the hyperboles from below, cannot be repeated in the course of the sales curve. As will become clear from the latter part of this Insert (Sections 37-38 and 41-42) this applies not only to the curve of the gross income, but also to those of the net income and of the rate of return. On the other hand, one or more points of inflection in the sales curve do not necessarily mean that the curve of earnings must have more than one maximum.

It also follows that a sales curve with the concave side facing upwards, such as the sales curve in Fig. A, results in a flatter peak of the gross income curve (and of the other earnings curves) than a sales curve with the concave side facing downwards and that the choice of the right price is of greater importance in the latter case. If the sales curve runs along one of the hyperbolas in Fig. C through a certain range of prices the curve of the gross income will be entirely horizontal for that entire range and it will make no difference on the income which price we choose as long as we remain within that range.

Hydroelectric Energy in France

Fuel Supply Being Inadequate, France Must Develop Her Sources of "White Coal" in Order to Meet Industrial Needs —America Can Co-operate in Hydroelectric Development

By C. W. A. VEDITZ

Former American Commercial Attaché at Paris and Madrid

IT IS recognized by most authorities in France that if that country is to become a greater industrial nation she will have to find some substitute for coal as a producer of motive power. In normal times, and more particularly since Alsace and Lorraine have been restored to her, the industrial situation of France is largely explained by two fundamental facts: France has an abundance of iron ore and a shortage of coal. In normal times France consumes about 60,000,000 tons of coal per annum, and her coal mines produce about 40,000,000 tons. (In 1913, the last complete year before the war, the amount was 40,844,000 tons, of which 67% came from mines in the Nord and the Pas-de-Calais—regions invaded by the Germans.) France's imports in 1913 included 18,711,000 tons of coal, 3,070,000 tons of coke, and 1,086,000 tons of fuel agglomerates, such as briquettes, etc. Most of the coal came from Great Britain, most of the coke from Germany, and most of the agglomerates from Belgium.

France, even though she draws more coal from her mines, and notwithstanding the coal output of the annexed territories, will undoubtedly need some substitute for coal to meet not only her future requirements, but also her present requirements. It should be noted particularly that the bulk of the coal produced in France is mined in the northern and northeastern parts of the country, whereas numerous new industrial plants requiring power are established already, or will be hereafter established, in the southeast, the center, and the southwest parts of France, to which places French coal has a "haul" long enough to make it dearer than elsewhere, and in which, therefore, the imported coal is used, especially near port towns. It is also recognized that even after peace is signed, coal, while it may not continue to be as dear as it was during the war, will nevertheless be much dearer than before the war; likewise, it is obvious that labor will be dearer in productive enterprises than it was before the war. On the basis of these facts, the following conclusions may be drawn:

Fuel and Power Conditions Confronting France.

(1) Labor will be dearer and scarcer, and therefore there will be increased incentive to substitute machinery and motive power for labor and human or animal power.

(2) Coal will continue to be insufficient for the needs of the nation as a producer of power, and will probably cost much more than it did before the war. The mines in the region invaded by the Germans have been left in a state deplorable beyond expression; the French chief inspector of mines states that many of them will require from five to ten years to be put into full working order.

(3) The new industrial establishments that will be established, or that will expand their activities, in the southern, western and central parts of the country, where coal is relatively dear, will welcome some other more economical method of producing power.

(4) Attention will have to be turned more largely in the direction of utilizing what the French call "white coal"—hydroelectric energy. The trend in this direction was manifested before the war, and has been emphasized during the war to a noteworthy extent, inasmuch as several newly established plants working for the government in the manufacture of munitions, and especially chemical products and gases, have utilized hydroelectric energy on a comparatively large scale.

The Hydroelectric Power Available.

From the standpoint of utilizing industrially the power of falling water, France is well placed. According to Robert Pinot, general secretary of *Forces Hydrauliques,* the following is the rank of European nations with respect to available hydroelectric power:

Country	Horsepower
Norway	7,500,000
Sweden	6,750,000
Austria-Hungary	6,460,000
France	5,857,000
Italy	5,500,000
Spain	5,000,000
Switzerland	1,500,000
Germany	1,425,000
Great Britain	963,000

These figures, taken apparently in part from the engineer Pacoret, and in part from reports of the German Union of Electricians, have of course been subjected to much discussion. One of the leading French advocates of the use of "white coal," M. Ader, estimated the minimum available power in France as 4,600,000 hp. and the *average* power as 9,200,000 hp. M. de la Brosse, engineer-in-chief and director of the hydroelectric service of the Alps, agrees on 4,600,000 as the minimum realizable power. Others give as a rule higher figures. But, of course, all of them fall short of the 30,000,000 hp. said to be available in the United States.

Comparing the available power with the size of the several countries, France has 6 hp. per acre, Norway 15, Sweden 8, Austria-Hungary 7.5, Spain 4, Switzerland, 4, and Germany 1.2 hp.

The available power is, of course, unevenly distributed throughout the French Republic. Half of the national area has no utilizable waterfalls. M. Ader has estimated that the minimum power or the low-water productivity of the Southern Alps region (the Savoys and the Dauphinate) is 1,000,000 hp.; for the Jura, the Vosges and the so-called Massif Central, 900,000 hp.; and 1,400,000 for the remainder of the country, including the Pyrenees region. According to de la Brosse, the distribution is as follows: 2,300,000 hp. for the Alps and the Pyrenees; 900,000 for the Center and the East; and 1,400,000 for the rest of the country. There is little doubt now that these figures are too low for the Alps departments of France.

Water Falls Not Yet Extensively Utilized.

If it be remembered that in 1868 and 1869 two paper manufacturers of the province of Dauphiné installed the first plants using water falls for power purposes along modern lines, and that the problem of transporting the power over considerable distances was solved between 1880 and 1900, France has made but little use of her opportunities. In 1911, only 600,000 hp. were produced in all of France, of which total 473,000 are in the Alps, 55,000 in the Pyrenees, and 51,000 in the so-called Massif Central. It is probable that at the present time the total is from 850,000 to 900,000 hp. The figures for 1916 probably represent about one-tenth of the available power, whereas Germany has utilized about one-half of the power utilizable in that country, despite the fact that Germany is a great coal-producing, and even coal-exporting, nation.

According to Prof. Auguste Pawlowski, France spent in 1913 one billion francs ($200,000,000) for hydroelectric industrial establishments, of which 650,000,000 francs ($130,000,000) went into enterprises for the production and transmission of power; and 200,000,000 francs additional have been since that time devoted to hydroelectric industries. Says this authority: "The work is still in its beginnings. All the available power should be realized, and in the quickest time possible, in the interest of the economic uplift of the country, of its social regeneration, and of its wealth; and in order to permit it to conquer the markets of the world. 'White coal' gives us the means for compensating our lack of coal, enables us to obtain electricity at a low price, to lower in many cases our industrial costs of production, and to improve our agriculture. It will become the surest weapon in the economic struggle of after-the-war."

M. Loucheur, former French Minister of War, now Minister of Industrial Reconstruction, and a leading authority on industry and transportation, speaking of the plan for utilizing the Rhone falls at Genissiat, presented by Messrs. Blondel, Harlé and Mahl, stated that it would involve the annual production of 1,300,000,000 kw-hr. As each kilowatt-hour corresponds to 1.2 kilograms (2.64 lb.) of coal, the falls at Genissiat would represent over 1,600,000 tons of coal, or the equal of more than one-third of the output of the coal mines of Lens or Anzin, or more than all of the output of the coal mines of Blanzy, the richest in the interior of France.

Utilizing "White Coal" for Railway and Traction Service.

The most important utilization of French "white coal" would probably be for railway traction. In 1909, according to the statistics of the "Service des Mines," the steam locomotives or those using self-produced power, represented a total of 7,373,000 hp., while traction current did not amount to more than 138,000 hp. Since then, however, a large number of electric tram lines in the larger towns have been substituted for horse cars, and numerous so-called secondary railways and local railway lines have been electrified. In the Alpine region, the tramways of Lyon and Grenoble, the railways of Dauphine and those along the Mediterranean coast are comparatively recent developments.

The tramways of Bayonne, Biarritz, and Pau are propelled by hydroelectric energy, but those of Toulouse, Perpignan and a number of other towns in this southwestern region are still tributary to steam-power establishments. Some local railway systems are operated by hydroelectric power. The big French Midi (Southern) Railway system inaugurated electric traction upon certain sections of its roads, and proposes to electrify 327 kilometers of its lines (203 miles). But at the present time there is hardly as much as 250 kilometers (155 miles) of railways and street tramways utilizing hydroelectric energy in all the south of France.

In the center of France, hydroelectric power operates the tramways of the Haute Vienne region, of Loir-et-Cher, of Puy, of Limoges, and of a few industrial towns like St. Etienne and Roanne. In all, France in 1914, at the outbreak of the war, had used hydroelectric energy for only a fractional part of her local or general railway system and lines.

Opportunity of American Interests to Co-operate in Development.

In conversations which I had from time to time with engineers and with public officials in France interested in hydroelectric developments, the suggestion was repeatedly made that France would welcome the co-operation of American engineers and of American capital in French engineering enterprises. They recognize our achievements in this line and, while they sometimes resent the "Look who's here" attitude of American visitors proud of the industrial and scientific progress we have made in controlling the resources of our vast continent, they now feel that the work of reorganizing industrial France after four years of exhausting war is not the work of France alone, but of the whole of allied civilization. To be sure, our engineering concerns hesitate to "go ahead" upon the basis of uncertain costs of material, of unusually high wages, of political factors of a more or less disconcerting nature. But did we not find it possible to make war under strange and foreign conditions, and do it fairly successfully? Are we less adaptable in the arts of peace than we have proved ourselves to be in the arts of war?

ELECTRICAL MEANS EMPLOYED IN THE ANTI-SUBMARINE CAMPAIGN.

Scientific Adviser to British Admiralty Tells of Developments Following Adoption of New Attitude.

One of the papers read at the Victory meeting of the North East Coast Institution of Engineers and Shipbuilders held at Newcastle-on-Tyne was contributed by Prof. J. C. McLennan, Scientific Adviser to the Admiralty, who took for his subject science and its application to marine problems. He said it was realized in the autumn of 1917 that the submarine problem was one of the most difficult ever presented to science for solution. It became clear that it was necessary to introduce into service practically a new system of physical science and engineering. It was accordingly decided to broaden the field from which scientific and engineering talent could be drawn and within the British Admiralty a Department of Research and Experiment was set up under the direction of Charles H. Merz. Professor McLennan could not give details of certain of the means and measures adopted in the anti-submarine campaign, but he gave particulars of developments in the following directions: Listening devices; echo methods; magnetic and electro-magnetic detection; leader gear; invisible signaling; wireless telegraphy and telephony; explosion pressures; sound ranges, and helium.

As a result of investigations in connection with listening devices, great improvements were made in hydrophones. Microphones and magnetophones of exceeding high sensitivity were realized, and after enormous labor, ways and means were devised for standardizing their construction and their functioning. Hydrophones were constructed and put into service which were suitable for use in water of moderate depth, and other types were made which could be used in water of great depth. In one particular type of instrument modifications and attachments were introduced which enabled one to detect with it the direction of bearing of a source of sound with a fair degree of accuracy. But probably the method of determining the direction of a source of sound waves in water which had proved to be the best was founded on the fact that the sound wave was in the same phase at all points of its wave front. Thus, if there were two hydrophones, in themselves non-directional, placed in the path of the incoming sound, they could be used for finding the direction of the origin of the sound if the phase difference between the sounds received could be detected. There were two ways of doing this: the "binaural" method and the "sum and difference" method.

The binaural method depends on the fact that if the sound from one receiver is conveyed to one ear and that from the second to the other ear, the impression is formed that the sound comes from a certain direction and this direction, as interpreted by the sensations experienced, changes as the phase difference is altered. It can be brought to a certain position with respect to the listener (say to the position directly in front) either by rotating the two receivers about an axis, or by introducing an artificial delay in some form of "compensator." This binaural method was the subject of much work on the part of both British and American scientists, and in the anti-submarine campaign it was found to be of very considerable service. In the "sum and difference" method the impulses from the two receivers are united before reaching the ear, the combined effect observed being a maximum when there is no phase difference between the waves and a minimum when the phases are in opposition. The French Navy developed a hydrophone or listening device known as the Walser gear which had been found very efficient.

With most hydrophones and many listening devices, ship's noises and water noises generally seriously interfered with their effective use, and in practice the chasing ship was compelled to stop at intervals and listen when not under way. This meant that in many cases the quarry was lost. This defect was overcome in a measure by towing a directional hydrophone encased in an artificial "fish" behind a chasing ship. By adopting stream-line formation for the towed body and suitably supporting the hydrophone, water noises were fairly well eliminated. Moreover, as the "fish" could be towed at a considerable distance behind the chasing vessel, many of the sounds emitted by the latter did not reach it and others which did arrive were received with weakened intensity. The development of sensitive listening devices of course received a great impetus by the use of thermionic amplifying valves. As it was found possible under certain conditions to render the propulsion of submarines practically silent, it became necessary to look in other directions for fundamental methods of detecting them.

A system of detection which is full of promise involves the use of a beam of sound waves sent out by a chasing ship in a manner analogous to the use of a searchlight. With such beams of sound waves it is possible to sweep the seas, and when an object of sound such as a submarine happens to come within the beam, the sound waves are reflected and echo effects are obtainable. The character of the beam is, of course, determined in large measure by the frequency of the waves constituting it. The method has been employed with great success and promises to be a very helpful agent. The method is obviously applicable to the locating of mine-fields and other obstacles to navigation as well as to submarine chasing.

In regard to magnetic and electromagnetic detection, Professor McLennan said that magnetic detectors usually require the movable system to be poised or pivoted. They can therefore be used as yet with only a moderate degree of satisfaction in towed bodies or in vessels subjected to violent mechanical disturbances. The range at which magnetic effects can be detected is, moreover, comparatively short. As a result of these defects the use of magnetic detection is somewhat circumscribed. Such instruments can, however, be used under certain conditions, and in particular sea area with great effect. In the war very considerable results were actually obtained by their use. The range at which electromagnetic detection can be applied is greater than is possible with magnetic detection, but the method is, however, essentially a short range one, and in many of the forms in which it has been worked out it cannot be used with success at greater distances than about 300 yards or in depths greater than about 100 fathoms.

The Leader gear represents an important application of an electromagnetic effect which was developed during the war. This gear consists of a cable laid on the bottom of the sea along the course of a narrow tortuous channel leading into a harbor or through a mine field. If an alternating electric current be passed through such a cable it is possible by means of delicate devices installed on a ship to obtain either aural or visual indications of the presence of such a cable, and by these indications the ship can be guided in safety in fog or darkness at speeds as high as 20 knots almost with as much precision as a tramcar by a trolley wire over a railway. Experiment has shown that it is a simple matter to apply this method in water of suitable depth for distances as great as 50 miles or longer.

Research has shown that it is possible under certain conditions to utilize polarized light or ultra-violet and infra-red radiations for secret signalling. With the last-mentioned type of radiation, especially valuable results are obtainable over considerable distances, even in the presence of light fogs. Where it is not advisable to use wireless communication between chasing ships, infra-red signalling is of special value.

One of the most remarkable developments which had taken place in the war, said the author, was in the field of wireless telegraphy and telephony. By the use of oscillating thermionic valves especially great progress had been made. It was now possible to hold conversation with ease between a land station or a ship and an airship or seaplane over considerable distances, and by this means observers on aeroplanes or aircraft could also converse with one another. With high power installations it had been demonstrated that wireless telephonic communication could be maintained on the sea over hundreds of miles. On the directional side of wireless great advances had also been made. If an aeroplane, an airship, or surface ship should send out continuously for a short interval a series of ether waves, these waves could be picked up over long distances by devices installed in a land station, the direction of the source of these ether waves could be ascertained, and in a minute or two the land station could give the observer of the emitting source his bearing within two degrees relative to the land station. With two land stations it was possible to obtain cross bearings, and the latitude and longitude of the sending air or surface ship could be determined with a high degree of accuracy. With directional devices installed on ships it would be possible for two ships whose positions were known to communicate its true position to a ship enveloped in a fog and situated several hundreds of miles away.

In the section dealing with explosion pressures Professor McLennan said that one method of investigating such pressures was suggested by Sir J. J. Thomson and applied by D. A. Keys. It consisted of the employment of the phenomenon long known to scientists that certain crystals become charged with electricity when subjected to pressure. The amount of the charge produced is proportional to the pressure applied to the crystals, so by having a suitable arrangement for measuring this charge and its variation with time, a complete record of the variation of pressure with time is obtained by placing the crystal detector at any given distance from the exploding charge. Since the duration of the wave in passing over the crystal or engulfing a submarine is only a few thousandths of a second and the pressure generated may be of the order of a half a ton or more per square inch, one can readily imagine the difficult nature of the problem in hand. But by making use of the inertia of a beam of cathode ray particles and employing the fact that they carry negative charges and are deflected by electrostatic and magnetic fields, it has been possible to obtain records of the variation of such pressures with the time. The electrons affect a photographic plate, i.e., they leave an impression on the plate when they strike it. This additional fact has made it possible to determine the change in pressure of the wave from the instant the charge is fired and at as small intervals as we please afterwards. Changes which have taken place in 1/100,000 of a second have been recorded by this means.

A LABOR SUBSTITUTE FOR THE WAREHOUSE.

Additional Features of Application of Electric Industrial Trucks and Tractors for Warehouse Use.

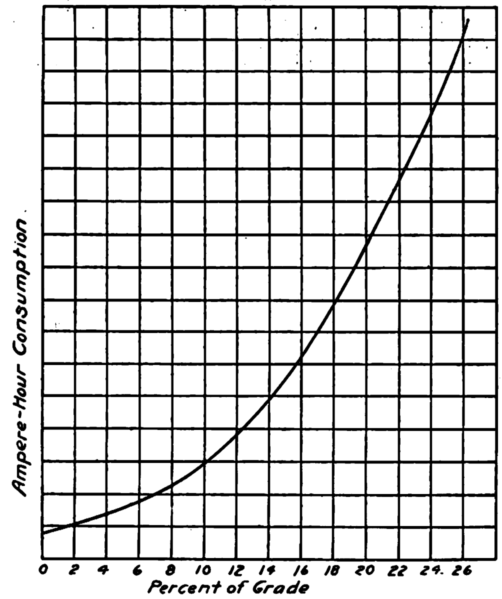
By D. L. Darnell.
The Baker R. & L. Co., Cleveland, Ohio.

During the war, when the army and navy had drawn upon our human resources to such an extent that there were two or even three jobs to every man, every employer wished for the return of the halcyon days when labor was plentiful. It was generally supposed then that peace would dump two or three million men upon the country and that the troubles of the employment man would be at an end.

Today peace is a fact. Except for a few divisions still on the Rhine our armies are back on this side of the water. The men have been discharged and have returned home to take up their old jobs, or better ones. But there is very little change in the labor market. Wages are still away up in the air, and it is next to impossible to find a man who is really experienced at anything.

There have been a number of reasons advanced to explain this condition, and probably the falling off of immigration is the best answer. For five years there has been no immigration at all and now that overseas transportation has been resumed there are few who wish to come—few as compared with the hordes of five years ago. The breaking down of the monarchial system in Europe, fewer men as a result of the ravages of war, more work for those who survived, the hope for a new future—these and many other reasons explain the stoppage of the labor reservoir to which we have looked in the past.

With the labor market in its present condition, and very little hope for improvement, warehouse men are of necessity learning how to do more work with fewer men. Many new labor-saving machines are coming into being and many new uses are being found for old ones. In this latter class comes the electric industrial truck, and even in the past few months numerous new adaptations of this labor-saving machine have been worked out. In fact, there is very little handling work about the average warehouse which these little electrical machines cannot take care of.



Curve Showing Relation of Ampere-Hour Consumption and Percentage Grade for Electric Truck.

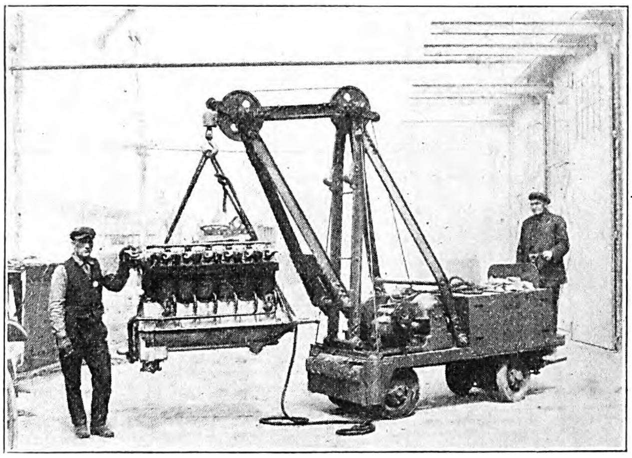
The application of a system of industrial transportation to any warehouse installation requires careful consideration of all the conditions and an intimate knowledge of the limitations and possibilities of the various truck models. The industrial truck salesmen must have this knowledge and the ability to quickly analyze conditions and solve for the proper answer. No one has time any more for the man who knocks at the purchasing agent's door and asks, "Are you buying any trucks today?"

There are two general systems which may be applied to warehouse installations—namely, the tractor and trailers or the load-carrying truck. This latter class embraces the utility truck, the elevating platform truck and the crane trucks.

The tractor and trailer installation seems to be best suited for large terminal warehouses where immense amounts of freight are carried for comparatively long distances. An installation of this sort will employ from 4 to 10 or more tractors and from 300 to 1,000 trailers. The empty trailers coming out of the inbound freight house or storage warehouse are dropped on the platforms along side of the freight cars to be unloaded. A crew of men at each freight car places the boxes, bales or other freight on the trailers and when there are enough to make a train a tractor comes along and picks them up, whisking them away to be either unloaded into storage space or onto drays for delivery.

In the outbound house a similar set of tractors and trailers carries the freight from the dray shed or the storage warehouse to the cars. The tractor drops its load and goes on to gather up some empties—it is always busy.

In many places it is becoming the practice to rent out portions of the warehouse to different manufacturing firms about the city. Material or supplies are received in carload lots and stored here until required.



Electric Truck Equipped With Crane for Handling Heavy Material.

In such installations the elevating platform type of truck presents a very convenient method of handling. The material is loaded right out of the cars onto wooden skids. The elevating truck picks these skids up and deposits them in the storage space in the warehouse. The material while in storage is kept right on these skids. When the manufacturer is ready to use it the elevating truck places the material still on the skids on the manufacturer's truck; then at the manufacturer's plant another elevating truck carries the material to its ultimate destination. In this way hand labor is absolutely eliminated from the time the material is unloaded from the cars until it is ready to be worked or used.

There has recently been brought out a skid equipped with casters. These live skids are very handy for terminal installations, as such a skid can be loaded right in the box car and then easily pushed out to the platform by hand. Also, in cases where it is necessary to move the skids from one floor to another, the elevating truck can deposit the skids one at a time at the elevator. When the elevator arrives at this particular floor, the operator can easily push three or four skids onto his elevator, take them to the proper floor and push them off again, where another elevating truck will pick them up and carry them to the proper place.

In some warehouses where heavy machines are stored a crane which will pick these up and carry them about is almost a necessity. Such a crane is shown in the accompanying photograph. This crane has a capacity of 3,500 lb. and with its 12-ft. lift can also be used for stacking.

In the foregoing the industrial truck is considered only as a substitute for hand labor, but there is another big point in its favor which is just as important nowadays. The electric industrial truck offers the cheapest, as well as the most efficient, handling method. For the sake of comparison, take the straight load-carrying type truck which is the least efficient of all the types. This truck will handle 4000 lb. at a steady speed of 4½ mi. per hr. It will make the return trip, empty, at 6 mi. per hr. and will not stall and rest in between loads.

Design of Buildings to Prevent Truck Traffic.

In some of the older warehouses conditions exist which prevent the use of electric trucks. Either the aisles are too narrow, or the floors are not in proper shape, or else the elevators have not sufficient capacity. In view of this, the owners must worry along with hand labor and all of its difficulties. So it is important that any firms which are considering building new warehouses should impress upon their architects the necessity of so designing the buildings that the most modern handling systems may be installed.

The most important points to consider are the aisles, the elevators and the ramps. Main aisles should be at least 12 ft. wide and the cross aisles 8 ft. wide. This will give plenty of space of maneuvering the truck and for passing.

Where elevating trucks are used, and it is not intended to move the truck itself from one floor to another, the elevator need only have sufficient capacity to take care of the load. This will depend upon the number of loaded skids which are to be handled at a time. Each skid with its load will weigh in the neighborhood of 4200 lb. If the truck is to be lifted as well as its load, the elevator should have a capacity of at least 7500 lb., and should be at least 8 ft. wide, or preferably 10 ft.

Where the tractor and trailer system is used, the ramp offers a convenient way of getting from one floor to another. However, it is quite important to see that these ramps are long enough so that the grade is not too steep. The limit of good practice is 15%, although some manufacturers make quite a point of the fact that their trucks can climb a grade of even 25%. This is all right as a stunt for advertising purposes, but for actual operation it is better to make the ramp twice as long and cut down the per cent of grade by half. It is a fact that a truck going from one floor to another on a 25% ramp will use 40% more current than if the ramp were twice as long and only 12½% grade. The reason for this is that all trucks are equipped with the series motor which gives a large starting torque. It is a characteristic of this motor that the number of amperes drawn from the battery is proportional to the load put upon the motor, while the speed decreases with the load. For this reason a truck operating on a 25% grade uses twice as much current as a truck operating on a 12½% grade. The reduced speed on the steeper grade is such that very nearly the same time is consumed in climbing the steeper grade, although it is only half as long.

The small diagram on this page shows how the current consumption increases as compared to increase in grade. Up to 15% grade the proportion between the current consumed and the height climbed is within the limits of good practice, but grades above this figure are not recommended.

Editorial Comment

Promote the Idea of Service

SERVICE as the fundamental aim of public utility organizations has made much headway in recent years. Progressive utility managers recognize that service is the primary object of their business and constantly keep this idea before their employes. The result has been most beneficial in those communities where this policy has been consistently followed out. Not only is the service given to the public of high standard and therefore the appreciation of the public shown by its good will to the utility, but the entire attitude of the utility employes is raised to a higher plane. Instead of looking upon their employment merely as a ready means of gaining a livelihood, they find in it also opportunity to serve the community.

The success of the service idea among utility organizations prompts us to suggest cultivation of the same spirit among the employes of municipalities and other public bodies. Within the present year there has been shown contemptuous disregard for the interests of the public by policemen, firemen and other employes of several of our American cities as well as of cities in Canada, Great Britain, France and other countries. Strikes of municipal employes are becoming almost as common as among industrial employes. Let these employes be taught that it is an honor to serve their communities and with fair remuneration the quality and continuity of their service will be raised to the standard on which it should rest.

French Water-Power Development

HYDROELECTRIC power is one of the important agencies that is going to put France back on her feet after the gruelling devastation of over four years of frightful war. The taking over of certain German coal-mining districts for a period of years will barely compensate for the deliberate destruction of French coal mines, so that France will remain short of fuel as before the war. This shortage and high cost of fuel combined with similar shortage and high cost of labor will call for more power developed from what the French so appropriately call their "white coal"—glaciers, mountain snows and water falls.

These facts are very clearly set forth in an article on this subject by Dr. C. W. A. Veditz that appears in this issue. He shows that French hydroelectric development has not yet been carried out very extensively and that there is room for an abundance of it, in which American engineers and other interests should co-operate. The French authorities clearly recognize the potential value of hydroelectric power development especially at this time when every energy and resource must be bent to hasten that nation's reconstruction. Although financial and other difficulties may seem formidable just now, it is to be hoped that these may be cleared away so that that courageous country may have every facility to return to a normal industrial and commercial basis as soon as possible.

A Brief for the Static Condenser

POWER-FACTOR, what it is, what it costs, the manner in which it affects capacity of machines and conductors and voltage regulation are subjects that have been discussed so long, so often and from so many angles that it would seem that everyone connected in any way with alternating-current workings, whether in the small or the vast system, should be conversant with the extravagances and drawbacks of low power-factor.

The fact is we all realize what low power-factor means. But it is only when we are brought face to face with some difficult situation, or the colossal waste the low power-factor entails is brought home to us, that we come to the full appreciation of the true significance of low power-factor. It is then that we seek palliative measures, whereas we might have, not always but quite often, prevented the cause. And prevention is almost always preferable to cure.

However, taking it for granted that the power-factor could be raised to advantage—which is the condition that obtains in practically every instance, whether it be the small alternating-current generating installation of the industrial plant, or the vast network of transmission lines with its interconnected generating stations and ramifications of distributing circuits—the question to be settled is to what extent it will be financially worth while to raise the power-factor, what will it cost to do it, and what is the gain in investment, in improved operation, and so forth. The condition that exists is the condition that decides what alleviative measure should be adopted. If it be over-motorization or too many lightly-loaded transformers, the remedy may be to change matters by adopting apparatus better suited to the need. On the other hand, it might be more practical to cure the situation rather than prevent it.

Elsewhere in this issue appears an article on the application of the static condenser to power-factor improvement. This is the second article in the ELECTRICAL REVIEW within recent months on this phase of power-factor correction; although editorial comment has repeatedly bespoken the cause of the static condenser. In this article Mr. O. C. Roff reviews the cost and the objections of low power-factor in a manner that makes one appreciate once more what a waste of material and fuel accompanies decreasing power-factors. He explains what the static condenser does and the conditions under which it may be successfully employed. The very limited application of the synchronous converter for power-factor correction, so limited and accompanied by so many objections that this piece of apparatus is rarely considered for corrective purposes, *per se;* and the much more flexible synchronous converter with its wide latitude in use, are both well understood. But the application of the static condenser, and the conditions under which it is an almost ideal piece of equipment are not so well understood. Mr. Roff's article should make the matter clear; and, incidentally, should serve to emphasize the many instances in which the static condenser should be used where at present low power-factor is tolerated where little excuse exists for such tolerance.

Electrical Engineering and Electrochemistry

IT IS the province of the engineer to utilize the forces and materials of nature. Chemistry is the science which deals with materials; and it is the chemist who studies the fundamental construction of materials, separating the common substances into their constituent elements, devising new combinations and producing new properties. Electricity, being a force, comes within the province of the engineer.

A combination of the two fundamental, forceful sciences—electricity and chemistry—the combination of the science of materials and the science of forces—has given the investigator, the inventor, the investor and the manufacturer a new vast field for action. And it is the combination of these sciences and these human associations that has, and will still more in the future, attain results otherwise unattainable.

The chemist, the electrochemist, utilizes electricity in two ways, according to what he aims to produce or attain: by high temperatures, as for the production of nitrogeneous compounds from the air and for the production of carborundum and steel; and secondly, by electrolytic action, as in the refining of copper, the electrolyzation of water for the production of hydrogen and oxygen. In these two ways, electricity has made vast and rapid progress in coming to the aid of the chemist, hence to the betterment of mankind. The full story is not yet told of what electrochemistry and the electrochemist accomplished in the waging of the World War.

Toward the close of this month the American Electrochemical Society convenes in Chicago. This is a comparatively young society, has a vigorous and active organization that has done much to co-ordinate effort and further matters pertaining to electrochemistry. The membership in the organization has increased very rapidly, almost phenomenally during the last few years, because of the vital importance that electrochemistry has played in the waging of war, and the vast field that remains to be explored and developed in the callings of peace. Many of the members are power engineers of the large central-station companies, for these men must be in touch with manufacturing methods "in readiness to serve" their clients; and continuity of supply of power is often of paramount importance.

Chemistry is a science unto itself; as is also electricity. But electricity facilitates chemical action and is sometimes indispensable. The electrical engineer does not need to be a chemist. But the electrical engineer well versed in chemical engineering is a better electrical engineer and is of greater value to himself and to his profession. And this, after all, is the criterion as we pass judgment upon ourselves.

Science and Marine Problems

ELSEWHERE in this issue we give particulars of some of the scientific achievements secured during the war in connection with the anti-submarine campaign. It is not too much to say that only the utter abandonment of the pre-war governmental attitude toward science in England cleared the way for investigation and practical application which were essential in dealing with what in the late months of 1917 was realized to be one of the most difficult problems ever presented to science for solution. It became necessary to introduce practically a new system of physical science and engineering and the British Admiralty agreed to broaden the field from which scientific and engineering talent could be drawn. Professor J. C. McLennan, fellow of the Royal Society, and scientific adviser of the British Admiralty at a Victory meeting of engineers held at Newcastle-on-Tyne has revealed particulars of some of the means and measures devised by scientific experts.

He confessed his inability to reveal everything of the kind, but vouchsafed such information as it was in the national interest to give in order to foster and stimulate co-operation in the development of science and of its application to naval and other marine problems.

It is interesting to learn that with a view to developing and extending the scientific results which were obtained under the stress of war, the British Admiralty has recently put forward proposals for a permanent establishment of a Department of Research and Experiment within the Navy.

Plans have been formulated for the erection of a central research institution for the investigation of first principles and for carrying on researches of a fundamental and pioneer character. Steps have been taken to organize a sea experimental station and to provide buildings and equipment for an engineering laboratory, a wireless and signal school, and a torpedo and mining school in place of "Vernon," and it is believed that these institutions will prove of great value in developing not only means of increasing the efficiency of the British Navy, but in providing aids to navigation for the mercantile marine.

Current Events

Pennsylvania Electric Association Meets—Electric Transportation—New N. E. L. A. Committee—Other Happenings

PENNSYLVANIA ELECTRIC ASSOCIATION HOLDS INTERESTING CONVENTION.

Quality of Papers and Exhibits Notable Features of Successful Meeting.

The twelfth annual convention of the Pennsylvania Electric Association, held September 3-6 at Bedford Springs, Pa., was opened by President Thomas Sproule, Philadelphia, who comprehensively reviewed the work of the past year, summing up what had been accomplished during after-the-war conditions.

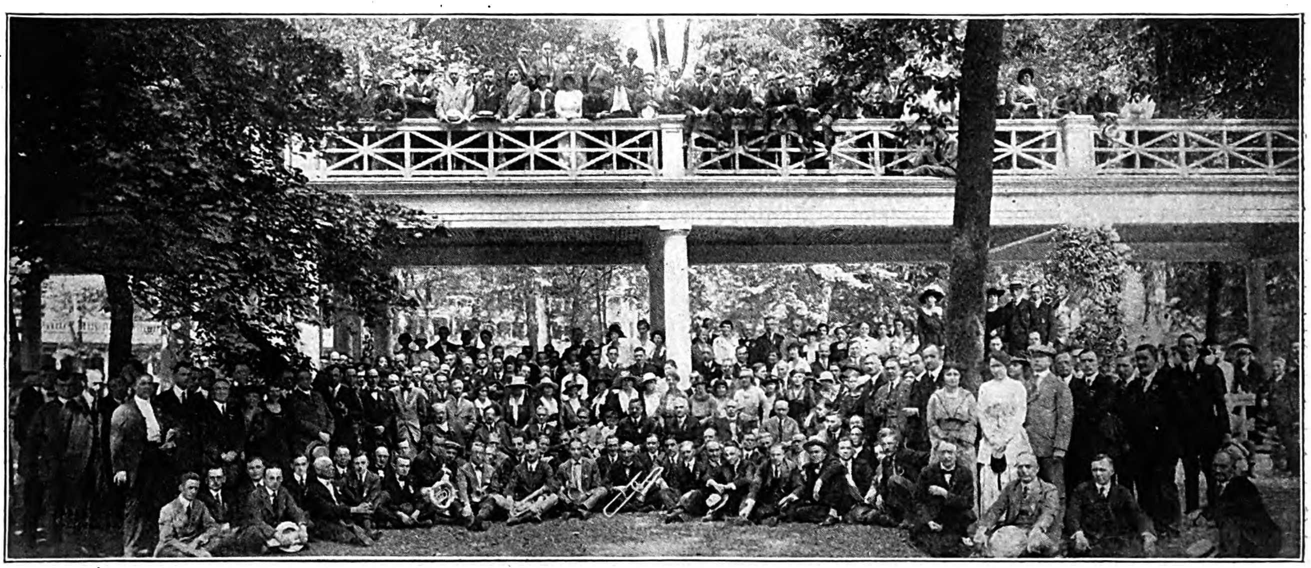
In reports of committees, that of the engineering committee was concerned with the joint use of poles and the elimination of the 5000-volt maximum clause, agreement on which will be reached later. Joseph B. Seaman, of Philadelphia, chairman of the geographic section's committee, reported on the feeling of good-will and mutual helpfulness derived from the meetings of the different geographic sections.

The first paper to be presented was on "Increasing Capacities of Existing Lines and Cables" by E. C. Stone, Duquesne Light Co., Pittsburgh, in which was given the relations between line capacity, costs and voltage regulation when increased capacity is obtained by increasing the copper and by increasing the insulation. In a general way, voltage regulation is not only a criterion of service but also of line cost, and when it becomes excessive, usually money can be saved in investment and operating cost by increasing line voltage. Line capacity can also be increased by improving the power-factor and is warranted if the total saving in line, transforming and generating equipment is greater than the cost of making the improvements. By means of charts and tables, Mr. Stone showed a comparison of methods of increasing line capacity under different conditions. In the discussion, the question of using regulators on 2300-volt power circuits was raised. In regard to furnace operations, it was suggested that the effect of a furnace on the line is solely a question of variation between the furnace load and load that the line can carry.

John A. Barnard's paper on "Effect of War on Boiler-Room Practice" showed savings made during the past year at the Schuylkill and Chester stations of the Philadelphia Electric Co., these being accomplished by training an economical coal-burning crew and checking its work by use of instruments. The discussion dealt fully with the use of pulverized coal, culm and fuel oil in place of coal. The statement was made that if the price of fuel oil could be guaranteed as anywhere near permanent it would pay to make the necessary changes in equipment to install fuel oil apparatus.

E. H. Tyson, Lehigh Valley Light & Power Co., Allentown, read a paper on "Method of Operating a Meter Department in Scattered Territory," in which was outlined methods for the organization and operation of a meter department for such conditions. The discussion enumerated the difficulties in securing efficient men, and the thought was expressed it was a good plan to draw from high school graduates, who usually remain for an average of one or two years and require but a short period of training.

A paper on "Economical Boiler Room Practice for Medium Sized Plants" was presented by H. B. Bryans, Counties Gas & Electric Co., Norristown. Methods employed to obtain more efficient operation of the Norristown plant in the face of high labor and fuel costs were given in detail. The discussion brought out the suggestion that gas house tar is valuable as a coating for boiler settings because it does not dry out.



Assembled Delegates at the Twelfth Annual Convention of the Pennsylvania Electric Association at Bedford Springs, Sept. 3-6.

The Manufacturers' Exhibit of Electrical Appliances in the "Big Top" at the Convention of the Pennsylvania Electric Association Helped in Large Measure to Make Its Convention Very Successful.

The use of an agitator in hoppers was advised. The evaporation of oil in gauges was mentioned, with the suggestion that they be kept as far as possible from heat. Tissue paper scale on tubes and savings in replacement resulting from regular cleaning out of scale were also included in the discussion on Mr. Bryans' paper.

H. P. Weaver discussed his subject of "Management and Men" extemporaneously, dividing his talk under five heads: Sincerity, honesty, willingness to lay aside prejudice, practicalness, and conservatism. In speaking of sincerity, he said the mere desire to do the right thing is not enough; the management must understand human nature sufficiently to know what is a fair deal. Under "honesty," he suggested that we must be honest with ourselves and then it would follow that we would be honest with others. Mr. Weaver cautioned against nostrums in dealing with the management and men question. He said there was no one remedy or system to fit the problem, but that it must be handled intelligently. He urged the necessity of drawing out the latent abilities in men and creating a mutual understanding between the management and the men so that both may understand that neither has "hoof and horn." He expressed the thought that the doing away of the limitation of production would be one way and perhaps the very best way of meeting present conditions. Mr. Weaver's paper provoked a great deal of earnest discussion, and the thoughts he presented were commented upon at length, several instances being given of the application of his suggestions and of the satisfactory results achieved.

In his paper on "The Story of the Insulations," C. E. Skinner, Westinghouse Electric & Manufacturing Co., gave the history of the development of sheet insulations, insulating varnishes and oils, mica, molded insulation, and glass and porcelain insulators, and indicated the trend of insulations of the future. In the discussion upon this paper, Mr. Skinner's ideas were very heartily concurred in. It was suggested that the permanent confinement of the equalizing potential to the selected path constitutes reliability; therefore the reliability of electric light and power apparatus is absolutely staked on insulation. Insulation's hope of climbing from the weak link to the strong link position that it deserves lies in the increasing requirement of reliability. Insulating varnishes were spoken of as being still worthy of serious consideration. Attention was called to the changes that have come about in the uses of mica and to the fact that the use of mica in large pieces cut to size has been abandoned in this country.

G. E. Wendle, Lycoming Edison Co., Williamsport, presented a paper on "Selecting a Switchboard for a Plant of Moderate Size," in which was given a resumé of changes in switchboard installation necessary to care for increases in power load and a comparison of the advantages of truck and cell-type panels.

At the Friday evening session W. H. Johnson, vice-president of the National Electric Light Association, enlarged upon the work of the association and the good to be accomplished through its various geographical sections.

The Hon. William D. B. Ainey, chairman of the Public Service Commission of Pennsylvania, in his address referred to the subject of capital and labor and to the necessity for them both to become better acquainted to the end that each could better understand the other. He said that there must be loyalty in service and loyalty in employment in order to insure harmonious relations and the accomplishment of the best good for both.

John W. Meyers, Philadelphia Electric Co., presented a paper on "Isolated Plant Costs as Influenced by the War," giving comparative figures on the cost of power plant materials and labor between 1916 and the present time, as well as reviewing economic features of the production and sale of electrical energy. Discussion on the paper was limited owing to the nature of the subject matter.

"Power-Factor Correction by Means of the Static Condenser" is the title of a paper presented by O. C. Roff, which is published in full in this issue. In the discussion it was stated that the static condenser will take a current which is proportional to the voltage and the kv-a. will be proportional to the square of the voltage. Accordingly, if the voltage decreases 10% the current will fall 10% and the reactive kv-a. by 19%. On the contrary, the synchronous condenser will take a considerably increased current and a somewhat larger reactive kv-a. This is due to the relative change of line voltage and excitation voltage, the decrease of line voltage corresponding to an increase in over-excitation since the excitation voltage does not change. The increase in current is approximately 20%, and the increase in kv-a. about 8% for a 10% drop in voltage.

It is evident then that the synchronous condenser will exert an increased correcting effect at the very time when the correction is most needed in order to maintain proper voltage while the static condenser will exert a decreased effect. This should not be interpreted to mean that the static condenser should not be used in any case, for it certainly is very much better than none at all, but is simply one of the points which should be considered in deciding upon the type of correction apparatus to be used.

It is interesting to note also the behavior of an induction motor under these conditions. If an average induction motor operating near full load and driving a load of constant torque, such as machine tools or hoists, experiences a 10% decrease in line voltage, the power component of the current will increase about 10% and the reactive component will be practically constant; that is, the necessity for correction is practically unchanged for moderate changes of voltage.

The officers elected for the succeeding year are: W. R. Kenney, Connellsville, president; Henry Harris, Pittsburgh, first vice-president; E. H. Davis, Williamsport, second vice-president; H. S. Cantlin, Allentown, treasurer. Members of executive committee (two year term), W. E. Long, Philadelphia; J. H. Shearer, Altoona, and G. M. Gadsby, Pittsburgh. Henry N. Muller was elected to fill out the unexpired term of Henry Harris.

ECONOMIC FUTURE OF ELECTRIC TRANSPORTATION UTILITIES.

Western Society of Engineers Conducts Symposium on Condition of Electric Railways.

An interesting symposium on electric railway problems of the times formed the topic of discussion at the opening meeting of the season held by the Western Society of Engineers in Chicago on the evening of Sept. 8. Four experts on electric railways presented different phases of the complicated economic problem.

The subject was opened by James R. Bibbins, of the Arnold Co., Chicago, in a paper introducing the problem as a whole and giving a historical review thereof. He showed the importance of the electric railway utilities to the communities they serve. Their capitalization of $4,800,000,000 has been subjected to heavy shrinkage. Not only have material costs risen, but wages also, while labor apparently has the whiphand. The public has been educated to the 5-cent fare and demands that consideration be given only to the depreciated value of the properties. Some nine different remedies have been proposed, of which many are quite radical. Mr. Bibbins reviewed the history of a railway system in a large city with 5-cent fare dating to 1860. Fairly stable conditions existed up to 1890 when the line were electrified; the heavy capital costs thereof practically wiped out earnings for nearly 10 years. As they picked up again, optimism was felt and franchise renewals were accepted without proper allowance for depreciation. The 5-cent fare does not now yield sufficient income.

A paper by P. J. Keeley, president of the Kansas City Railways Co., on "Valuation and Accruing Depreciation" was read by Secretary Nethercut in Mr. Keeley's absence. At first the problems seemed local and greatly diversified, but more recently they have become national and crystallized into realization that the companies cannot render service on their present incomes. The Federal Electric Railway Commission may produce some valuable findings from its investigation. One feature coming to be recognized is that it is impossible to keep a street-railway property in better than 80 to 90% perfect condition, yet it can give 100% service. The practice set by the Wisconsin Railroad Commission of fixing rates on the depreciated value of the property is being abandoned by this and other commissions because it is essentially unfair to the investor. Valuation based on reproduction new is now the accepted practice because equitable. Solution lies in acceptance of the cost-of-service principle as basis for rates.

"The Actuarial Problem" was the title of a paper by W. J. Hagenah, consulting engineer, Chicago, read by Mr. Jirgal in the author's absence. Depreciation funds are seldom set aside specifically as such. The practice of accountants is usually to draw on the general surplus or reserve for renewals instead of on special depreciation funds. Each generation should bear its share of development expense and depreciation. Patrons must provide sufficient income to meet costs and investors must make proper allowance for current and accrued depreciation in order to permit continuous service and keep the property intact. Depreciation must be provided for in advance and the income must be sufficient to permit this. There is an undoubted tendency toward using the reproduction cost new as basis for rate making.

George Weston, consulting engineer, Philadelphia, presented a paper on "Electric Railway Policy." One of the most important problems is to secure harmony between labor and capital, then to promote economy and give the best possible service. Public authorities must be fair; in the past they have taken the "pound-of-flesh" attitude too often and denied a fair deal to the companies. Labor must be assigned a participating partnership in the business and compelled to assume its obligations. Assuring it full opportunity to have redress for wrongs, it must be deprived of the right to strike. Mr. Weston referred to the success of the Philadelphia Rapid Transit co-operative plan, which has been developed during 9 years. A feature of it is to promote thrift and stimulate service. Most companies cannot resort to such slow development of co-operative service in the present emergency and must have more revenue.

The subject was discussed by Colonel Junkersfeld and Messrs. Lewis, Bibbins, Mabbs, Jirgal and Stephenson.

TWO NEW COMMITTEES ARE ESTABLISHED BY N. E. L. A.

Committee on Service and Committee on Co-operation in Industry Are Formed.

President R. H. Ballard of the National Electric Light Association has received the acceptance from S. M. Kennedy, general agent of the Southern California Edison Co. of Los Angeles to act as Chairman of the Committee on Service, and from Lee H. Newbert of the Pacific Gas & Electric Corporation of San Francisco to be chairman of the Committee on Cooperation in the Industry. Both of these important committees will pursue lines of original investigation and will make reports along constructive lines to the national convention of 1920, which will be held in Southern California.

Mr. Kennedy's committee will work on the conditions of service from this viewpoint: With the regulation of rates and finances by state utility commissions, to provide only safe returns on capital invested, and with a courageous attitude toward these regulating commissions to see that such return is allowed; electric utility companies are entirely out of politics and should devote their energies to the service of the public, without any encumbrance to the achievement of its highest development.

Mr. Kennedy is well known in the national forum of the industry both as a progressive official and an author.

Mr. Newbert's committee will endeavor to formulate and submit to the next convention a plan by which all of the branches of the electrical business may co-operate and to show specifically how this can be practically worked out in the geographic sections.

Mr. Newbert has been very active in the California Electrical Co-operative Campaign, of which he has for several years been chairman. This movement had its origin in the Pacific Coast Section, has met with remarkable success in the centralization of central stations, manufacturers, jobbers and contractor-dealers, and has demonstrated that they can work together for the general good of the industry. Chairman Newbert, in appointing the members of his committee, will make selections from all branches of the industry.

CENTRAL STATIONS CONFRONT PROBLEMS DURING READJUSTMENT.

Chairman Britton of Public Policy Committee, N. E. L. A., Outlines Policies to Be Adopted.

In anticipation of weighty problems that confront the central-station industry during the readjustment period, John A. Britton, chairman of the public policy committee, N. E. L. A., has written the following letter to members of that committee with a view to standardizing fundamental policies of public utilities, to place rate regulation on principles of equity, to promote water-power development in the West, and to correlate the work of the different committees so that the problems of the year may be handled consistently and well.

To the Members of the Public Policy Committee, National Electric Light Association:

As chairman of the Public Policy Committee of the National Electric Light Association, I wish to discuss with the members of that committee the policies deemed essential by me to be pursued during the coming year.

First and foremost, I am in sympathy with and ready to stand back of all the plans which have been suggested by President R. H. Ballard, and pledge myself to support him in his more than laudable effort to make his administration year a record one for the association. I hope that the members of our committee will assist Mr. Ballard in securing men of prominence in the industry for chairmen and members of several new general committees he is trying to organize to work out the big problems now confronting us. These will require the thought of some of the best minds and work of the best men.

We of the West want the East to know us better. We want to expand the usefulness of the association; we want it to be nation-wide in its influence. It can be of the greatest good.

The fundamental policies which must govern the attitude of public utilities should be alike. In my judgment this can best be accomplished through the suggestions made by our president, particularly with reference to the formation of Geographic Sections.

The methods of approach to the rate regulating bodies must be upon sound principles of equity. Individual opinions enforced through argument in special cases should not be permitted to raise questions inimical to the public utilities as a whole.

The East has never been appreciative of the necessities of water power development; it has been more or less inactive in support of Western needs and conditions. This condition must be remedied.

Standards should not be encouraged in one section of the country that might be detrimental to other sections. In this concert of action is necessary.

The Public Policy Committee should be a judicial body acting upon the general questions raised in the association and coming through the avenues of the different committees. For that reason it should be closely in touch with the action of all committees, but more especially the Executive Committee, and should have intimate knowledge of what is being discussed and of the problems that concern each of the subdivisions of the organization. I have arranged with the president that copies of the minutes of the Executive Committee meetings will be sent to each member of the Public Policy Committee.

If ever there was a time in the history of our association when to overcome the insidious working of antagonistic interests we should stand together, that time has now arrived.

National legislation and state legislation should be correlated with the needs of all states, so as not to form dangerous precedents. Matters of this kind can best be worked out through the agency of such a committee as the Public Policy Committee.

I want each and all of you to pledge yourselves to a shoulder-to-shoulder campaign with our president. Like the West from which he comes, he is progressive, ambitious and resourceful.

I am sending a copy of this letter to you, to each of the vice-presidents, and invite from you and them such suggestions of matters to be considered at the meeting of the Public Policy Committee to be held in September as may occur to you as things that should receive consideration at the hands of that committee in line with the policies which I have outlined in the preceding paragraphs.

Yours very truly,
JOHN A. BRITTON,
Chairman, Public Policy Committee, N. E. L. A.

MANY FEATURE EXHIBITS PLANNED FOR NEW YORK SHOW.

Model Electrical Home and Complete Vehicle Display to Be Shown at Exposition Sept. 24 to Oct. 4.

A model of a modern home, in the form of a small apartment equipped with electrical machinery and devices which either supplant entirely or greatly lighten the manual labor associated with the operation of a household will be a feature exhibit of both interest and value at the New York Electrical Exposition which opens Sept. 24 in Grand Central Palace, New York City. These machines and devices are literally as well as figuratively electrical servants.

The idea of the model home originated with Arthur Williams, Federal Food Administrator, and also head of the exposition. He called together a staff of experts and told them to lay out an average small home, and then to apply electrical devices and machines to every manual labor task necessary for its operation. They have succeeded beyond expectations and found many new inventions applicable to the work. Altogether a remarkable demonstration of the emancipation of household drudgery through the modern application of electricity is provided.

In addition practically every make of electric passenger car and electric motor truck, including the small industrial trucks, will be exhibited. There will also be numerous displays of the various accessories applicable to the electrical vehicle, ranging from batteries to decorative lighting. Those engaged in the automobile business will have a further interest in the electrical show, because of the many exhibits of electrical devices for the garage and repair shop and the wonderful displays of electric lighting and decoration for large showrooms.

Commercial Practice

Successful Merchandising Methods—Refixturing Campaign of Commonwealth Edison—Advantage of Irons as Specialty

ELECTRICAL MERCHANDISING METHODS OF DETROIT EDISON CO.

Abstract of Interesting Paper Read at Michigan Section Meeting by A. H. Touscany.

The methods employed by the Detroit Edison Co., Detroit, in conducting and promoting the sale of electrical merchandise in its territories were fully described in a paper, "Electrical Merchandising," presented at the recent convention of the Michigan Section of the National Electric Light Association by A. H. Touscany.

In Detroit, this company sells only lamp socket heating devices such as irons, toasters, etc., leaving the marketing of the larger devices to the electrical contractor-dealers, department stores and hardware merchants. There are about 250 such stores in the city at present. A number of these, having important agencies, support excellent selling organizations. During 1918, approximately the following number of major devices were sold: 16,979 cleaners, 8153 washing machines, 1335 ironing machines and 1536 sewing machines.

Most of the business is obtained by soliciting and it can safely be said that no housewife in Detroit need go shopping for such devices. Because of the existing competition every reasonable courtesy is extended to the customer.

The one device that the Edison company will perhaps always handle is the flat iron. This is because many of the other merchants have a tendency to handle the cheaper lines of this appliance and if the business were left entirely to them the company's lines would be flooded with low priced goods of inferior makes that would cause considerable trouble.

In the small towns outside Detroit, known as the Eastern Michigan Division, little or no attention is paid to the development of the electrical appliance business by the local dealers. In order to develop these territories the company carries an adequate stock of devices in all its local offices.

By establishing such stores it is also hoped to bring the small town dealer to a better realization of the opportunities offered in the sale of electrical appliances for in the future a large portion of his business will come from this source.

In this connection the possibilities of the electric appliance business were brought out. The range, washer, cleaner, sewing machine and ironing machine were described as the popular major electrical devices of today and will undoubtedly be sold in ever increasing quantities in the future. The dishwasher and clothes drying machine are devices expected to be brought forth in the near future and the electric refrigerator has already been developed but not exploited as yet to any extent. In addition, electrical merchandise is the cleanest line of merchandise there is today, and every time a labor-saving device is sold the customer is rendered a valuable service which gains his confidence and good will—a wonderful asset to any business.

In regards to the methods used to stimulate appliance sales, Mr. Touscany is of the opinion that the house-to-house hawker method of selling is undesirable for a central station to employ. It is true a certain amount of educational work must be done but it seems to him that a certain portion of the line is sufficiently introduced to make it unnecessary to continue what is considered by the largest and most sucussful merchants to be a most undesirable method of getting business.

In its Eastern Michigan Division in which there are 30 display rooms the Detroit Edison Co. is endeavoring to market electrical appliances in much the same way as a hardware dealer sells his goods. It is trying to teach its customers through window display, newspaper advertising and store demonstrations the uses and advantages of electric appliances. By pursuing this policy the merchandising business in this division is growing steadily,—the 1917 sales being 50% greater than in 1916, in 1918 they were 85% greater than in 1917 and during the first six months of this year it has had a 148% increase over the same period last year.

Everything is sold at manufacturers' list price, no commission or bonuses are paid and no free wiring is done. The company believes in local newspaper advertising but does not advertise any particular make of appliance, and although nationally advertised products are preferred it does not disfavor new lines being put on the market. Advertising matter is sent out in the monthly bills but the company's name does not appear on the advertisements. The show windows are also used as advantageously as possible and the returns justify all the time, money, care and thought that is put into them. It has been found that the simple window exhibiting a single thought is the most successful. Such windows can be trimmed more easily and the displays are changed as often as three times a month.

Special attention is paid to store arrangements and the stores are so arranged that a customer in paying a monthly bill walks through the entire display. All of the small heating devices are kept in glass show cases which not only adds materially to the appearance of the store but allows a sample of each device to be kept on display constantly without depreciating their value. Washing machines and ranges are connected so that customers can see the devices in action.

All our appliances are sold on a deferred payment basis, and although there is no set rule governing time and payments, terms are usually arranged to suit the customer's convenience. Every opportunity to demonstrate to customers is taken advantage of and it is found that the stores doing the must demonstrating make the greatest number of sales. The value of dignified store solicitation cannot be over-estimated and the increase in business is largely due to the fact that the merits of electrical devices are being continually demonstrated in all display rooms. Service, of course, is the most essential requirement. One of the main reasons for a central station being in the appliance business is because it furnishes a greater chance to serve the customer.

As mentioned before, the Detroit Edison Co. offers no bonuses or commissions to its sales people in the sale of appliances. Recognizing that there should be some incentive offered, a comparative appliance sales report is issued each month. These reports are not only sent to each local office, but to all officers of the company interested in the development of appliance sales. This report not only indicates the amount of appliance sales for each town and district, but it shows the amount of appliance sales in cents per meter. Because of the close attention that is paid to this report by various officers of the company and because the district agents are vitally interested, each local agent is very anxious to make a good showing for his community.

In conclusion, the paper called attention to the necessity for enthusiasm in selling electrical appliances. Enthusiasm is the biggest word in business today. Cash can buy, but it takes enthusiasm to sell. The slogan of the best salesman is "Enthusiasm," because it is the zeal that puts zero in competition. Enthusiasm is what gets you home from third. It is that power that compels you to stick in the home stretch. Without it, the fullest measure of success cannot be achieved as it is the contributing factor of any finished product. The best clerks, the most resourceful salesmen, are those filled with enthusiasm. Each and every one of us dealing in electrical appliances should be filled with a sincere enthusiasm for the wonderful line of merchandise which we sell.

TENANTS URGED TO BUY THEIR OWN LIGHTING FIXTURES.

Commonwealth Edison Co. Plan Enables Apartment Building Tenants to Improve Lighting Conditions.

For many years central stations, contractors and the rest of the electrical industry, as well as the public, have realized that the lighting fixtures installed in the average apartment building left much to be desired both from the artistic and practical viewpoints. This is due to the fact that the lighting fixtures are usually the final purchase in constructing a building and must be paid for out of the money left over after all other expenses are paid. On account of the large number of extras encountered in the construction, this amount is seldom as large as originally intended and the cheapest possible fixtures are usually installed.

In addition practically every occupant of such a building possesses a different style of furniture and for each of these styles there should be installed a corresponding electric fixture if the best results are to be obtained. People will go to a great deal of expense to purchase furniture of a certain period or style and arrange it tastily only to have the whole effect spoiled by a lighting fixture that is not in harmony with the rest of the room, for the lighting fixture dominates everything else in the room. Furthermore, existing lighting fixtures are seldom used properly. They are either equipped with lamps of a size too large or too small or every socket is not filled with a lamp.

To overcome this condition a fixture department has been added to the Electric Shops of the Commonwealth Edison Co., Chicago, where tenants may purchase their own fixtures to harmonize with their furniture and individual tastes. The fixtures are sold on the time-payment plan which makes their purchase much easier. Although the plan is a comparatively new one and has not been widely advertised as yet—the advertisement reproduced herewith being the only one to date—the demand for fixtures is already exceeding all expectations and promises to become an important factor in its business.

NOTICE to TENANTS

Own Your Fixtures as You Do Your Furniture — Many a tenant, moving into an apartment, finds fixtures that, even if modern, are discordant with the period furniture. The problem is solved by selecting and owning fixtures in keeping with such furniture—replacing the landlord's fixtures during tenancy.

The Fixture Room at Our Electric Shop — We make this easily possible. The Fixture Room at Electric Shop displays a most comprehensive variety of period as well as modern designs in artistic effects, in keeping with every possible need. Select the fixtures you wish—we will arrange for their installation in your apartment.

Small Monthly Payments — Make a small payment, and you may pay the balance—added on your lighting bills—spread over eleven months.

Tenants and Landlords — Whether you are a tenant, or a landlord, you are urged to avail yourself of the convenience afforded by this plan.

COMMONWEALTH EDISON
ELECTRIC SHOPS
72 West Adams Street

ELECTRIC SHOW COMING OCTOBER 11-25—COLISEUM

Recent Advertisement of Commonwealth Edison Co. Electric Shops Urging Tenants to Buy Their Own Fixtures.

SEWING MACHINE DEALERS URGED TO HANDLE ELECTRIC IRONS.

A recent issue of *Sewing Machine Times*, a publication devoted to the interests of the sewing machine trade, contained an interesting article explaining the advantages of carrying a line of electric irons as a specialty for dealers in that line. It was pointed out that by handling such devices as a side line the sales of sewing machines and other appliances could be materially increased. The sewing machine dealers were urged to take advantage of the advertising and sales campaigns conducted from time to time by electrical manufacturers and central stations by tying in their own advertising and concentrating their sales efforts on these articles during such periods. The article then described the methods that have been used with success in the past by different electrical interests in the conduct of such campaigns.

Without attempting to discuss the desirability of such a procedure from a practical point of view it surely indicates the attractive selling qualities of such appliances and it is interesting to note that another industry recognizes the great demand that has been created for electrically operated appliances and the advisability of handling them.

Operating Practice

Intermittent Ground in Turbogenerator Field—Heating of Underground Conductors—Synchronous Motor Ammeters

OBSTRUCTION IN VENTILATING DUCT CAUSES INTERMITTENT GROUND.

Peculiar Ground Existed Only with Machine in Rotation. Location of Cause and Moral?

Many companies make it a practice to test periodically the fields of their machines for earths or grounds. In this way many occurrences can be brought to light and worse happenings prevented. In steam generating stations containing turbogenerators and extensive exciter systems it is particularly advisable to make frequent tests for grounds on the exciter system and the generator field circuits.

In one instance recently a rather peculiar form of ground occurred. When making the periodic tests for grounds it was discovered that one of the turbogenerators had a ground on its field. This unit was of 25,000 kw. and was in service at the time the ground was discovered. When the unit was shut down, repeated tests showed that the ground had disappeared. Starting the machine again showed that when up to speed or nearly so, the ground existed, but when the machine was at rest or turning over very slowly it had disappeared. Such grounds occur frequently, and are usually found in the flexible leads that pass from the actual field coils to the rings, and may be due to frayed insulation, the collection of greasy dirt containing conducting particles such as metal dust.

As it was found impossible to locate the ground by test or inspection it was necessary to take out the field and remove some of the field end plates. The fault was found to be half way down in one of the slots directly in line with the spot where the field leads come out of the field. End plates were removed from each end of the field and the insulation on the end turns of the field coils was then found to be damaged quite extensively. The reason for the damage was found to be due to the fact that the bolts holding the end plates in position had been pulled up so tightly that the insulation on the coils had been badly crushed. As bearing out this cause of damage to the insulation, was the further fact that the supporting studs against which the end plates are pulled up against were badly buckled and marred, the end plates themselves even being sprung where the bolts passed through.

On pulling out the defective coils, it was found that the ground had been occurring in the bottom of the slot directly on top of one of the ventilating ducts. At this point inspection of the core showed that a brass wedge, such as is employed for securing the pole laminations, was resting in that ventilating duct that terminated at the fault in the field conductor. This wedge was standing on edge and was free to move backward and forward along the ventilating duct, according to whether the field was turning over or at rest. When the field was rotating, this wedge was thrown out against the faulty conductor, striking the insulation at the point where it had been cut and causing a ground.

The cause of the ground on the field resulted from the wedge, the crushed insulation due to the end plates being pulled up too tightly, being only incidental and a fact that was brought to light only because the conductor in a certain slot was pulled out. While being a weakness, the crushed insulation had not caused trouble up to the time the field was overhauled. The moral from this incident seems to be that special precautions should be taken to prevent loose objects from being left in ventilating ducts and similar places, and that the force that it is possible to exert through the leverage of wrenches, etc., be not abused, as had obviously been the case in the present instance, since the end plates had even been sprung.

HEATING OF UNDERGROUND CONDUCTORS UNDER INTERMITTENT LOAD.

Abstract of Paper Describing Experiments Before A. I. & S. E. E. in Philadelphia.

BY A. L. FRERET,

Assistant Electrical Engineer, Tennessee Coal, Iron & Railroad Co.

When a conductor is carried in conduit buried in solid material, convection of heat is prohibited and the heat created by the current must be dissipated by conduction through the insulation and through the conduit into the surrounding substance. The amount of heat so dissipated through conduction is roughly proportional to the temperature difference between conductor and surrounding solid substance, and is also proportional to the area of radiating conductor.

The process of conduction of heat from the cable is so slow compared to the process of convection from a conductor suspended in air that the limiting carrying capacity of the underground cable is the temperature dangerous to the insulation. This temperature is reached long before the power losses represented by the heating reach values which need be seriously considered.

Obviously, heavier currents can be employed when they exist only intermittently than when existing continuously, and experiments were carried out to determine safe loading with intermittent loads. The experiments were carried out by constructing a pine box 10 ft. long, and 1 ft. wide and high, the pine boards being ⅞-in. in thickness. Several rubber-covered cables were laid at different times in the box and surrounded by ground firmly packed. Heat runs were made and the current and time required to attain 100° F. was noted.

Tests were then made to determine the effect of an intermittent current upon the temperature rise of the conductors. Current was applied for one minute, was shut off for two minutes, and then on again for one minute, and so on for two hours. In the case of a 2/0 cable carrying 200 amperes with the intermittent current of 200 amperes on one minute and off two minutes, after two hours a temperature of 107° F. was attained compared with 180° F. for continuous load, a difference of 73° F. In the case of a 4/0 cable carrying 300 amperes, the temperature attained with intermittent load was 120° F. compared with 220° F. continuous load, a difference of 100°.

The conclusions reached are that with an intermittent load, one minute on and two minutes off, an underground cable need only have 56% area of the conductor for carrying the same load continuously.

The foregoing shows that the current being intermittent, the heating of the cable really depends upon the mean effective current, which is the square root of the mean squares of the current. In the case where the current is on and off the same length of time, that is, one minute, this would correspond to the $\sqrt{2}$ and for current alterations amounting to one minute on and two off, this same value is very nearly correct, so that the simplest way to arrive at the safe value of current for underground cables in intermittent service would be to use the manufacturer's rating multipled by the $\sqrt{2}$.

EXPERIENCE OF THE HAZARDS OF SYNCHRONOUS MOTOR FIELD AMMETERS.

Relative Methods of Starting Motor—Location of Field Ammeter.

By B. H. Smith.

The synchronous motor has passed through a stage of development during the last five years by which its operating characteristics, pull-in torque, starting torque and stability in running have been greatly improved. Today, the synchronous motor can replace the induction type of motor for many applications, whereas its use would not have been even considered a few years ago. However, while there are many modern synchronous motors in service, with the latest improvements, there are also many of the older types still in service, with their shortcomings and their dangers. The following serves to emphasize one of the dangers of the old methods of starting synchronous motors and how it could be overcome under such circumstances, and how the danger has been eliminated by recent improvements in motor design.

Methods of Starting Synchronous Motors.

When starting a synchronous motor from rest, a partial voltage is applied to the armature or stator. The field winding or rotor acts as the secondary of a transformer, of which the primary or stator is the winding to which potential is applied. Under these circumstances, of course, a voltage is induced in the field winding of the synchronous motor, this voltage depending upon the ratio of turns in stator and rotor, the applied voltage, the frequency in the rotor circuit or flux density, according to the familiar transformer equation.

At the instant of starting from rest, the potential induced in the field winding is a maximum, because the frequency of the stator is the same as that of the rotor. As the rotor gains speed, the frequency of the rotor becomes lower until the motor "pulls in," when the frequency of the induced current in the rotor is zero, because no potential is induced since no flux is cut by the rotor.

The ratio of field turns to armature turns of the synchronous motor is such that at the time of starting a high voltage is induced in the field winding. To guard against breakdown of the field coils, it is the custom to break up the field winding into sections, thereby limiting the number of turns in series. In the latest types of synchronous motors it is the practice to start the motor with the field short-circuited upon itself through a resistance, thereby preventing the piling up of a potential dangerous to insulation or persons. Moreover, the low-resistance bars or winding in the pole pieces also serves to reduce the induced potential in the field while the motor is being started up. In other words, the synchronous motor of today presents little danger to insulation or to persons.

As many of the older types of synchronous motors are still operating, it may be instructive to describe a serious accident that occurred, explaining the manner in which it could have been and has since been avoided. The synchronous motor was employed for driving an alternating-current generator and thereby changing the frequency from 25 to 60 cycles. The motor was rated at 1000 kw. and operated at a line pressure of 9000 volts, 25 cycles. The motor was equipped with wattmeter, voltmeter and ammeters on the alternating-current side and with a voltmeter and an ammeter in the field windings.

Location of Field Ammeter.

The motor was started up from an autostarter or autotransformer, at about 50% line voltage, or 4500 volts. It so happened on the day under consideration that the chief operator was supervising the starting of the unit by an assistant operator. The former was standing at the switchboard, before the panel controlling the unit to be started, with one hand resting upon the case of the ammeter in the synchronous motor field circuit. When the assistant operator closed the motor to the autotransformer, the chief operator received a shock that caused him to be unconscious for several minutes and that resulted in burns that kept him in the hospital for several weeks.

A consideration of this case shows that (1) ammeters in the field circuit of synchronous motors should be treated with the respect due to apparatus subjected to high voltages, and should not be touched while the motor is being started; (2) that the ammeters of synchronous-motor fields should be located on the exciter bus side of the field circuit-breaker so that the ammeter and its shunt are isolated from the field coils until excitation is applied to the field winding.

In the present instance the synchronous motor received its excitation from two sources, an exciter at the end of the synchronous motor shaft and a separately driven exciter set. The ammeter was located close to the field winding of the motor, so as to shorten up the heavy leads from the direct-connected exciter. In other words, the circuit-breaker located at the rear of the switchboard only controlled the separately driven exciter set. The same result could have been obtained by installing the circuit-breaker on the panel carrying the knife switches for the direct-connected motor exciter.

With the present-day practice of short-circuiting the synchronous-motor field through a resistance, plus the grid resistance winding in the pole pieces, the danger mentioned above is very remote. However, as there are many of the older types of synchronous motors still in service, the precautions outlined above deserve consideration.

Contracting-Construction

Co-operative House-Wiring Campaign in Chicago—English House-Wiring Problem—Effort to Standardize Construction

HOUSE-WIRING CAMPAIGN TO BE CONDUCTED IN CHICAGO.

Union Officials Call Meeting to Arrange Plans for Campaign During Coming Winter.

About 110 Chicago members of the Illinois Electrical Contractors Association were present at a meeting held in Chicago on Sept. 5. This meeting was called by the officers of Local 134 of the International Brotherhood of Electrical Workers and in addition to these officers and the contractors there were present representatives of the Commonwealth Edison Co. and of the Electrical Inspection Department of the city. Charles Paulsen, president of the labor union, presided.

The purpose of the meeting was to arrange the plans for carrying on an intensive campaign to wire existing buildings during the coming winter and to work out a solution to some of the problems encountered in such work. Due to labor difficulties that have risen in Chicago and for which the electricians' union is by no means responsible, construction work in this city has been practically at a standstill and with the cold weather coming on it is not probable that it will be resumed to any extent until spring. In order to provide work for the electricians therefore, it was decided to urge the local electrical contractors to exert every effort they possibly can toward securing a large number of old house-wiring contracts during the winter period.

The principal speakers on this occasion were Victor H. Tousley, chief inspector of the city's inspection department; E. W. Lloyd, general contract agent of the Commonwealth Edison Co.; M. J. Boyle, business agent for the labor union, and J. W. Collins, secretary of the contractors' association. Mr. Tousley explained very clearly the requirements and provisions of the new Chicago license ordinance, which was described in our issue of Aug. 9. A lively discussion followed in which the advantages of the new ordinance and many of its important provisions were fully brought out.

Mr. Collins explained the arrangements which he has recently completed for bonding the members of the association. Under the new ordinance each contractor is required to provide a $5000 bond. Mr. Collins has arranged with a prominent company to bond all the members of the association collectively. This has reduced the amount of the individual bond fee to a large extent, more than enough to pay the association membership dues, and has resulted in a great increase in the membership. He has also arranged with a local banking company to finance a time-payment plan for old house wiring for the membership of the association, whereby the contractor can receive cash immediately for his contracts and the bank accepts the responsibility for making the collections.

Mr. Lloyd spoke of the Chicago Electrical Show to be held Oct. 11 to 25 at the Coliseum. The success of this show is already assured and the contractors were urged to co-operate and participate in it as far as possible. All of the electrical contractors' associations in Chicago have co-operated and made arrangements for a booth at the show and the state association will hold a meeting while the show is in progress.

The difficulties encountered in conducting the old house-wiring business in Chicago were then discussed. The principal difficulty seems to be in getting the buildings connected after the wiring is completed. In order to overcome this the electrician, contractor, central station and the inspector must co-operate very closely to avoid any unnecessary delay. Several plans have already been developed to accomplish this, but to date these have only been successful in a small degree. As a result of this meeting, however, steps are to be taken by the various factors in the industry which will undoubtedly result in the elimination of such delays.

INTERESTING FEATURES OF ENGLISH HOUSE-WIRING PROBLEM.

J. W. Beauchamp Advocates Use of More Completely Manufactured Fittings to Reduce Labor Costs.

Some interesting information regarding the wiring costs of small buildings in England was recently brought out in an address by J. W. Beauchamp, director of the Electrical Development Association, before a joint conference of electrical engineers, contractors and supervising electricians recently.

In this address Mr. Beauchamp stated that it was seldom that an opportunity occurred of wiring a large number of houses at the same time in quantity and in a businesslike manner, and at a time when the construction of the houses was not completed. Generally the houses are wired one at a time and are in quite a completed condition, which involved a lot of extra work.

Assuming the case of an average house situated about a mile from the shop of the wiring contractor, it would appear that at pre-war prices some 10 to 15% of the labor cost in wiring was spent for "walking time" and the transport of materials to the job, leaving only 85 to 90% of the labor cost for effective operation within the house. Today, the percentage lost in this way has increased to 15 to 20%, owing to the change in the working hours. It was obvious that everything possible must be done to reduce the number of days spent on any job of this kind and to expedite the transport of men and materials to the job; very strong arguments in favor of using some form of mechanical transport for conveying both men and materials. Where an estate or block of houses was being wired, a clerk and a hut could be set on the job, stores accumulated, and a great deal of loss avoided.

Another point was that the underlying principle of improved wiring systems was to get a larger proportion of the money spent in a factory and a lesser proportion spent actually in the house being wired. For example, in a standard building wired in a simple way throughout with plain pendants, the usual class of material and conduit, and full-price trade union labor, it appears that the total cost (without overhead charges and profits) is divided as follows:

	Per cent of total cost. 1914.	1919.
All fittings and accessories	14	17
Cable	15	12
Conduit	13	17
Labor	40	41
Lamps	18	13
Total	100	100

Thus, although the total cost was almost exactly doubled, there had been no great change in the relative proportion of the cost of the several items. The manufactured fittings, conduit, and the labor were up a little; cable was relatively lower, and lamps are reduced by a substantial percentage. For these reasons there is no great prospect of reducing the labor cost, excepting where large blocks of houses were being wired at once and better organization and more division of labor could be brought together to effect economies.

However, Mr. Beauchamp believes that by giving the workmen more completely manufactured articles than coils of wire and lengths of tube and thus bringing more of the work within the four walls of a factory the labor cost could be materially reduced. After amending the present regulations if possible to permit the use of simpler and less elaborate wiring systems, the industry should then devise a system in which the wiring and fittings were produced in the most finished possible form in the factory, leaving the smallest call upon the skill of the workmen to fit them neatly to the installation.

Mr. Beauchamp also called attention to the fact that the percentage of the total cost of electrical work expended for labor was very high compared with other accessories of the house, for instance, the fixing of the fire grates, hot water systems and baths. In the case of these other articles the cost of the goods as purchased from the manufacturer was much higher in relation to the cost of installing them than was the case with electric wiring. This proves that such articles are much more completely finished in manufacture than electrical devices.

COMMITTEE FORMED TO STANDARDIZE CONSTRUCTION.

New Committee of National Federation of Construction Industries Expected to Solve Problem.

One of the greatest problems confronting the construction industry at present is the lack of standardization. This applies to building codes, to state legislation relative to licensing and inspection as it refers to construction and care of buildings, to building equipment of all kinds, to construction materials, to building specifications, to contractors' methods of bidding, etc., to financial operations in connection with construction, and to other considerations involved in the construction industry.

If it were possible for manufacturers of construction materials to standardize their product into a minimum number of varieties compatible with successful building operations, the manufacture of such material could be placed upon a bulk basis which in many cases is now impossible. Quantity manufacture has made the United States supreme as an industrial nation. The construction industry, however, is in many particulars so unstandardized that quality production is now impossible.

In order to overcome this difficulty the National Federation of Construction Industries has recently created a Committee on Standardization which will be formed as rapidly as possible. It is intended to organize this committee so as, if possible, to reach into all phases of construction interests, since it will be practically impossible to effect standardization without the co-operation and assistance of all of the interests concerned. The work of this committee will undoubtedly extend over a number of years, and the results which are possible of achievement are at the present time almost beyond estimate.

BOSTON DISTRICT CONTRACTORS TO HOLD IMPORTANT MEETING.

Report of Activities at National Convention of Contractors and Dealers to Be Read.

There will be a meeting of the Boston district of the Massachusetts State Association of Electrical Contractors and Dealers on Sept. 18 at the Boston City Club. On that occasion, Alfred J. Hixon, National Committeeman from Massachusetts, will make a report on the activities of the annual convention of the National Association of Electrical Contractors and Dealers in Milwaukee. Many matters of vital importance were considered at this convention and notwithstanding the fact that they have been published in the trade press, Mr. Hixon will give a more lucid explanation than it would be possible to obtain from reading matter. Also the members will have an opportunity of asking questions upon matters not fully understood from reports of the National Secretary.

It is particularly desirous that a large attendance be present at this meeting, as it is possible that later on the association may be called upon to express an opinion upon vital questions that possibly may affect the entire industry.

REQUIREMENTS FOR RUBBER-COVERED WIRE IN AUSTRALIA.

Commonwealth Imposes Rigid Specifications on Manufacture of Wire.

In order to insure the quality of the rubber-covered wire used in Australia and keep the possibilities of danger or fire arising through the failure of insulation at a minimum the Australian Commonwealth authorities impose the following regulations on rubber-covered wire: Each coil must bear (1) the maker's name and address; (2) the length of wire; (3) the date of manufacture; (4) the gauge of conductor; (5) the insulation resistance per statute mile after 24 hours' immersion in water at 60° F. and one minute's electrification at . . . volts—the voltage to be plainly marked on the label—or details of the test voltage applied, or other definite and comprehensive description of quality.

QUESTIONS AND ANSWERS

All readers are invited to submit questions and answers to this department. Anonymous communications will not be considered. Questions should relate to electrical matters of any kind. Answers contributed by readers should be submitted preferably within eight days of the date of publication of the question and should be limited, if possible, to 300 words. Payment will be made for all answers published.

Questions.

No. 464.—Transformer Design.—I am trying to build a transformer with 110-volt primary and 14 steps on the secondary varying by 7½ volts up to 105 volts, thus, 7½, 15, 22½, 30, etc. Each step must be capable of carrying 10 amperes. What size and amount of wire is necessary on the primary and secondary windings?—W. A. S., Augusta, Kans.

No. 467.—Operating Cost of Electric Household Refrigerators.—I would like to know from some reliable source what is the operating cost of the electrically operated refrigerators that are being recommended for household use. What is the experience as to their dependability?—R. H. T., New York, N. Y.

No. 471.—Ringleman Charts for Determining Smoke Density.—The use of Ringleman charts is frequently mentioned in connection with the determination of the density of smoke emitted from smokestacks. I would much appreciate an explanation of what the Ringleman chart actually is and how the density of smoke may be determined from its use.—M. A. P., Spokane, Wash.

No. 472.—Rewinding a Transformer.—I have the complete core and case of a 2½-kw., type H, 60-cycle G. E. transformer which I would like to rewind for the ratio of 88-176-volt primary and 115-230-volt secondary of about 2 kw. capacity. The inner core is 3 by 3 ins., extending over the outside of the coil in four equal sections of 2½ by 1¼ ins. cross-section, leaving a winding space around the core of 2 by 5¾ ins. The original voltage ratio was 1200-2400 primary and 120-240 secondary. The use of this transformer is to be for intermittent service only of about 2 to 3 hours' duration for demonstration of fractional-horsepower alternating-current motors. Please advise what size of wire and number of turns to use on primary and secondary windings. Would it have to be oil-cooled like the original? Would a 3-hp. direct-current motor, old style G. E., wound with two No. 14 B. & S. wires in parallel, wave-connected, running as converter on 115-volt direct-current line, be sufficient for this purpose or would it be necessary to decrease the capacity of the transformer to suit the converter? The present alternating-current voltage obtainable at the converter averages 88 volts, 60 cycles, single phase.—V. S., Portland, Ore.

Answers.

No. 468.—Wiring Lights from a Bell-Ringing Transformer.—Is there any provision in the National Electrical Code against reducing 110 volts to a lower voltage by means of a bell-ringing or toy transformer and then wiring some small lights from this? Is it all right to run this wiring in the same way as ordinary bell wiring? If this is permitted, what is the highest voltage and wattage permissible on such bell wiring?—S. T. E., Bridgeport, Conn.

I find no provision in the Code covering this class of wiring and would conclude that it is not prohibited. The local inspector would have to be the judge as to the voltage and wattage permitted on bell wiring; my own opinion would be not over 12 volts and 10 watts. I should advise using No. 18 or 16 wire if the lamps are located at a distance over 50 ft. (one way) from the transformer or if the load is as much as 25 watts on 24 volts; this is to prevent excessive voltage drop and therefore poor light from the lamps and also to make a more substantial installation. There is not much to be gained from such wiring unless the lamps are very small and used for signals or decoration instead of real illumination. Christmas-tree lights up to 13 volts are sometimes wired in parallel from such a transformer to avoid the trouble of having all of the usual series string go out when one of them burns out or breaks. There are some combined transformer and lamp sets on the market that are especially suited for economical use as low-voltage night lights; these have the outfit connected to the ordinary 115-volt circuit and the transformer forming the base or other part of the lamp steps the voltage down to 5 or so volts. For permanent service such an outfit is certainly preferable to a makeshift use of bell wiring and a toy transformer; the latter would not be recommended by me for lamp service except in small, emergency and temporary installations or for small signal lights.—H. T. M., Indianapolis, Ind.

No. 469.—Length of Motor Branch Line.—What limit, if any, is there to the length of a tap line from a No. 0000 feeder to an autostarter for a 2300-volt motor? The tap line is to be No. 6 or No. 8 lead-covered cable run in conduit.—A. S. N., Plymouth, Mass.

If the size and type of the motor and the allowable percentage volt drop were given, the length of the branch could be stated. For ordinary short-distance wiring, such as one finds in the average shop, No. 8 wire would serve for a 75-hp., three-phase, 2300-volt, 60-cycle motor and No. 6 for a similar 100-hp. motor. If the motor is a 75-hp. machine and No. 8 wire is used, the branch can be run up to nearly 8000 ft. without exceeding a voltage drop of 5% on a 2300-volt supply.—A. W. S., Youngstown, Ohio.

No. 470.—Pulling in Lead-Covered Cable.—I would like information in regard to pulling lead-covered cable into iron conduit. What kinds and sizes of grips are suitable for use in pulling No. 0000 triple-conductor, lead cable of 2-in. outer diameter into 2½-in. conduit? Through how long a run and around how many elbows is it safe to pull this? I should like similar information regarding other cable sizes down to ¾-in. in diameter.—A. S. N., Plymouth, Mass.

Answer A.—A 2-in. Gem grip would answer the purpose, but in the absence of such a grip I would use a home-made hitch made of pieces of No. 15 iron wire wound about and lapped over each other to form a sort of laced loop at the end of the cable. If the runs are long, would use elbows very sparingly or make them of very large radius. Junction boxes would be preferable to use in this case, and in underground work manholes. Facilities for actually pulling in a heavy cable like this and supply of proper tools must also be considered.—J. H. L., North Cambridge, Mass.

Answer B.—This subject was discussed in three illustrated articles by Terrell Croft, entitled "Attaching Conductors to Fishing Wires and Pulling-in Lines," that appeared in the Electrical Review of Jan. 11, 18 and 25, 1919.—Editor.

NEW YORK TELEPHONE CONSTRUCTION PROGRAM.

The New York Telephone Co., which operates the telephone exchanges in New York City, reports that the increase in local calls since the armistice was signed is unprecedented. To relieve the traffic load, the company is carrying on a construction program that will involve the expenditure of $20,000,000 within the city during the coming year. This expenditure will provide the equipment necessary to catch up with the requirement of traffic. The rate of expansion of traffic is indicated by the fact that company is adding girls to its staff of operators at the rate of 125 per week.

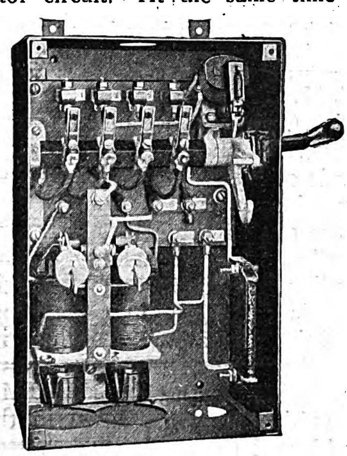
New Appliances

Motor-Starter Developments—Vaporproof Reflector—New D. C. Motors—Solderless Connector—Semi-Portal Crane

Two Enclosed Motor Starters with Overload Relay and Starting Resistor.

A starter with inverse-time-limit overload protection for squirrel-cage motors and a standard induction motor switch with a starting resistor, both having important operating safety features, are now manufactured by the Cutler-Hammer Manufacturing Co., Milwaukee, Wis., and known as Bulletins 9117 and 9118, respectively.

The Bulletin 9117 starter has, besides a low-voltage release, a duplex time-limit overload relay which is a complete unit in itself. The design of this overload movement is such that it does not open the circuit of the low-voltage coil on a high initial inrush of current nor on a momentary overload, but it will not permit a harmful overload to be maintained. This condition is obtained by retarding two moving plungers in oil dashpots. The plungers, which are actuated by two operating coils, trip a single contact-making device, thus opening the motor circuit. At the same time the

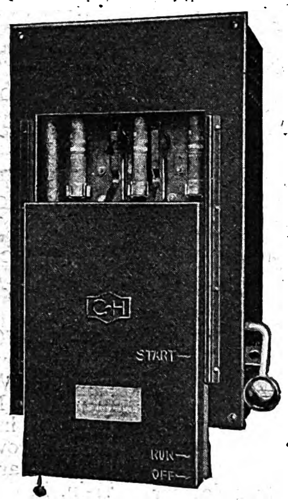


Bulletin 9117 Starter with Front Cover Removed, Showing Contactors, Duplex Relay and Low-Voltage Coil.

force of each plunger must overcome an adjustable weight which may be set at various positions along a lever arm, depending upon the amount of current desired to operate the plunger. By turning an adjusting screw the flow of oil around the plunger head may be regulated, thereby changing the time required for the relay to operate on any given overload condition. A coil, plunger, lever and weight are provided for each of two phases.

To start the motor, the operator moves the starter handle to the "up" position. This connects the motor to the line and brings into position an interlock which prevents opening the cover of the case. To stop, the operator simply moves the lever back to the stop position, which opens the circuit with a quick break and removes the interlocking bar. The starter is made with either three or four poles for use with standard squirrel-cage motors from 3 to 15 hp., and with high-torque motors of the "internal starter" type from 7½ to 25 hp. where the line voltage does not exceed 550 volts.

The starter known as Bulletin 9118 is essentially a modification of the en-



Lowering the Panel of Bulletin 9118 Starter Makes Fuses Dead and Accessible for Renewal—Switch Cannot Be Closed While Panel Is Lowered.

closed polyphase motor starter, Bulletin 9116, a description of which has already appeared in these pages. This starter is adapted for those motors which cannot be connected directly to the line without resulting in a dangerously large starting current. One step of resistance is provided in each of three phases during starting, allowing the motor 60% line voltage and an inrush of approximately three times full-load current. By using another set of terminals the resistor is decreased to give approximately 75% line voltage, and 3½ to 4 times normal current. The low-voltage protection coil automatically returns the switch to the "off" position upon failure of voltage.

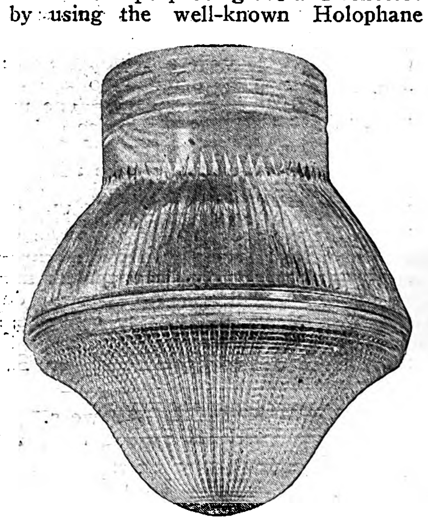
The motor is started by raising the handle to the starting position which closes the switch. The handle is held here until the motor has reached full speed. Releasing the handle causes the switch contacts to slide into the running contacts, without opening the motor circuit. The fuses are not in the motor circuit until the switch is in the running position. Therefore, they do not carry the large starting current, and need be of no greater capacity than proper protection demands. This starter is designed for starting standard polyphase squirrel-cage motors of from 1 to 10 hp. on any commercial voltage not exceeding 550 volts. The starter can be furnished with resistors suitable for two-phase four-wire circuits, in which case an additional knife switch is required to entirely disconnect the motor.

Both types of starters are completely enclosed and are so designed that it is impossible to touch any live parts either while operating or while renewing fuses and making adjustments. Contact posts and fingers are of standard C-H construction used in the heavy drum controller, easily inspected and renewed. The enclosing cases are arranged for conduit wiring.

Vaporproof Prismatic Reflector Globe.

In the past all vaporproof lighting fittings have been equipped with clear glass globes and in order to obtain an efficient and glare-free lighting unit it has been necessary to place a reflector over the glass globe and a diffuser around the globe.

The Holophane Co., 340 Madison avenue, New York City, has designed a combined vaporproof globe and reflector by using the well-known Holophane



Holophane Vaporproof Reflector Globe.

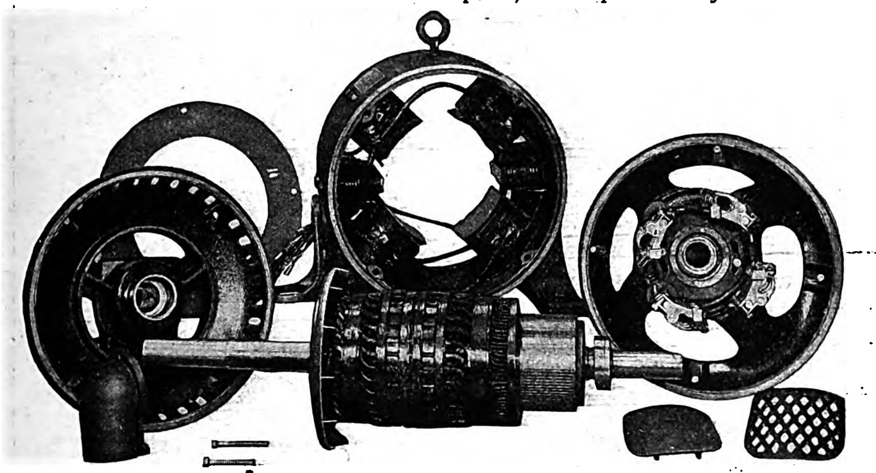
prismatic construction. The reflecting prisms are on the upper portion of the globe to redirect the light in downward directions and the refracting and diffusing prisms are on the lower surface to distribute the light in different directions in the desired proportions so that the resulting illumination on the work will be uniform.

Tests show that the useful illumination is increased by 75 per cent over that given by an ordinary clear vaporproof globe.

These vaporproof reflector globes are made for the 40 and 60-watt Mazda type B lamps and for the 75, 100 and 150-watt type C lamps for use in connection with the standard vaporproof fittings now on the market, including the navy thread.

A New Line of Direct-Current Motors Developed by Allis-Chalmers.

In the new line of commutating-pole direct-current motors and generators which has just been introduced by the Allis-Chalmers Manufacturing Co., Milwaukee, Wis., the machines are not only rugged and compact, with excellent operating characteristics, but the many details which contribute to accessibility, reliability and safety have been thoroughly worked out. Commutating-pole construction was chosen because of its sparkless operation and possibility of getting wide speed adjustment.



Type "E," 25-hp., 230-Watt, 1150-r. p. m. Motor Dismantled.

This line includes the following standard ratings:

(1) Continuous rated (50° C. rise) motors, for applications where the power requirements are definitely known.

(2) Normal rated (40° C. rise) general purpose motors.

(3) Adjustable-speed motors for continuous or intermittent service.

(4) Generators and exciters.

For constant-speed motors the ratings and speeds are the same as those of 60-cycle induction motors, and they can thus be used interchangeably with induction motors for direct-connected applications without changing the method of drive or the ratio of gearing.

Adjustable-speed motors, intended particularly for machine tool and similar applications, are provided for 2:1, 3:1 or 4:1 speed range.

The generator speeds also correspond to those of induction motors, thus permitting direct coupling of the machines to form motor-generator sets in various combinations.

The line of ratings now complete covers motors from ½ to 50 hp. and generators from ½ to 40 kw., while larger sizes are under development.

Cast-steel yokes, combining light weight and rigid construction, are used for the larger ratings while the smaller machines, which are of the bipolar type, have riveted frames.

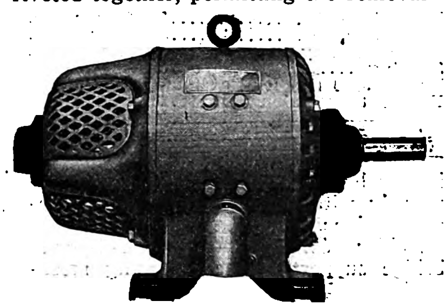
The accessibility of the commutator is apparent from the accompanying illustrations. Protecting grid covers can be provided for these openings in the front bearing bracket; they are readily attached and may be applied even to machines in service without affecting the rating. Solid covers are used with completely enclosed motors, the rating of these machines being somewhat lower than open or semi-enclosed motors.

All machines have ring oiling dust-proof bearings, while the windings are treated to resist oil and moisture. Conduit terminal boxes of simple design are regularly supplied; they have removable covers, giving ready access to the terminals; these boxes serve admirably in protecting the terminals and connections.

Box-type brush holders are adjustable for tension and suitable for either direction of rotation. Each holder can be removed independently with a screw-driver or wrench. At least two brushes per stud are used.

The field coils are wound on metal spools, which prevent any movement of the coils, and are protected by an outside layer of enameled wire.

The armature core has the laminations riveted together, permitting the removal



Semi-enclosed Type "E," Direct-Current Motor.

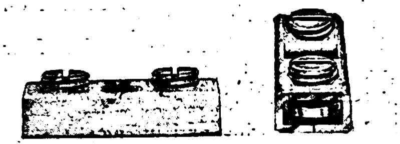
of the shaft without dismantling the core or commutator, while for ratings of 20 hp., 850 r.p.m., and larger the core and commutator are built on a sleeve, so that the shaft can be pressed out of the finished armature without disturbing the windings.

An important feature of the machines is the very thorough ventilating system which has been provided, the heated air being drawn out by the fan mounted on the rear armature head; fresh cool air flows in through the liberal ventilating ducts and takes up the heat from the iron and windings. This heated air is forced out through openings in the periphery of the rear bearing bracket. With thorough ventilation the internal temperatures are kept low thus greatly prolonging the life of the insulation.

This new line, which is designed as the Allis-Chalmers type "E," is completely new throughout, no attempt having been made to re-design old apparatus or to employ parts from any previous machines. The motors are designed for belted as well as direct-connected applications and are particularly suited to the exacting requirements of machine tool service.

Sherman Solderless Fixture Connectors.

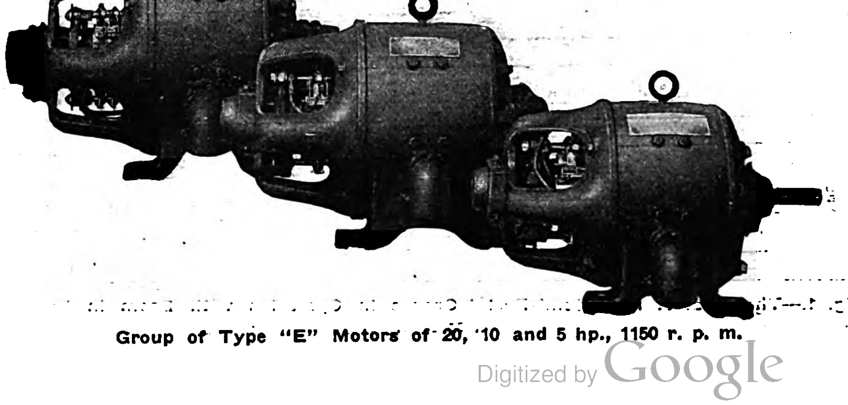
One of the best established rules in electrical installation work requires wire splices or joints to be made both mechanically and electrically secure without solder, and then they must be soldered unless made with some *approved* splicing device. Several such devices



Side and End View of Sherman Fixture Connector.

are now available on the market, a recently developed one with unique features being the Sherman fixture connector made by the H. B. Sherman Manufacturing Co., Battle Creek, Mich. As shown in the accompanying views, it is of very simple and effective design. It is made entirely of heavy brass to give high conductivity and freedom from danger of corrosion and consists of only three parts. The body or sleeve is of rectangular section with a depression in the upper side between the two screws forming a sort of bridge or dividing wall in the middle of the wire channel. This makes a definite place for each wire and insures that the end will be clamped by the proper screw. These screws are made of one piece each, the inner end being enlarged to give an unusually large bearing and contact surface and also to prevent the screw from dropping out.

It will be observed that this construc-



Group of Type "E" Motors of 20, 10 and 5 hp., 1150 r. p. m.

tion has several important advantages. The screws are always in place and ready for use and they have a large thread that is not likely to get crossed. Thus no time is lost in looking for screws or in driving them home. No connectors need be discarded because of missing screws. The connectors are of durable make and can be used to join any fixture or lighting wires up to No. 12 in size. Two No. 12 solid wires can be accommodated at either end or three No. 14 wires. From this brief description it is evident that the Sherman connectors have all the usual advantages of good solderless connectors with the additonal features noted; also their cost is low.

Electric Semi-Portal Hoist Cranes at Boston Army Supply Base.

The Wellman-Seaver-Morgan Co. is now installing four semi-portal bridge-type hoist cranes at the U. S. Army Supply Base, Boston. The first of these cranes is in operation and is shown in the accompanying illustration, Fig. 1.

This crane carries a lifting boom operated from a carriage, which in turn is mounted on a semi-portal bridge, and arranged to rotate about a fixed axis. The bridge runs on two rails, one located near the face of the wharf, and the other supported on brackets carried on the side of the wharf shed.

It will be seen that the crane has four distinct motions:

1. Bridge travel along the wharf;
2. Trolley slewing;
3. Boom hoisting and luffing;
4. Load hoisting.

All of these motions are under the control of the operator located in the cab on the rotating carriage.

The crane is designed so that another drum can be added and a 2-rope grab bucket operated. The crane is rated to handle 8000 lbs. at a distance of 29 ft. from the face of the capsill at the rate of 200 ft. per min., and 500 lbs. at a distance of 52 ft. at 250 ft. per min. It will, however, take care of occasional loads of 8000 lbs. at 52 ft. from the center of rotation without any undue stress in any part of the crane.

The principal dimensions of the crane are as follows:

Horizontal span, center to center of runway rails	26 ft. 5 in.
Maximum reach of boom from face to capsill	44 ft.
Minimum radius of boom	29 ft.
Angle through which boom may be slewed	360°
Concrete counterweight required, about	3 cu. yds.

Speed.—The various motions of the crane have approximately the following speeds under full load:

Hoist 5000 lbs.	250 ft. per min.
Hoist 8000 lbs.	200 ft. per min.
Boom hoisting or luffing	125 ft. per min.
Slewing	2 rotations per min. with 5000 lbs. load at maximum radius.
Bridge travel along wharf	200 ft. per min.

The different mechanisms are so arranged that the motion of either hoisting or luffing can be operated simultaneously with both rotating and traveling motions.

Bridge Structure.—The semi-portal bridge supporting the operating mechanism was designed in accordance with the "General Specifications for Steel Railway Bridges" issued by the American Railway Engineering Association in 1910, 100% being added to all live loads to allow for impact. In designing this structure, ample allowance was made for the swaying of the load. To the deck of the semi-portal is bolted a steel casting for supporting the revolving superstructure. This casting has a track

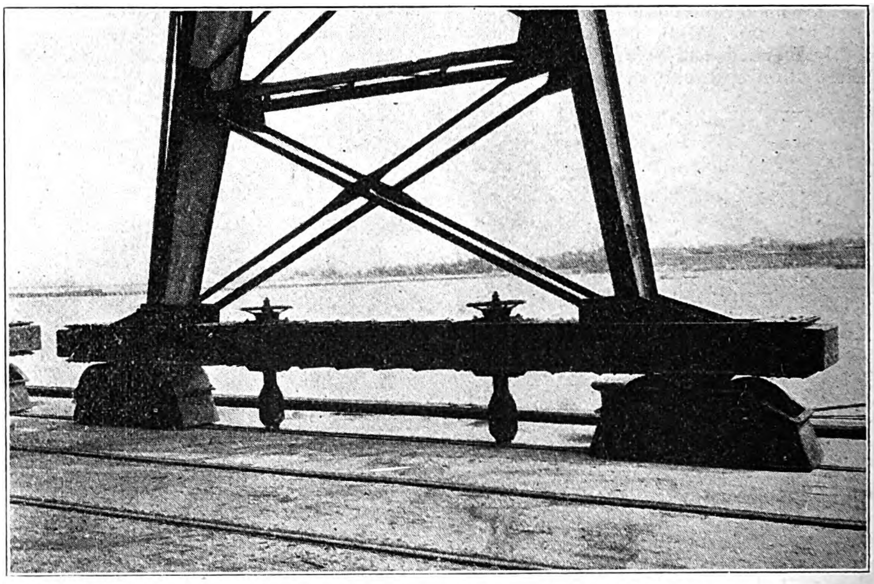


Fig. 2.—View of Trucks and Rail Clamps.

plate, and bolted to the outside, a circular rack for the slewing motion. Concentric with this casting is a hollow center pivot pin, the lower end of which is securely held by cross-framing between the main girders of the semi-portal. A portion of deck not covered by the casting is covered with Diamond pattern steel plate. Hand railings are provided along the sides and outside edges of the deck, and a steel ladder is attached to one of the legs to give access from the wharf.

Wheels.—Each leg on the wharf side is carried on two wheels (as shown in Fig. 2) which are driven through the necessary spur and bevel gearing by the traveling motor. Each pair of wheels is equalized for the proper distribution of load. On the shed rail, the frame is supported by two wheels, one at each corner. These track wheels are double-flanged, high-carbon, cast steel, of ample size to carry maximum load and accurately finished to the diameter. The flanges of the wheels running on the shed rails are placed to give about a 7-in. tread. Wheels running on the wharf rail have the flanges spaced to allow proper clearance for the head of the rail upon which they run. All track wheels are forced on steel pins of ample size arranged to rotate in Hyatt roller bearings carried by the truck brackets.

Base Frame and Rollers.—The base frame is made up of rolled-steel shapes and plates well braced in all directions. The revolving superstructure is carried on six steel rollers or wheels, four in front where the heaviest load occurs, and two on the back. The front rollers are carried in a pair of steel equalizers. These rollers or wheels are of steel of ample size arranged to rotate on Hyatt roller bearings and placed so as to properly run on a circular track of about 5-ft.

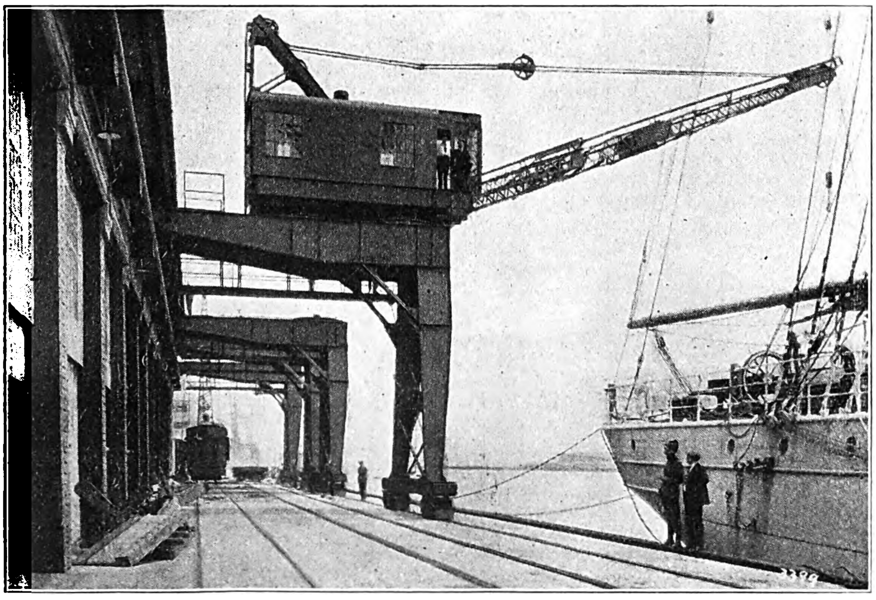


Fig. 1.—The First of Four Semi-Portal Cranes in Operation with Boom in Lowest Position.

radius about a pivot pin. A babbitted casting free to rotate about the center pivot pins is attached to the base frame to hold the crane concentric with the center pivot pin and to transmit longitudinal and overturning loads from the revolving superstructure to the semi-portal.

Pivot Pins.—The center pivot pin is made of a hollow steel casting to permit the threading of conductors through its center to the collector rings on top. The crane is designed so that under normal operating conditions, with a 5000-lb. hook load at the maximum radius, no appreciable load will be thrown on the center pin. It is, however, designed to transmit any possible vertical or horizontal load from the revolving jib crane to the semi-portal bridge without cramping or binding in any part.

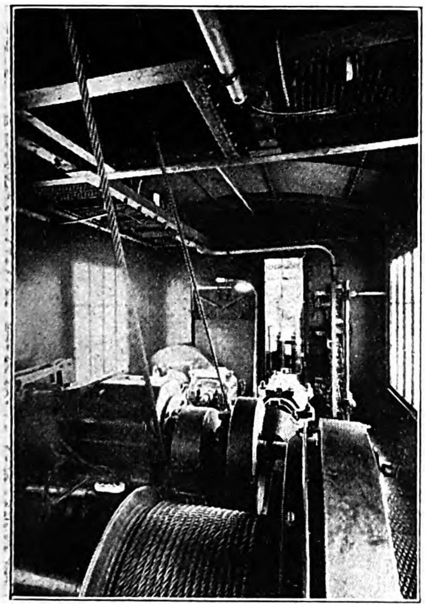


Fig. 3.—Inside of Machinery Section of Cab.

Jib and Main Frame.—The jib and main frame is made of steel plates and shapes well stiffened in all directions. The frame is designed to support the jib, counterweight, machinery, electrical equipment and operator's house. A steel ladder is provided on the jib to provide access to the sheaves and other parts.

Counterweight.—The counterweight is made of concrete blocks in such shapes and sizes that they can be readily handled in case it is desired to dismantle the crane.

Cab.—The cab is composed of a steel framework covered with sheet steel. It contains the main part of the hoisting, luffing and rotating mechanisms. The control of all motions is so located that the operator has an unobstructed view of the load at all times. Figs. 3 and 4 show the interior of the cab.

Hoisting Mechanism.—The hoisting and lowering mechanism includes a winding drum, driven through a jaw clutch and a train of spur gearing by a motor equipped with a solenoid brake and necessary control apparatus and miscellaneous parts.

Luffing Mechanism.—The luffing of the boom is accomplished by a worm-driven drum operated by the hoisting motor through a jaw clutch and gearing so arranged that the boom can be raised or lowered at the convenience of the operator. The pitch of the worm is such that no mechanical brakes are required to prevent the load from lowering; but, as an additional safety, a pawl is provided to lock the luffing drum in any desired position.

Slewing Mechanism.—The slewing is accomplished by means of a motor operated through a train of spur and bevel gearing and a pinion meshing with the master gear attached to the semi-portal bridge. A powerful foot brake is provided on this mechanism having a latch, by means of which the brake can be locked for any desired fixed position of the revolving superstructure.

Traveling Mechanism.—A motor for traveling the bridge is mounted on one of the girders of the semi-portal bridge. This motor is connected to the driven track wheels through spur and bevel gearing and line shafting. One truck on the wharf rail is driven and one wheel on the shed rail. A solenoid brake is mounted on the armature shaft extension. Control apparatus for traveling is located in the operator's house. Electrical connections between the conductors on the semi-portal bridge and on the revolving superstructure are made through collector rings mounted on the center pivot pin or an extension of same. In addition to the solenoid brake, hand-operated rail clamps (shown in Fig. 2) are provided which clamp the wharf rail to hold the bridge in any fixed position.

Winding Drum.—The winding drum for hoisting mechanism is made of cast iron with turned grooves to fit the rope.

Electrical Equipment.—The electrical equipment is designed for direct current, 230 volts. The motors, controllers and magnetic brakes are General Electric Co.'s standard make. The motors are of the following rating:

1. Main hoist and luffing......one 65 hp.
2. Slewing ....one 15 hp.
3. Bridge travel ....one 24 hp.

The controller for the hoist and luffing motor is of the reversing magnetic switch, dynamic-braking type, consisting of a control panel, heavy-duty, cast-grid resistor and a vertical-handle master controller.

In connection with the clutch-shifting lever which engages the hoist and luffing gearings with the driving motor, there is an interlocking switch mechanically operated. When the clutch-shifting lever is in central or neutral position, with both clutches disengaged, this switch prevents the operation of the motor. In other words, the function of this switch is to prevent the starting of the hoist motor without any load.

The slewing motor is controlled by a magnetic-switch reversing and plugging controller, consisting of a control panel, heavy-duty cast-grid resistor and a vertical-handle master controller. The plugging feature incorporated allows the motor to be reversed from full speed in one direction to full speed in the opposite direction without exerting over approximately 180% full-load torque.

The bridge-motor control is of the magnetic-switch reversing type with shunted armature points and consists of a control panel, heavy-duty cast-grid resistor and a vertical-handle master controller. The armature shunting points allow slow bridge speeds and also permit accurate control in case a favorable wind may help the motor in traveling, which would ordinarily give an excessive speed.

All of the above controllers are equipped with series relays for accelerating motors.

Safety Devices.—Ample provision is made for the protection of workmen. Guards extending down close to the rails and forming part of the truck brackets are placed in front of the track wheels. All gears are enclosed. Ladders and platforms are provided for access to mechanical parts of the crane which are subject to inspection and repairs. Hand railings are provided around all platforms. Sheaves are provided with tight-fitting guards where necessary. A limit switch is provided to prevent overtravel in the hoisting direction on the main hoist motion. A pressed-steel foot gong is provided in the operator's cab for signaling purposes. There is a mechanical gong on the bridge motion. This gong will ring continuously.

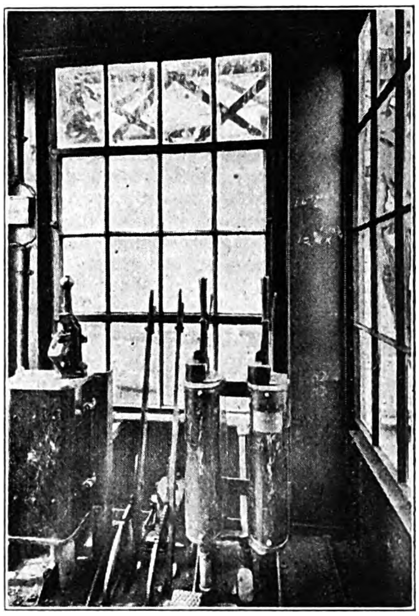


Fig. 4.—Inside of Operator's Part of Cab.

Bearings.—Hyatt roller bearings are used throughout the different motor-driven units.

Adaptable and Portable Electric Drill and Hammer Stand.

A portable stand to permit a safer, simpler and more economical method of using electric drills and hammers in overhead work has been placed on the market by the Hammerstand Manufacturing Co., 370 Pearl street, Brooklyn, N. Y. This device is for use in installation of electrical apparatus, pipe work, supports in concrete stone work and such location where the workman would ordinarily have to employ a ladder and scaffolding to support himself and his tools.

The hammer stand can be moved readily from place to place upon wheels. The drawing handle automatically raises the wheels off the ground when the tool is in position. Very light pressure applied to the lever keeps the drill hammer following the work. The operator stands on the floor while working. An attachment enables holes to be drilled in corners and other awkward places. The attachment is simply a rigid horizontal bar bolted to the top of the stand on one end and carrying the drill in the other.

Trade Activities

General Electrtc Exhibit at Chemical Exposition—Electric Furnace Installations—Western Electric to Erect New Plant

The Valentine-Clark Co., producer of cedar poles, having offices at Chicago, Minneapolis and Toledo, has lately established a western office in Peyton building, Spokane, Wash.

Page & Hill Co., Minneapolis, Minn., has greatly increased its facilities by the installation of a new 15-ton Browning locomotive crane. This crane will be used in handling cedar poles at the butt-treating plant and for loading cars at Minnesota Transfer.

Electric Furnace Construction Co., Finance building, Philadelphia, advises the receipt of an order from the Hammond Steel Co., Syracuse, N. Y., for one 3-ton furnace for the manufacture of high grade tool steels. A Greaves-Etchells furnace is also being installed for the Hong Kong Steel Foundry Co., China.

Western Electric Co., New York City, has purchased for a consideration of $190,103 55 acres of land, situated in Berkley, Norfolk, Va., from the St. Helena Corp., and within a few weeks will build shops on the site for the manufacture of submarine cables and other products. The land was formerly used by the Tunis Lumber Co., and fronts on the south branch of the Elizabeth river. It is believed that a large financial outlay will be involved in the establishment of the new shops and that 1000 or more employes will be given work. It has also been stated that in addition to the manufacture of cables, a large number of other electrical products will be made at the Berkley plant.

The Cutler-Hammer Manufacturing Co., Milwaukee, Wis., has issued a new 8-page, 8½ by 11-in. booklet on "C-H Mine Duty Apparatus." This booklet makes special reference to the Cutler-Hammer mine duty apparatus installed in the plant of the St. Louis Smelting & Refining Co. at St. Francois, Mo. A detailed description of the method of handling the ore from the three levels of the mine until it is ready for shipment is given. Special emphasis is laid on the hoist and conveying machinery and the C-H automatic control and safety apparatus used on this machinery. The illustrations show the mine hoist control panel, master switches, limit switches, overspeed governors and electrically operated brakes; also the automatic starters for the crushers and conveyors. These starters are controlled from push-button stations and the speed of the conveyors and crusher is governed by armature regulators. The front and back covers of the booklet display a panoramic view of the buildings above the mine, including everything from man-hoist to chat dump.

The Detroit Electric Furnace Co. has sold to Oregon Brass Works, Portland, Ore., two Detroit electric rocking brass furnaces of 2000 and 1000-lb. charges, respectively. It is expected that the installation of the two furnaces will be completed in the next sixty days. The Oregon Brass Works, of which H. C. Prier is president and manager, has thus taken the initiative in equipping its brass foundry with the first electric furnaces in the Northwest, to better meet the demands for marine and structural bronze.

A. C. Mannweiler Co., Fort Wayne, Ind., manufacturer of miniature incandescent lamps, is illustrative of the remarkable growth of this industry, having within the brief period of its existence increased its output from 25 to 50 bulbs per day to the present daily output of 4000 lamps. This concern had its inception about six years ago, having as its president and founder Anthony C. Mannweiler, who prior to that time had had an extensive experience in the manufacture of incandescent lamps. The company, which began operations in very modest quarters, consisting of only one room, has grown to such generous proportions that today it ranks as one of the largest manufactories in Fort Wayne. The product of this organization has a wide range of application, being used extensively for flash lights, illuminating mines, for surgical instruments, automobile lights, boat lights, switchboards, etc.

Allis-Chalmers Manufacturing Co., Milwaukee, Wis., is distributing Bulletin No. 1106 introducing the new Type "E" motors and generators. In developing this new line it has been the aim of the company to produce not only a rugged, serviceable motor, with superior operating characteristics, but also to incorporate the many details which contribute to reliability and safety. These machines are designed for belted as well as direct connected applications and particularly suited to the exacting requirements of machine tool service. Among the important features claimed for the Type "E" motors are: Ratings and speeds corresponding to standard 60-cycle induction motors; complete line of constant and adjustable speed ratings; rugged cast steel yokes; commutating poles, insuring sparkless commutation; dust-proof bearings; windings treated to resist oil and moisture; thorough ventilation; conduit terminal boxes on all motors; improved box type brush holders; standard enclosing covers; interchangeable parts, and accessibility of all parts, all of which are illustrated and described in detail in the bulletin.

Williamsport Wire Rope Co., Williamsport, Pa., manufacturer of wire rope, announces the establishment of its warehouses in Chicago at 753-55 West Quincy street, also a branch office at 122 South Michigan avenue, both under the management of C. M. Ballard. Every size and construction of wire rope, cut to any desired length, will be carried at the Chicago warehouse. The company through the establishment of this local branch will be enabled to give its customers better service than in the past.

Landers, Frary & Clark, New Britain, Conn., manufacturers of Universal electric heating and cooking devices, are erecting a new factory in the eastern part of Plainville, located on the bank of the Housatonic river, and it is expected that the new quarters will be ready for occupancy in about a month. The building, which is a four-story structure of fireproof construction, will be used as a celluloid plant. A power plant, which will furnish power and light for the new plant, has been erected on the bank of the river. The walls are of double brick thickness, with three or four set divisions throughout the entire building.

General Electric Co., Schenectady, N. Y., will exhibit at the Chemical Exposition, to be held at the Coliseum, Chicago, Sept. 22 to 27, a very interesting model of a precipitation outfit, illustrating the Cottrell process of precipitation. The model is the property of N. H. Gellert of the Gellert Engineering Co., which holds the precipitation patents as applies to blast furnaces. It was made by the General Electric Co., and is an exact miniature of the apparatus and is completely operative. Other apparatus exhibited by the General Electric Co., includes a KT-312-6-15 hp. 1200 r.p.m. 440-volt motor with frame and coils completely coated with an acid resisting insulation, which is particularly adapted for use in chemical and fertilizer plants. Two stater coils of this motor will be shown. Another feature will be an RC-25, 2-hp. 1150 r.p.m. 230-volt totally enclosed DS-2 shunt wound motor which is equipped with the new Argute plug bearings. A 100,000-volt Kenetrom with a filament heating transformer will be shown in operation. Of special interest will be an exhibit board, showing welded terminals for flexible cables used on blast furnaces. Chester T. McLoughlin of the power and mining department, Schenectady Works, will be in charge and will be assisted by Raymond Barclay, and several representatives from the Chicago office of the General Electric Co.

Current News

Weekly Record of Construction Activities—Conventions

EASTERN STATES.

Rutland, Vt.—In connection with the construction of the new plant of the Tauber-Lipton Co., work on which was commenced recently, contract has been awarded to the Rutland Railway Light & Power Co. for furnishing electric energy for light and power for the operation of the new works.

Cambridge, Mass.—Work has recently been commenced by Page & Shaw, 18 Ames street, on the construction of a power plant to be used for the operation of a six-story manufacturing works now in course of construction. The plant will be about 60x140 ft., and will be used for increased capacity. Considerable mechanical and electrical equipment will be required. The E. A. Abbot Construction Co., 3 Park street, Cambridge, is the contractor.

Bridgeport, Conn. — Bridgeport Brass Co. will build a one-story, 150 x220 ft. addition to its casting shop on Grand street. Electric power to operate crane will be installed. The estimated cost of the work is $150,-000.

Albion, N. Y.—Board of Managers of the Western House of Refuge for Women has awarded a contract to the John W. Danforth Co., 70 Ellicott street, Buffalo, for extensions and improvements in the heating system at the institution, at $8187. Lewis F. Pilcher, Capitol Building, Albany, state architect.

Canandaigua, N. Y.—Lisk Manufacturing Co., 160 Fifth avenue, New York, has awarded a contract to Curren & Swartout, Granite building, Rochester, for the construction of a one-story power plant at its local properties, about 63x87 ft.

Geneva, N. Y.—O'Malley Motor Co. plans the erection of a three-story, 50x100 ft. machine shop, garage and service station, on Canal and Exchange streets. Transmission and electric power will be installed. Estimated cost, $50,000.

Long Island City, N. Y.—Large quantities of electrical and mechanical equipment will be required in connection with the construction of the proposed plant of the American Trunk Co., to be located at Thompson, Mound Markey streets and Mott avenue, preliminary work on which was inaugurated recently. The entire new works are estimated to cost in excess of $1,000,000.

Long Island City, N. Y.—In connection with the construction of the six-story and basement plant of S. Karpen & Brothers, 68 West 34th street, New York, on Jackson avenue, near Hulst and Harold avenues, Long Island City, large quantities of electrical and mechanical equipment will be required. The new plant, contracts for which have been awarded, is estimated to cost $725,000.

New York, N. Y.—Contract has been awarded by the Fulton Laundry, 312 East 92nd street, for alterations and improvements in the boiler plant at its property, to facilitate operations.

New York, N. Y.—Announcement has been made by the Commercial Cable Co., 20 Broad street, of a reduction in commercial cable rates from all parts of the United States, the Philippines and China of 22 and 20 cts. per word, respectively, effective Sept. 1.

New York, N. Y.—Following the purchase of the Chesebrough building by Henry L. Doherty & Co., 60 Wall street, negotiations have been completed for the acquirement of the Battery Park and Maritime buildings on State street, located between Pearl and Bridge streets, held by the same interests formerly controlling the Chesebrough structure. The entire consideration for the three buildings is said to be approximately $5,-000,000.

Syracuse, N. Y.—U. S. Hoffman Co., 329 Temple street, is making rapid progress on the construction of its one-story building at Taylor and Oneida streets. The structure will be about 80x195 ft., and is estimated to cost $23,000.

Talcville, N. Y.—St. Lawrence Transmission Co., which has purchased the rights of A. J. McDonald in the Freeman Talc Mines, plans extensive improvements and the installation of crushing and conveying machinery and electrically driven units. Estimated cost of improvements, $60,000.

Boonton, N. J.—Eastern Signal & Supply Co., 30 Church street, New York, has rented property in a local building covering about 5000 sq. ft. of floor space for a new establishment. The company specializes in the manufacture of primary storage batteries.

Camden, N. J.—American Ice Co., Philadelphia, Pa., is having plans prepared for the construction of a new brick and concrete ice plant at 12th and Federal streets, Camden.

Dover, N. J.—Contract has been awarded to the Jersey Corp. by the Paige & Jones Chemical Co. for furnishing electric energy for light and power purposes for the operation of the new plant to be established at Boonton.

Harrison, N. J.—Driver-Harris Co., Middlesex street, manufacturer of electric wires, cables, etc., has had plans prepared for the construction of a new three-story reinforced concrete structure at its plant, about 50 x100 ft. The building is estimated to cost $50,000. Lockwood, Greene & Co., 103 Park avenue, New York, are engineers.

Lambertville, N. J.—Lambertville Public Service Co. has inaugurated preliminary work for the construction of a new high-tension transmission line from Lambertville to Flemington for improved electric service, and new generating equipment is being installed in the local power plant. At the present time the company has under way the construction of a similar transmission line between Netcong, Morris county, and Newton, Sussex county, passing through Stanhope and Andover. Harold R. Wilbur is local manager.

Newark, N. J.—American Transformer Co., 178 Emmett street, has filed plans for alterations and improvements in its local plant to facilitate operations. The work is estimated to cost about $5700.

Perth Amboy, N. J. — Lighting Committee of Board of Aldermen has under consideration plans for the installation of electrical machinery in the municipal light and power plant.

Pompton Lakes, N. J.—Tri-County Electric Co. has been granted a franchise by the Borough Council, Wanaque, for furnishing electricity for lighting and power service to the borough. The company purchases electric energy from the municipal power plant at Pompton Lakes.

Trenton, N. J.—Fire on Sept. 1, seriously damaged one of the large dynamos at the power plant of the Trenton & Mercer County Traction Co., on Lincoln avenue. It is understood that the company will make repairs immediately.

Trenton, N. J.—City Commission has completed plans for the installation of considerable new electrical and hydraulic apparatus at the city pumping station on Calhoun street. An appropriation of $150,000 was authorized some time ago to cover the cost of the improvement, but owing to war conditions the work has been delayed. It is proposed to proceed with the installation at once.

Trenton, N. J.—Trenton Malleable Iron Works, New York avenue, have had plans prepared for the construction of a new one-story power plant and boiler house, of brick and concrete construction, to be used for works operation. R. A. Schuman, 923 Lexington street, Trenton, is architect.

Trenton, N. J.—Hearnen Storage Battery Co. has completed negotiations for the purchase of the plant and property of the Charles W.

Carll Co., at West Front and South Warren streets, for a new establishment.

Allentown, Pa.—City Council has recently inaugurated tests in the new electric street lighting system installed in various thoroughfares of the city.

Bolivar, Pa.—It is reported that Bolivar has under consideration the installation of an electric light plant.

Harrisburg, Pa.—Harley D. Carpenter, Crawford county, has filed application with the Public Service Commission for approval of contracts to furnish electric energy for lighting service, etc., to Cochranton Borough and the townships of North, West and South Shenango, and East and West Fallowfield.

Philadelphia, Pa.—American Ice Co., Sixth and Arch streets, is having plans prepared for the erection of a new plant at Mascher street and Ducannon avenue, in the Olney section. It is planned to use a portion of the building for manufacturing and another section for storage purposes. Walter Lee is vice-president.

Philadelphia, Pa.—Electric Storage Battery Co. has awarded a contract to the William Steele & Sons Co., 1600 Arch street, for the construction of a new one-story brick addition to its plant at 19th and Willard streets. The structure will be about 32x97 ft., estimated to cost $14,000 and will be used for increased operations.

Philadelphia, Pa.—Caledonian Dye Works, Cornwall and Emerald streets, have awarded a contract for the construction of a new boiler plant at their works, about 18x22 ft., for increased operations. The structure is estimated to cost $14,000. J. K. Petty & Co., Stephen Girard building, are the contractors.

Philadelphia, Pa. — Pennsylvania Salt Manufacturing Co., Widener building, has had plans prepared for alterations and improvements in the boiler plant at its works at Delaware avenue and Porter street, estimated to cost $5000.

Pottsville, Pa. — Philadelphia & Reading Railroad is understood to be considering plans for the electrification of the Pottsville and Mill Creek Junction section of its system this fall.

Titusville, Pa.—Titusville Light & Power Co. has filed notice with the Public Service Commission of the operation of a new schedule of increased rates for service, effective Sept. 1.

Wilkes-Barre, Pa.—Guaranty Silk Co. is taking bids for the erection of the proposed power plant at its works to be used for general factory operation. Reese D. Isaacs, Anthracite building, is architect for the company.

Huntington, W. Va.—The secretary of state has issued a charter to the Electric Unit Corp., of Huntington, with a capital of $50,000 for the purpose of carrying on a general electrical buisness in Huntington. Incorporators: C. C. Hartzell, H. T. Lovett and others.

DATES AHEAD.

Association of Edison Illuminating Companies. Annual meeting, New London, Conn., Sept. 16-18. Secretary, H. T. Edgar, Stone & Webster, Boston, Mass.

Southeastern Section, N. E. L. A. Annual convention, Asheville, N. C., Sept. 17-19. Secretary-treasurer, T. W. Peters, Columbus, Ga.

Iowa State Association of Electrical Contractors and Dealers. Annual convention, Sioux City, Iowa, Sept. 22 and 23. Secretary, F. Bernick, Jr., Oskaloosa, Iowa.

New England Section, N. E. L. A. Annual convention, New London, Conn., Sept. 22-24. Headquarters, Hotel Griswold. Secretary, Miss O. A. Bursiel, Boston, Mass.

Association of Iron and Steel Electrical Engineers. Annual convention, St. Louis, Mo., Sept. 22-26. Secretary, John F. Kelly, Empire building, Pittsburgh, Pa.

American Electrochemical Society. Fall meeting, Chicago, Sept. 23-26. Headquarters, Congress Hotel. Secretary, Prof. Joseph W. Richards, Lehigh University, Bethlehem, Pa.

International Association of Municipal Electricians. Annual convention, Chicago, Sept. 23-26. Secretary, Clarence R. George, Houston, Tex.

Northwest Electric Light and Power Association. Annual convention, Seattle, Wash., Sept. 24-27. Secretary-treasurer, George L. Myers, Portland, Ore.

Empire State Gas and Electric Association. Annual meeting, New York City, Oct. 9. Secretary, Charles H. B. Chapin, 29 West 39th street, New York City.

National Association of Electrical Inspectors. Annual meeting, Springfield, Mass., Oct. 13 and 14. Secretary, W. L. Smith, Concord, Mass.

Illuminating Engineering Society. Annual convention, Chicago, Ill., Oct. 20-23. General secretary, Clarence L. Law, 29 West 39th street, New York City.

Illinois State Electric Association. Annual convention, Chicago, Oct. 22 and 23. Secretary-treasurer, R. V. Prather, Springfield, Ill.

American Society of Mechanical Engineers. Annual meeting, New York City, Dec. 2-5. Secretary, Calvin W. Rice, 29 West 39th street, New York City.

Black Mountain, N. C.—J. S. Kuykendall, Winston-Salem, N. C., has prepared plans to furnish electric power.

Homestead, Fla.—An election will be held Sept. 23 upon the issuance of $12,000 bonds for doubling the capacity of the electric light plant. Address the mayor.

Savannah, Ga.—City of Savannah has taken options on 1600 acres of land, with 2500 ft. frontage on the Savannah river, with a view of developing a municipally owned and operated terminal and wharves. The plan involves about $200,000 initial consideration, which will later be expanded to an outlay of practically $5,000,000.

NORTH CENTRAL STATES.

Alliance, Ohio.—Architect Wade Steidler, City Hall, has prepared plans for $525,000 gas producing station to be erected by city. The building will be brick construction, steam heating, plumbing, electric lighting.

Dayton, Ohio.—Gem City Ice Cream Co., 1005 West Third street, plans to enlarge its plant and will install a 180-ton Hardwick ice machine and new electric motors.

Kent, Ohio. — Ohio Machine & Tool Co., Canton, Ohio, will erect a factory addition. The building will be 40x80 ft. in dimensions, brick and reinforced concrete construction, steam heating, plumbing, fireproof interior finish, boilers and pumps, electric lighting. Estimated cost $75,000.

La Grange, Ohio.—$20,000 in bonds have been authorized for electric light system. C. S. Adams.

Bluffton, Ind.—H. C. Bay Piano Co. will erect a three-story office building and salesroom. The main office of the company will be removed from Chicago to Bluffton. The company is now operating a plant in Bluffton employing 650 men.

East Chicago, Ind.—Fire has destroyed the west part of the General American Tank Corp. plant, with loss estimated at $300,000. The burned buildings include the brass foundry, car shop and insulating shop. The newer part, which is of metal construction, was saved.

Greenfield, Ind. — Charlottesville Electric, Heat & Power Co. has been incorporated to establish a plant for the town of Charlottesville.

Indianapolis, Ind.—Extensive improvements are planned by the Interstate Public Service Co., which operates the electric traction line between Indianapolis and Louisville. The company plans the expenditure of approximately $350,000 which will make the line between the two cities one of the best equipped in the Central West.

Chicago, Ill.—William R. Johnston Manufacturing Co. has purchased property on Crawford avenue, Schubert avenue, between Fullerton and Wrightwood avenues, having a frontage of 150 ft. and depth of 750 ft., and contains an aggregate of about 100,000 sq. ft. As soon as building conditions warrant, the company will erect a modern building, having about 50,000 sq. ft. of floor space, to cost about $100,000.

Hawthorne, Ill.—A $5,000,000 addition to the present Hawthorne plant of the Western Electric Co. is contemplated. The addition is needed on account of the steady growth of the business.

Medora, Ill.—An election will be held to vote on the issuance of $12,000 light and power bonds. Address city clerk.

Springfield, Ill.—An election will be held Nov. to vote on the issuance of bonds to the amount of $400,000 to extend the electric service to the entire city.

Springfield, Ill. — The property owners of Douglas avenue have petitioned for an extension of the ornamental lights. Address City Engineer Seeley.

Ecorse, Mich.—Village will soon let contracts for building elevated steel tank with capacity of 150,000 gal., two motor-driven centrifugal pumps, with capacity of 500 gal. per minute, reinforced concrete reservoir, 500,000 gal. capacity, and 8000 ft. water pipe. Separate bids on steel tank and on remainder of job complete. R. A. Murdock, 706 Free Press building, Detroit, engineer.

Marquette, Mich.—City Commission has had plans prepared for the erection of a power plant. Plans call for a building of brick and steel, reinforced concrete construction, including steam heating. The specifications include electrical equipment. Contracts will be let by the city clerk.

Vassar, Mich. — The council is planning ways and means to improve the light and water system. Address village clerk.

Emmons, Minn.—Contracts have been let to Minnesota Gas & Electric Co., Albert Lea, for building a high-tension line from its central plant to Emmons for light and power.

Atlantic, Iowa.—The city is having plans prepared for a $26,000 addition to the power plant. Generators, pumps, motors, etc., will be purchased. Address city clerk.

Mason City, Iowa.—C. H. McNider and associates are planning the erection of an eight or nine-story hotel to cost with the site $650,000.

Tama, Iowa.—Contracts have been let to Blythe Brothers for grading of electric line to be built from Tama to Toledo. Address Perry Walters, Toledo, Iowa.

Bison, Kans.—A 6-mile transmission line will be built from Bison to La Crosse. D. M. Rothweeler, mayor.

Chanute, Kans.—A bond issue of $250,000 has been voted by the city to build water works and an electric light plant.

Hugoton, Kans.—The City Council is contemplating the erection of a new electric light and water plant.

Winfield, Kans.—Plans are being prepared for a $45,000 electric light plant. Address city clerk.

Mountain Grove, Mo.—J. Fred Ellis and L. H. Williams contemplate building a dam and power plant at Double Grove Spring near Dora. The plant will develop 1000 hp.

St. Joseph, Mo.—A turbine of 12,500-kv-a. capacity is being installed in the steam plant of the St. Joseph Railway, Light, Heat & Power Co. The entire plant is being remodeled and equipped for oil burning. The steam capacity of the plant will be increased by the installation of two 1000-hp. Bigelow Hornsby boilers, and two smoke stacks of 16 ft. and 12 ft. in diameter, each 260 ft. high.

SOUTH CENTRAL STATES.

Lexington, Miss.—The city will vote on the question of issuing $20,000 additional electric light system. W. L. Jordan, city clerk.

Starkville, Miss.—The city will issue $55,000 in bonds for water, electric system. Address mayor.

Springdale, Ark. — The city has voted to issue $200,000 in bonds for sewer and water system. J. S. Ewalt, mayor.

Chelsea, Okla.—The sum of $30,000 in bonds have been voted to erect light and water plant. Address mayor.

Enid, Okla.—Enid Pipe Line Co., owner of the line from the oil fields to the Enid refineries, decided to construct a new power plant. The plant will be located where the line turns west from the oil fields towards Enid. Houses for employes and other improvements will also be built.

Pawhuska, Okla.—The attorney general has approved the issuance of $67,000 electric light bonds. Address mayor.

Stroud, Okla. — City will vote bonds for a light and water plant. W. A. Hadley mayor.

Hearne, Tex.—The city will increase the capacity of the light and water plant 100%.

San Angelo, Tex.—San Angelo Water, Light & Power Co. contemplates the erection of a water filtration and purification plant to cost between $40,000 and $50,000.

WESTERN STATES.

Buhl, Idaho.—Idaho Power Co. will increase the generating power of its plant at Thousand Springs from 6000 to 8000 hp. Improvements will include the installation of gates and dredges. R. B. King, district manager.

Roosevelt, Ariz.—Salt River Valley Water Users Association, Phoenix, plans fo erect a 5000-kw. steam generating plant for furnishing power to about 60 pumps, which will be used to lower underground water level. C. A. Van der Verr is secretary.

Yuma, Ariz.—Yuma Ice Co. has placed an order for transmission-line poles with R. E. Downie, Seattle.

Hardin, Mont.—The Hardin electric light and power plant is to be remodeled, new and larger steam boilers and engines and a new generator installed. As soon as the new equipment is ready, both day and night service will be given, instead of only night service, as at present.

Astoria, Ore.—Pacific Power & Light Co. has arranged for the purchase of a 15-acre tract on Young's Bay, as a site for a power plant, which is to be built at a cost of $750,000. It will comprise equipment for electric generation and the production of gas. The electric plant planned, it is estimated, will be of a capacity sufficient to supply all power and lighting demands in the lower Columbia river region.

Bandon, Ore.—The proposal to build a municipal electric power plant at Bandon is receiving the consideration of the mayor and council. A water-power site on Elk river is being investigated.

Princeville, Ore.—$150,000 in bonds have been voted to complete the municipal dam and power system.

Reedsport, Ore.—A $10,000 railroad spur which will serve four mills and one warehouse is planned by the firms concerned. Warren Reed, V. G. Hindmarsh and C. McJohnson are interested.

Everett, Wash.—The city commissioners have engaged Burns & McDonnell, Kansas City, to prepare and present data with the view of either buying or building a light, heat and power plant for the city.

Seattle, Wash.—An ordinance is before the council providing for an issue of $432,000 in bonds to be used in constructing electric road, building a saw mill and a temporary electric plant.

Seattle, Wash.—Mayor Fitzgerald has announced as the result of an inspection trip made by him to the Cedar river dam and the Cedar Falls power plant, bids will be called at once for the installation of a 10,000-kw. generator at the Cedar Falls plant and the new pipe line from the dam to the power house. Provision has been made for these extensions by the city council, utility bonds in the sum of $1,755,000 being available.

Spokane, Wash.—Universal Electric Co. will erect a building at 1218 Second street at a cost of $10,000.

Tacoma, Wash.—The city will install an Allis-Chalmers 1500-kv-a. 3-phase outdoor transformer, from which energy will be furnished for motor drive in the mills of St. Paul & Tacoma Lumber Co.

Fresno, Cal.—San Joaquin Light & Power Co. has ordered 7500 wood poles from R. E. Downie, Seattle, Wash.

Pasadena, Cal.—Warnerlite Co., Davenport, Iowa, manufacturer of lighting plants and electrical products for automobiles, will start within six months the construction of a $100,000 factory building in Pasadena. This building will be the first unit of a plant in Pasadena to manufacture products to supply the Pacific Coast and export trade of the company.

Sierra Madre, Cal.—Plans are under advisement for civic improvements, involving an expenditure of about $100,000, which will include extensions to waterworks, sewer systems and installation of ornamental street lamps.

CANADA.

Naramanta, B. C.—Town Council has awarded contract to K. Winger, Peachland, for the construction of power house.

St. John, N. B. — The Department of Public Works, Ottawa, Ont., has awarded contract for the construction of a coffer-dam at Courtenay Bay, at the entrance to the dry dock of Bedford Construction Co., Halifax and St. John. Two 12-in. electrically driven water pumps will be installed.

Forest, Ont.—The town plans to build a water works system to include electrically driven pumping equipment. James, Loudon & Hertzberg, Excelsior Life building, Toronto, engineers.

PROPOSALS

Centrifugal Pump.—Until Sept. 17 bids will be received by the purchasing agent of Kansas City, Mo., for furnishing pumping station with centrifugal type pump driven by steam turbine through reduction gears; centrifugal pump driven by vertical cross compound Corliss engine. W. C. Goodwin, engineer.

Lighting Plant and Distribution System.—Bids will be received by C. H. Bolland, town clerk, Tishomingo, Okla., until 8 p. m., Sept. 18, for the construction of a complete electric light plant and distribution system, consisting of a power house, two 75-kv-a. generators, direct connected to semi-Diesel oil engines, switchboards, 15,000 lbs. copper wire, 400 poles, line material, etc. Johnson & Benha, construction engineers, Firestone building, Kansas City, Mo.

Motor-Driven Pumping Plant.—Bids will be received Sept. 16 at the office of the country auditor at Wapello, Iowa, for furnishing all material, labor, tools and appliances and constructing as a part of the drainage system of the district a complete drainage pumping plant. Bids are desired upon several types of plants as follows: Steam-driven pumping plant, motor-driven pumping plant to operate on electric current furnished under another contract, oil engine pumping plant, combination plant with present plant. Address F. G. Wright, acting on behalf of drainage district No. 13.

Conduits and Wiring.—Bids will be opened in the office of the supervising architect, Treasury Department, Washington, D. C., at 3 p. m., Sept. 30, for furnishing the labor required in the construction, complete (including heating, plumbing, electric conduits, and wiring), with materials that will be furnished by the Government for senior medical officer's quarters, attendants' quarters, tuberculosis pavilion and approaches, for the United States marine hospital at Boston, Mass. Drawings and specifications may be obtained from the custodian, or at the above office, in the discretion of the supervising architect, James A. Wetmore, acting supervising architect.

FOREIGN TRADE

[Addresses of firms referred to in these trade opportunities may be obtained by writing to the Bureau of Foreign and Domestic Commerce, Washington, D. C., or its branch and local co-operative offices. Request for each opportunity should be on a separate sheet and the file number given.]

Pumps, Motors, Turbines, Etc. (30,552).—The representative of a firm in Spain is at present in the United States and wishes to secure an agency for the sale of electrical machinery, material for central generating stations, small electrical material, pumps, turbines, internal combustion motors, and lamps. References.

Electrical Supplies (30,556). — An agency is desired by a man in Italy for the sale of agricultural and general machinery, tools, metals, electrical supplies, cloth and yarn. Correspondence may be in English. References.

NEW PUBLICATIONS

Prices of Coal and Coke, 1913-1918, is a publication of 115 pages by C. E. Lesher, prepared in co-operation with the United States Fuel Administration and War Industries Board. This paper, which deals with the prices of domestic coal and coke from 1913 to 1918, inclusive, is one of 50 similar studies of war-time prices in different industries prepared by or at the request of the War Industries Board. The aim of these studies is both to make the price quotations gathered by various Government agencies available to men concerned with problems of business readjustment and also to provide a permanent record of the great revolution in prices that accompanied the World War. The report is one of the products of the joint efforts of the United States Fuel Administration and the United States Geological Survey, which during the war combined their statistical work on coal and coke. It is published as a chapter in the history of the Fuel Administration and as a part of the annual report on the mineral resources of the United States by the Geological Survey for 1918; it is also combined with reports on other commodities in the history of prices published by the War Industries Board.

Telegraphs — The Bureau of the Census, Department of Commerce, has issued a report on the census of telegraphs and municipal electric fire-alarm and police-patrol signaling systems for 1917. This report is a part of that on electrical industries which in its entirety covers telephones, electric light and power stations and street and electric railways, and covers 61 pages.

The Constitution and Metallography of Aluminum and Its Light Alloys with Copper and with Magnesium is the title of a new publication of the Bureau of Standards, Scientific Paper No. 337. This paper deals with the solubility-temperature curves of $CuAl_2$ and of Mg_4Al_3, and incitally with the solubility of $FeAl_3$ and the condition and solubility of silicon in aluminum. The solubility-tempertures curves were determined by the method of annealing and microscopic observation and it was found that aluminum dissolves about 4.2% of copper as $CuAl_2$ at 525° C and abcut 12.5% of magnesium as Mg_4Al_3 at 450° C. The solubility of both compounds decreases with decreasing temperature. Observations are made regarding the structural condition of iron and of silicon in commercial aluminum. This publication is now ready for distribution and copies may be obtained by addressing a request to the Bureau.

INCORPORATIONS

Stuart, Fla.—Stuart Public Service Co. has been incorporated with a capital of $50,000. Geo. R. Hilty, president; J. A. Philips, secretary.

Delray, Fla.—Delray Utility Co. has incorporated with a capital of $10,000. Address D. K. Carter, general manager.

Chicago, Ill.—Paramount Electric Co. has been incorporated with capital of $10,000 by Joseph Vickman, Leonard Cohn and Joseph Rosenberg.

Ventnor City, N. J.—Valentine Engineering Co. Capital, $100,000. To engage in a general electrical engineering capacity. Incorporators: M. G. Valentine, Alfred B. Ripel, and W. F. Sooy.

New York, N. Y.—Manhattan Lamp Works, Inc. Capital, $10,000. To manufacture electric lamps and kindred appliances. Incorporators: G. P. Leberthon, M. Burkelman, and F. R. Geering, 44 Seventh avenue, Brooklyn.

Brooklyn, N. Y.—Hygrade Lighting Fixture Corp. Capital, $10,000. To manufacture electric and gas fixtures, etc. Incorporators: H. S. Axelrod, H. Cohn and P. L. Woodward, 115 Broadway.

Rome, N. Y.—Halstead Wire Co., Inc. Capital, $50,000. To manufacture wires, cables, and kindred products. Incorporators: F. W. Wallace, Plainfield, N. J.; J. P. Halstead, and H. T. Dyett, Rome.

Tamaqua, Pa. — Souder, Hornsley Co. Incorporated under Delaware laws with a capital of $100,000. To manufacture heat regulating apparatus. Incorporators: Daniel F. Graham, Robert H. Souder, and John H. Hornsley.

Decatur, Ill.—Argenta-Warrensburg Electric Co. has incorporated with a capital of $25,000 by Lloyd W. Brown, III, M. Bekemeyer and G. N. Conover. The principal office is in the new Suffern building in Decatur.

Newton, Ga.—Application has been made for incorporation of Southwest Georgia Power Co., and Baker County Power Co., to develop water power on Notchaway Creek, use of one of two or more sites being contemplated. It is proposed to furnish electricity at different points in southwest Georgia. Address R. L. Hall.

Indianapolis, Ind. — Stutz High Duty Fire Engine Co. has been incorporated with capital of $250,000 to manufacture motor-driven fire engines. The company is independent of the Stutz Motor Car Company although several of the directors will be identical. Among the Stutz Motor Car Company men interested are W. N. Thompson, secretary and treasurer; Edward G. Sourbier, Frank H. Wheller and Martin M. Hugg.

Personal

W. R. Kenney Elected President of Pennsylvania Electric Association—M. H. Wagner Joins Kelso Co.—Changes

BURTON R. STAIR, Seattle, has taken over the agency of the Independent Pneumatic Tool Co., of Aurora, Ill., manufacturer of Thor electric tools.

W. M. STRONG, hydroelectric and mining engineer, formerly of Denver, Colo., has opened an office in Alaska building, Seattle, Wash.

J. E. CRILLY has severed his connection with the National Conduit & Cable Co. to become Pacific Coast representative of the Habirshaw Electric Cable Co., with headquarters at the San Francisco office of the Western Electric Co.

E. H. BULL, who for seven years has served the Green Engineering Co., East Chicago, Ind., in the capacity of engineer, is now a member of the firm of Bull & Liversparger, which has been appointed sales representative of the Green company in Chicago and northern Illinois territory.

WILLIAM H. CHURCHMAN recently severed his connection with the East Bay Water Co., Oakland, Cal., as superintendent of pumping stations, and has become constructing and erecting engineer of steam, electric and hydraulic machinery with the California Hydraulic Engineering & Supply Co., San Francisco, Cal.

H. E. CAVE, for a number of years a member of the Benson Lighting Fixture Co., Baltimore, Md., has severed his connection with that concern to take charge of the sales department of the Luminous Specialty Co. of Indianapolis, Ind. Mr. Cave's wide experience in artistic decorating and lighting will doubtless prove invaluable in pushing the sales of the Luminous Specialty Co.

MAJ. ALLEN E. RANSOM recently returned from France and joined the Westinghouse Electric International Co. as special representative in the west coast of South America with headquarters at Valparaiso, Chile. He was formerly a sales engineer with the Seattle office of the Westinghouse company, and was later identified with other machinery interests. During the war Major Ransom served as chief electrical engineer for the St. Nazaire base and later as major commanding the 137th engineer battalion.

GEORGE M. WOOD has been appointed supervisor of power plants for the Connecticut Co., New Haven, Conn. Mr. Wood has been connected with the Connecticut Co. in the power department for about eight years, first serving for two years as draftsman and later being connected particularly with erecting jobs on the company's plants and heating systems. In 1913 he was made assistant engineer in the operating department, and in 1915 was transferred to the construction department. He was graduated from the Sheffield Scientific School of Yale University in 1908, with the degree of Ph.B.

T. AROSIN, who has been engaged in power construction work in Portland, Ore., has accepted the appointment of station operator of the Isleton (Cal.) plant of the Great Western Power Co.

SIG. NORMAN is back with the Page & Hill Co. after 20 months' service in France with the 20th Engineers. Mr. Norman was on board the *Tuscania* when it was sunk, but was rescued. He has taken up his station with the Page & Hill Co. as assistant manager of the Newport, Wash., office.

MILTON H. WAGNER, electrical engineer on the staff of the Bureau of Standards, Washington, D. C., resigned August 25 to become associated with the Charles M. Kelso Co., industrial engineer and contractor, Dayton, Ohio, as manager of the electrical department. Mr. Wagner received the degree of electrical engineer at the University of Cincinnati in 1908, since which time he has been connected with the power and mining engineering department of the General Electric Co., Schenectady, N. Y., and the Dayton (Ohio) Power & Light Co. Mr. Wagner was in charge of the entire transmission and distribution system of the Dayton company, during which period he was chairman of the Transmission and Distribution Committee of the Ohio Electric Light Association and a member of the Overhead Lines Committee of the National Electric Light Association. During the war Mr. Wagner entered the Government service as power engineer for the United States Fuel Administration, Washington, D. C., and later was appointed electrical engineer on the staff of the Bureau of Standards for the purpose of assisting in the formulation of safety standards in connection with the design, construction and operation of the central stations and their transmission and distribution systems and all industrial electrical installations.

Milton H. Wagner.

J. B. ERBLANG has been appointed auditor of the Northern States Power Co., Faribault division, succeeding H. O. Alm.

M. E. KEEFE, formerly with the Mercantile Bank of America, has joined the sales force of H. M. Byllesby & Co. at the New York office.

LIEUT.-COL. C. F. HIRSHFIELD recently received his discharge from the service and returned to his old duties at the Detroit Edison Co.

CHARLES EDISON, of Thomas A. Edison Co., West Orange, N. J., has become treasurer of the National Social Unit Organization, a society organized for the promotion of community development and organization.

A. J. SCHOOBEIN, who has been an assistant in the accounting department of the Fort Wayne, Ind., branch of the General Electric Co., has been named head of the accounting department to succeed J. H. Lotz, who has taken a position as traveling auditor with headquarters at Schenectady, N. Y.

D. C. HOPPER, formerly assistant superintendent of underground cable system, Commonwealth Edison Co., Chicago, and more recently in charge of the electric distribution and signal systems of the American International Shipbuilding Corp., is now connected with the Newport News & Hampton Railway, Gas & Electric Co.

J. E. LYNCH has returned to the Page & Hill Co., producer and dealer in cedar poles, and has taken over the management of the firm's Chicago office. He served in France with the 311th Engineers. Mr. Lynch enlisted as a private and received promotion to the rank of lieutenant shortly after the signing of the armistice.

F. H. SWAYSE, who for a number of years has been connected with the Western Electric Co., has been appointed eastern district line material manager. He was first employed in the general auditing department of the American Telephone & Telegraph Co. about 18 years ago and after one year was transferred to the purchasing department. He joined the Western Electric Co. in January, 1904, when that company absorbed the purchasing department of the A. T. & T. Co. The Western Electric Co. immediately organized its cedar and chestnut timber operations in North Carolina and Tennessee into a separate corporation called the Carolina Pole Co., Mr. Swayze acting as assistant treasurer and later as manager. In 1907 he was transferred to Philadelphia for field work under the dean of them all in chestnut poles, H. P. Marshall, and in

1909 was given charge of that work in the territory of the Philadelphia house, Pittsburgh house territory having later been added.

Brig. Gen. George H. Harries, head of the American military mission in Berlin and in private life a vice-president of H. M. Byllesby & Co., has left that city with his staff homeward bound, via Copenhagen. General Harries was the first United States officer in Berlin a few weeks after the armistice, and from his headquarters in that city has performed service of the most important kind with distinguished success.

E. H. Waddington, recently appointed western district manager, line material department of the Western Electric Co., with headquarters at St. Louis, Mo., entered the employ of the company in 1910 and was located with the Minneapolis branch for about two years as lamp, fixture and street lighting specialist. For the past five years Mr. Waddington has been connected with the St. Louis branch, handling syndicate and large industrial business. During the period of the war he was responsible for all transactions with the Government in his territory. He is president of the St. Louis Electrical Board of Trade.

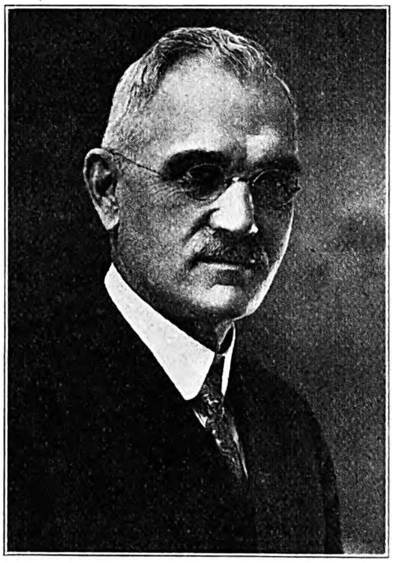
Capt. Lucius A. Fritze, Sanitary Corps, U. S. Army, has become associated with the technical staff of Wallace & Tiernan Co., Inc., New York City, manufacturer of chlorine control apparatus. Captain Fritze, who was sanitary officer of the Rainbow Division, after the armistice was assigned to the office of the Surgeon General in Washington and while there prepared a history of the Sanitary Corps of the A. E. F. Captain Fritze will be the manager of a new office which the Wallace & Tiernan Co. is opening at Kansas City, Mo., serving territory comprised in the states of Montana, Wyoming, Colorado, North Dakota, South Dakota, Nebraska, Kansas and Missouri.

Philip K. Condict, recently appointed vice-president of the International Western Electric Co., in recognition of his service to the telephone and telegraph development in Japan, has had conferred upon him by that nation the Order of the Rising Sun, Fourth Class, an honor that comparatively few Americans have received. The ceremony took place on July 17, at the official residence of the Minister of the Department of Communications in Tokyo. Mr. Condict has been connected with the Western Electric Co. since his graduation from Yale in 1903, with the exception of the time he served as a major in the Signal Corps during the war. He has spent a number of years in foreign fields, and for six years was secretary of the Nippon Electric Co., Ltd., an allied company of the Western Electric Co. in Japan.

E. K. Hall, formerly vice-president of the New England Telephone & Telegraph Co., returned to the Bell System on Sept. 1 as vice-president of the American Telephone & Telegraph Co. He will be associated with N. C. Kingsbury, who is first vice-president in charge of the operation, and will give particular attention to relations with the personnel. His connection with telephone matters began some twenty years ago when he entered the Boston law firm of Powers & Hall, who were the attorneys for the New England Co. of which he later became vice-president and a director. Mr. Hall is a graduate and a trustee of Dartmouth College. He was a famous all-around athlete in college and he has been actively identified with college athletics ever since. For several years he has been chairman of the American Inter-Collegiate Football Rules Committee.

Mr. Hall was business director of the Students' Army Training Corps during the war, remaining in the War Department after the armistice, in charge of settling the contracts between the department and the college. He has long been closely connected with the Boston Chamber of Commerce of which he was vice-president, and he represented that body in the National Council of Chambers of Commerce of the United States. He is widely known, not only as a telephone executive, but also as an authority on civic matters and on business and public relations. Since January, 1917, he has been vice-president of the Electric Bond & Share Co. of New York.

W. R. Kenney was elected president of the Pennsylvania Electric Association at its convention in Bedford Springs last week. The new president



W. R. Kenney.

has been identified with the electrical industry in Pennsylvania during his whole career. Beginning in the modest capacity of electrican's helper he rose to the position of superintendent of the Westmoreland County Light, Heat & Power Co., Greensburg, Pa., and of the Greensburg & Southern Railway Co., continuing in the same capacity when these companies became a part of the West Penn Power Co.'s system in 1903. Five years later he was transferred to Connellsville to become superintendent of light and power of Division A of the West Penn Power Co., which position he now holds. Mr. Kenney has been particularly ardent in his support of association activities, having given unstintingly of his experience, knowledge and enthusiasm to the National Electric Light Association and the Pennsylvania Electric Association, eminently fitting him for the important and responsible duties of chief executive of the latter organization.

E. M. Cutting, formerly Pacific Coast manager of the Edison Storage Battery Co., with headquarters at San Francisco, has been appointed manager of the company's railroad department with headquarters at Orange, N. J. In 1888 he entered the employ of the Southern Pacific Co. in the signal department, and rose to the position of signal supervisor for the western division by 1897. In 1905 he was also given charge of the car-lighting on the Southern Pacific lines and in 1908 became engineer of train lighting, heating and ventilation and in 1912 he resigned to accept the position of Pacific Coast manager of the Edison Storage Battery Co. Mr. Cutting has always taken an active interest in electrical affairs, having been instrumental in initiating the movement which culminated in the Association of Railway Electrical Engineers, of which he was the second president, and also being a past president of the San Francisco Electrical Development League. He is widely known on the Coast, and while his friends will be pleased to learn of his new advancement, they will regret his removal from the electrical field on the Pacific Coast.

A. G. Nabors, formerly district pole manager of the Western Electric Co., Chicago, has been promoted to the position of central district pole line material manager. He has been affiliated with the Western Electric Co. since 1905, prior to which time he was for five years employed with the American Telephone & Telegraph Co. in the capacity of paymaster of a line construction gang and at other jobs in connection with building telephone lines. The last position he held with the company was in the pole line inspection department. When the purchasing and inspection of poles was transferred by the telephone company to the Western Electric Co. he was transferred to the latter company. He was located at its New York and Philadelphia offices for three or four years and was then sent to the Pittsburgh office. In July, 1916, he was transferred to Chicago to take the positon of district pole manager, which position he held until his recent promotion.

E. P. Peck, for more than thirteen years a member of the engineering staff of the Georgia Railway & Power Co., was recently appointed general superintendent of the electrical department of the Utica (N. Y.) Gas & Electric Co. Mr. Peck was born in Atlanta, Ga., Aug. 13, 1882, and attended the Georgia School of Technology. In 1903 he took up practical work, and for two years was connected with electrical construction, maintenance and repair work in northern cities. In 1905 he entered the employ of the Georgia Railway & Electric Co., serving in the repair and meter shops. One year later he was appointed foreman of the testing department, continuing this position until 1912, at which time he was promoted to assistant electrical engineer in charge of electrical station layouts and construction and of testing. Five years later he was again advanced to superintendent of operation. This position he held until October, 1918, when he resigned to take up war work in Washington, D. C. Mr. Peck has an extensive operating experience and is well known in the industry because of his original investigations and development work as a member of the Georgia Railway & Power Co.

Electrical Review

ol. 75. No. 12. CHICAGO, SEPTEMBER 20, 1919 Three Dollars a Year

Electrical Review

WITH WHICH IS CONSOLIDATED WESTERN ELECTRICIAN AND ELECTROCRAFT.

VOL. 75—No. 12. CHICAGO, SATURDAY, SEPTEMBER 20, 1919. PAGE 469.

Night View in a Knitting Mill Where Indirect General Lighting Eliminated Complaints About Glare from the Needles and Wiped Out High Labor Turnover.

How Better Industrial Lighting Can Improve Working Conditions

Working Conditions, Including Welfare of Employes, Can No Longer Be Ignored—Up-to-Date Lighting Makes Better Conditions and Reduces Labor Turnover and Labor Disputes

By F. H. BERNHARD

DURING the late war was witnessed one of the most splendid examples of national concentration of effort toward meeting a great emergency. With practical unanimity the country saw the need for greater production and proceeded to meet it by more intense and efficient application in all the industries except those non-essential to winning the war.

A different kind of emergency now confronts us. Continuance of high costs of the necessities of life is given as a primary cause of the serious industrial unrest so prevalent in our country as well as abroad. While there is some truth in this, it is not all the truth. Nevertheless, this unrest is a serious menace that threatens to further increase the cost of living. Instead of stimulating efficient production, which is doubtless the most effective remedy for high costs of products, it retards production. Clearly the situation calls for concerted efforts to fight the high costs and allay the unrest.

In an article published in these columns two weeks ago the writer undertook to show that improved industrial lighting can aid materially in stimulating production and thus help reduce the costs of commodities. In the present article an effort will be made to show that better lighting brings about substantial improvement in working conditions and thus affects production favorably while at the same time eliminating some of the causes for large labor turnover and possible labor disputes.

Growing Importance of Attention to Working Conditions.

Any discussion of the value of some proposed improvement in working conditions usually takes for granted that a corresponding improvement in production must follow. This is not always true because the extremely variable human element enters. When we discuss improvement in the efficiency of employes, however, there is a directly proportional relation between efficiency and output, as was pointed out in the article referred to. Betterment of working conditions may in some cases cause more than a corresponding increase in output, while in others the increase may be considerably less than in direct ratio; the latter is especially true where some artificial restriction, such as that of a labor union, is placed upon the output. Thus when we consider workmen merely as productive agencies, like machines, we find their production obeys almost mathematical laws, while when we must take into account their desires, prejudices and frailties as human beings the relation between stimulus and result is no longer as direct. This is one of the reasons why employers have formerly not given as much attention to working conditions as they do now.

Effects of working conditions are of many kinds, depending upon what is covered by the term. One may distinguish at least four different kinds of working conditions: (1) Those associated with the industry, trade or operation considered and determined by the standards developed with the progress of the art. (2) Physical conditions and environment of the plant, outside and inside; the latter includes daylight and artificial lighting conditions, ventilation, heating, sanitary facilities, etc. (3) Conditions set by the management, such as wages, hours of work, superintendence, character of foremen, etc. (4) Conditions determined by workmen, such as character and nationality of fellow-employes, requirement of labor organization, etc. The aggregate of these various conditions determines the desirability of employment in any particular occupation and particular plant.

Great changes have taken place in the importance placed on working conditions during the last few decades. Formerly the workman took up the trade or occupation of his father to a much larger extent than now. He assumed as inherent to that trade the peculiar nature of its work and the hazards and joys, if any, associated with it. The employer determined the principal conditions of employment and there was little change from year to year.

Gradually, however, the employes have taken a more and more active part in saying what the conditions shall be. If these were not satisfactory, many would quit and go to plants where they were better. Shop committees presented requests for improvement; if these were not granted, definite organization and affiliation with labor unions often followed together with subsequent strikes.

Any unbiased person must admit that through the labor unions there have resulted extremely important improvements in working conditions, the net result of which has been a marked raising of the standard of living of the great mass of our population. He must also admit that, in the last few years especially, many of the leaders of the unions have seemingly lost their heads and have presented demands beyond all reason, backing them up by provoking unwarranted strikes that constitute a very serious economic loss to the country and, if not checked, may become a grave menace to the nation. The president of the National Association of Manufacturers has just stated that during the last eight months strikes and threatened strikes have cost our country an average of about $10,000,000 a day—an outright and needless loss in wages and business. Under such conditions no manufacturer can afford to ignore giving close attention to the working conditions in his plant, any one of which may become the seed for the growth of discontent and thus lead to disputes and stoppage of work.

In presenting the following discussion of the several ways in which up-to-date lighting can improve working conditions, it is fully recognized that it is not a panacea in this regard. In fact, there is no single panacea; high wages alone do not constitute an offset for insanitary conditions or an arbitrary foreman with present-day discriminating employes, nor does welfare work make up completely for low wages. There is no question, however, but that reasonable attention to all the working conditions, as a right of the employes and not as a charity, is fully appreciated by them. It demonstrates the employer's real interest in their welfare and develops loyalty to his firm. Further, it makes it very difficult for professional agitators to get a responsive hearing. Therefore it fully pays from every angle it is considered.

Most discussions of improvement in industrial lighting bring out the increase in production as its most important benefit, the other advantages being incidental. There is much truth in this in most cases, especially when production increase is so urgently needed as just now. However, the other benefits are often very substantial and in certain cases of even greater monetary value than increase of output. It is believed, moreover, that they all have also a more or less direct bearing on production increase and this will be brought out in the following. While it is not easy to segregate the welfare benefits from the production benefit, the fact that the former contribute to the output increase must not be lost sight of in determining the aggregate value of an up-to-date lighting system.

How Improved Lighting Betters Conditions for Working.

Some ten or a dozen years ago the appalling number of accidents in American industrial plants began to make an impression from which grew the "Safety First" movement. During the year 1910 an analysis was made of about 91,000 industrial accidents reported to one of the largest accident insurance companies with the surprising result that 23.8% of them were found due to poor lighting or in which poor lighting was an important contributing factor. Eight years afterward a similar study showed that this percentage had fallen to about 18%, a reduction of nearly 6%, in this class because of the intervening years of lighting betterment in the larger plants especially. Even with this reduction, the actual figures for the year 1918 show that our industries lose the services of 108,000 men for a whole year annually because of fatal and serious casualties due to lighting that is inadequate for safety, and 75 men each day lose their lives from such meager lighting in American plants. These figures represent a frightful toll in lives and suffering that should be almost entirely preventable. There is also the heavy loss to employers from paying workmen's compensation. In the state of Massachusetts this loss and that of wages due to industrial accidents of this class is estimated to aggregate $1,000,000 annually, or sufficient to equip each factory, mill and workshop with an ideal lighting system and operate this for several years.

On this score it is not surprising to find that six states have in recent years enacted factory lighting codes laying down requirements as to lighting to safeguard the lives, limbs and eyes of factory employes. Several other states have pending the drafting of similar codes. All these codes are based primarily on the promotion of safety; their specified lighting intensities do not concern themselves with the stimulation of production, since the state cannot compel a manufacturer to be so progressive as to look out for his own best interests. It can compel him, however, to equip his plant with such safeguards, including lighting, as will remove the manifest hazards to his employes.

While he is rehabilitating his lighting to meet the modest safety standards, he would be shortsighted indeed if he did not at the same time and at slight additional cost exceed those standards and provide for lighting intensities that would clearly add to the productive efficiency of his men 10 to 25% or more, as was shown in the article published two weeks ago.

As regards safety and lighting it can therefore be definitely stated that the latter is absolutely necessary to the former and will become more so with the growing tendency to operate plants on the double or triple-shift basis per 24 hours. Data are at hand showing that industrial accidents are more numerous in winter than summer due to the larger percentage of dark hours. Modern lighting can make the night hours as safe and as productive as the daylight hours. The interests of the country require elimination of all preventable accidents, especially at a time when every idle hand is needed to add to the production of all those necessities that the entire world is turning to us to supply.

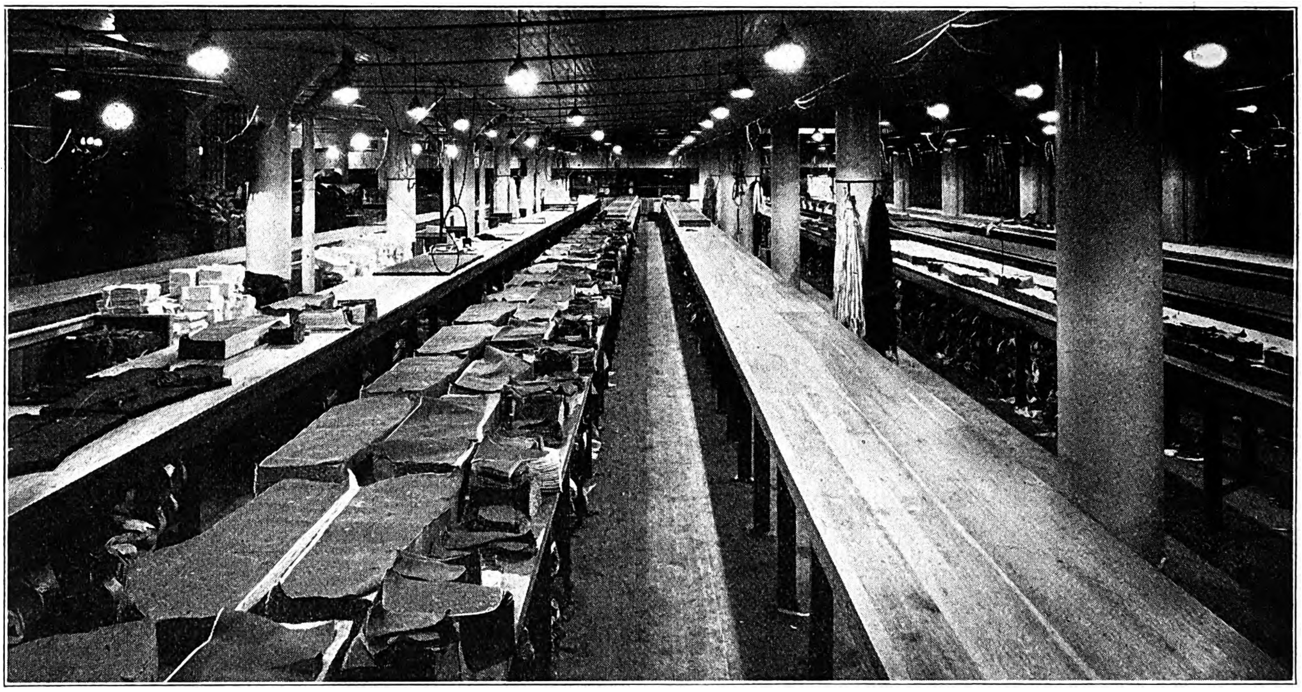
It is generally known that any effort to read or work in a meager light leads to serious eye strain. Similar strain is caused by improperly directed or poorly diffused light which may be ample as to intensity. Thus both inadequate and improper lighting are frequently the source of bad visual conditions by day as well as under artificial light.

One of the first results of eye strain is slowing up of the work; it takes longer to perform any operation under poor visual conditions than when the light is ample and suitable. Then continued eye strain produces a tendency to permanent impairment of vision and reduced visual efficiency. The gradual blindness thus often produced at relatively young ages is one of the saddest sacrifices to the plain disregard of scientific principles of illumination by either ignorant or negligent industrial managers.

Whether the poor lighting is temporary or prolonged, its accompanying poor visual conditions almost invariably result also in much work being spoiled. This, in fact, is found to be one of the most prolific causes of the heavy loss from spoilage in American industries, which amounts to the extraordinary sum of $28,000,000 annually due to poor lighting alone. This is a dead loss to the manufacturer which he can only compensate by adding to the cost of production.

The final results of eye strain and improper visual conditions from poor lighting are inferior quality of product, diminished output because of the lowered efficiency of the employe, increased labor turnover and frequently the growth of discontent developing into disputes. An example of this is depicted in an accompanying illustration showing a view in a knitting mill. The former direct lighting caused very serious glare due to the specular reflection from the polished needles. This almost blinded the operators and it was difficult

View in a Foundry the Excellence of Whose Lighting Makes Accidents Unlikely and Working Conditions Much More Favorable Than in the Average Foundry Where the Gloom Is Both Impressive and Depressive.



Night View in Cutting Room of an Overall Factory—Accidents and Spoilage Would Be Serious if Lighting of This Kind Were Not Provided.

to get them to hold their positions for much over a week. The time and money lost in training new operators almost ruined the firm. Finally a system of indirect lighting was installed that eliminated the glare and the troubles at once ceased.

In the old shops and mills it was quite common to find very dingy workrooms with low ceilings cluttered up with shafting, pulleys and belts; the windows were small, few in number and very dirty. Lighting conditions in such rooms were abominable even in broad daylight. On cloudy days and in the morning and evening hours these rooms were like dungeons and it is not surprising that the operators moved about as if they were in a daze. Accidents were very frequent, spoilage was high and the output low. Such gloomy and depressing workrooms are now rather scarce, thanks to the lighting codes referred to and to the activity of factory inspectors that have not waited for enactment of such codes.

There are still very plentiful cases of factories whose owners have not realized the full value of cheerful workrooms with large and clean windows and skylights, brightly painted walls and ceilings, unobstructed aisles and ceilings, orderly arrangement of machines, workbenches and stacks of material. A bright and pleasant workroom is like a cheerful environment in any place, it has a most wholesome influence in making the employes keen, alert and attentive to their work so that more accurate and speedier work is done, fewer mistakes are made, less material is spoiled, accidents become rare, less fatigue and depression is experienced, grumbling and discontent are almost unknown and the workers are more loyal to the interests of the firm.

Reference has been made to high labor turnover. The day is past when an employer felt this to be a convenient means for keeping down wages. Even when labor is plentiful large labor turnover is a serious loss and burden. It disrupts the organization, increases mistakes and accidents, and lowers the efficiency of the whole plant. Wherever it occurs there is something radically wrong that should by all means be remedied.

In not a few cases poor lighting has been the cause. One case has already been cited. Many cases are on record where employes have quit or threatened to leave in large numbers because the lighting was so inadequate that they could not produce the quality or quantity of work of which they might be proud. Especially has this happened where piecework or bonus payments prevailed; with poor lighting it was impossible to maintain desired standards and insufficient, acceptable product could be turned out to maintain a desirable compensation. Thus not only were the employes displeased but the employer was a loser.

The cost of an up-to-date lighting system that meets all the requirements of productive intensity, freedom from visual strain, safety, efficiency and low upkeep is surprisingly low in terms of the benefits derived thereby. This low cost is due to the rapidity of the scientific and practical development of the lighting art which in the last few years has made very important advances. Thus it has made possible production increases from 10 to 35% at a lighting cost of less than 1% up to about 5% of the payroll and this without adding to the number of employes. Aside from these ascertainable output increases there were the less definitely known but no less real betterments in working conditions referred to in this article.

It has already been shown that most of these miscellaneous benefits have a direct bearing on the output and are therefore partly included in the production increase from good lighting. But even if all of these benefits were intangible and there were no ready check on their monetary value, they are there and of great importance to the manufacturer and his employes as well. Take, for instance, reduction of labor turnover and possible disputes over lighting developing into strikes. The serious losses from these sources are by no means to be ignored and the manufacturer who puts in a modern lighting system as insurance against these troubles is doing nothing more extraordinary than the one who has removed from his plant all possible hazards from combustion and installed the best possible sprinkler system as at least partial insurance against trouble from fire.

Central-Station Rates in Theory and Practice

Eleventh Article—Conclusion of Mathematical and Graphical Analysis of the Conditions Under Which Price Splitting or Reductton Is Advantageous as Regards the Earnings of the Central-Station Company

By H. E. EISENMENGER

This is the eleventh article of this series of which a general outline appeared in the issue of July 5. The first seven articles, beginning July 12, were devoted to a discussion of the cost of electric service on which modern rate systems are based. In the last three articles the general principles underlying rate making have been treated, it being shown that what the author calls the "value-of-service" principle is superior to the strict "cost-of-service" plan. Insert IX, begun Aug. 30 and ended this week, analyzes the conditions for price reductions without curtailing earnings. A summary of the important conclusions of this analysis will be included in the next article when the main text will be resumed and continued through practically the remainder of the volume.

PART II—THE PRICE OF ELECTRIC SERVICE—Continued.

Insert IX—Appendix to Section 80 et Seq.—Relations Between Selling Prices and Earnings—Continued.

II. PRICES DEPENDING ON THE CUSTOMER'S VALUATION (VALUE-OF-SERVICE PRINCIPLE).

2. *Net Income.*

a. Shape of the Net Income Curve.

1. What Is the Net Income or the Rate of Return of a Group?

SECTION **25.** The preceding Sections 16-23 have shown how the conditions for an increase of the aggregate gross income as a consequence of a lowering of the price to certain groups of service can be reduced to certain qualities of the gross-income curve which belongs to the respective group (or groups) in which the price is to be lowered. If we try to extend this method to the net income (and to the rate of return) we must first decide what is to be called "the net income" or the "rate of return," respectively, of a particular group. We can determine the gross income of a certain group of service, but we cannot say without certain additional defining assumptions how large the net income or the rate of return is which results from that group because the aggregate cost (total cost) and the total capital invested cannot be assessed to the individual groups in a definite way unless we make certain assumptions.

26. We can now make various assumptions about what we want to call the "net income" and the "rate of return" of a certain group for the present purpose. The most obvious two methods of defining the net income and return of a group are (a) the incremental net income (return of the increments) and (b) what might be called the group's "segregate" net income (segregate rate of return); (compare also Section 3 of the main text).

27. The "*incremental net income*" is the difference: Increment of the gross income caused by the addition of that group to the other groups minus the increment of the combined cost[1] over the combined cost (aggregate cost) of all other groups. In other words, it is the difference of gross income derived from that group minus the increment of the combined (aggregate) cost of all other groups. The "*rate of return of the increments*" is the incremental net income, as just defined, divided by the increment of the capital.

28. The group's "*segregate net income*" is the difference of that group's gross income minus the group's segregate cost (see Section 3 of the main text; the "group's segregate cost" is the cost of serving that group alone if no other groups were in existence). Likewise the group's "*segregate rate of return*" is the quotient of the segregate net income, as just defined, divided by the capital which would be necessary to establish a manufacturing plant (central station, etc.) just large enough to provide for that group alone.

2. Incremental Net Income of the Group. (Sufficient and Necessary Condition.)

29. Starting again with the assumption that we have two groups of service only, G and g, we call N_{t_0} and N_{t_1} the aggregate net incomes from both groups, corresponding to the aggregate gross income B_{t_0} and B_{t_1} above (Section 16 of this Insert). N_{t_0} is therefore the aggregate net income if the unit prices charged in both groups are the same and equal to p_0, resulting in the sales M_0 and m_0 units in the two groups, respectively, whereas N_{t_1} is the aggregate net income if in group G the price is maintained at p_0 and in group g it is lowered to some other amount p_1, increasing thereby the sales in that group from m_0 to m_1. Let the symbol $f(m)$ denote again the function which determines the cost (excluding the capital cost) if the amount produced is given by m (variable). We have then

$N_{t_0} = (M_0 + m_0)p_0 - f(M_0 + m_0)$...Uniform price p_0. (17)

$N_{t_1} = M_0 p_0 + m_1 p_1 - f(M_0 + m_1)$........Price splitting downwards (lowering price in group g)............(18)

If price splitting downwards shall improve the net income, that is, if N_{t_1} shall be $> N_{t_0}$, then

$m_1 p_1 - f(M_0 + m_1)$ has to be $> m_0 p_0 - f(M_0 + m_0)$ ...(19)

or using, as above, the symbol b (gross income) for the product mp so that $b_0 = m_0 p_0$ and $b_1 = m_1 p_1$

$(b_1 - b_0) - [f(M_0 + m_1) - f(M_0 + m_0)]$ must be > 0..(20)

Writing this in the form

$$\{ b_1 - [f(M_0 + m_1) - f(M_0)] \} - \{ b_0 - [f(M_0 + m_0) - f(M_0)] \} > 0 \quad \text{..........(21)}$$

we have in the first couple of braces the incremental net income of the group if the price is p_1 and in the second couple of braces the incremental net income over the other group if the price is at its original amount p_0. This means: *Lowering the price in a certain group is of advantage to the aggregate net income, if the incremental net income of that group is improved thereby.*

Such an improvement of the group's incremental net income according to relation (21) is the *necessary and sufficient* condition for an improvement of the aggregate net income by price splitting downwards, which means, if the

[1] The increment of the cost is the amount by which the aggregate cost is raised in consequence of the fact that the respective group is being supplied with service. The sum of the increment costs of all groups will be smaller than the total aggregate cost and the sum of the aggregate costs of all groups will be larger than the total aggregate cost. A balance will remain after summing up the increment costs of all groups which has not been assigned to any one of the groups (overhead cost). If we regard the total service as one group, the increment cost of that group is the excess of the aggregate cost over the cost at the production 0, and the cost at production $0 = OS_0$ (on the left-hand part of Fig. A*) will be left over, and not accounted for, so to speak. The same will apply if we have more than one group, provided the line of cost $s = f(m)$ or S_0ST, is a straight line, otherwise the unaccounted portion will be greater (always taking the incremental cost of every group over the combined cost of all other groups).

The same considerations prevail for the increment of the capital.

*See page 389 of Sept. 6 issue.

group's incremental net income is improved by price splitting downwards, the latter is always profitable and conversely, if price splitting downwards is profitable, the group's incremental net income must be improved thereby.

3. Segregate Income of the Group. (Sufficient But Not Necessary Condition.)

30. Can we establish a similar relation between the aggregate income of all groups and the *segregate* income of the group in which the price is to be lowered?

The segregate net income of group g at the lowered price p_1 is greater than at the original price p_o if

$$b_1 - f(m_1) > b_o - f(m_o)$$

or $(b_1 - b_o) - [f(m_1) - f(m_o)] > 0$ .... (22)

How does this compare with relation (21)? A glimpse at Fig. D will make this clear. We have here

$OA' = m_o$ .... $A'A = f(m_o)$

$OB' = m_1$ .... $B'B = f(m_1)$

where m_1 is greater than m_o because the price p_1 is obtained from p_o by price splitting downwards so that $p_1 < p_o$, consequently according to fact No. 1 of Section 1 of this Insert m_1 must be $> m_o$.

We have further in Fig. D

$$A'C' = B'D' = M_o = \text{constant}$$

$OC' = m_o + M_o$ .... $C'C = f(m_o + M_o)$

$OD' = m_1 + M_o$ .... $D'D = f(m_1 + M_o)$

$$\left.\begin{array}{l} B''B = f(m_1) - f(m_o) \\ D''D = f(M_o + m_1) - f(M_o + m_o) \end{array}\right\} \text{..........(23)}$$

If now the curve $f(m)$ complies with fact No. 3 of Section 1 of this Insert, that is, if it rises continuously with increasing abscissae, turning the concave side towards the

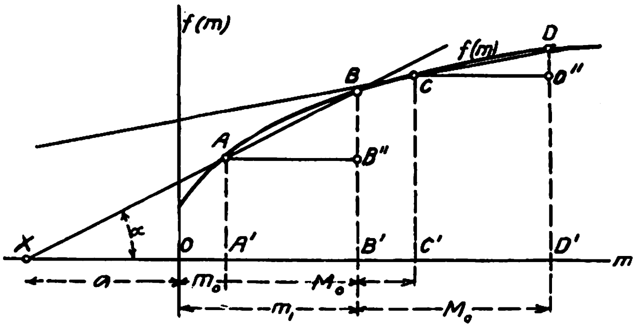


Fig. D.

axis of abscissae and approaching with increasing abscissae asymptotically a straight line, this means that $B''B > D''D$, because $A'B' = m_1 - m_o$ and $C'D' = (m_1 + M_o) - (m_o + M_o) = m_1 - m_o$ and consequently $A'B' = C'D'$. For the limiting case where the $f(m)$ line is a straight line $B''B = D''D$.

This means from (23)

$f(m_1) - f(m_o) \geqq f(M_o + m_1) - f(M_o + m_o)$ .. (24)

Multiplying by (-1) and adding $(b_1 - b_o)$ to both sides (24) becomes

$$(b_1 - b_o) - [f(m_1) - f(m_o)] \leqq$$
$$(b_1 - b_o) - [f(M_o + m_1) - f(M_o + m_o)]$$

The left side of relation (22) is therefore always $\leqq$ than the left side of (20), or if relation (22) is true, (20) and (21) must of necessity also be true, because if the term of (22) is positive, the term of (20) which is equal or greater, must of course also be positive. But we can reverse the statement only in case the $f(m)$ line is a straight line, which means: Unless $f(m)$ is a straight line there will exist cases in which (21) is true, but (22) is not.

In other words: An increase of the segregate group income for a certain price reduction is a sufficient condition for an improvement of the aggregate net income by price splitting downwards by means of that price reduction, but it is not a necessary one, unless the $f(m)$ curve is a straight line.

4. General Remarks.

31. What has been proved in Sections 18 and 19 of this Insert for the gross income can be demonstrated in exactly the same manner for the group's incremental net income and the group's segregate net income. It is unnecessary to repeat in detail all these results in their application to the net income (maximum of the aggregate net income, more than one maximum of the group's net income curve, increase of the net income either by price reductions in *all* or in some of the groups, increase of the net income if the original system of prices has been so designed as to result in the highest possible net income attainable with a uniform price). We can also without difficulty extend the conclusions to more than two groups.

32. Which condition is more strict, that for an increase of the gross income or of the net income by price splitting downwards? The gross income can be raised by price splitting downwards if, according to relation (14), $m_1p_1 > m_op_o$, that is $b_1 > b_o$. The corresponding condition for the net income is, according to relation (20), $b_1 > b_o + [f(M_o + m_1) - f(M_o + m_o)]$. Now since $p_o > p_1$, it follows, according to fact No. 1 of Section 1 of this Insert, that $m_o < m_1$ and, according to fact No. 3, that $f(M_o + m_o) < f(M_o + m_1)$. Therefore $[f(M_o + m_1) - f(M_o + m_o)]$ is always positive. Consequently with a given sales curve for group g and with a given upper price p_o, high enough so that price splitting downwards increases the aggregate *gross* income, there will always exist certain values of the price p_1 which, although making $b_1 > b_o$, and therefore improving the aggregate *gross* income B_t if added as lower prices, still will reduce the aggregate *net* income N_t because b_1 does not reach the value $b_o + f(M_o + m_1) - f(M_o + m_o)$.

For a graphical representation of the fact set forth in this Section see Section 33 et seq. of this Insert.

b. Shape of the Sales Curve.

33. It is of interest to investigate again, as has been done in the case of the gross income (Sections 20-23 of this Insert) how the condition for the possibility of increasing the net income without raising the prices to anybody is expressed in the shape of the sales curve. Calling

$$f(M_o + m_1) - f(M_o + m_o) = \Delta f(M_o + m_o)$$

we can write relation (19) as

$m_1p_1 > m_op_o + \Delta f(M_o + m_o)$ .... (25)

If we now call $r = \dfrac{\Delta f(M_o + m_o)}{m_1 - m_o} = \dfrac{\Delta f(M_o + m_o)}{\Delta m_o}$ .... (26)

this means r is the average cost increment per unit[2] if the quantity produced rises from $(M_o + m_o)$ to $(M_o + m_1)$, or we can say $r = \tan\gamma$ in Fig. A.* If we substitute the value for $\Delta f(M_o + m_o) = r(m_1 - m_o)$ from equation (26) into (25) we get

$$m_1p_1 > m_op_o + r(m_1 - m_o)$$

or $m_1(p_1 - r) > m_o(p_o - r)$ .... (27)

The limiting case of this relation is given by changing the inequality sign into an equality sign:

$m_1(p_1 - r) = m_o(p_o - r)$ .... (28)

34. Assuming now for the present that curve $s = f(m)$ be a straight line, the cost increment r per unit will then be constant for any values of m_o and m_1 (or p_o and p_1, respectively). Equation (28) is then represented by a family of equilateral hyperbolas which is identical with that of equation (16) of this Insert, except that the vertical asymptote does no longer coincide with axis of ordinates m. It runs now at the distance r to the right of that axis (Fig. E). The reasoning of Sections 22 and 23 of this Insert can now be applied to these hyperbolas.

The net-income hyperbola passing through a certain point will be steeper than the gross-income hyperbola passing through the same point. This is illustrated by comparing the family of net-income hyperbolas with the dash-and-dot gross-income hyperbola in Fig. E which has been selected at random.[3] Consequently, considering Section 23 of this Insert, the lowest limiting slope of the sales curve of group g which still allows an increase of the earnings by lowering the price in that group will be greater in case of the net income than in case of the gross income. In other words, the conditions for an increase of the net income by price splitting downwards are more strict than the corresponding conditions for the gross income. (Compare Section 32 of this Insert.)

35. If now the curve $s = f(m)$ is no longer a straight line, but curved, in the only way in which it can be curved, that is with the concave side pointing steadily downwards, this means that r, see equation (26), will no longer be a constant for every m_1, but it will (for a given m_o and M_o) grow smaller as m_1 increases and vice versa. It will, how-

[2] See the first footnote to Section 75 of the main text.

* See page 389 of Sept. 6 issue.

[3] It is hardly necessary to prove this in a more scientific way by comparing the angles of the slope of the two curves as given by the first derivative dm/dp in both cases:

Gross-income hyperbola....... $mp = \text{constant}$...... $\dfrac{dm}{dp} = -\dfrac{m}{p}$

Net-income hyperbola.. $m(p - r) = \text{constant}$...... $\dfrac{dm}{dp} = -\dfrac{m}{p - r}$

Therefore dm/dp is smaller for the net-income hyperbola than for the gross-income hyperbola, but since dm/dp is essentially negative in both cases, the absolute value of the angle of inclination of the net-income hyperbola is greater than that of the gross-income hyperbola passing through the same point.

ever, for very large amounts m_1—mathematically expressed, for $m_1 = \infty$—still have a finite positive value, viz.: the limiting value $c_{1\infty}$ of the increment-cost c_1 per unit, if very large quantities of the "commodity" are manufactured (very large central stations). We will get, therefore, a different set of hyperbolas for every value of m_1 in such a manner that the vertical asymptote will move nearer and nearer to the vertical axis of co-ordinates with increasing m_1 without ever getting closer to it than a certain minimum $c_{1\infty}$. Consequently we can say that in case of a curve $f(m)$ line the conditions for increasing the net income by price-splitting downwards will be less strict for larger quantities m_1 than for smaller ones, but they will always be stricter than the corresponding conditions for the gross income.

The results of this graphical investigation are therefore entirely in harmony with the results of the analytical investigation carried out in Section 32 of this Insert.

3. *Rate of Return.*

a. Shape of the Rate-of-Return Curve.

1. Total Rate of Return of All Groups.

36. Proceeding along the same general lines of reasoning as in Sections 16-24 and 25-35, respectively, of this Insert, we can investigate the criterion for an increase of the rate of return either analytically or graphically and arrive at the same results with either method.

Using the same symbols as heretofore, we can write

$$v_0 = \frac{(M_0 + m_0)p_0 - f(M_0 + m_0)}{F(M_0 + m_0)} \quad \ldots\ldots\ldots\ldots (29)$$

and

$$v_1 = \frac{M_0 p_0 + m_1 p_1 - f(M_0 + m_1)}{F(M_0 + m_1)} \quad \ldots\ldots\ldots\ldots (30)$$

where F is the symbol for the function of m which represents the capital invested (see left side of Fig. A) so that $F(m_x)$ is the capital necessary as an investment for the annual production of m_x units; v_0 and v_1 are then the rates of return corresponding to the gross incomes B_{t0} and B_{t1}, or to the net incomes N_{t0} and N_{t1}, respectively, in the preceding Sections of this Insert, in such a manner that v_0 is the rate of return obtained if the price p_0 is charged to both groups G and g, and v_1 is the rate of return if the price is lowered to p_1 in group g and maintained at p_0 in G (price splitting downwards).

2. Return of the Increments. (Sufficient and Necessary Condition.)

37. In analogy with the investigations of "Net Income" (Sections 25 to 35 of this Insert) we shall investigate whether and how the criterion for an increase of the rate of return as a consequence of the lowering of the price in group g alone can be expressed in terms of

(a) the return of the increments of group g (see Section 27 of this Insert);

(b) the segregate rate of return of group g (see Section 28 of this Insert).

The condition that the rate of return is raised by the change of the price p_0 to p_1, in group g only is: $v_1 > v_0$ or $v_1 - v_0 > 0$, that is from (29) and (30):

$$\frac{[M_0 p_0 + m_1 p_1 - f(M_0 + m_1)]\, F(M_0 + m_0)}{F(M_0 + m_0)\, F(M_0 + m_1)} - \frac{[(M_0 + m_0)p_0 - f(M_0 + m_0)]\, F(M_0 + m_1)}{F(M_0 + m_0)\, F(M_0 + m_1)} > 0$$

This fraction is greater than 0 if the numerator is greater than 0 because the denominator is essentially positive. The condition can therefore be written as

$$[M_0 p_0 + m_1 p_1 - f(M_0 + m_1)]\, F(M_0 + m_0) - [(M_0 + m_0)p_0 - f(M_0 + m_0)]\, F(M_0 + m_1) > 0 \ldots\ldots (31)$$

Substituting into this, for the sake of brevity, the following short symbols: B_0 for $M_0 p_0$, b_0 for $m_0 p_0$, and b_1 for $m_1 p_1$ we get

$$[B_0 + b_1 - f(M_0 + m_1)]\, F(M_0 + m_0) > [B_0 + b_0 - f(M_0 + m_0)]\, F(M_0 + m_1) \quad \ldots\ldots\ldots\ldots (31^*)$$

Setting $f(M_0 + m_1) - f(M_0 + m_0) = \xi$

and $F(M_0 + m_1) - F(M_0 + m_0) = \eta$

we can write (31*) as

$$[B_0 + b_1 - f(M_0 + m_0) - \xi]\, F(M_0 + m_0) > [B_0 + b_0 - f(M_0 + m_0)]\, [F(M_0 + m_0) + \eta]$$

from which $(b_1 - b_0 - \xi)\, F(M_0 + m_0) > [B_0 + b_0 - f(M_0 + m_0)]\, \eta$

or

$$\frac{b_1 - b_0 - \xi}{\eta} > \frac{B_0 + b_0 - f(M_0 + m_0)}{F(M_0 + m_0)} \quad \ldots\ldots\ldots\ldots (32)$$

The fraction on the left side of this relation is the "rate of return of the increments," as will be readily seen by comparing it with the definition of that term as given in Section 27 of this Insert. The right side is the actual rate of return of both groups under the original charges v_0 [equation (29)], that is when the price p_0 is charged in both groups. It is easily seen that this can be extended to more than two groups and we arrive thus at the following law:

Price splitting downwards by groups is of advantage to the rate of return as long as the rate of return of the increments in the respective group where the price is lowered is greater than the original rate of return. (Sufficient and necessary condition.)

3. Segregate Rate of Return. (Sufficient But Not Necessary Condition.)

38. In an attempt to introduce, in analogy with what has been shown previously (Section 30 of this Insert) about the net income, the more convenient term of the segregate rate of return $\dfrac{b_1 - f(m_1)}{F(m_1)}$ we start from the sufficient and necessary condition for an increase by price splitting downwards as given in relation (31*):

$$[B_0 + b_1 - f(M_0 + m_1)]\, F(M_0 + m_0) \text{ has to be } > [B_0 + b_0 - f(M_0 + m_0)]\, F(M_0 + m_1)$$

Calling the two sides of this relation X and Y, respectively, so that $X > Y$, we can replace X by a term $X_1 < X$ and the new relation $X_1 > Y$ will still be a condition for an improvement of the rate of return by price splitting downwards because, if even the smaller value X_1 is greater than Y, the larger value X will all the more be greater than Y. We can thus say that any change in relation (31*) which reduces the left side relatively to the right side will leave the changed relation (31*) a condition for the improvement of the rate of return. But it will no longer be a *necessary* condition after that change because there will be cases where, although the substitute relation $X_1 > Y$ does not hold true, still the real criterion $X > Y$ will be fulfilled. On the other hand, we are never justified in *increasing* the left side relatively to the right side.

Let us now after this introductory remark turn back to relation (24), which may be written in the following form:

$$f(M_0 + m_1) - f(m_1) \text{ is always} \leqq f(M_0 + m_0) - f(m_0) \ldots (33)$$

From fact No. 4 of Section 1 of this Insert we have further

$$F(M_0 + m_0) \text{ is always} < F(M_0 + m_1) \ldots\ldots\ldots\ldots (34)$$

because $m_0 < m_1$.

Multiplying the left and right sides of (33) and (34) with one another, respectively, we get

$$[f(M_0 + m_1) - f(m_1)]\, F(M_0 + m_0) \text{ is always} < [f(M_0 + m_0) - f(m_0)]\, F(M_0 + m_1) \quad \ldots\ldots (35)$$

Adding (35) and (31*) will increase the right side of (31*) more than the left side, and is therefore permissible, according to what has just been found out above. (31*) then changes into

$$[B_0 + b_1 - f(m_1)]\, F(M_0 + m_0) \text{ has to be } > [B_0 + b_0 - f(m_0)]\, F(M_0 + m_1) \quad \ldots\ldots\ldots\ldots (36)$$

Returning now to Fig. D of this Insert it can be shown[4]

$$\frac{A'A}{C'C} < \frac{B'B}{D'D} \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (37)$$

Assume now the curve in Fig. D to represent not the $f(m)$ line but the $F(m)$ line, an assumption which is perfectly permissible since both curves have the same character. We can thus write (37) as

$$\frac{F(m_0)}{F(M_0 + m_0)} < \frac{F(m_1)}{F(M_0 + m_1)} \quad \ldots\ldots\ldots\ldots\ldots\ldots (38)$$

---

[4] The secant AB, produced to the left, intersects the axis of abscissae at the distance a to the left of the origin of coordinates and the secant CD intersects it at the distance c where $a \leqq c$. The slope of the secant AB will be called α and that of CD will be called γ. We have now (see Fig. D):

$$\frac{A'A}{C'C} = \frac{(a + m_0)\tan\alpha}{(c + M_0 + m_0)\tan\gamma} \text{ and } \frac{B'B}{D'D} = \frac{(a + m_1)\tan\alpha}{(c + M_0 + m_1)\tan\gamma}$$

For a comparison of the sizes of the two terms we can suppress the factor $\tan\alpha/\tan\gamma$ in each term and write the remaining part of $B'B/D'D$ in the form

$$\frac{(a + m_0) + (m_1 - m_0)}{(c + M_0 + m_0) + (m_1 - m_0)}$$

We see that this fraction which represents $B'B/D'D$ corresponds to the fraction that represents $A'A/C'C$ except that both numerator and denominator are enhanced by the same amount $(m_1 - m_0)$. If we add a constant amount to both numerator and denominator of a fraction the value of that fraction will approach closer to unity and since $\dfrac{a + m_0}{c + M_0 + m_0}$ is smaller than unity (because $a \leqq c$) the value of the fraction will increase, that means $B'B/D'D > A'A/C'C$.

It is now again permissible to multiply (36) by (38) because this will relatively reduce the left side of (36) and we get thus the requirement as

$[B_o+b_1-f(m_1)]\,F(m_o)$ has to be $>$ $[B_o+b_o-f(m_o)]F(m_1)$

or
$$\frac{B_o+b_1-f(m_1)}{F(m_1)} \text{ has to be } > \frac{B_o+b_o-f(m_o)}{F(m_o)} \quad \ldots (39)$$

or
$$\frac{B_o+n_{s1}}{F(m_1)} \text{ has to be } > \frac{B_o+n_{so}}{F(m_o)} \quad \ldots\ldots\ldots (40)$$

where n_{s1} and n_{so} are the segregate net incomes of group g for the prices p_1 and p_o, respectively.

These last two relations (39) and (40) are as close as we can get to basing a sufficient but not necessary condition on the segregate income and segregate capital of the group g. It is impossible to further simplify this relation by the elimination of B_o for the following reason. We have obviously
$$\frac{B_o}{F(m_1)} < \frac{B_o}{F(m_o)} \quad \ldots\ldots\ldots (41)$$

because $F(m_1) > F(m_o)$. If it were permissible to subtract (41) from (40) this would eliminate B_o but it would mean relatively increasing the left side of (40) with respect to the right side and that is just what is *not* permissible, as shown above.

We can therefore formulate as follows a sufficient but not necessary requirement for an increase of the rate of return by price splitting in group g: *The lowering of the price must increase a modification of the segregate rate of return of group g which is formed by adding the gross income of all other groups G to that of group g before the reduction of the segregate cost of group g and the division by the capital necessary for the group g.*

4. General Remarks.

39. Here again everything that has been said in Sections 18 and 19 of this Insert for the gross income can be proved for the group's rate of return of the increments and for the modification of the group's segregate rate of return, the former as necessary and sufficient requirement, the latter as sufficient requirement. This refers, for instance, to the maximum of the rate of return obtainable by price splitting downwards, etc., as per Section 31 of this Insert.

b. Shape of the Sales Curve.

40. We can get a clearer mental picture of the conditions under which a lowering of the price in group g can improve the rate of return from all groups if we apply to the rate of return (dividend) the graphical method which has been shown with reference to the net income in Sections 33-35 of this Insert. This is done in the following:

Call
$$\left.\begin{array}{l}\Delta m_o = m_1 - m_o \\ \Delta p_o = p_1 - p_o\end{array}\right\} \quad \ldots\ldots\ldots (42)$$

and
$$\left.\begin{array}{l}\Delta f(M_o+m_o) = f(M_o+m_1) - f(M_o+m_o) \\ \Delta F(M_o+m_o) = F(M_o+m_1) - F(M_o+m_o)\end{array}\right\} \quad \ldots (43)$$

Substituting this in relation (31), which is the condition for an increase of the rate of return by price splitting downwards in group g, we get

$[M_op_o + (m_o+\Delta m_o)(p_o+\Delta p_o) - f(M_o+m_o) - \Delta f(M_o+m_o)]\,[F(M_o+m_o)] - [(M_o+m_o)p_o - f(M_o+m_o)]\,[F(M_o+m_o)+\Delta F(M_o+m_o)] > 0$

or after proper reduction

$[m_o\Delta p_o + p_o\Delta m_o + \Delta m_o\Delta p_o - \Delta f(M_o+m_o)]\,F(M_o+m_o)] > [(M_o+m_o)p_o - f(M_o+m_o)]\,[\Delta F(M_o+m_o)]$ ....(44)

We call now in analogy to equation (26) of this Insert
$$t = \frac{\Delta F(M_o+m_o)}{\Delta m_o} \quad \ldots\ldots\ldots (45)$$

$t = \tan \tau$ (see left part of Fig. A) represents the same value with respect to the capital-curve k as r does with respect to the cost-curve s. We get by substituting (26) and (45) into (44):

$[m_o\Delta p_o + (p_o+\Delta p_o - r)\,\Delta m_o]\,F(M_o+m_o) > [(M_o+m_o)p_o - f(M_o+m_o)]\;t\Delta m_o$

Divide both sides by $F(M_o+m_o)$ and substitute v_o from (29)

$m_o\Delta p_o + (p_o+\Delta p_o - r)\Delta m_o > v_ot\Delta m_o$

$(p_o+\Delta p_o - r - v_ot)\,\Delta m_o > m_o(-\Delta p_o)$

or
$$\frac{\Delta m_o}{m_o} > \frac{-\Delta p_o}{p_o+\Delta p_o - r - v_ot}$$

Adding the denominator to the numerator on both sides and substituting m_1 for $(m_o+\Delta m_o)$ and p_1 for $(p_o+\Delta p_o)$ from (42) we get
$$\frac{m_1}{m_o} > \frac{p_o-(r+v_ot)}{p_1-(r+v_ot)}$$
$$m_1[p_1-(r+v_ot)] > m_o[p_o-(r+v_ot)] \quad \ldots\ldots (46)$$

This formula is entirely analogous to (27) of this Insert except that, instead of deducting the unit increment cost r of the service from the price, we have to deduct the sum of the unit increment cost plus the interest v_ot on the unit increment capital t, the interest being computed at the same rate of return v_o at which the original capital has been bearing interest before the price reduction.

41. Everything that has been said in Sections 33 to 35 of this Insert regarding the effect of price splitting downwards on the net income applies also to the rate of return, except that the distance of the vertical asymptote from the axis of ordinates (Fig. E) is not r (increment cost) but $r + v_ot$ (increment cost plus interest on the increment capital). This makes the condition for an increase of the rate of return stricter than that for the net income (compare Section 34 of this Insert).

4. Resumé.

42. A resumé in non-mathematical terms of those of the above laws which are concerned with the advantageousness of price splitting downwards is contained in Sections 81 to 86 of the main text. This resumé brings out a few points of view not touched upon in this Insert.

(*To be continued.*)

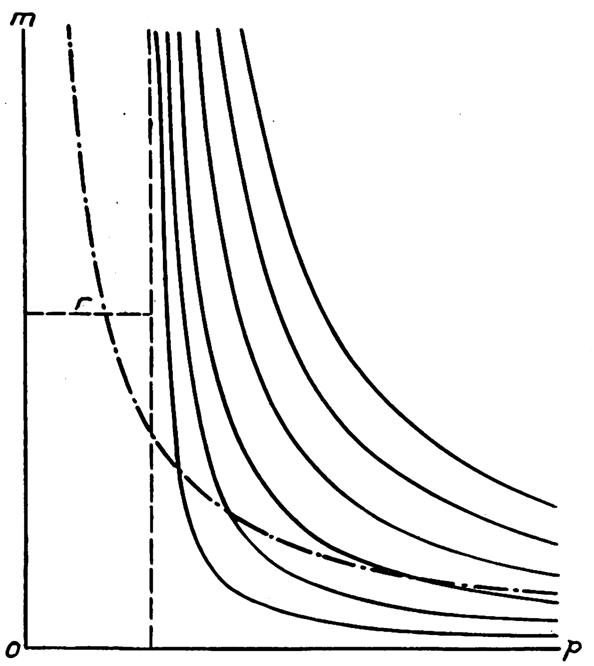


Fig. E.

SUMMER COURSE COMPLETED BY ENGINEERING TEACHERS.

Eleven college professors, representing institutions from Brooklyn to Tokyo, recently concluded the annual course for engineering teachers at the East Pittsburgh works of the Westinghouse Electric & Manufacturing Co. The course was of a month's duration and composed inspection trips throughout the plant, observation of work, and lectures by the various experts of the company. A feature introduced at the lectures was the use of motion pictures to portray the important work of electricity in modern andlarge-scale-engineering projects of many kinds.

The professors who were in attendance at the summer course are: M. P. Cleghorn, Iowa State College; W. D. Emerson, University of Maine; R. S Howell, Georgia Institute of Technology; L. J. Hodgins, Maryland State College; J. E. Lear, University of North Carolina; B. K. Northrop, Cornell University; S. Noda, Imperial University of Japan; C. W. Piper, Purdue University; J. W. Shuster, University of Wisconsin; A. F. Puchstein, Ohio State University, and E. B. Wood, Pratt Institute.

Details of Proposed 220-Kilovolt Transmission Line for California

Conditions to Be Met — Salient Features of 220-Kv. Line to Transmit 1,500,000 Kw. 1100 Miles — Paper Read Before A.I.E.E. Convention

By R. W. SORENSON, H. H. COX and G. E. ARMSTRONG

FUELS, particularly oil, must soon be used for isolated power only in places where electric power is not available, as in the propelling of air and ocean craft. In large power systems, especially in the West, the use must be limited to standby service, for peak loads, low water periods, and other emergencies.

Power Resources.

California has available ample hydroelectric power to supply the industrial and agricultural demand for many years.

Small developments aggregating 325,000 kw. have been completed and many others of this type are available. There are also four large projects as indicated in Table I which can be readily developed to a capacity of 1,500,000 kw. in the near future.

TABLE I—LARGE POWER RESOURCES.

	New developed and under construction. Kw.	Proposed developments 1926. Kw.	Reasonable future development (not ultimate capacity). Kw.
Pit River	None	200,000	500,000
Feather River	100,000	200,000	300,000
Big Creek	100,000	300,000	500,000
Colorado River	None	None	200,000
Total	200,000	700,000	1,500,000

Total 1926 hydroelectric power development including small projects, 1,025,000 kw.

The data for the tables given here of resources and loads, of the northern part of the state, is taken from the various reports which have been published, and no attempt has been made to verify them.

Load Demand.

The best available information indicates a demand in 1926 approximately as shown in Table II.

TABLE II.

		Kw.
1.	Sacramento Valley, northern portion	70,000
2.	Truckee River electrification	40,000
3.	Sacramento Valley, southern portion	125,000
4.	San Francisco Bay district	250,000
5.	Fresno district	90,000
6.	Bakersfield district, including Tehachapi electrification	125,000
7.	Los Angeles district	300,000
8.	Barstow and Needles district, including railroad electrification	40,000
	Making a total of	1,040,000

In order to carry this load, approximately 500,000 kw. additional in hydroelectric capacity will be required.

A demand for power such as is shown in Table II can be supplied most economically by power developed in large units. Large power units require transmission lines of the highest possible economic voltage.

It has been shown by Silver, June A. I. E. E. Proceedings, that for long transmission 220,000 volts is economical under conditions which require a much more expensive construction than has proven adequate for the 150,000-volt lines of the Southern California Edison Co.

California Transmission Bus.

On this basis a plan as shown on the map of Fig. 1 is proposed. In this plan the interconnection of all the California power companies has been assumed as an economic necessity for its best utilization. Interconnections of limited capacity are not entirely satisfactory because they fail just at the time they are needed most to transfer from one system to another large blocks of power.

The plan of the proposed scheme involves the construction of a two-circuit transmission system extending from Pit River to Los Angeles, a distance of 570 miles. Branch lines of like voltage connect the three other power projects and the San Francisco load center to this main line on which the other load centers are located. The main line thus becomes a high-tension bus extending nearly the entire length of the state, hence its name: California transmission bus.

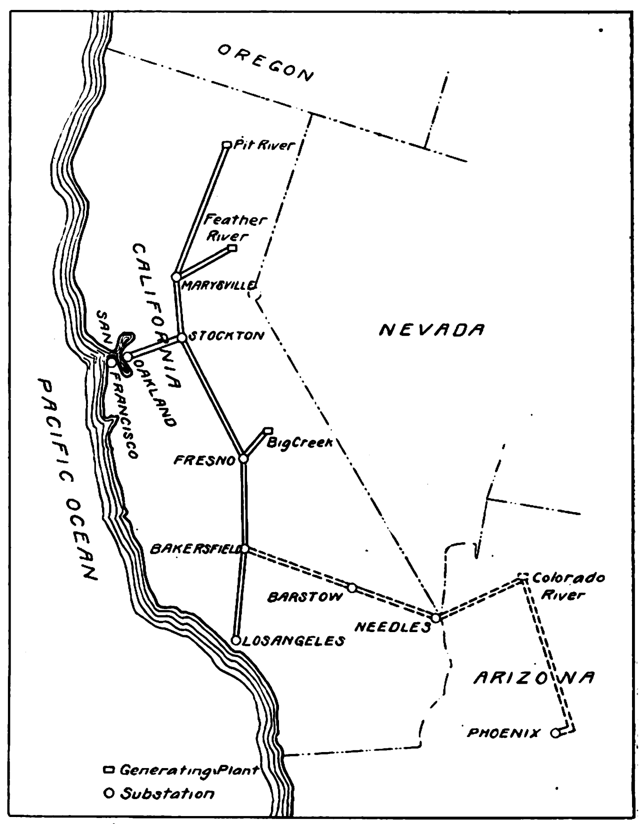


Fig. 1.—California 1100-Mile 220-Kv. Transmission Bus.

This arrangement makes possible unlimited interconnection and exchange between all the power companies of the state.

Substations have been located at Marysville, Stockton, San Francisco, Fresno, Bakersfield and Los

Angeles. These points are natural load centers and suitable points for connecting with the present power systems. On the Colorado River branch, the construction of which is dependent upon the electrification of the transcontinental railroads, substations would probably be located at Barstow and Needles. The substations divide the lines into sections of suitable length for practical operation, the longest section being 150 miles, as shown in Table III.

TABLE III.

	Miles.
Pit River to Marysville	150
Feather River to Marysville	60
Marysville to Stockton	90
Stockton to San Francisco	60
Stockton to Fresno	130
Big Creek to Fresno	40
Fresno to Bakersfield	100
Bakersfield to Los Angeles	100
Bakersfield to Barstow	110
Barstow to Needles	150
Needles to Colorado River	100
Colorado River to Phoenix	100
Pit River to San Francisco	300
Big Creek to Los Angeles	240
Big Creek to San Francisco	230

The Transmission Line.

The standard frequency, 60 cycles, has been assumed on the basis that the Southern California power systems operating at 50 cycles will ultimately find it advantageous to conform to the A. I. E. E. standard. In the natural growth of the load as shown in Table II, 70% of the 1926 load will be supplied by the 60-cycle systems. Interconnection of such large load centers or power sources through frequency changers, limits the exchange of power, is uneconomical, and increases tremendously the required operating vigilance.

The practicability of the high-voltage line has been well demonstrated by over five years of remarkably successful operation of the 150,000-volt lines of the Southern California Edison Co., which, during this period, have delivered from the Big Creek power houses over the 240-mile lines to the Los Angeles distribution systems, 1,200,000,000 kw-hr. at an average efficiency of 87.5% with a 45% load-factor. During this period there have been no interruptions for which the high voltage is responsible, and on the contrary, the system has been free from disturbance and interruption to a greater degree than the lower voltage lines in the same locality.

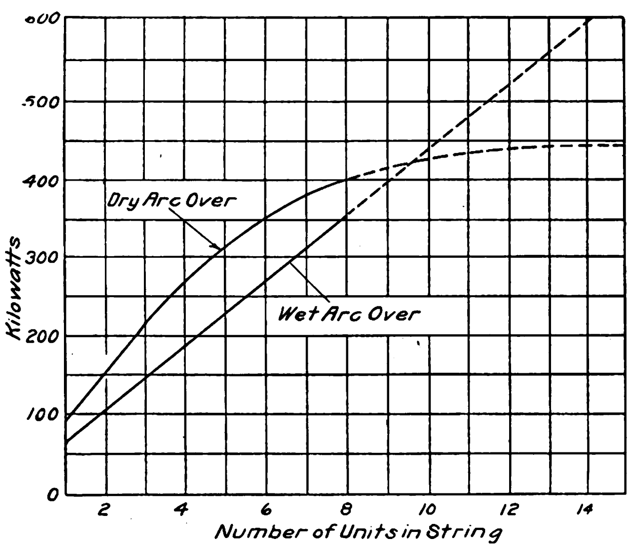


Fig. 2—Typical 60-Cycle Arc-Over Characteristics of Suspension Insulators.

The present Big Creek lines can be operated at 220,000 volts, 60 cycles, without material change, and this is proposed as a link of the transmission bus, and its operation under these conditions will be analyzed and applied to conditions of the proposed system.

Analysis of Big Creek System.

Corona.—As now operated at 150,000 volts and 50 cycles, the voltage is only 80% of the lowest critical voltage of any part of the line and there is no corona loss. At 220,000 volts, 60 cycles, corona loss occurs to some extent on the entire line but amounts to but 0.4% of the line capacity during fair weather. With storm conditions over the entire line, and with an assumed reduction of 20% in the critical voltage, the corona loss would be 8% of the line capacity. This loss is not sufficient to make the line inoperative and would occur too rarely to be an economic factor.

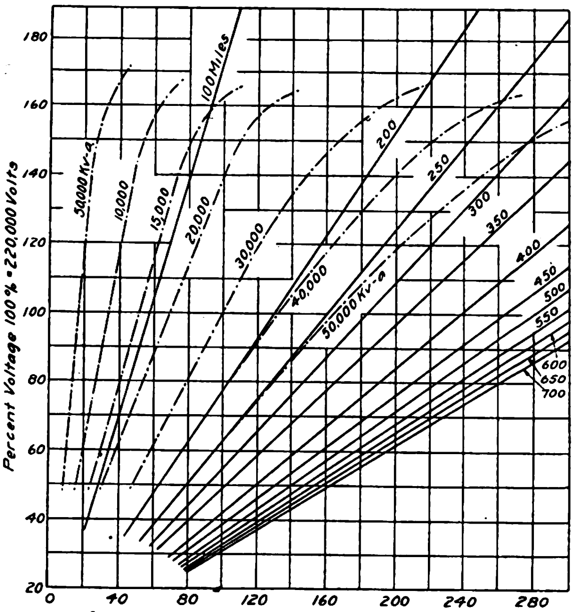


Fig. 3.—Generator and Line Characteristics: 60 Cycles, 220,000 Volts, Generators With Short Circuit Ratio 1.0.

Insulation.—The Big Creek 150,000-volt lines have nine units in each suspension string and two 11-unit strings in parallel on dead ends. During the five and one-half years of operation only two insulator string failures have occurred. Both of these were during normal conditions of operation without any apparent cause, other than that of being in a location where the insulators have been found to have a relatively high rate of deterioration.

The Big Creek line towers allow sufficient clearance to permit the lengthening of the nine unit suspension strings to eleven units, and to any desired number of units at dead ends. Table IV shows safety factors for insulator strings, wet and dry.

TABLE IV.

Safety Factors for Insulator Strings.

	Wet arc-over 9-unit string.	Wet arc-over 11-unit string.	Dry arc-over 9-unit string.	Dry arc-over 11-unit string.
(87 kv. to ground) 150 kv	4.3		4.8	
(127 kv. to ground) 220 kv		3.7	3.3	3.4

The Big Creek line operated at 220,000 volts is at the critical corona voltage and any disturbances resulting in a higher voltage will quickly expend their energy in producing corona loss, which will permit a smaller safety factor to be used.

Fig. 2, curves showing arc-over voltage as reproduced from Mr. Silver's paper, "Problems of 220-kv. Power Transmission," show no practical gain in dry arc-over voltage for strings of more than ten units and with these facts in view, it is proposed that for operating the Big Creek line at 220,000 volts, suspension strings have 11 units and dead end strings 12 units in series. Insulator testing crews have several times reported four and five defective units in a nine-unit suspension string, without any indication of trouble. The only apparent value of a longer string than that proposed would be a decreased probability of sufficient defective units in a string to cause breakdown. Developments of methods of grading insulator units and shielding insulator strings will, in all probability, materially change curves of Fig. 2.

Present-day methods of insulator testing and maintenance would probably have prevented the two failures which have occurred on the Big Creek lines as previously mentioned. These methods applied to the lines operating at 220,000 volts, and the use of the better types of insulators now available, will insure successful operation.

Charging Current.—Long high-voltage lines can not be operated without synchronous condensers at the receiving station to regulate the voltage, and as a consequence the charging current, even at the standard 60-cycle frequency, becomes a factor of no great importance as long as these synchronous condensers are connected to the line.

Without these condensers the line charging current must be furnished entirely by the generators, in which case the generators may become greatly overloaded and at the same time produce a very high voltage over which the operator has no control. To avoid this emergency a transmission line with its generators, transformers and synchronous condenser must be considered as a unit and as such should be securely coupled together electrically at all times. This has been proven practical in the case of the Big Creek system in which it is possible to start the 15,000-kv-a. condensers and bring them up to speed with the generators.

Line Capacity.—The Big Creek lines as operated at 150,000 volts with 30,000-kv-a. condenser capacity per line at the receiver end are each good for 57,500 kw. at 85% power factor, and will have under these conditions a line drop of 11%.

Operated at 220,000 volts, these lines should each have a capacity of 125,000 kw. with an equal line drop when provided with the proper condenser capacity, which is approximately 75% of the line capacity in kilowatts.

This is a fair indication of the conditions which will exist in the proposed system, the load centers of which are so distributed as to limit the actual average distance of transmission to about 200 miles. The economic gain in doubling the capacity of lines which cost approximately $6,000,000, the present cost of which would be at least 30% more, would more than offset the cost of all necessary changes, including the adoption of the standard frequency.

Mechanical.—The type of construction used on the Big Creek line has proven entirely adequate for California conditions. There have been only three mechanical failures, all of which occurred shortly after the line went into service and were all due to defective line hardware. In one case the failure was due to faulty design. This fault was entirely corrected by re-designing the cable clamp so as to grip the steel core independently of the aluminum conductor. The other two were due to individual defects in parts. There have been no tower failures and no tower maintenance whatever has been required. Approximately 20% of the Big Creek line is subject to ice and snow conditions, parts of it reaching altitudes of 5000 ft. Similar conditions exist over practically the entire proposed 220,000-volt system.

Operation.—The most interesting feature of the operation of the Big Creek system is its reliability, which has been equal to that of steam plants of similar capacity located near load centers. Flashovers have caused only momentary interruptions and have in no case resulted in damage such as to prevent immediate resumption of service. During the greater part of the time the power has been carried over a single line for a large part of the distance.

The operating history of the Big Creek system discloses no evidence of any trouble due to the high voltage of the system, and in addition has demonstrated that higher voltages may be used with equal or greater reliability. The Big Creek 17,500-kv-a. generators have operated at 60 cycles satisfactorily and delivered full output at this frequency.

High tension line switching and synchronizing has been carried on consistently throughout the operation of the Big Creek system without trouble and should be possible on the 220,000-volt system. During times of switching slight discharges, never followed by any energy current, occur on the arresters. Operating at corona voltage rather than at 80% of the critical

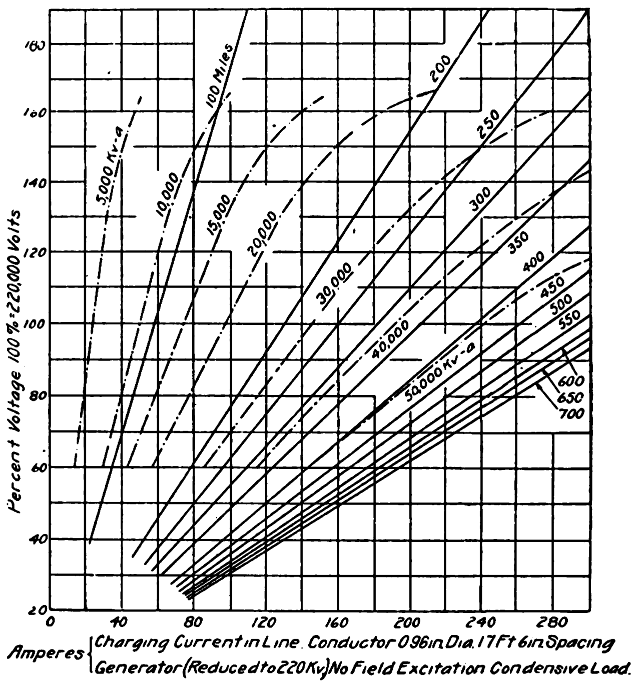


Fig. 4.—Generator and Line Characteristics: 60-Cycles, 220,000 Volts, Generators With Short Circuit Ratio 1.5.

voltage, it may be possible to absorb these disturbances without arresters.

Complete parallel operation of all lines must be adhered to in the proposed system. Satisfactory protective relay systems for dropping defective sections with little disturbance have been developed for present parallel transmission lines and there appear to be no obstacles to extending these to the higher voltages.

Generators.—Curves of Figs. 3 and 4 show generator and line characteristics for 60-cycle, 220,000-volt systems. The full lines are the charging currents in amperes for different lengths of line plotted against per cent normal voltage. The broken lines are generator characteristics of various sizes of generators when connected to condensive loads with no field excitation. The point of intersection of the generator curves with the line charging current curve for any particular length of line determines the voltage to which the generator will build up when connected to that length of line with no field excitation. Fig. 3 is for generators with a short circuit ratio of 1.0 while Fig. 4 is for those with a ratio of 1.5.

Fig. 3 shows that with 50,000 kv-a. of generating capacity connected to a line of 250 miles, the line can be charged without losing control of the voltage with generators of this design. By having synchronous condensers connected to the line at the receiving station generators of this capacity will bring up any length of line necessary to the successful operation of the proposed system. Those curves show that generators for such a system should be designed with the highest short circuit ratio that other conditions will permit, in order to reduce to a minimum the tendency to become self-exciting.

COMPARATIVE DATA.

	Big Creek lines at 150-kv.	220-kv. lines as proposed by Silver
Aluminum steel cable:		
Diameter, ins.	0.95	1.036
Circular mils	683.000	808,900
Weight per ft., lbs	0.75	0.94
Length of average span, ft	750	800
Weight of towers without footings, lbs.:		
Suspension	4,300	9,000 to 14,000
Anchor	6,450	24,000
Stringing tension at 80° F., lbs.:		
No ice allowance	4,740	
Ice allowance	3,130	
Maximum tension allowed, lbs	8,500	17,300
Insulator strings to carry load:		
Suspension	1	2 and 3
Anchor	2	6

Immediate Action Needed.

Such a system as proposed is needed immediately; all engineering fundamentals essential to a solution of its problems are well understood, and the Big Creek system can be used as a part of the project without material reconstruction.

To supply this need, arrangements should be made without delay for a complete working out of all details of the proposed system, as otherwise in the future it may be necessary to do a large amount of reconstruction to bring together individually designed systems, which is never a wholly satisfactory procedure.

AMERICAN SOCIETY FOR TESTING MATERIALS CHANGES HEADQUARTERS.

Moves Its Offices from University of Pennsylvania to the Engineers' Club of Philadelphia.

Announcement is made by the Executive Committee of the American Society for Testing Materials that the headquarters have been changed from the University of Pennsylvania to the Engineers' Club of Philadelphia, 1315-17 Spruce street. The headquarters of the society will be on the third floor where extensive alterations are now being made. Pending the completion of the alterations, the society will occupy temporarily the first floor of the building, beginning Sept. 13.

The change of headquarters of the society, which has been located at the University of Pennsylvania since its inception in 1902, is made necessary by its growing activities and membership. In continuing the office at Philadelphia the Executive Committee has not acted hastily, but have taken time to compare the advantages of the Philadelphia location with those that would exist in other parts of the country. The city of Philadelphia presented so many advantages that the Executive Committee decided upon that place as the most satisfactory location.

The new headquarters of the society are centrally located and convenient to the principal hotels and railway stations. The Engineers' Club is affiliated with the Philadelphia section of many of the national engineering and technical societies, and is the center of engineering activities in Philadelphia. An auditorum on the second floor of the bulding, with a seating capacity of 125, and a committee room in the society's headquarters will offer very satisfactory facilities for meetings of the committees of the society. Out of town members may use the society's headquarters as their mailing address while in Philadelphia, and facilities will be provided in the society's rooms for correspondence.

WASHINGTON COAST UTILITIES TAKE OVER PORT ANGELES PLANT.

The Washington Coast Utilities, Seattle, has taken over the active management of the hydroelectric plant and transmission lines of the Northwestern Power & Mfg. Co. of Port Angeles, Wash. The property comprises two 3000-kw. generators on the Elwha river, operating under a 100-ft. head, and 110 miles of transmission lines, carrying energy at 66,000 volts. Where this line crosses Hood's Canal, to Port Gamble, a new submarine cable 9000 ft. long is being laid, whereby the company's carrying capacity will be doubled. Transformers of 3000-kv-a. capacity are being installed on each side of the canal by which the voltage is to be stepped down to 15,000 for submarine transmission, and then stepped up to the regular line voltage. This cable is composed of three No. 4 and No. 2 copper conductors, insulated by 11/32-in. of 30% para rubber, and it is then jute covered and armored. The cable weighs 8 lbs. to the lineal foot.

F. D. Nims, who has the management of Washington Coast Utilities, states that power produced here is wholesaled to Port Angeles, Port Townsend, the Coast Defense forts, to Bremerton and the Navy Yard.

FIXTURE MANUFACTURERS WILL MEET IN DETROIT IN FEBRUARY.

The next convention of the National Council of Lighting Fixture Manufacturers will be held in Detroit, February, 1920. This was decided upon at the mid-summer convention held in Cleveland, Ohio, Aug. 5 and 6. Other important work done by the convention was the appointment of a committee for the registration of new designs and of another to perfect a uniform cost accounting system for the members of the council.

All the principal concerns in the country were represented at the convention. The first day's session was held in the club rooms of the Electric League, in the Statler Hotel, and the second day's meeting was at Nela Park, where all those in attendance were guests of the National Lamp Works.

Equipment for Handling Coal and Ashes in Power Plants—

Influence of Methods Upon Plant Operation—Classification of Mechanical Methods of Handling Coal and Ashes—Power Calculations

By ROBERT JUNE

Mechanical Engineer.

"WHAT do you consider the most important advantage of your mechanical coal handling equipment?" I asked the superintendent of a large manufacturing plant the other day.

His answer, given without a moment's hesitation, was, "Elimination of the large and uncertain labor element. We have twenty 500-hp. boilers, and at two seasons of the year we require every pound of steam we can get from those boilers, day and night for weeks at a time. Before we put in our automatic coal handling system we were at the mercy of the coal handlers and passers.

"Time and again the operations of our entire plant were embarrassed and the work in some departments even brought to a dead stop, by the lack of a full boiler-room crew. We always paid good wages, but the physical conditions under which the men had to work were not good, and on a number of occasions I have been called up at my home late at night, and had to dress and start out in my car on a search for laborers. This was no joke at any time, but when it happened on a cold rainy night, or with a blizzard for accompaniment, you can imagine the difficulties in getting men to leave their warm beds for any money or other considerations I might offer. On more than one occasion, when I arrived at the plant with my hastily gathered crew, they took one look at our coal piles drowned in rivers of rain and sleet, or else frozen solid with a forty mile gale whisking about them and the thermometer down around zero, and refused point-blank to touch a tool.

"Automatic coal handling has changed all that. Because of the assurance of continuity of operation, the mechanical system we now have in is worth several times what it cost us. We would employ it, if it cost us twice as much per ton delivered to the boilers as hand labor."

That is one point of view. Another man, manager of a good sized plant, said, "We installed mechanical coal handling because we were able to lay out a system which gave us three times as much storage capacity as we formerly had, and we felt it essential to insure an adequate supply of coal at all times."

A third point of view, typical of many, was expressed by a large operator. "We wanted to reduce handling costs as much as possible, and therefore substituted mechanical means for manual handling. Need I tell you that the savings effected have been very large, particularly during the past two years."

As a rule, one good reason is all a man wants as explanation for an action, hence the failure of the gentlemen quoted to mention the advantage which appealed to the others. Upon further questioning, however, each mentioned the additional points as supplementary benefits which they enjoyed.

There does not seem to be any doubt that nineteen plant managers out of twenty, who have installed mechanical handling are thoroughly satisfied that they made a move in the right direction. Some of them, it is true, would make radical changes in their equipment and layout if they had the work to do over. The point is that they *would* do it over again. Dissatisfaction, where it exists, is with the application of the system, not with the principle.

As Reginald Trautschold sums up the situation: "The coal scarcity has made adequate coal reserve of the utmost importance to every manufacturer and its high cost necessitates that the fuel be handled at the

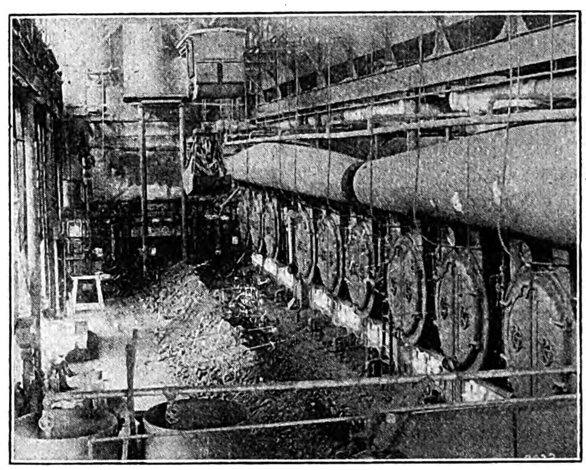


Fig. 1.—Grab Bucket Hoist Shown Inside Power House and Placed Where Coal Is Discharged for Firing Boilers.

plant as economically as possible. This condition has tended to make more general the mechanical handling of coal, for any plant, large or small, cannot now afford to pay the price of manual handling. The attention thus focused on the question of coal handling has resulted in radical changes in the methods employed to store the coal supply and to feed it to the boilers. So effective have been these changes that it would be little, if no exaggeration, to claim that today, a boiler plant for a large manufacturing power plant, exclusive of its steaming equipment, could be erected and furnished with adequate coal storage facilities and equipped with a complete system of conveyor mechanisms for handling coal from the point of receipt at the yards to the furnace grates, for less money than the most efficient layout of ante-bellum days. This, too, in spite of today's high cost of equipment, materials and labor."

Call in an Expert.

Having made out such a strong case in favor of the general handling of coal and ashes by mechanical means, a word of caution is here necessary. When you come to consider the proposition as applied to your own plant, get the advice of a consulting engineer or engineering firm specializing in power plant design.

I do not mean to be little the advice and suggestions of your own works construction engineer, or the engineering departments of the various conveyor manufacturers, or of the engineers and architects who handle your general building construction.

These men are all apt to have mighty good ideas, and they should by all means be consulted. But, as they are all general practitioners, whereas you need a specialist, the law of averages is decidedly against your getting as good results from their plans, as from those of a man who makes power plant design his chief business.

Various Methods Employed.

The delivery of coal to the boilers and the removal of ash are usually the largest items of boiler-room expense. The best method of handling coal and ash in any given plant is that which will do the work at the lowest final cost. I use the term "final cost" because insurance of continuity of operations and adequate coal storage are factors which do not appear in a cost-per-ton comparison of methods, but which may have considerable bearing on what may be termed "earning power" of the power plant. (That is, it may be cheaper in the end to install a particular type of handling system, which will cost more per ton to operate, but will insure avoidance of monetary losses caused by shut-downs, due to lack of coal or labor difficulties.)

That the problem of proper selection of method is not easy is indicated by the almost numberless combinations of means and devices to be found in American plants. The principal factors which influence the choice of system are size and location of plant and cost of fuel and labor. The various systems in use may be tabulated as follows:

1. Hand shovelling, without or with wheelbarrow or car.
2. Conveyors
   (a) Screw or spiral.
   (b) Flight or scraper.
   (c) Apron and buckets.
   (d) Overlapping dump buckets.
   (e) Continuous belt.
3. Hoists
   (a) Hoist and hand car.
   (b) Hoist and automatic cable car.
   (c) Hoist and trolley telpherage.
4. Cranes
   (a) Railroad with clam shell-bucket.
   (b) Transfer with clam shell-bucket.
5. Vacuum System.
6. Combinations of above. (So-called "silo" system, etc.)

Hand Shovelling.

What are the practical limits of economical hand shovelling? No general answer can be given to this question. Its solution depends upon individual circumstances. It is not necessarily a factor of the number of boilers to be served—for instance, the Burroughs Adding Machine Co., Detroit, finds it economical to employ mechanical coal handling for three boilers, whereas the Mulkey Salt Co., of the same city, serves eight large boilers in a thoroughly efficient manner by hand work. The consideration governing the choice of means in each of these cases was point and manner of delivery, and this is the principal factor to consider.

If coal is dumped from cars or dealers' delivery wagons into bins or on platforms directly in front of the boilers, it is certain that no cheaper means can be devised for hand-fired furnaces. In such instances, one man may handle the coal and ashes and attend to the water level of 200 hp. With hand shaking and dumping grates one man may take care of 300 hp.

In cases where coal cannot be stored in front of the boilers, but must be hauled by wheelbarrow, cart or hand lorry, the practical economic limit of haul is usually 100 ft. and the economic quantity limit 20 tons per day. While this is generally true, it is not a hard and fast rule. Thus Professor Gebhart states: "Hand-fired furnaces and manual handling of coal and ashes are usually associated with small plants of 500 hp. and under, but a number of large stations are operated in this way with apparent economy. A notable example is the steam power plant of the Wood Worsted Mill, Lawrence, Mass., in which 40 return tubular boilers are fired by hand. A tipcart with a capacity of one ton brings the coal a distance of 100 ft. to 200 ft. to the firing floor, and firemen shovel it onto the grate. Four men are stationed at the coal pile. One man drives two carts (one of which is being filled while the other is gone with its load), sixteen firemen attend to the furnaces, and two men dispose of the ashes.

A good man is capable of shovelling 40 to 50 tons of coal in eight hours when unloading a car, provided it is only necessary to shovel the coal overboard. An average figure for handling coal by barrow and shovel is not far from 2.5 to 3 ct. per ton per yard, up to 5 yd. Above 5 yd. about 0.2 ct. per ton should be added for each additional yard.

Obviously, the first step in any consideration of the installation of mechanical coal handling in a manually served plant is an accurate knowledge of the methods, results, and costs of the hand work which may be displaced. Study your conditions and costs thoroughly. Perhaps you can make comparatively inexpensive changes in your present methods, which will so improve matters that a mechanical installation will seem inadvisable. If no improvement in methods in use, which can be suggested, appears to meet the situation adequately, the time for an intensive study of mechanical systems is at hand.

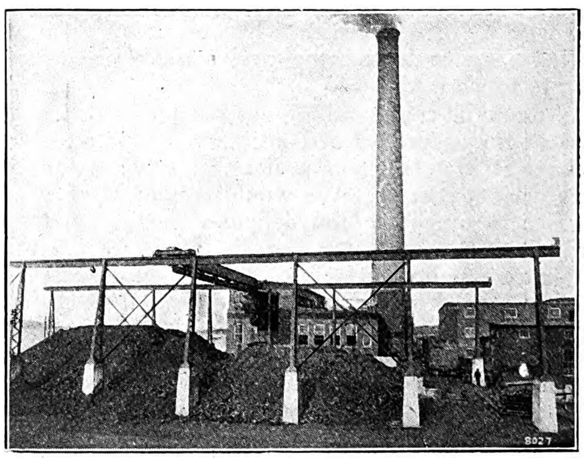


Fig. 2.—View of Installation Showing Transfer Crane Equipped with Grab Bucket Hoist. This Plan Provides for Future Extension.

Conveyors.

Conveyors, like airplanes, are classified as "tractors" or "pushers," depending upon whether they pull or push the load. A third class are genuine "carriers" since the moving parts bear the weight of the load. Of these general classes the "carriers" are usually more economical of operation and maintenance. Before deciding, however, the characteristics of the various types should be examined.

Screw Conveyors: These are of the "pusher" type, the apparatus consisting of a hollow shaft, attached to which is a continuous spiral of sheet metal.

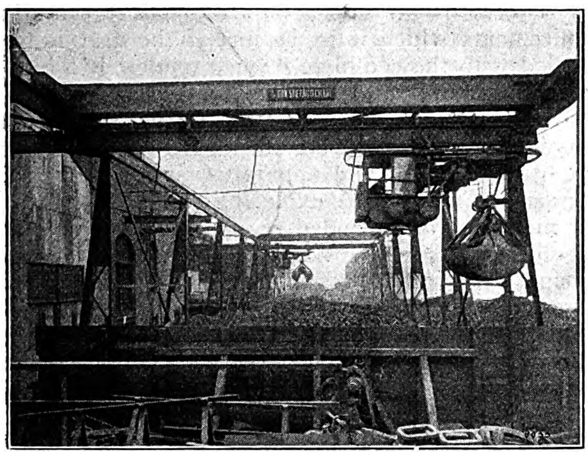


Fig. 3.—Shepard Transfer Cranes Equipped with Grab Bucket Hoists Over Coal Storage Pile. Coal Shown in Background in Barges and Transferred to Storage.

This shaft is revolved by means of a motor in a trough of slightly larger diameter than the spiral, with the result that as the operation proceeds, material placed in the trough is worked forward.

Screw conveyors may be used up to 100 ft., and in sections of limited length up to an angle of 15°. Speeds, capacities, and horsepower requirements are approximately as follows:

TABLE I.

SCREW CONVEYORS—HORIZONTAL RUNS.

Diameter of screw in in.	Highest r. p.m.	Capacity tons fine coal per hr.	Hp. required for each 10 ft. of length (coal).	Capacity cu. ft. ashes per hr.	Hp. required for each 10 ft. of length (ashes)
6	115	6	.5	125	.5
7	110	8	.6	175	.5
8	105	14	1.0	350	.5
9	100	17	1.2	425	.6
10	95	22	1.6	575	.8
12	90	35	2.5	950	1.3
14	85	48	3.5	1,200	1.8
16	80	80	5.6	2,000	2.8
18	75	110	7.7	2,700	3.8

Advantages of this type are low first cost, adaptability, and small space required for installation, but these may be offset by high cost of maintenance, due to rapid and excessive wear and tear, by losses caused by breakdowns at important periods, and by the high cost of power to operate.

Flight or Scraper Conveyors: These are of three types, plain, suspended flight, and roller flight. The trough is of any section, but is usually built with greater width than height. Flights which conform to the shape of the trough are attached to single or double strands of chains. Material is usually discharged through gates in the bottom of the trough.

The design of the plain scraper provides for the suspension of the flights from the chain, which drags them along the trough, pushing the load ahead. Crossbars, having wearing shoes at each end are provided with the suspended flight conveyor. The arrangement is such that the flights do not touch the trough at any time. Differing slightly from the suspended type, the roller flight substitutes rollers for the wearing shoes.

As between the three types of flight conveyors, service and maintenance considered, there is not a great deal to choose. The general layout of the plant will usually suggest the type to be employed. In this connection, we will illustrate one or two typical installations of flight and scraper conveyors in the continuation of this article next month.

The power required to operate flight conveyors may be closely approximated by the following empirical equation[1]:

$$Hp = \frac{AWLS}{1000} + \frac{BLT}{1000} + X$$

in which

Hp = the horsepower required at the conveyor drive shaft.
AB = constants as in Table II.
W = weight of conveyor per ft. of run, lb.
L = distance between centers of head and tail sprockets, ft.
S = speed of conveyor, ft. per min.
T = capacity of conveyor, tons (2000), per hr.
X = 1 for conveyors up to 100 ft. centers and 2 for longer conveyors.

If the conveyor is composed of portions on different inclines compute the power for each section separately and add 10% for each change in direction.

As a general proposition flight conveyors are low priced and offer an economical and efficient means of handling coal and ashes in small plants.

Next month we will discuss other types of conveying apparatus.

[1]C. K. Baldwin. The Robins Conveying Belt Co. quoted by Prof. Gebhart.

(To be continued.)

TABLE II.

VALUE OF CONSTANTS IN CHAIN CONVEYOR POWER FORMULAS.

Angle of Conveyor with Horizontal Deg.	A				B Scraper Apron and Open Open Top Conveyors			B V-Buckets and Pivot Buckets		
	Sliding blk.	3½-in. roller 3½-in. pin	6-in. roller 1⅛-in. pin	6-in. roller 1½-in. pin	Anthracite coal	Bituminous coal	Ashes	3½-in. roller ¾-in. pin	6-in. roller 1⅜-in. pin	6-in. roller 1½-in. pin
0	0.030	0.0043	0.0046	0.0050	0.33	0.60	0.54	0.070	0.70	0.083
6	0.030	0.0043	0.0046	0.0050	0.43	0.69	0.63	0.18	0.18	0.19
12	0.030	0.0045	0.0045	0.0049	0.54	0.79	0.73	0.28	0.28	0.29
18	0.029	0.0041	0.0044	0.0048	0.63	0.88	0.82	0.38	0.38	0.39
24	0.028	0.0039	0.0042	0.0046	0.72	0.95	0.90	0.48	0.48	0.49
30	0.026	0.0037	0.0040	0.0043	0.79	1.02	0.97	0.57	0.57	0.58
36	0.025	0.0035	0.0037	0.0040	0.80	1.08	1.03	0.66	0.66	0.66
42	0.023	0.0032	0.0034	0.0037	0.92	1.12	1.07	0.73	0.73	0.74
48	0.020	0.0029	0.0031	0.0033	0.97	1.13	1.11	0.60	0.60	0.81

HOUSING AND ELECTRICITY SUPPLY IN GREAT BRITAIN.

Organization and Useful Work of the British Electrical Development Association—Electric Service for Workmen's Dwellings.

By Our British Correspondent.

We have in preceding issues stated briefly the main purposes for which British electrical interests have set up the Electrical Development Association (Great Britain and Ireland). The director and secretary, J. W. Beauchamp, is now getting down seriously to tackling the big tasks which everybody recognizes lie before him and his committee if the nature and extent of operations are to be appropriate to the peculiar need and exceptional opportunity of the times or in proportion to the present dimensions and the potential greatness of the electrical industry.

The association only came into existence this year and the first task has been to incorporate itself in formal manner and to set about deriving regular revenue from the individual firms and supply authorities. A good deal of useful literature has already been prepared, however, and some of this is now circulating for the purpose of assisting in assuring for electricity a proper place in connection with schemes of national reconstruction. In the following notes, through the courtesy of Mr. Beauchamp, the writer is enabled to indicate in sufficient detail the constitution, aspirations, intentions and some of the performances down to date.

So far as the constitution of the Association Committee is concerned there is no room for question as to representative character. This being so, it might be supposed that there would be no doubt concerning the amplitude of the funds at its disposal, but that is still dependent on a number of unsettled circumstances and if the thing is to be well done, as American readers have full reason for knowing, most generous allocations are essential. The association has been formed "on a co-operative basis to carry out publicity and propaganda work on behalf of the electrical industry, and its committee of management is representatives of the three sections—supply, manufacturing and contracting—which jointly provide the service of electricity to the consumer." These three sections are not equally wealthy, of course, nor have they all the same freedom of action in the disposal of funds for purposes of this kind. What the organized manufacturers may be prepared to do may depend to some extent upon whether other sections standing to gain from publicity and efficient propaganda make reasonably generous contributions. Liberal and prompt financial assistance will enable the organization to secure a recognized position as:

(1) A medium for directing attention to the developments of the industry, their meaning and potentialities for public service.

(2) A means of creating interest in electrical methods and a better public understanding of the relationship existing between the work of the several branches of the industry, and the services rendered by inventors, manufacturers and the public and private enterprises which have brought the public supply of electricity to its present position of importance.

(3) A recognized source of information for press, public and government departments upon those problems which relate more particularly to the uses of electricity, the interests of the consumer, the economic basis of charges and costs, and the influence of controls and restrictions.

(4) A link between the industrial interests concerned and the user of electricity, assisting that coordination of the work of the designer of apparatus and the experience of the supply authority which is essential to secure the benefits of mass production and to avoid waste of effort arising from independent work carried on without full knowledge of the needs and objects of all sections of the industry and the requirements which must be met if the user is to be satisfied with the complete service rendered to him by the manufacturer and supplier.

It is recognized by the committee that urgent questions lie before the industry in regard to reducing the cost of installation and apparatus, simplifying mains and service work, and exploring the possibilities of new methods and amended regulations. These essential objects will follow more rapidly from intensified demand for electricity supply than from any other cause, and money spent on cultivating new and additional business should react to the advantage of the industry and of the consumers, by stimulating the development of new methods and designs and assisting in standardization of apparatus and production in bulk which is needed to meet the increase in cost of all classes of electrical work.

"The prosperity of all branches of the electrical industry must ultimately depend upon the general recognition of electricity supply as a public utility of the first order." At no period in the history of British electrical industry have circumstances been more propitious for a general and organized effort to instill in the public mind a proper appreciation of the part which electricity can take in helping to solve the urgent problems of national reconstruction, which stated generally, consist in: (1) Improving personal health and efficiency. (2) Increasing effective output of all classes of workers whilst reducing personal effort and hours of work. (3) Economizing the natural assets or wealth of the country.

In the association the following are acting in "co-operative organization" for "promoting the public service of electricity supply": Institution of Electrical Engineers; electricity supply undertakings (publicly and privately owned); manufacturers of electrical machinery and appliances; contractors for installation and maintenance of electrical apparatus. It is unnecessary to detail the names of the various associating organizations and their representatives on either the general or executive committees.

The "E. D. A.", as the body is known, did what it could to assist in connection with electrical illumination arrangements for the peace celebrations but the time was so short that it had no real opportunity for showing of what it would have been capable if there had been many months in which to prepare as in the case of coronation celebrations, if there had been no war-time consequences restricting the available supplies of suitable materials, and if there had not existed the disturbing menace of labor unionism unwilling to co-operate.

Housing and Electric Service.

A direction in which the association may be able to render service of a serious national kind with lasting good both for the public and for the electrical industry is in connection with the vital question of housing. On July 17 this year there were issued "Preliminary Notes on Housing Schemes and Electricity Supply," particularly housing schemes for working class colonies and garden cities. These notes indicated the points of view from which the subject required to be explored: mains and services, internal wiring, fittings, uses of electricity other than wiring, tariffs, general. This was followed a week or two later by a larger pamphlet: "Housing Construction and Electricity Supply No. 1." It was appropriately illustrated and so written as to inform public authorities, officials, architects and contractors interested in building schemes, and it invited all of these who were interested in the application of electricity supply and electrical apparatus to get into communication with the E. D. A. at Hampden House, Kingsway, London, WC., the central offices.

This pamphlet may be quoted from with profit:

On any important building scheme the supply of electricity, as of water, should be made available before work is commenced.

Artificial light and mechanical power are thus provided for the work of laying out roads, constructing sewers and buildings, hoisting, pumping, sawing, crushing, mixing, and driving workshop machines on the site. Hand labor can be superseded as far as possible; plant situated and driven in positions most suitable for the work in view, and moved from time to time, with resulting economy in labor and haulage of material—all the advantages of a modern factory become available to the contractors without waste of fuel and labor and the noise and dirt inseparable from the employment of portable steam engines. A safe and flexible means of lighting is also provided from the same source, enabling work to be carried on efficiently underground or in dark weather.

Where electricity can be obtained from artificial lighting no other system is likely to be adopted and its influence upon design should be taken advantage of. With this illuminant some reduction may be made in the height of rooms, and consequently in the cost of construction; lamps may be fixed close to the ceilings and advantage taken of their reflecting character to reduce expenditure upon shades and fittings; lighting and extinguishing from any convenient point or several points can be effected, and the provision of small-power lamps over fireplaces, sinks, and in other positions where household work is carried on makes for convenience, helps to reduce accidents and breakages, and simplifies the task of the architect by providing him with a means of lighting which entails no special provision for ventilation—can be used in close proximity to ceilings and walls, is available in any power from a pilot light upwards, can be operated from a distance, does not introduce the use of matches, flame or the risk and dirt inseparable from any other illuminant.

Most of the advantages and conveniences conferred by the use of electricity arise from the ease with which it can be converted into light, heat, or power, without any combustion taking place on the consumer's premises or in his appliances. The whole process of deriving energy from fuel is carried out at the generating works under centralized and economical conditions, concentrating in one place the handlings and burning of coal or other fuel and the removal of its residues. The consumer obtains the results of these operations in the form of electricity which he can convert into light, heat for warming and cooking, power for driving machinery, fans, and the small labor-saving appliances which are developing so freely under the present conditions of difficulty in regard to domestic help.

The expenditure to be incurred on working-class housing schemes is very large and it is worth while to consider the cost of any items of equipment as a percentage of the total cost per house erected. Looked at in this way it will be found that many of the modern appliances and working conveniences put forward in connection with these schemes, although perhaps costing considerable amounts, really increase the total expenditure involved by a very small proportion.

At the present time people will live in any house they can obtain, but when the pressure is relieved by the increase in accommodation they will undoubtedly pick and choose and take into consideration the various factors of position, amenity, and particularly of the internal fittings and the public service provided in so far as those fittings and service reduce their personal labor and add to their convenience.

The houses which are most completely equipped with modern devices for comfort and easy work will attract the better class of tenants who in their turn will help to conserve and maintain those houses and their equipment. There can be no doubt that in houses of the class under contemplation good internal equipment and arrangements will prove as the years go by to be a sound investment resulting in the house being always occupied by good class tenants, and a fair rent obtainable, even when the present rush for accommodation has been overcome.

Particulars have been received of a number of large schemes in which very comprehensive proposals for the use of electricity for lighting, heating and cooking are included. In some of these also provision is made for common supply of hot water from the power station. Such schemes will be watched with interest; however, where something less comprehensive is to be attempted there is still a very strong case for the use of electricity for cooking and heating.

In working-class houses and cottages, one frequently finds that the fireplaces in bedrooms are only used in the event of illness and at other times serve but for ventilation, if they are not closed up, as is often the case.

The necessary ventilation can be provided more scientifically and more cheaply when buildings are being constructed, and if in some of these small rooms the fireplaces and chimney breasts were omitted, the reduction in the cost of construction would be considerable; in some cases sufficient to pay for the whole of the electrical equipment. There appears to be a case for constructing houses of this class without fireplaces excepting in the main living and cooking rooms. These may be provided with stoves adapted to consume coal, coke and refuse, and combined with the hot-water system of the house. If such appliances are properly installed and associated with electric cooking ranges, whilst some of the other rooms are permanently fitted with electric heating, the remainder being equipped with plugs so that portable electric fires can be used in them, the result is a dwelling with many labor-saving features, one in which the cost of maintenance and decoration will be low, the occupants' furnishings will be preserved, and the housework reduced in every possible way.

It would appear that colonies fitted in this up-to-date manner must cost the community considerably less in regard to cartage of coal and ashes, the maintenance of roads, and the work of scavenging. The indirect benefits accruing from a less smoky atmosphere, and a happier and less harrassed community need not be explored here, but that they are real cannot be doubted.

The above information is rounded off with the following impressive statement printed in boldface type:

It is of importance at the present time that everyone interested should cast aside prejudice and the shackles of custom and seize the greatest opportunity that has ever been presented for improving the lot of the small householder, by giving him a dwelling in the design of which the architect and the engineer have collaborated to use the latest appliances available and to prepare and provide for the great development of electrical methods in the household which is now likely to be progressive and continuous.

It will be observed that the E. D. A. has gone into this subject of housing with a thoroughness which augurs well for efficient handling of the many public questions that may ultimately fall within the compass of its operations.

DRAINAGE DISTRICT BUYS ELECTRIC PUMPS.

Drainage District No. 7, Skagit county, Washington, has purchased the equipment for two pumping plants which will be installed in the vicinity of La Conner, within the next 60 days. One plant, to be placed near the district seawall, will consist of a 24-in. centrifugal pump of the capacity of 20,000 g.p.m., to be direct-connected to a 100-hp., 440-volt motor. The pump will discharge over the seawall against a maximum head of 20 ft. Both pump and motor are the Fairbanks, Morse & Co. manufacture.

The second plant will be installed a mile from the first one and will discharge into a creek channel. This installation will consist of a 10-in. centrifugal pump of 7500 g.p.m., and will be driven by a 40-hp., 440-volt motor, both of which are also Fairbanks-Morse make. Electric energy will be purchased from the central station company.

Editorial Comment

Selling the Electrical Idea

IN these rapidly moving days the trend of modern business is to seek results and get them quickly. Custom sets the style, even in business, so we are not easily reconciled to let things take the "natural course of events." Direct rather than indirect results are usually preferred.

At the same time efforts are being put forth to obtain direct results it is good policy to establish means for securing indirect benefit. This is especially true of electrical merchandising. Opening up avenues for future sales is good common-sense business.

Electrical manufacturers and central stations who sell appliances have, as a general rule, appreciated this fact, and the result has been they have endeavored to sell not only electrical devices but the idea of their use. For instance, they have tried to sell the idea of good lighting along with fixtures, the idea of the convenience of electric ranges with the ranges themselves.

This pioneer work done by manufacturers and central stations in building up for future sales has been in a large measure responsible for the impetus given in recent years to the sale of electricity and appliances. It has resulted in nation-wide acceptance of the electrical idea.

Dealers and contractors have contributed largely to the movement, but it is doubtful if they all appreciate their opportunities in this direction. Wiring contractors can suggest the use of appliances; it is not necessary to suggest additional outlets if they prove of real service to the customer. They can help sell the idea of good lighting in industrial plants, offices, etc. In like manner the dealer can pave the way for future business by advancing timely suggestions about the utility of the many electrical devices that prove a boon to people after they have been sold on the idea of their use.

Distillation of Coal

ELECTRICITY and gas are prone to play a part in which each is of vital interest to the other before many more years have passed. The only pity is that that day is not now. The reason that those days are not with us now is because as a nation we are opportunists, and we do what we find most immediately economical now, and allow that which is most economical in the ultimate to bide its time. And in this we are, like many a politician, selfish, shortsighted and unwise.

Much is said about our conquest of the mysteries of the German chemical industry; that our dyes and drugs are inferior to none and we can produce enough to satisfy the world; that we shall hereafter be independent of the saltpeter mines of Chili, that we can produce all the fertilizer we need and more for intensive horticulture. True, but are we doing these things? More or less, but not seriously, not wholeheartedly, not sufficiently. From the viewpoint of the chemist, from the viewpoint of those who would conserve the nation's coal; from the viewpoint of those who would safeguard the nation's health; from the esthetic, from the economic, from the philanthropic, and from the common-sense viewpoints, we should carbonize our coal wherever possible instead of wastting it as we do so largely at the present time by burning nearly all of it in the raw state.

The war has taught us the value of the by-products of our coal, of those thousand and more products that can be turned to usefulness or into smoke according to whether we use our coal as we should or as we ought not to do. It is almost appalling when we stop to realize that by burning our coal in our houses, in our factories and under our boilers in lumps as we do, we are sending millions of tons of soot and smoke into the atmosphere to injure health, corrode structures and ruin materials where we could, if we would, make the gases distilled from that same coal into drugs, antiseptics and disinfectants, into dyes, fertilizers, oils and many other products required by a world at peace, not to mention those products necessary for waging war.

One of the pressing problems of the day, a problem of readjustment, a problem of reconstruction, a problem of national security, is that of tackling this matter of wasting the most precious constituents of our coal needlessly where we might, if we would, obtain them and still obtain the heat that is being obtained at so costly a price now.

The beehive coke ovens are being replaced by ovens of the recuperative type where the by-products of distillation are recovered for their thousand and more uses. The rate at which this has gone on during the last five years is the one bright page in the history of our waste of coal since we awoke to the fact that coal not properly used is coal gone forever. But this should be only the beginning, a beginning that should act as an incentive for hastened action to utilize the latent by-products of coal that now go to contaminate the atmosphere, lower the efficiency of our boilers and interfere with obtaining the heat that is obtained so wastefully.

The day must surely come when our gas works will furnish the gas for heating and for steam making, and lump coal will be employed only where it is worthless for anything else—it will be pulverized then, probably. Our cities will be cleaner and healthier then. Our central stations and our gas works will be adjacent, as so many of them are today, but they will be working together instead of in opposition, having learned that each has its own part to play; that there is room for both, and that each needs and can advantageously co-operate with the other.

Of course, such things are not happening now. They are not happening not because it is not desirable that they happen, because it is urgent that they should from every aspect. They are not happening because it would be rather expensive for them to happen, not expensive in the ultimate but now. These things are not happening because it is cheaper for the investor to waste coal now than to save it. But it is to be hoped that public opinion, patriotic spirit and the acumen for which American industry is famed will assert themselves and make the distillation of coal a nation-wide movement.

A 220-Kilovolt Bus for California

CALIFORNIA, it seems, is once again to take the lead in adopting something new, something of vital economic value to the state and something that will have an important bearing upon the utilization of water power. It is proposed that a 220-kilovolt transmission line, which it is suggested should be called a "bus" because that is what it would virtually be, shall traverse the state of California. This bus would connect together a vast number of hydroelectric plants, some now existing and some in the potential stage, and likewise many different widely-scattered markets. By such an arrangement many water powers could be harnessed to advantage, whereas at present it would not be financially worth while to develop them. There are, of course, many other benefits from such a unified system.

One of the statements made by the advocates of this 220-kilovolt bus is that by 1926 the demand upon the unified system would approximate between 1,400,000 and 1,500,000 kilowatts, a demand that almost staggers one, even in these matter of fact days of big things. This is not all, for the bus proposed would extend about 1000 miles. Elsewhere in this issue will be found advanced the reasons for suggesting that a 220-kilovolt bus be made to traverse almost the entire length of California, and the result of weighted conclusions why such a proposal is feasible and appears desirable without loss of time.

Experience with operating the Big Creek line at 150 kilovolts has shown that reliability is equal to that of steam plants of similar capacity located near load centers; in fact the operating history of this line has disclosed no evidence of trouble from the high-voltage system. It has been quite general experience that increasing line voltage brings greater and greater immunity from lightning and similar difficulties so long as the proper precautions are taken in the initial design of the system. Judging from the suggestions of the engineers who look upon a 220-kilovolt bus as the solution of the power problem in California, it would appear that they do not expect any serious difficulty from the high voltage, *per se*, so long as the insulation adopted has a proper factor of safety, so long as generator and the synchronous condenser are treated as an integral unit, and insulator maintenance keeps pace with deterioration.

Another fact worth noting—a fact which, by the way, opens up a very interesting line of thought—is that when operating the Big Creek line at 220 kilovolts corona will occur, whereas the 150 kilovolts now employed is only about 80% of the critical voltage. Operating at the critical voltage will, of course, increase the line loss somewhat, 0.4% normally and during bad weather about 8%. However, this loss is so small as to hardly enter in comparison with the gains that accompany corona loss, which are that a lower factor of safety of insulators will suffice and disturbances due to switching and other causes tending to pile up potential will be more rapidly dissipated, thus reducing system troubles and dangers to apparatus. Incidentally, the corona may be found a valuable agent when it comes to protection.

Heavy investments in transmission lines necessitate high load-factors for maximum return upon the investment. And the higher the load-factor tends to be, the more numerous the markets linked up together. Higher load-factors and the greater the interconnections or linking up, the greater the opportunity for employing large generating units, which means economy in use of water and low unit cost of machines. The Big Creek 150-kilovolt line cost about $6,000,000 to construct. By an expenditure of about 30% more, required to change over to 220 kilovolts, it is claimed the capacity of this line could be doubled. Obviously such an expenditure is worth while.

Almost every feature of the proposed bus strikes one at first as very extraordinary, but the engineers that present the details of the scheme are not promoters nor visionary enthusiasts. They are farsighted enough to plan now for meeting economically the greatly increased power demands of the near future.

Dr. George Otis Smith, director, Geological Survey, pointed out in his masterly address on "Planning for Power" before the N. E. L. A. convention this spring the great desirability of conserving water power, reducing the waste and use of coal by interconnecting and connecting up power plants and power resources on the Atlantic Coast. In veiled words he advocated something similar to this development now advocated for California. We hope that California goes ahead rapidly toward the ambitious scheme proposed and that the states along the Atlantic will give California a strenuous race for the glory of being the first to place in service a 220-kilovolt bus.

Current Events

Electrical Convention Season at Its Height — Gatherings Being Held and Projected in All Parts of the Country

EDISON ILLUMINATING MEN ADVOCATE ENDING FREE LAMP RENEWALS.

Spirited Discussion of Lamp Renewals, Rates and Fuel Marks Annual Convention of Association of Edison Illuminating Companies.

The thirty-eighth annual convention of the Association of Edison Illuminating Companies was held at the Hotel Griswold, New London, Conn., on Sept. 16 to 18. About 300 members and guests were in attendance, the gathering being quite representative of the long established central-station companies, and including nearly all of the pioneers of the association excepting Samuel Insull, of Chicago, and Joseph B. McCall, of Philadelphia. The three-day gathering comprised a full program of papers and discussions together with an interesting entertainment program including several golf contests as the principal attraction.

In the technical sessions three questions received chief attention, these being retention of the long established policy of free lamp renewals, central-station rates, and the fuel situation. The first of these subjects formed the principal topic for the Tuesday sessions, the discussion being carried over to the evening and continued until after midnight. Both sides of the argument were presented very completely. It was estimated, however, that fully 75% of the association membership is in favor of dropping the policy of lamp renewals and charging full list price for lamps. All of the technical sessions were as usual held behind closed doors and the conclusions reached have at this writing not been disclosed by the publicity committee.

An interesting feature of the meeting was the successful demonstration of radio communication between a naval hydroplane some 2000 ft. in the air and a submerged submarine located at Fishers Island, six miles from the New London harbor. Radiotelephonic communication was freely kept up between plane and submarine and was listened to by a large party of delegates to the convention.

INDIANA CENTRAL-STATION MEN DISCUSS FACTORS OF INDUSTRY.

Papers Presented Bring Out Points on Merchandising, Service Connections, Rates, Public Policy and Finance.

The annual convention of the Indiana Electric Light Association was held at French Lick Springs, Ind., Sept. 11-12. Representatives from a majority of central stations in the state were present and enjoyed a comprehensive program which included papers on such topics as merchandising electric appliances, service extension policies, rates, public utility policies, and financing utilities.

Pres. Thomas A. Wynne, Indianapolis, opened the convention on Thursday with a review of the association's activities and of the progress made by the central stations during the past year. In spite of wartime and so-called reconstruction conditions the load on Indiana central stations is steadily increasing, making it difficult to keep pace with the calls for energy and for line extensions.

The first paper presented was on "Should Central Stations Sell Electrical Merchandise?" by Charles B. Hart, Ft. Wayne & Northern Indiana Traction Co. In view of the fact that central stations, as a general rule, were first to institute the sale of electrical appliances and since their dealings with customers made it natural that they should sell appliances, it was argued that they should remain in the field until dealers were able to adequately handle merchandising alone. The financing of a successful range campaign was also discussed in Mr. Hart's paper, by which it was shown that the proper co-operation between central stations and dealers produced results entirely satisfactory to all.

In his paper on "The Future of Electric Utility Extensions in Indiana," H. O. Garman, chief engineer of the Indiana Public Service Commission, told of the change in policy made by the commission with regard to regulation of extensions of public utility service in municipalities and also the formulation of standards of service. In the past the commission has assumed more or less jurisdiction in these matters, but in the future the municipalities must assume these responsibilities. Referring to service standards he quoted from the new act, which gives municipalities the right to determine by contract or ordinance the quality and character of service furnished, and to require such additions and extensions to the central station's physical plant as shall be reasonable and necessary in the interest of the public. Controversies will be referred to the commission. Mr. Garman quoted proposed rules regarding extensions. These are given in another section of this issue.

"Power-Factor Correction and Its Relation to Electric Power Rates" was the title of an interesting paper presented by R. H. Carlton, Schenectady, N. Y.

At the Friday session J. W. Robb, Wabash Valley Electric Co., Clinton, Ind., read a paper on "Minimum Rates for Residential Lighting," in which he outlined methods of dealing with this class of business.

In a paper on "Public Policy in Utility Operation," E. J. Condon, Indiana Utilities Co., Angola, Ind., brought out points in regard to lowering generating costs and linking transmission lines, educating men in the electrical industry, municipal ownership, public service commissions, rates, water power, and financing public utilities.

Alex R. Holliday, Indianapolis, presented the last paper on the program. It was on "Financing Utilities" and gave comparisons of the purchasing power of the dollar of 1914 and the "dollarette" of 1919 and concluding with statement that the only solution of the financial problems of the central station will be increased charges to the consumer if they are to receive service commensurate with their needs.

The following officers were elected: K. H. Palmer, Kokomo, president; F. J. Hass, Evansville, vice-president; Thomas Donahue, LaFayette, secretary-treasurer, the last named being re-elected. The following men compose the executive committee: Thomas W. Wynne, Indianapolis; P. J. Ohmer, Elkhart; S. W. Greenland, Fort Wayne; E. J. Condon, Angela; E. M. Walker, Terre Haute, and G. O. Murphy, Indianapolis. J. W. Robb, Clinton; Thomas F. English, Muncie, and M. D. Plain, Hammond, compose the advisory committee. It was decided to hold all future meetings at French Lick Springs.

MUNICIPAL ELECTRICIANS WILL HOLD CONVENTION IN CHICAGO.

Papers by Dr. Steinmetz and W. D'A. Ryan Are Features of Program to Be Given Sept. 23-26.

The twenty-fourth annual meeting of the International Association of Municipal Electricians will be held at the Auditorium Hotel, Chicago, Sept. 23-26. Indications are that there will be an unusually large attendance at this meeting, for which an ambitious program has been arranged. W. D. A. Ryan will present one of the leading papers, his subject being "History of Illumination," which will be illustrated with colored slides.

Tuesday Morning Session.—Address of welcome, Mayor William Hale Thompson; response, Dr. Charles P. Steinmetz; president's address, C. E. Diehl; report of executive committee, Jacob Grimm, chairman; report of secretary; report of treasurer; report of auditing committee; appointment of committee on exhibits; appointment of committee on resolutions; address, "Chicago's Novel Fire Alarm System," Wm. G. Keith, commissioner of gas and electricity, Chicago, Ill.; address, "Regulating Motion Picture Theaters," Washington Devereaux, chief of the electrical department, Philadelphia Fire Underwriters' Association, Philadelphia, Pa.

Tuesday Afternoon Session.—Address, "Protection for Fire Alarm and Police Signal Circuits," J. Tyler Green, city electrician, Toledo, Ohio; address, "Planning and Layout of Flashlight Signal System," G. F. C. Bauer, inspector, police signal system, Buffalo, N. Y.; address, "Reminiscences of a Superintendent of Fire Alarm Telegraph," Adam Bosch, Wyoming, N. J.; address, "Municipal Electricians in Relation to Electric Power Engineering," Dr. Charles P. Steinmetz, General Electric Co., Schenectady, N. Y.

Tuesday Evening.—Complimentary dinner and smoker, Auditorium Hotel.

Wednesday Morning Session.—Report of standardization committee, R. A. Smith, chairman; address, "High-Voltage Pole-Line Construction for City Streets," Dr. Morton G. Lloyd, Bureau of Standards, Washington, D. C.

Wednesday Afternoon.—Laboratory test of electrical fittings and fire test of wired glass windows at Underwriters Laboratories; fire pump test at Chicago municipal pier.

Thursday Morning Session.—Address, "History of Illumination," W. D'A. Ryan, director, illuminating engineering laboratory, General Electric Co., Schenectady, N. Y.; address, "Effective Lighting for Streets," Wm. G. Keith, commissioner of gas and electricity, Chicago, Ill; address, "Relation of Fuses to Knife Switches and Service Wires," E. Zynmeyer, Frank Adam Electric Co., St. Louis, Mo.

Thursday Afternoon.—Automobile trip over Chicago boulevards.

Thursday Evening.—Dinner, vaudeville and dance at the Congress Hotel.

Friday Morning Session.—Address, "Industrial Motion Pictures," F. A. Barron, engineer, wiring sales department, General Electric Co., Schenectady, N. Y.; address, subject to be selected, William F. Devlin, Belden Manufacturing Co., Chicago, Ill.; report of committee on exhibits; report of committee on resolutions; election of officers.

Friday Afternoon.—Visit to plant of Kellogg Switchboard & Supply Co.

PROGRAM OF APPROACHING CONVENTION, AMERICAN INSTITUTE OF MINING AND METALLURGICAL ENGINEERS.

Ambitious Program, Diversity of Subjects and Many Trips Are Salient Features.

The one-hundred and twentieth meeting of the American Institute of Mining and Metallurgical Engineers will take place in Chicago during Sept. 22 to 26, the headquarters for the convention being the Congress Hotel. There will be 17 sessions, dealing respectively with non-ferrous metallurgy, mine taxation, coal and gas, geology, milling, industrial organization, iron and steel, oil, sulphur in coal, mining and local resources, pyrometry with special reference to iron and steel metallurgy, symposium on pyrometry.

A number of interesting trips of inspection have been arranged for those members who are desirous of undertaking them. These include a visit to the famous steel plant at Gary, Ind., a tour of the zinc smelters, coal mines, cement works, permanganate works and varied industries around La Salle, Ill.; coal fields at Franklin and Macoupin; the lead refinery and oil refinery at East Chicago and Whiting; many and varied metallurgical plants in vicinity of Chicago and the tungsten and molybdenum reduction plants at North Chicago and Milwaukee, Wis.

The papers of most interest to electrical men are those by H. W. Young on "Outdoor Substations in Connection with Coal-Mining Installations"; "Engineering Features of Modern Large Coal Mines," by C. A. Herbert and C. M. Young; "Electric Resistance Furnace of Large Capacity for Zinc Ores," by Chas. H. Fulton; "Chemical and Electrochemical Problems Involved in New Cornelia Copper Company's Leaching Process," by H. S. MacKay; "Electrolytic Zinc," by C. A. Hansen; "Fundamentals of Pyrometry," by C. E. Mendenhall; "Thermoelectric Pyrometry," by Paul D. Foote; Potentiometers for Thermoelement Work," by W. P. White; "Self-Checking Galvanometer Pyrometer," by H. F. Porter; "Some Factors Affecting the Use of Base-Metal Thermocouples," by O. L. Kowalke; "Resistance Thermometry," by F. W. Robinson; "Resistance Thermometry for Industrial Use," by Chas. P. Frey; "High Temperature Control," by C. O. Fairchaild and Paul D. Foote; "Alloys Suitable for Thermocouples and Base-Metal Thermocouple Practice," by J. M. Lohr; "Temperatures of Incandescent Lamp Filaments," by B. E. Shackleford; "Applications of Pyrometry to Problems of Lamp Design and Performance," by I. H. Van Horn.

The Fifth National Exposition of Chemical Industries will be in progress at the Coliseum and First Regiment Armory during the same week, and the members of the American Institute of Mining and Metallurgical Engineers are welcomed. On Wednesday a joint session of the above institute and the Electrochemical Society is planned.

NORTHWEST ELECTRIC LIGHT AND POWER ASSOCIATION TO MEET.

Program of Twelfth Annual Convention, to Be Held at Seattle, Wash., Sept. 24-27.

The Northwest Electric Light and Power Association, which is a geographic section of the National Electric Light Association, will hold its twelfth annual convention at Seattle, Wash., on September 24, 25, 26 and 27, in the Press Club rooms. The program, in brief, is as follows:

Wednesday Morning, Sept. 24.—Welcoming address by the mayor of Seattle; address by H. J. Gille, president of the association; reports by various committees and other addresses.

Afternoon.—Report of technical committee by G. E. Quinan, chief engineer of Puget Sound Traction Light & Power Co., chairman; "Accounting," by J. S. Simpson, of Washington Water Power Co.

Evening.—Lecture, "Electricity Today," by Dr. W. H. Easton, of Westinghouse Electric & Manufacturing Co.

Thursday Morning, Sept. 25.—Round-table conference on "Improving Electrical Merchandising," L. A. Lewis, of Washington Water Power Co., chairman; discussion to be participated in by speakers, assigned by the chairman, from among central-station men, jobbers, contractors, and dealers.

Afternoon.—"Ranges and Water Heaters," a round-table conference, with A. C. McMicken, of Portland Railway, Light & Power Co., as chairman, and J. F. Roche, of Montana Power Co., as vice chairman; all phases of subject will be discussed by other speakers to be assigned.

Friday Morning, Sept. 26.—"Value of Public Utility War Experiences and Their Effect on the Future," a paper by W. H. McGrath, of Puget Sound Traction, Light & Power Co.

Afternoon.—"Industrial Electric Heating," a paper by C. A. Winder, of General Electric Co. This will include the electric furnace as a feature. It will be followed by the reports of nominating and other committees, and the election of officers.

The closing day will be devoted to a large extent to trips of inspection and entertainment.

PRESIDENT BALLARD OF THE N. E. L. A. STARTS ON TOUR OF COUNTRY.

Will Attend Conventions of New England and Southeastern Sections and Committee Meetings in New York and Chicago.

President R. H. Ballard of the National Electric Light Association left Los Angeles, Cal., Sept. 12, on a second eastern trip in the interests of the organization. He will attend a meeting of the Public Policy Committee, which has been called by Chairman John A. Britton, to be held at Association headquarters in New York on Oct. 1. Both Mr. Ballard and Mr. Britton will be in attendance at this meeting. A meeting of the Executive Committee is called for Oct. 2, when the Southern California city, at which the convention of 1920 will be held, will probably be selected, and a general meeting of the Committee on Geographic Sections which has been called by Chairman R. F. McClelland, and Vice-president Bump on Sept. 29. It is expected that this meeting will be in session for two days, as the general question of dividing the country into geographic sections will be taken up and thoroughly discussed, and some definite program will be agreed upon.

Taking advantage of President Ballard's presence in the East, a general meeting of the Membership Committee has been called by Chairman Walter Neumuller of New York, and of the Company Sections Committee by Chairman Frank A. Birch of Philadelphia. Both of these meetings will be held in New York.

Conferences have been arranged between President Ballard and Vice-president M. R. Bump, of New York, and Chairman I. R. Moultrop of Boston, on affairs relating to hydroelectric generation and technical sections; with Vice-president Walter H. Johnson, of Philadelphia, and Chairman John G. Learned and George B. Foster, of Chicago, on matters connected with the Commerical and Electric Vehicle Sections, and also with Vice-president Frank W. Smith, of New York, and Chairman R. W. Symes, of Detroit, concerning matters appertaining to the Accounting Section.

Mr. Ballard will stop in St. Louis on Sept. 15 for a discussion of Association affairs in that section of the country with company executives residing in that region.

The convention of the Southeastern Section will be held at Asheville, N. C., Sept. 17 to 19. President Ballard will address the convention on the morning of Sept. 18.

The convention of the New England Section will be held at New London, Conn., Sept. 22 to 24. President Ballard will speak at the banquet on the evening of Sept. 23.

At the close of the New England convention he will return to New York arriving there the evening of Sept. 24, and plans to be at headquarters for the following two weeks.

Returning to the Pacific Coast in October, President Ballard's tentative itinerary provides stops at Detroit, Chicago, Minneapolis, Butte, Seattle, Portland and San Francisco.

COMPREHENSIVE PROGRAM ARRANGED FOR INSPECTORS' CONVENTION.

Topics of Interest to All Branches of Electrical Industry to Be Discussed at Springfield, Mass.

A tentative program for the reconstruction convention of the National Association of Electrical Inspectors, which is to be held in Springfield, Mass., Oct. 13-14, has been completed. It consists of a number of forums which will be led by men who have made a life study of the subjects assigned to them.

These subjects will concern the personal accident and fire hazards and will be of interest, not alone to electrical inspectors, but to fire, life, accident, liability, casualty and compensation insurance interests, electrical transmission companies, electric light and power companies, electrical contractors and wiremen, water companies, fire departments and municipal officials. They will be for the single purpose of explaining how electrical hazards may be safeguarded and will be open for a liberal discussion on the part of all who may attend. For this reason a general invitation is extended to the allied electrical interests to be present and take part in the proceedings.

The Hotel Kimball will be the convention headquarters and those intending to be present are urged to make early reservation for hotel accommodations. The Chamber of Commerce of Springfield is sending out letters, accompanied with a list of the hotels in Springfield, together with the prevailing rates. The banquet committee announces that ladies will be permitted to attend the banquet, which will be held Monday evening, Oct. 13.

PROGRAM:

Opening of the Convention—Allen W. Hopkins, past president, Western New England section, National Association of Electrical Inspectors.

Address of Welcome—Hon. Arthur A. Adams, mayor of Springfield.

Response—Washington Devereux, president, National Association of Electrical Inspectors.

"The Beginnings of the National Electrical Code," F. Elliott Cabot, the first chairman of the electrical committee.

"Radio Developments and Their Relation to the Code," Clarence D. Tuske.

"Electrical Inspections and the Electrical Contractor," J. S. Smith, Philadelphia.

"Electrical Inspections and the Power Company," P. H. Bartlett, engineer of installations, Philadelphia Electric Co.

"Electrical Inspections and Their Value to the Fire Insurance Interests," Ralph Sweetland, secretary of the electrical committee.

"Some Code Problems of Present Interest," Dana Pierce, chairman of the electrical committee.

"Insulating Joints—What of Their Future?" Joseph C. Forsyth, Board of Underwriters, New York City.

"High-Potential Wiring," G. C. Lawler, electrical engineer, Associated Factory Mutual Fire Insurance Companies, Boston.

"The National Electrical Safety Code," M. G. Lloyd, Bureau of Standards.

"A Uniform Type and Design of Attachment Plugs—Is Such a Device Needed and Is It Possible to Achieve?" speaker to be announced.

"Polarization and Protective Grounding," W. J. Canada, Stone & Webster, Boston.

"Interbuilding Service Connections," H. S. Wynkoop, Bureau of Gas and Electricity, New York City.

"The Visual Marking of Fuses," Thomas H. Day, past president National Association of Electrical Inspectors, Hartford.

There will be a session, for members only, the morning of Oct. 15, the room and time to be announced during the convention. All other sessions will be open.

THIRD EDITION OF MANUFACTURERS' ACCOUNTING SYSTEM READY.

Standardized Accounting and Cost System Prepared by Joint Committee of Electrical Manufacturers Now Widely Used.

Joseph C. Belden, president of the Belden Manufacturing Co., Chicago, Ill., and a member of the Committee on Standardized Accounting and Cost System of the Electrical Manufacturers' Council, announces the following in reference to this system:

"The third edition of the Manual of Standardized Accounting and Cost System of Electrical Manufacturing Industries will be issued about October 1. In 1916 the Electrical Council appropriated funds for this work and appointed a committee consisting of executives and accountants from 15 representative manufacturing companies which has done a large amount of work since then.

"This manual is really a complete specification of modern factory accounting on practical lines. Standard rates of depreciation and methods of charging depreciation into costs are given. The correct manner of handling experimental and development charges is given and charges are segregated so that only proper overhead gets into costs. Comprehensive definitions are given throughout.

"The importance of correct accounting is today clearly recognized and 80 electrical manufacturers are now using this system. It can be used by any electrical manufacturer, regardless of size. Edwin M. Hurley, former chairman of the Federal Trade Commission, and Secretary Wilson of the Department of Commerce have both officially endorsed this system."

This manual is sold only to electrical manufacturers. Members of the Associated Manufacturers of Electrical Supplies, Electrical Manufacturers' Club and the Electric Power Club can obtain the manual of this system for $2.00, and other electrical manufacturers for $2.50. Address S. L. Whitestone, General Electric Co., Schenectady, N. Y.

INDIANA COMMISSION FORMULATES RULES FOR EXTENSIONS.

Rules Proposed to Eliminate Unreasonable Demands of Consumer and Unfair Refusal of Extensions by Utility Companies.

The Indiana Public Service Commission has formulated new rules which are proposed to govern extensions of electric utility service. These rules, which are given below, are to be used as guides for municipal governments in handling these matters and are indicative of the commission's attitude when ruling upon such when brought to it on appeal.

Jurisdiction.—The Indiana Public Service Commission law contains the following provisions:

> "Sec. 110. Every municipal council shall have power, . . . to require of any public utility by ordinance or otherwise such additions and extensions to its physical plant within said municipality as shall be reasonable and necessary in the interest of the public, and to designate the location and nature of all such additions and extensions, the time within which they must be completed and all conditions under which they must be constructed subject to review by the commission . . . ."

In the matter of extensions of facilities for utility service the commission exercises only appellate jurisdiction. In case of appeal to the commission it will be guided somewhat as outlined in the following paragraphs.

Free Extensions.—Each utility should upon written request for service by a prospective consumer or a group of prospective consumers located in the same neighborhood, make free of charge a line extension necessary to give service and furnish free service connection when the income for the first year from the prospective consumer or consumers is equal to one-third (1/3) to one-fifth (1/5) the direct cost of the extension.

Extension Above Free Limit.—If the line extension required in order to furnish service at any point within the corporate limits of any city or village, or for any adjacent suburb of a city or village, is greater than the free extension specified above, such an extension should be made under the following conditions: The utility may require a deposit of the cost of the extension above the free limit and should, in such a case, refund an amount equal to the cost of the free main extension for each additional consumer whose service shall be taken off of the entire extension within a period of ten years from the making of such an extension, but at no time shall the rebate made exceed the original deposit. If the extension is of such length and the prospective business which may be developed by it is so meager as to make it doubtful whether the business from the extension would ever pay a fair return on the investment, the facts may be reported to the commission for investigation and determination as to the reasonableness of such extension. If at any time the utility desires to purchase an extension to its distribution system which was built in whole or in part, by the consumer or consumers it may do so, subject to the approval of the commission, after making payment of a fair and reasonable price fixed by the commission, due allowance being made for depreciation and previous payments made thereon.

This rule shall not be construed as prohibiting any utility from making free extensions of lengths greater than above specified, or from providing a method of return of deposits for extensions more favorable to consumers, so long as no discrimination is practiced between consumers whose service requirements are similar.

Contract for Service.—Utilities should not be required to make line extensions as described in this rule unless those to be served by such extensions shall contract to use the service for at least two years.

Example: Assume a proposed $800 extension. Assume that we have 10 consumers who will pay at least $18 per year each, 10 times $18 times 5 equals $900 in five years. This extension will pay and should be made free of charge, because the estimated revenue in five years exceeds the direct cost of the extension. Now if we do not have ten consumers, but only two, namely, A and B, the revenue from them for five years at $18 each equals $180. It is seen that this proposed extension would not be remunerative and if constructed would become a burden to the older consumers, and if there were too many of such non-remunerative extensions then the rates would have to be raised. If, upon investigation, it appears that this extension would ultimately have to be made but that it would require a period of ten or twelve years to become remunerative then the utility should make the extension if the proposed consumers will deposit with the utility at 6% interest an amount equal to the direct cost of the extension less what the proposed now consumers are entitled to as a free extension.

Example: Assume the proposed extension will cost $800. A and B wish to be consumers at $18 per year each, $18 times 2 times 5 equals $180, or A and B are entitled to $180 of free extension, they therefore make a deposit of $800 minus $180 or $620 with the utility at 6% interest. Suppose at the end of the fifth year C comes on at $18 per year the utility will pay back to A and B each one-half of 5 times $18 or $45. The utility now has three consumers, A, B and C, and a deposit of $530. At the end of the sixth year assume D comes on as a consumer at $18 per year, he like the others is entitled to $90 of free extension, so the utility pays again to A and B each $45, so the utility now has 4 consumers, A, B, C and D, and a deposit of $440. At the end of the ninth year assume E and F come on at $18 each per year and they are also entitled to their free extension of 2 times 18 times 5 equals $180, so the utility takes on E and F and pays A and B each $90, reducing the deposit to $260, and has connected consumers A, B, C, D, E and F. At the end of the ten-year period assume that no additional consumers come on, then the utility pays to A and B what interest remains due to them at 6% and keeps the $260 remaining of the original $800 deposit as part compensation to the older consumers and the utility for making an extension which was not remunerative during its earlier days.

No extension should be made where it does not give promise of being compensatory some time.

CHICAGO ELECTRIC CLUB TO MEET AT ELKS CLUB.

At a meeting of the Board of Managers of the Electric Club of Chicago, held on Sept. 8 it was decided to change the place of the Club's weekly meetings from the Hotel Sherman to the Elk's Club where excellent facilities are available for such luncheons. The day of the regular meeting was also changed from Thursday to Tuesday.

The first meeting in the new location was held on Sept. 16 at which John J. Garrity, general superintendent of police of Chicago, was the principal speaker.

The Electric Club has been holding its meetings at the Sherman for a number of years.

ELECTRIC CLUB TO BE A FACTOR OF CHICAGO ELECTRICAL SHOW.

At the Chicago Electrical Show, to be held at the Coliseum, Oct. 11-25, the Electric Club of Chicago will have a booth at which it will maintain a general information bureau as well as a registry center for out-of-town guests. Those in attendance at the booth will be ready to offer whatever service they can to visitors who should register.

One day of the show is to be called "Electric Club Day" and the club's regular meeting will be held in the Coliseum on that day. Samuel Insull will be the speaker.

TO HOLD INTERNATIONAL TRADE CONFERENCE AT ATLANTIC CITY.

Plans have been made by the Chamber of Commerce of the United States for an international trade conference at Atlantic City, N. J., Sept. 30. Business representatives from all over the country and from England, France, Italy and Belgium will meet to discuss problems of domestic and foreign trade.

CHICAGO ELECTRICAL CONTRACTORS HAVE FIELD DAY.

The Electrical Contractors' Association of Chicago held a field day at the new Evanston Golf Club on Sept. 18. The day was largely devoted to golf, there being no meetings scheduled. Manufacturers and jobbers were also in attendance.

Commercial Practice

Home Economy Bureau — Contracts for Rural Lines—Irrigation Service in Montana — Other Commercial Events

LOUISVILLE UTILITY COMPANY INAUGURATES HOME ECONOMY DEPARTMENT.

Louisville Gas and Electric Co. Adopts Co-operative Bureau for Housewives.

A new field of activity has been opened for the commercial department of the Louisville Gas & Electric Co. with the inauguration of its Home Economy Bureau. The innovation will be in charge of Miss Grace Otter, under the supervision of Robert Montgomery, manager commercial department of the company, who is responsible for the idea. Miss Otter is a graduate of the Kentucky College at Danville, has completed a course in home economics and is a specialist in dietetics.

If a Louisville housewife finds herself confronted with a dinner or luncheon party and a lack of ideas as to menus, table arrangements, or the proper way to cook a dish she need only telephone Miss Otter who will immediately respond with suggestions and will lend every possible assistance to make the affair a success. If a housewife is puzzling over the problem of relative food values with an eye to economy or health, the home economy bureau will solve her problems upon request.

If it is a problem of house management, for example, the task of finding the simplest and easiest way of arranging the housework, or the quickest and best way to wash the clothes or iron them, or to clean house or cook a meal, Miss Otter and her bureau is available free of charge to assist the housewives of Louisville and vicinity.

The home economy bureau will be fitted up with all the important gas and electric labor saving appliances for demonstration purposes. A series of newspaper advertisements have been started in the Louisville daily papers concerning the "New Service." These include feature photographs of Miss Otter demonstrating various appliances, and invite requests for her new booklet "Economy Helps for the 20th Century Housewife, with Tested Recipes." The booklet contains besides menus and recipes, many suggestions for the saving of money, time and labor in household management.

CONTRACT SUITABLE FOR FARMERS' LINES.

Form of Agreement Used for Farmers' Co-operation in Construction of Farming Community Lighting and Power Lines.

The accompanying agreement for the use of farmers requiring the construction of a transmission line through their properties by the central station is one that has been drawn up and found very satisfactory by the Greenville Electric Light & Power Co., of Greenville, O. According to D. L. Gaskill, president of the company, this agreement answers the purpose admirably, since it covers the construction of the line, provides for the equitable payment by the various subscribers to the line and takes care of the disposal of the line after its construction.

AGREEMENT.

In relation to the construction and use of an electric transmission line extending from the 2300-volt distribution line of ....Company, on.................. in ...., on and along the following territory: (Describe route).

Whereas, a considerable number of residents along the above described road in .... Township, of .... County, desire to use electric current for supplying their homes and buildings,

And, whereas, it is necessary that such line be constructed at the expense of those who desire to use said current,

It Is Therefore Agreed to by the signers to this instrument that such line shall be constructed upon the following terms:

First. The construction of said line and the making of the contract therefor shall be placed in a committee of three of the shareholders hereto, and which committee shall have full power to make contracts and look after all things necessary in the construction of said line. Such committee shall keep account of all the cost of the construction of said line and shall collect the sums necessary from each of the shareholders hereto to pay the entire cost of construction of said line, the same to be divided equally among shareholders in proportion to the number of shares for which he subscribes and owns.

Second. The line to be constructed shall be capable of transmitting 2300-volt single-phase 60-cycle electric current and shall be of sufficient capacity to serve all of the residents along the highways in which such line is constructed. All material and the plans and specifications for said line and the construction of said line are to be subject to the approval of and to be of the kind specified by The.................. Company, of ....

Third. It is understood that this agreement shall cover only the 2300-volt transmission line and shall not cover transformers or service lines to serve any of the shareholders to this agreement, each shareholder being required to provide his own transformer and service line from the 2300-volt transmission line herein provided for. Payment for the construction of said 2300-volt transmission line to be made as follows: 50% of the estimated cost thereof to be paid to the committee before the work is undertaken; 25% to be paid to the committee when the poles are erected, and the balance upon the completion of the line.

Fourth. It is further understood and agreed that upon said line being completed a bill of sale for the entire line, not including transformers and service lines, but to include the 2300-volt transmission line only, is to be made out and turned over to The .... Company, the consideration for which transfer of ownership of said transmission line to be that The .... Company shall maintain said line and assume full ownership of the same from the time of its completion and the turning over to it of said lines and to be responsible in every way for the ownership of said line the same as if it had originally constructed it.

Fifth. The committee in charge of the construction of said line shall keep an accurate account of the entire cost of the same and such cost shall be apportioned equally among the shareholders hereto in proportion to their shares, and in case other shareholders are created within ten years from the date of the construction of said line along the highway then such users of current from said line shall pay to the committee in charge of the shareholders' interest an amount equal to the amount which was paid by each shareholder originally in the construction of said line and the committee in charge of such collection shall pro rate to the original shareholders equally in proportion to the shares held by them any amounts that may be received from subsequent users on said line.

Sixth. It is understood that the share spoken of in this agreement applies to the property rather than to the individual and that in case any shareholder shall dispose of his real estate such right to the use of said line shall pass with the real estate to the subsequent purchaser thereof. It is further understood and agreed that The .... Company, in addition to approving the plans and specifications and construction of said line, shall have the right to extend such line from its terminus to points further beyond without objection or hindrance from the respective shareholders to this agreement.

Seventh. It is understood that the signing of this agreement by us constitutes a contract between the signers and the balance of the shareholders to carry out the terms of this agreement and by signing of the same we do hereby bind ourselves, our heirs, administrators, and assigns.

In Witness Whereof, We have hereunto set our hands this .... day of ...., 19...

Name....................... No. Shares................
Name....................... No. Shares................
Name....................... No. Shares................

WIRING OLD HOUSES PROGRESSING STEADILY IN BOSTON.

Statistics to July Show Satisfactory Progress—Revenue Expected.

For the month of July 47 wiring agreements were signed for wiring of houses already built without wiring, by the Edison Electric Illuminating Co. of Boston. These contracts represent about 52 kw., with an estimated income of $1160. The total cost of this wiring amounted to $7881.25 or an average per house of $167.68.

For the four months ending July 31, 271 housewiring agreements were signed, totaling 263 kw. anu an estimated income of $6384. The total wiring expense was $37,716.16, or an average of $139.17 per house. The above contracts were distributed among 36 contractors, the highest contract amounting to $14,155.50, the second highest to $4274.81 and the third highest to $2700.90.

The above only serves to emphasize the very great help that utility campaigns are to the local contractors where the campaign is carried on. Moreover, the value of co-operation of utility and contractor-dealer should be obvious to all those who have at heart the mutual welfare of these two forces in the electrical industry.

IRRIGATION IN MONTANA IS PROVING A PAYING PROPOSITION.

Service from Mountain States Power Co. Brings Farmers Big Revenue.

The subject of irrigation is receiving more and more attention in Montana. Recently an investigation trip was made in the Flathead Valley district by business men, farmers and others interested in increased crop yields under the auspices of the Kalispell Farm Bureau. A number of farms which are irrigated by means of electric power furnished by the Mountain States Power Co. were visited. It was shown by W. B. McDonald, manager of the Kalispell Division of the company, who accompanied the party and explained the advantages of electric power pumping, that at an expense of approximately $14.00 per acre (depending on the size of the farm) an electric irrigating system could be installed which would insure an abundant supply of water at all times. It was further shown that the increased crops as a result of the irrigation more than pay for the installation in a single year. In one instance two crops of alfalfa brought the owner $100 per acre. An editorial in the Kalispell Interlake of August 25 is quoted:

"Today a well known local farmer who has been practicing irrigation for several years, makes the statement that returns from his alfalfa fields will this year yield returns equivalent to going rates of interest on land valued at $1000 per acre.

"This isn't a theory but a fact determined by actual practice. Of course, prices of hay are high this year and have been for the past three years, but even in an average season it has been found that the plant has paid a big return on the investment."

NORTH DAKOTA FARMER ENTHUSIAST FOR UTILITY SERVICE.

Threshing and Other Work All Done Electrically on Fargo Dairy Farm.

According to M. L. Hibbard, manager, Union Light, Heat & Power Co., Fargo, North Dakota, there are a number of farmers in his territory who have found central-station service so beneficial as to become enthusiastic regarding its convenience, its reliability and low cost when such factors as readiness to serve, availability, lack of trouble are taken into consideraion.

Mr. Hibbard cites one farmer in particular, A. D. Scott, who operates a large dairy farm about two miles southwest of Fargo. This farmer is doing his entire threshing with electric power, and for the past two years had done most of the work around the farm electrically. It is found that the work can be done for much less cost when done electrically than when done in any other way attempted.

GROWTH OF NEW BUSINESS IN MINNEAPOLIS UNPRECEDENTED.

Minneapolis New Business—Power Output Increased 23.8 Per Cent.

The new business being connected to the lines of the Minneapolis General Electric Co. in Minneapolis is increasing at an unprecedented rate, according to reports coming from Minneapolis. Total contracts for the week ended August 29 numbered 80, with 751 kw. of lighting and 268 hp. in motors—a total of 1269 hp. for the week. Connected load gain (net) included 204 customers with 161 kw. of lighting and 128 hp. in motors. Appliance sales 97. Electric energy output was 33.8% greater than for the same week of 1918. For the year to date it is 23.8% ahead of the same period last year.

WATER POWER IN JAPAN.

In common with other countries, Japan is making a survey of its available water power. The investigation, which began in 1918, will be completed in about five years, and all power sites where there is a prospect of more than 1000 hp. being developed will be fully investigated. It is stated that at present about 1,000,000 hp. are being developed, while 2,000,000 hp. are awaiting exploitation.

Operating Practice

Fighting Turbogenerator Fires—Coal Consumed by Banked Fires — Combustion of Coke — Economizer Maintenance

COMPANY OPINIONS AS TO MEDIA FOR FIGHTING TURBOGENERATOR FIRES.

Water Finds Greater Favor Than Steam Among Thirty Operating Companies.

A number of central-station companies have quite recently, during the last two years, adopted some definite method of fighting internal fires in their turbogenerators, recognizing that this form of apparatus does catch fire and once afire may be difficult to extinguish.

With the advent of permanently-installed fire extinguishing provisions in generators, the use of steam has received very serious consideration, and there is at the present time a wide difference in opinion as to the relative merits of water and steam for this purpose. Of the thirty companies reporting to the Committee on Electrical Apparatus, N. E. L. A., the use of water is definitely favored by nine and opposed by eight, and the use of steam favored by seven and opposed by twelve. Eighteen generators of four companies are now provided with permanent steam equipment, as against nine units of three companies with water equipment.

The principle of operating in using steam differs from that in using water primarily in that displacement of air in the generator by steam is very largely depended upon to smother the fire. It is extremely important, however, in using steam to shut off the supply of air to the generator as completely and promptly as possible, and some means of facilitating this operation should be provided. It would seem that the air damper could be placed more effectively in the outlet rather than the inlet wherever the design permitted. The wetting of the generator windings from condensed steam may also be helpful. In using water, the idea is to wet the windings as far as possible, this being aided by the natural ventilation of the machine.

EXPERIENCES OF COUNTIES GAS & ELECTRIC CO. WITH COAL CONSUMED BY BANKED FIRES.

Influence of Careful Operation Upon Coal Consumption Shown by Actual Tests.

The coal consumed by banked fires acts to materially increase the coal consumption of a plant compared to the coal consumption as based upon water evaporated at so many pounds of water per pound of coal. As a matter of fact, many of the smaller companies do not realize the large amount of coal used up for banking fires, nor do they appreciate the importance of making the bank carefully and the proper adjustment of dampers.

In a very interesting paper entitled, "Economical Boiler Room Operation for Medium Sized Plants," presented before the Pennsylvania Electric Association recently by Henry B. Bryans, chief engineer, Counties Gas & Electric Co., figures were presented to show what amount of coal was being consumed by banked fires at this company's generating station. The station uses underfeed stokers with high-grade, low-volatile bituminous coal. There are 13 boilers of a total capacity of 5420 b-hp.

Tests made by this company show that on a Sunday when fires may be banked for 24 hours, the coal consumed by a banked fire may reach as high as 18%. A careful investigation was made, and among others the following results covering the banking of two batteries of two 500-hp. boilers may be of interest. The period is for 24 hours:

Boiler numbers.	Fuel used— Total amount, lbs.	Rate per boiler hp. per hr. in lbs.	Rate per retort per hr. in lbs.
8 and 9	5,405	0.23	19.0
11 and 12	8,000	0.33	27.0

It will be seen that it took almost 50% more fuel to bank the second battery than it did the first. Investigation revealed the fact that dampers were not closed as tightly as indicated from outside of the breaching and also that one damper was badly warped and could never be closed. These conditions were corrected and the standby losses were materially decreased.

EXPERIENCES IN THE COMBUSTION OF COKE UNDER BOILERS.

Experiences Obtained in Germany During the War Indicate Measures Necessary for Success.

Experiences in the burning of coke under steam boilers are related in the February 28 issue of Zeitscrift fur Dampfkessel and Maschinenbetrieb. It is pointed out that a clear distinction should be made between gas coke and metallurgical coke. Gas coke is easier to ignite because its structure is less compact, while coke from coke ovens, especially that made from fat coals, has a compact structure and is less easy to ignite.

When burned, coke keeps the shape of the lump longer than coal; it is more difficult to bring to the state of incandescence, but it burns slower. It does not give off its heat with the same speed as coal and because of this, in order to burn the same weight of fuel one has to employ a larger grate and use a deeper fuel bed; its lower specific weight as compared with coal also makes a larger grate necessary.

The size of the lumps is essential. If the lumps are too large, the surface subject to the action of the air is too small to maintain the combustion process, if the draft remains within the same limits. The limits of size are indicated by the author as 0.4 in. minimum to 1.6 in. maximum.

The finer sizes, and in particular coke breeze, make too dense a layer and with ordinary draft do not provide for a sufficient contact with the air. Their combustion on a plain grate is possible only when special appliances are used.

As a rule, coke requires a stronger draft, which is due to the greater depth of the fuel bed and the resulting increased resistance to the flow of air.

It is a fact that with coke a boiler cannot deliver as much steam as with coal, especially when working at overload. This is due to the unsatisfactory flame formation resulting from the lack of volatile compounds (1 to 2% in coke as compared with 20 to 30% in coal) and also to the slower combustion of coke equivalent to a lower grate output. Hence, when it is impossible to increase the grate area, the output of steam is apt to fall off.

Likewise, lower superheater temperatures have to be taken into consideration, as the exhaust gases enter the superheater at a lower temperature than when coal is used, due partly to the shorter flame and partly to greater excess air.

Coke firing makes greater demands on the fireman. It is recommended that in large plants those boilers that carry normal load be fired with coke, while the peaks of the load curve should be taken care of by boilers equipped for mixed or straight coal firing.

As regards the grate construction it was obvious that the traveling grates designed for coal would not do for coke. This problem was solved by subjecting the coke to a generator action. This means that the coke was brought to a bright glow in a separate hopper and from there delivered on to the traveling grate in a layer from 1.31 to 1.64 ft. deep, depending on the size of the coke. On the grate the coke was burned in a gradually decreasing depth, Fig. 1. At the end of the grate slag pockets were provided to prevent too much air from entering.

That the combustion should go on properly, it is important to maintain a powerful fire in the lower part of the auxiliary hopper, the purpose of which is to ignite the mass of coke lying above it. A sort of hearth is employed, so arranged that it has nothing to do with the advance of the fuel toward the traveling grate proper, but lies more or less at rest on an inclined grate (Fig. 1) while the fuel for the traveling grate moves over it. In this connection, the angle of inclination of the inclined grate is of material importance. If it is placed at too sharp an angle, the purpose desired will not be achieved and the fuel layer from the contact hearth will be carried away by the

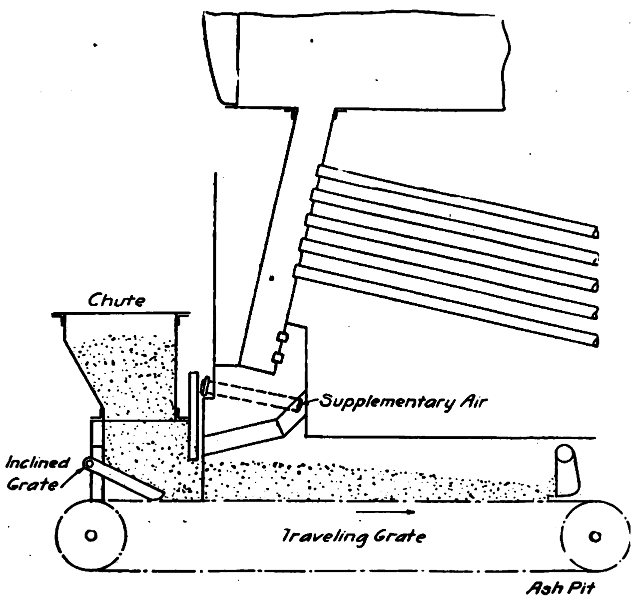


Fig. 1.—Traveling Grate With Producer Hopper.

moving mass of coke, which will result in stopping the ignition of the coal in the hopper and "freezing" the latter.

The producer action of the auxiliary hopper, to-

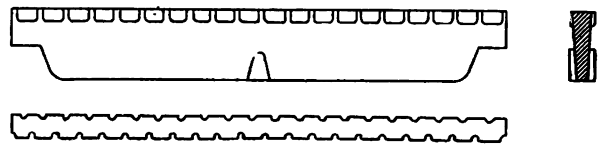


Fig. 2.—Nozzle Grate Bar.

gether with the deep layer of fuel, favor the production of carbon monoxide and hence flame formation, which is highly desirable. In order, however, to bring about a complete combustion of the gases, it is necessary to admit fresh air directly into the combustion space, which can be done most simply by means of tubes passing through the fire arch.

Experience shows that operating boilers at high ratings leads to an excessive wear of the grates, which cannot be maintained for any length of time. On the other hand, it appears that coal-firing installations can be converted to coke firing with comparative ease by the employment of steam jets as auxiliaries in the production of draft.

This arrangement can be used particularly well

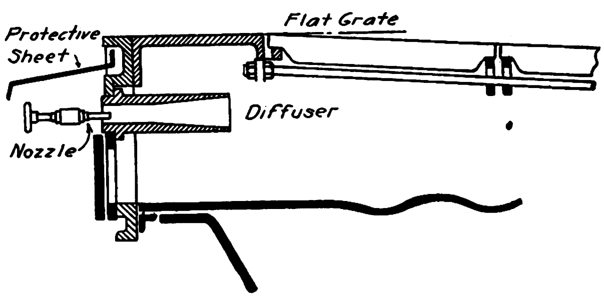


Fig. 3.—Steam-Nozzle Underfed Stoker.

with fine coke, when either a grate with small interspaces may be used or, preferably, a so-called nozzle grate bar designed substantially as shown in Fig. 2.

In order to raise the air pressure under the grate the steam nozzle is led into the smaller end of a conical tube, a diffuser, whereby the air compression is raised from 0.6 in. to 0.8 in. of water. As shown in Fig. 3, the air suction occurs through the ring-shaped space between the nozzle and the tube. In accordance with the size of the furnace, one or more nozzles may be used side by side.

MAINTENANCE COSTS OF ECONOMIZERS A SMALL MATTER.

The economizer is finding rapid application in power plants since the fuel economy accompanying its use comes to be better appreciated. Central stations where the load-factor is relatively high, where higher steam pressures are in vogue and high rates of steam making are employed and special attention is being given to economical use of station auxiliaries, especially are taking to the economizer.

In some quarters there seems to be a misapprehension as to the cost of economizer maintenance. As a matter of fact the cost of maintaining economizers has been found to be remarkably low. One of the largest economizer manufacturers recently made the statement that covering one million dollars' worth of economizers, the average cost of maintenance for the first ten years was believed to be well under one-half of one per cent of the investment.

Contractor-Dealer

Suggestions for Boosting the Sales of Electric Sewing Machines — Details of Window Displays Deserve Attention

SPEEDING UP SALES OF ELECTRIC SEWING MACHINE MOTORS.

Timely Suggestions for Stimulating Interest in Sewing Machines and Other Electrical Devices.

It will soon be the season for the annual fall sewing. It is a time of worry and confusion for the average housewife, and anything that will lighten her labors at this busy period is sure to receive careful consideration. This, then, is the time to push the electric sewing machine motor and by means of catchy ads, supplemented by window displays that show the advantages of this convenient device, work up a satisfactory business in them.

One of the cleverest of electric sewing machine ads noted recently was that of Eatons, the Big Store, of Toronto, Canada. At the top was the cut of a young woman operating a motor-driven machine and beneath it:

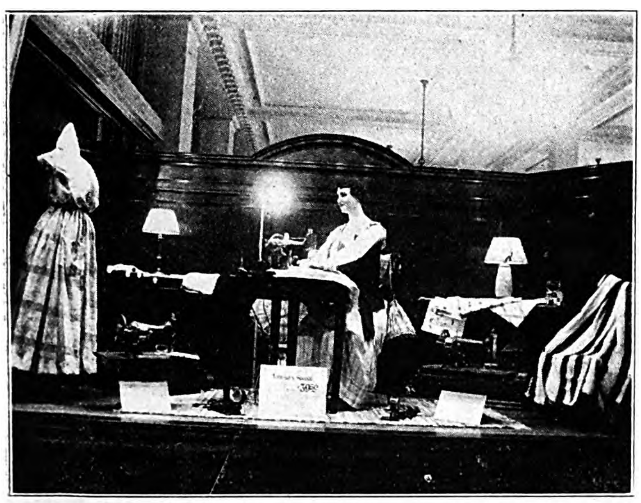
> IF THE MAN FROM MARS MET SISTER SUSIE
>
> the chances are he would demand to know why she carried such a monstrous hand bag. And casting about for an answer that would satisfy this most curious individual, it is as likely as not that dear Susie would reply that the ELECTRIC SEWING MACHINE at her sewing society turned out such a quantity of garments per hour that it was necessary to have a receptacle as big as Aunt Samanthy's carpet bag to take home an afternoon's work for the finishing stitches.
>
> Nor would she be wandering far from the truth in making such a statement, for truly it is the achievement of one of these popular portable ELECTRIC SEWING MACHINES which makes it so popular.

The window display that would complement this ad very effectively was arranged by the Philadelphia Electric Co. The window represented a sewing room, floored with a rag rug. In the background was a clothes chest covered with cretonne, and near it a chair over which was thrown a new fall frock. At one end of the room, on a dress form, was a creation in the process of making. Close by was a table on which lay a paper pattern, several partly cut out garments and an electric pressing iron, together with an electric lamp with adjustable shade. Down front center was an electric sewing machine operated by a young woman in smart frock, and at either side of her were other electrically operated machines. Several cards scattered through the window called attention to the advantage of the motor driven sewing machine: "The cost of electric current for operating this machine continuously for an hour is one-half cent," "This electric sewing machine is guaranteed for five years." Such a display would be easy to arrange, borrowing the dresses from any convenient dry-goods store.

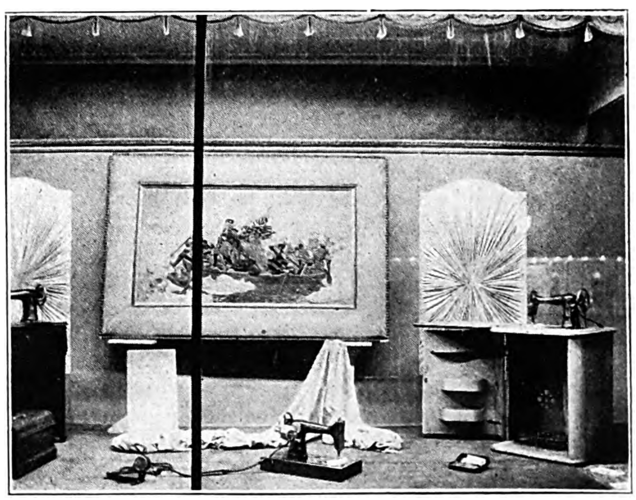
At this season of the year the housewives are thinking not only of fall sewing but fall house cleaning, and a campaign showing the value of electric aids is therefore decidedly timely. Barker Bros., Los Angeles, Cal., conducted a very successful one. In order to arouse interest in the start, they placed a small ad in the paper:

> HOW MANY TIMES CAN YOU WRITE OUR NAME ON A CARD?
>
> A series of prizes will be given to the persons writing it the greatest number of times, in a legible manner, without writing over or across other letters. Come in and ask us about it.

This announcement piqued the curiosity and scores came to the store to learn about the offer. Each inquirer was handed a card with the name of the firm printed at the top, the remainder of the space being left free for the contestant to exercise his skill. On the opposite side was printed: "Write the names of three electrical household appliances which you do not possess." The rules of the contest were simple. All writing must be done with ink; all words must be



Clever Sewing Room Display Used to Show the Utility of Electrically Operated Household Devices.



Picture Made on Motor-Driven Sewing Machines Attracts Attention to Display.

legible: all cards must bear the name and address of the writer, together with the names of three electric household conveniences. These addresses were tabulated and the writers circularized with pamphlets describing the advantages of the electric articles mentioned on their cards. The prizes were electric household necessities, which were displayed in the show window.

This contest was followed by a series of concise pointed newspaper advertisements, adorned with cuts of a vacuum cleaner, a sewing machine motor and an electric washing machine operated by young matrons in morning dresses. Their forceful ad follows:

LET MODERN ELECTRIC EQUIPMENTS MAKE MORE SPARE HOURS FOR YOU.

This, of all times and seasons, is ideal for the outfitting of your home with modern household machinerey that will make life easier and happier, save time and strength, conserve food and fuel, facilitate your spring house cleaning and help you to work longer and more zestfully.

COME TO BARKERS.

Let us show you how quickly, easily and pleasantly you can do all your housework with better equipment—electrical, of course.

THESE ARE THE IMPORTANT TIME-SAVING NECESSITIES.

Electric Sewing Machine Motors.
Electric Vacuum Cleaners.
Electric Washing Machines.

The window was fitted up as a sewing room, in which sat a woman busily engaged making a child's dress, using an electric motor to operate the machine. A card suggested, "One can run this sewing machine all afternoon without fatigue, as it requires head power instead of foot power to operate it."

Another excellent display of the use of the motor-driven sewing machine was arranged by the W. C. Munn Co., Houston, Texas. This showed a room with buff background and gilded fixture molding all around the wall. Set in the wall at either side were two panels of shirred silk of steel gray. At one end was a long French window with similar shirred panels. In the center background set on two gilded supports was a huge picture of brocade bound in gold, containing a picturization of "Washington Crossing the Delaware." A card advised, "Picture done entirely in colored silk thread and make on a regular sewing machine." At either side were sewing machines and cabinets and down in front a sewing machine with motor attachment.

Perhaps the most striking of any of the recent displays, however, was that of the Brush Power Co., Galveston, Texas. The two glass sides of the window had painted on them a succession of red interrogation points a foot high. A sign suspended above the heads of spectators inquired, "Which way do you sew?" First was shown an old-fashioned sewing machine run by foot power, with a card, "The Old Way—Pedal, pedal, on the treadle. Tires you out and makes sewing a drudgery. The machine is heavy, takes up valuable room and is always in the way." By its side was shown a portable electric motor sewing machine and case, likewise with a card, "Portable sewing machine, no bigger or bulkier than a typewriter. Easy to operate. Out of the way when you are not using it—unobtrusive when you are." Other catchy cards were scattered through the window and shown inside the store, where a demonstration was given twice daily of the beautiful, easy and rapid work done on this modern sewing machine. The cards stated, "The modern way." "With an Electric Sewing Machine you can sew in any room of the house, upstairs or down." "It requires no effort—makes sewing a real pleasure." "Just attach the cord of the motor to your electric light socket and you are ready to work." Attention was called to a speed device by a red cardboard arrow pointing to it on which was printed in black letters, "This is the speed treadle—You work it with your foot—Just press a little harder when you wish to sew faster." Outside the window was a little rack containing folders describing the new machines in detail and a card above the holder gave the invitation to "Take One."

WHY WINDOW DISPLAYS SHOULD BE COMPLETE.

The Skeptic Is Always Ready to Grasp Any Opening and Spoil Effect.

In every crowd of people there is always one loud-mouthed skeptic who is sure to voice his sarcastic opinions, whether they are correct or not, in an endeavor to create a doubt in the minds of the rest of those present. On the other hand the average person who is ready to accept things at their face value until he is convinced otherwise is very slow to voice his opinions or take up sides with the skeptic unless he is absolutely sure of his convictions and has some personal interest at stake.

This condition especially applies to window displays and advertising. Here the skeptic holds forth in all his glory confident that no one will contradict him. The dealer is busy inside the store or the advertiser miles away and the skeptic's arguments stand alone. Moreover the impression created by his insidious remarks are very difficult to overcome unless corrected on the spot.

The influence of such persons was demonstrated recently at a display of gas appliances. The display was both unique and attractive and drew quite a crowd before the window at all times. It was arranged so that the apparatus shown inside the windows could be operated by anyone in the crowd from the outside and the actual operation of the device could be watched. At this particular time the traffic along the street was very light, but still a crowd of about 10 people were in front of the window, all interested in the device being displayed.

Then the skeptic came. He operated the device once, watched the responding action of the apparatus on the inside and then exclaimed in a voice loud enough to be heard by all, "It looks all right, but it would eat you out of house and home to use it. I know, you can't show me." and walked scornfully away. Immediately all but two in the crowd assumed the same expression and left the display.

One of the two that remained turned to the other and said, "That fellow's all wrong. I own one and the service cost is nothing when compared with the convenience afforded, but, I'm not selling them." The other laughed, he was interested but not a prospect. However, it is reasonable to assume that some of the others were prospects who would require some real salesmanship and a great deal of trouble to convince them now that the skeptic was wrong.

Had the window decorator inserted a small card in the window stating the approximate cost of operation there would have been no argument and probably some sales would have been made that were otherwise lost.

New Appliances

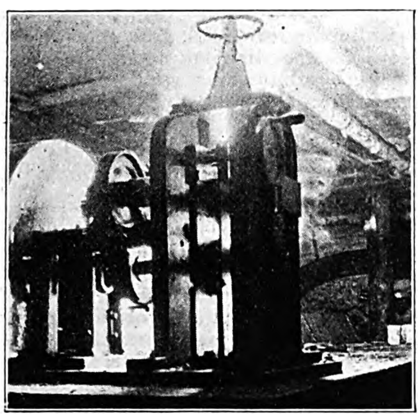
Machine for Stripping Scrap Power and Light Cables Increases Salvage Value Greatly — Electric Stucco Machine

Cable-Stripping Machine Lowers Labor Cost.

The cable-stripping machine illustrated herewith is used by one of the largest central-station companies in the Middle West in reducing its junk cable to marketable form. Prior to its design and use this work had been done by hand labor which was slow and rapidly becoming too expensive, due to increased labor costs. The necessity for a more efficient method of doing this work resulted in the planning and construction of a machine for the particular purposes of cable stripping.

Large companies have found that the "pull in" and "pull out" method, with respect to their transmission and distribution cables, is best both from an economic as well as an operating standpoint. Naturally a large amount of wire and cable finds its way to the scrap pile, which should be turned into money with very little delay.

The disposition of the lead and copper at the best market values then becomes a matter of consideration. It has long been known that in selling mixed lots of copper and lead, the return is apt to be disappointing unless the exact amount of each is known. This can rarely be stated to the satisfaction of both buyer and seller when the lead, copper and insulation are combined in the cable. At the same time advantage cannot be taken of market conditions which at any particular time might be low for lead but high for copper and vice versa. Unless the cable can be separated into its several parts the selling must be done at a loss.



Cable-Stripping Machine.

Fortunately this new machine separates the parts into almost the pure form which allows them to be disposed of advantageously. It cuts the lead and insulation from the copper conductor, by means of two circular knives or cutters, the distance between their centers being adjustable. They are set to cut two slits in the cable, on opposite sides of it as it passes between the cutters. These knives are keyed to the shaft, can be taken off, sharpened or renewed whenever necessary. The distance between centers of the knives is adjusted by means of the hand wheel on top of the machine, and it is necessary to adjust this according to size of the cable which is being stripped. On both sides of each cutter separate cylinders are mounted which support short prongs for the purpose of digging into the cable sufficiently to pull it through the machine. Single-conductor cables are disposed of by passing through once only, but with three-conductor cables the first cut takes off only the lead and the outer belt of insulation. Each insulated conductor is then passed through to separate the copper from the insulation. It has been found that lengths of cable not over 10 ft. can be handled easiest, and where necessary it is the work of a few seconds to cut a cable into 10-ft. lengths. The lead and copper can then be stacked up separately ready for sale.

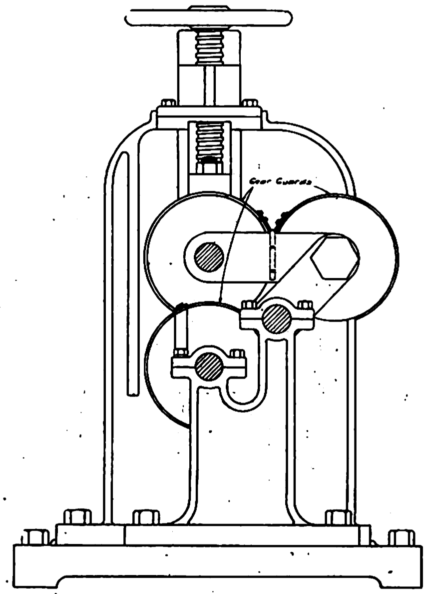
Cambric insulation, or oil-impregnated paper is used in the heating furnace and makes excellent fuel.

No cable smaller than No. 0 is put through the machine, because of the extremely small saving in the case of smaller cables makes it appear doubtful if there is any economy at all in stripping them. They are sold as junk lead.

This apparatus can be located at a central tool room where help is obtainable at odd times and where extra supervision is not necessary. Two, three or four men can work efficiently with this machine. A larger number are apt to interfere with each other and raise the unit cost somewhat. Where four men work at it, two men ordinarily carry up and feed the cable through the machine. One of the other two takes care of the lead and the fourth man carries away and stacks up the copper.

The machine is mounted on a table about 3 by 10 ft. by 30 ins. high. It receives its power from a 2-hp. d.-c. shunt motor mounted on the underside of the table, and belted to the stripping machine. A belt guard absolutely encloses the pulley and the belt so there is no danger of clothing getting caught and accidents happening through negligence. Guards enclose the other gears making the machine very safe even with help unaccustomed to working around machinery. A starting box and safety enclosed switch are included in the outfit and are mounted so as to be immediately at the hand of the man who is feeding the cable into the machine.

For centering different sizes of cable with respect to the knives, two guides were found necessary. They consist of flat plates hinged at the bottom, the distance between them being adjusted by means of a small hand wheel at the side of the machine.



Side Elevation of Cable-Stripping Machine.

The copper which is used in the manufacture of cable is pure to a high degree and when separated by this process is, with the exception of a small amount of oil adhering to the copper, as pure as the original. It is sold for the same price as scrap copper, which is approximately 85% of the market price for ingot copper. The lead is sold without further treatment at about 75% of market price for pure lead.

Electric Stucco Machine.

Putting on stucco with an electric machine now makes easy work of what is usually regarded as a difficult and tiresome job. With the help of an assistant who attends to the supply of stucco in the hopper, the operator can cover space rapidly with the Hodges stucco machine. The spider blades revolve at the rate of 1500 r.p.m. The force with which the material is thrown brings to the surface of this material an ooze of moisture or film of water that causes a skin or enamel to form, leaving a surface impervious to moisture.

Trade Activities

Hemingway Glass Combines Offices — Holtzer-Cabot Employes Receive Gift for Ten Years' Service — Literature

The Trumbull Electric Manufacturing Co., Plainville, Colo., is sending out circular No. 39, containing data on Circle "T" wire connectors for stranded, and solid and stranded cable.

Chicago Mica Co., Valparaiso, Ind., has recently acquired the services of L. T. Frederick as consulting engineer and production manager. Mr. Frederick was formerly process engineer of the Westinghouse Electric & Manufacturing Co., East Pittsburgh, Pa., and has had a broad experience in the manufacture and application of all lines of electrical insulation.

Beardslee Chandelier Manufacturing Co., Chicago, is sending out a new trade discount sheet, effective Sept. 15, and applicable on catalogs S-5, No. 20, No. 22 and S-4. Due to the continued advance in all commodities used in the manufacture of chandeliers, the company has been compelled to withdraw all previous prices, discounts and quotations. While the new discounts are subject to change without notice, the company is reasonably sure, with the work being done to reduce costs, that there will be no further advance in prices this year.

American Steam Conveyor Corp., Chicago, in its latest illustrated folder asks its prospective customers the pertinent question, "Have you ever counted the cost of moving ashes from boiler plant to bin or pile?" The folder advances in a very logical way, arguments favoring the use of an American steam ash conveyor in power plants, and shows the savings that can be accomplished through its use. The company has also published a book of 160 pages on "Modern Methods of Ash Disposal," which contains much valuable engineering data and should be of special interest to engineers, superintendents or owners of power plants.

The Holtzer-Cabot Electric Co., Roxbury, Boston, Mass., recently presented a gift of $100 to every man and woman who had been in the employ of the company for ten years or more, and in recognition thereof they presented a testimonial to the president. It contains an expression of thanks of the generous recognition and the good feeling that has always existed between the officials of the company and its employes. The testimonial bore the signatures of all who were recipients of the gift and also recorded the number of years of service of each employe. Heading the list of male employes was the name of J. George Rick with 44 years of service with the company, and Miss Jennie L. Conroy heading the list of ladies with a record of 31 years.

Engineer Co., New York City, is distributing a 15-page book which has for its title "The Development of an Idea." This publication, 8x11 ins. in size, is devoted to a discussion and explanation of Turner baffle walls and shows installations of these baffles. It is well illustrated and includes an efficiency chart showing the savings that may be secured by the improvement of CO_2 and of flue gas temperatures.

Berthold Electrical Manufacturing Co., Chicago, has recently issued a new folder on its electric washing machine, and offers a solution to the problem of "Blue Monday," lessening the drudgery of washday which has ever been a source of work and worry to the housewife. Not only is this machine claimed to wash clothes but to launder them like new. The Berthold electric is a compact, motor-driven machine operated on the revolving cylinder plan, made possible by reversing mechanism. This the company claims is a big feature and the result of the continual reversing is that a washing is completed in a time much shorter than that required by many other machines on the market today.

Buda Co., Railway Exchange building, Chicago, manufacturer of "Buda" motor and supplies for mill, mine and railroad, has issued a very interesting booklet entitled "The Buda-Ross Electric Light Plant." The booklet shows in an attractive and instructive form, the one kilowatt and the one-half kilowatt steam turbogenerator electric light plant manufactured by the company for lighting small industrial plants using a steam boiler, small steam boats, dredge boats, steam shovels, well drilling rigs, small mines, small saw mills, cotton gins, and any other industry using a steam boiler where the lighting requirements do not run over one kilowatt. The Buda Co. began the manufacture of small steam turbogenerators for locomotive headlight service about six years ago. It has been adopted by many industries and the demand for this kind of a lighting plant has grown to such an extent that the company has made some recent improvements in it, enlarged the facilities for production, and will market it generally through dealers as one of the main lines of Buda products. This booklet will be furnished upon request to the company.

Major Equipment Co., Inc., Chicago, Ill., is distributing a 16-page booklet which has for its subject "Better Lighting Effects in the Theater" as provided through the application of Major pre-selection system of remote control. This booklet presents a description of the elements of the Major system, which meets the most rigid safety rules of municipal authorities and safety boards, and explains the operating mechanism of this equipment. The system is recognized by theater authorities as one of the highest developments offered for producing lighting effects and giving the service required by present-day theaters. A number of the installations of Major boards and control are described in detail in this publication.

Hemingway Glass Co., manufacturer of glass insulators, which heretofore mantained a factory at Muncie, Ind., and offices at Covington, Ky., has combined the Covington offices with the office located at the factory at Muncie, effective Sept. 8.

E. B. Badger & Sons Co., American Spray Department, Boston, is distributing Badger Service bulletins Nos. 100 and 102. The first deals with the cleaning and cooling of air with sprays as applied to the generator, laying particular stress on the advantages from an operating standpoint of a supply of cool, clean air for generator use. The second publication has for its subject "Cooling Water with Sprays" and describes a spray cooling system which meets the demand for an efficient dependable and inexpensive method of cooling water for condensers, ice plants, cotton and cement mills, or in fact, any industry requiring an abundant supply of cold water. Detailed and illustrated descriptions of this equipment are contained in both publications and views of typical installations are shown.

Roller-Smith Co., 233 Broadway, New York, is distributing new publicity matter describing a number of its products. Bulletin sheet No. 96, revised May 1919, contains a detailed description of the Columbia induction watt-hour meters for alternating current, switchboard type, and switchboard type instrument transformers. Another bulletin (No. 100) has for its subject Roller-Smith electrical instruments for signal system testing, including direct and alternating current portable volt-ammeters and direct reading portable ohmmeters. In this publication is introduced the new "Handy S. S." type of direct-current volt-ammeter. This instrument is small, compact and entirely self-contained, and is recommended for maintenance work where cost and size are paramount. Large numbers of these instruments are in constant service, and they are looked on with increasing favor because of their dependability. They are of rugged construction and will withstand much abuse without losing their accuracy.

Current News

Weekly Record of Construction Activities—Conventions

EASTERN STATES.

New Bedford, Mass.—In connection with the construction of the proposed hotel building by the New Bedford Hotel Co., to be located at Middle, Pleasant and Foster streets, to cost $1,000,000, considerable electrical equipment will be required. Clinton & Russell, 32 Nashua street, New York, are architects for the company.

Watertown, Mass.—Engineer F. D. Smith, Ashburton Place, Mass., has prepared plans for $15,000 improvements for water system. Electric pumping apparatus will be purchased. Metropolitan water and sewerage board, Ashburton place, Boston, owner.

Hartford, Conn.—Hartford Electric Light Co. has commissioned Stone & Webster, Boston, to prepare preliminary plans for a generating plant station with a capacity of 100,000 kw. or 125,000 hp. to be located on the Connecticut river in that city. The proposed plant is to be more than three times the size of the present plant at Dutch Point.

South Norwalk, Conn.—In connection with the new plant to be erected by Crofut & Knapp, South Norwalk, on Van Zandt street, East Norwalk; plans have been prepared for the construction of a power plant, 60x150 ft. for factory operation. Ground has recently been broken for the initial work on the main manufacturing building, which will be a five-story structure, about 60x300 ft. It is understood that upon completion of the work the company will concentrate operations at the new plant.

Binghamton, N. Y.—Work has recently been completed and operation inaugurated on the new electric street-lighting system extending from Court to Lewis street on State street. Lighting units of 250 cp. are utilized.

Binghamton, N. Y.—Bids have been taken by the State Hospital Commission, Albany, E. S. Elwood, secretary, for the construction of the proposed power plant at the Binghamton State Hospital.

Binghamton, N. Y.—Paul A. Hilbert Co., Newark, N. J., operating an electrical contracting establishment, has completed plans for the opening of a new local branch.

Central Islip, N. Y.—State Hospital Commission has awarded a building contract to Benjamin Rayner, Locust Avenue, Islip, L. I., for the construction of the proposed power house at the State Hospital, Central Islip. The structure will be about 80x120 ft., and is estimated to cost, with equipment, about $150,000. Lewis F. Pilcher, Capital building, Albany, is state architect.

Lockport, N. Y.—Lockport Light, Heat & Power Co., 111 Main street, has filed application with the Public Service Commission for permission to revise its rates for electric lighting and power service.

New York, N. Y.—In connection with the proposed four-story and basement plant, 90x200 ft., of the Mint Products Corp., 949 Broadway, to be erected at Port Chester, N. Y., at a cost of about $350,000, considerable electrical and mechanical equipment will be required.

New York, N. Y.—Victory Battery Co., Inc., 30 West Houston street, has filed notice with the Secretary of State of an increase in its capital from $20,000 to $30,000, for business expansion.

New York, N. Y.—Board of Managers of the Fordham Hospital, South boulevard, have had plans prepared for the construction of a new one-story brick power plant, about 46x86 ft., at the institution, estimated to cost $5000.

New York, N. Y.—Wilson Maulen Co., 781 East 142nd street, manufacturer of pyrometers and kindred specialties, has had plans prepared for the construction of a new three-story brick plant, about 50x100 ft., for increased operations.

Poughkeepsie, N. Y.—Smith Bros., North Hamilton street, are taking bids for the erection of the proposed plant at Michigan City, Ind., estimated to cost $250,000. The works will comprise main manufacturing building, supplemented by a power plant for factory operation. William P. Field, 763 Broad street, Newark, N. J., is architect for the company.

Utica, N. Y.—Board of Managers of the Utica State Hospital, State Hospital Commission, E. S. Elwood, secretary, is having plans prepared for the construction of a new power plant at the institution. Lewis F. Pilcher, Capitol building, Albany, is state architect.

White Plains, N. Y.—American Traction Ring Co. has filed notice with the Secretary of State of an increase in its capital from $10,000 to $150,000.

Bloomfield, N. J.—Sprague Electric Works of the General Electric Co. has recently inaugurated work on the construction of a new addition to its plant on Lawrence street. The structure is estimated to cost about $15,500. Salmond Brothers, Elm street, Arlington, have the erection contract.

Butler, N. J.—Borough Council is planning for the installation of a new electric lighting system along Carmonton road, Bloomingdale. Plans for the proposed work are now being prepared.

Irvington, N. J.—Yocum Chemical Co., 325 Academy street, Newark, has awarded a contract for the construction of a new one-story factory and boiler plant, about 40x117 ft., to be located at 168-78 Coit street, Irvington.

Kearny, N. J.—Contract has been awarded by the Ford Motor Co., Detroit, Mich., to the Lord Electric Co., 105 West 40th street, New York, for electrical work in connection with the construction of its large new local assembly plant.

Newark, N. J.—J. Brochie & Co., Inc., 8 Railroad place, is having plans prepared for alterations and improvements in its boiler plant and works at Llewellyn avenue and Fulton street, Bloomfield, to cost about $30,000.

Trenton, N. J.—Harry E. Stahl, Trenton, has submitted a low bid to the city commissioners for the installation of electric, steam and hydraulic apparatus in the municipal pumping station of the city waterworks on Calhoun street, at $108,941.

Wanaque, N. J.—Active plans are in process of formation by the Borough Council for the installation of the proposed electric street-lighting system throughout the borough. Contract for furnishing service for operation was recently awarded to the Tri-County Electric Co., Pompton Lakes.

Allentown, Pa.—In connection with the plans and specification now in course of preparation by the City Council for the installation of a new sewage disposal plants, pumping stations, etc., considerable new electrical and mechanical equipment will be required.

Allentown, Pa.—Lehigh Navigation Electric Co. has filed with the Public Service Commission a new schedule of rates for service, effective Oct. 1, 1919. The new tariff eliminates from the schedules for wholesale power at 110,000 volts, and for service to public service electric light and power companies, the "coal clause" making corresponding changes in energy rates.

Catasauqua, Pa.—A street lighting system will be established. Address Daniel Gillispie, Borough Secretary.

Gettysburg, Pa.—At the November election the question of issuing $50,000 municipal light bonds will be submitted to vote.

Harrisburg, Pa.—Western Union Telegraph Co. has filed application with the Public Service Commission for permission to remove the overhead wires in the central and eastern parts of the city by way of Cameron and Paxton streets, and the installation of underground conduit system to replace the present facilities.

Kittanning, Pa.—Public Service Commission has denied the application of the Borough Council for permission to construct a municipal water plant. It is held that the building of a new plant would be a duplication of the facilities of the Armstrong Water Co., and would necessitate the expenditure of about $300,000, which would exceed the limit of indebtedness allowed the municipality.

Morrisville, Pa.—Mechanical and electrical machinery will be installed in the new sewerage disposal plant to be constructed by the Borough Council, at an estimated cost of about $200,000. Thomas F. Bovie, engineer, will prepare plans and specifications.

Morrisville, Pa.—Plans are under consideration by the Borough Council for the issuance of bonds for $40,000 for the installation of a new municipal water supply and distributing system. The State Board of Health is interested in the proposed work.

Philadelphia, Pa.—Rockland Hosiery Co., Kensington avenue, is taking bids for the erection of a new boiler plant and factory building, for increased operations. It is understood that an administration building will also be constructed, the entire work being estimated to cost $100,000.

Philadelphia, Pa.—Wirt Co., Arma and Lena streets, manufacturer of electrical specialties, has prepared plans for a new plant, two stories, 62x158 ft., to cost $60,000. Charles Wirt is president.

Philadelphia, Pa.—Department of Public Works has received bids for the furnishing and installation of four new turbo-centrifugal pumping units at the Queen Lane pumping station of the city, to have a capacity of 40,000,000 gals. each every twenty-four hours. The new units will replace the present equipment comprising one pump, 25,000,000-gal. per day capacity and four pumps of 20,000,000 gal. each installed some few years ago. It is also proposed to make other extensions and improvements in the municipal water system.

Reading, Pa.—It is interesting to note that the Metropolitan Edison Co. has received contracts for the wiring of 145 old residences for electric service during the month of August.

York Haven, Pa.—York Haven Water & Power Co. has been granted permission by the Public Service Commission to construct a new electric transmission line from Middletown to Annville.

Wilmington, Del.—Sun Telephone & Telegraph Co. of Mississippi, a Delaware incorporation, has filed notice with the Secretary of State of an increase in its capital from $50,000 to $150,000, to provide for general business expansion.

Wilmington, Del.—Delaware Marine & Motor Co. has had plans prepared for the construction of a new machine shop at the foot of Commerce street, for increased operations.

Wyoming, Del.—Wyoming and Camden have voted unanimously for a $10,000 bond issue for the purchase jointly of the water works and electric light plant.

DATES AHEAD.

Iowa State Association of Electrical Contractors and Dealers. Annual convention, Sioux City, Iowa, Sept. 22 and 23. Secretary, F. Bernick, Jr., Oskaloosa, Iowa.

New England Section, N. E. L. A. Annual convention, New London, Conn., Sept. 22-24. Headquarters, Hotel Griswold. Secretary, Miss O. A. Bursiel, Boston, Mass.

Association of Iron and Steel Electrical Engineers. Annual convention, St. Louis, Mo., Sept. 22-26. Secretary, John F. Kelly, Empire building, Pittsburgh, Pa.

American Electrochemical Society. Fall meeting, Chicago, Sept. 23-26. Headquarters, Congress Hotel. Secretary, Prof. Joseph W. Richards, Lehigh University, Bethlehem, Pa.

International Association of Municipal Electricians. Annual convention, Chicago, Sept. 23-26. Secretary, Clarence R. George, Houston, Tex.

Northwest Electric Light and Power Association. Annual convention, Seattle, Wash., Sept. 24-27. Secretary-treasurer, George L. Myers, Portland, Ore.

Empire State Gas and Electric Association. Annual meeting, Buffalo, N. Y., Oct. 24. Secretary, Charles H. B. Chapin, 29 West 39th street, New York City.

National Association of Electrical Inspectors. Annual meeting, Springfield, Mass., Oct. 13 and 14. Secretary, W. L. Smith, Concord, Mass.

Illuminating Engineering Society. Annual convention, Chicago, Ill., Oct. 20-23. General secretary, Clarence L. Law, 29 West 39th street, New York City.

Illinois State Electric Association. Annual convention, Chicago, Oct. 22 and 23. Secretary-treasurer, R. V. Prather, Springfield, Ill.

American Society of Mechanical Engineers. Annual meeting, New York City, Dec. 2-5. Secretary, Calvin W. Rice, 29 West 39th street, New York City.

Baltimore, Md.—Baltimore County Electric Co. plans the immediate construction of a new one-story pumping plant at Towson, Md., to cost about $15,000.

Baltimore, Md.—Maryland Casualty Co., Baltimore street and Guilford avenue, is having plans prepared for the construction of a new electric power plant to be used for operation of its printing works.

Baltimore, Md.—In connection with the proposed plant of the Eastern Rolling Mill Co., estimated to cost in excess of $5,000,000, all equipment throughout will be electrically operated, power to be supplied by the Consolidated Electric Light, Gas & Power Co. The company has awarded a contract for the main manufacturing building of the initial unit, to be about 360x1000 ft., estimated to cost $500,000. It is proposed to have an annual capacity of about 60,000 tons of steel sheets, to be used mainly for the production of automobile bodies, as well as for manufacturing stoves, etc.

Baltimore, Md.—Baltimore Gas & Electric Co. is operating its various electric plants at capacity. The company is making extensive improvements and additions at its generating station at Westport to increase the present capacity from 80,000 to 160,000 hp.

Chesapeake City, Md.—United States Government is considering plans for the construction of an additional pumping plant for the Chesapeake & Delaware Canal, to provide sufficient water for the dredges operating in the canal and for the additional locks. At the present time one pumping station is already in operation at the site, but it is proposed to utilize two hydraulic dredges which will require a larger quantity of water than now supplied. The new plant will be designed to have a capacity of 50,000,000 gal. of water daily, and will be electrically operated.

Union Bridge, Md.—Union Bridge Electric Manufacturing Co. is understood to be considering plans for the extension of its transmission lines to New Windsor, Taneytown, Legore, Key Mar, Middleburg, and New Midway, to provide for increased operations.

Richmond, Va.—Tower-Binford Electric & Manufacturing Co., Fourth and Cary streets, is planning for the erection of a new one-story building, 90x116 ft., for the manufacture of electrical fixtures, to cost about $35,000.

New Cumberland, W. Va.—West Virginia-Pittsburgh Coal Co. is considering plans for the construction of a new electric power plant at its local properties. In connection with other improvements to be made at the works, the total cost is estimated at approximately $100,000.

Greensboro, N. C.—North Carolina Public Service Co. is considering plans for the installation of new ornamental street-lighting standards. The removal of the present overhead wires is included in the plans.

Murphy, N. C.—City has approved a bond issue for $100,000 to cover the cost of the installation of a new electric lighting system.

Laurens, S. C.—An election will be held to vote on the question of issuing $25,000 water, light, and school building. Address mayor.

Sumter, S. C.—City has recently completed negotiations for the purchase of a number of buildings to be used as a site for the electric light and ice plants for municipal service. It is proposed to make extensive improvements followed by the installation of turbine, condenser, stoker, boiler and spray cooling equipment, as well as boiler feed pumps and auxiliary apparatus, the entire work being estimated to cost about $90,000.

Varnville, S. C.—F. L. Moxon, Varnville, is said to be considering plans for the construction of a new local electric light plant.

Daytona Beach, Fla.—Nelson Mounts has received an electric light and power franchise.

NORTH CENTRAL STATES.

Minerva, Ohio—Architect Froelich-Emery, 412 Second National Bank building, Toledo, has prepared plans for $50,000 power plant to be erected by village of Minerva. The building will be 40x120 ft. in dimensions, brick and concrete construction, steam heating, brick interior finish, electric lighting. Address R. A. Penneth Mayn, Minerva.

Anderson, Ind.—Union Traction Co. of Indiana has arranged for improvements totaling $100,000 at the Anderson central power station. New boilers are being placed in service and the turbine electric elevators are being overhauled.

Brazil, Ind.—Prox & Burgett, Terre Haute, Ind., have the contract for the lighting and heating systems for the new high school building at Bridgeton, Ind. Urban & Apple, Brazil, Ind., have the contract for the general construction of the building for $38,000.

Indianapolis, Ind.—J. D. Hunt Manufacturing Co. has increased its capital from $7000 to $15,000.

Indianapolis, Ind.—State purchasing committee has awarded to the Indianapolis Electrical Supply Co. a contract for providing the state institutions with electrical apparatus for the coming year. The contract is drawn up on a cost plus 11% basis. The state purchases about $11,000 of electrical supplies annually.

Logansport, Ind. — Logansport Utilities Co. has been formed for the purpose of taking over the Logansport Heat & Power Co., which is now in the hands of a receiver. This company will provide heat for many of the business houses, electric light for commercial and residential use and power to industries.

Chicago, Ill.—Architect Charles W. Kallal, 1012 City Hall, has prepared plans for $300,000 electric plant to be erected by the city. The building will be 80x86 ft. in dimension, steam heating, plumbing, fireproof roofing, fireproof interior finish, engine and transformer, electrical equipment. Address R. F. Francis, 401 City Hall.

De Kalb, Ill.—The contract for the installation of a boulevard system of lighting in the Horsech addition, which includes that part of the city from Locust and Linden around College was let to Philip Swanson for the sum of $5444.30, the cost to be covered by special assessment.

Galena, Ill.—A new 33,000-volt transmission line will be built to connect the lines of the Interstate Light & Power Co. at Shullsburg with the lines of the Lena Electric Light & Power Co. near Apple River, a distance of about 10 miles. Under a ten-year contract electric energy will be furnished the Lena company for distribution in Apple River, Warren, Nora, Lena, Pearl City, Shannon and Lanark, Ill.

Hillsboro, Ill.—Engineers have been engaged at the Hillsboro plant of the Southern Illinois Light & Power Co. with plans for the installation of additional machinery to double the capacity of the plant.

Marseilles, Ill.—Latimer & Hoenshall have opened a new electrical merchandise store in this city.

Port Byron, Ill.—Coe Light & Power Co. has petitioned for authority to issue $6000 of capital stock and to construct a telephone line. Address S. L. Woodford, Port Byron.

Rock Island, Ill.—City will install 11 additional street lamps at a rate of $21 a year each. The new lamps are to be tungsten in variety and will be installed as a result of a contract made a few months ago with the Peoples Power Co. for arc street light service for $55 instead of $60 each year as was paid under the old contract.

Rock Island, Ill.—Rock Island Brake Shoe & Foundry Co., with capital of $100,000, has been organized by M. I. Morris, Hyman Lewis and Simon Lewis.

Taylorville, Ill.—The council is considering the matter of establishing a municipal light plant, unless the Central Illinois Public Service Co. does something that is in some degree satisfactory to the committee of the city council and the citizens heat committee. Further definite steps will be taken. Address Mayor Downee.

Urbana, Ill.—The contract for the ornamental lighting system in the southwest part of the city, adjacent to the campus of the University of Illinois, has been awarded to Freeman Sweet Co., of Chicago, at a bid in excess of $26,000.

Woodstock, Ill.—The Woodstock municipal lighting plant for the year 1918 showed profits of $11,774.69 at a selling figure of 6.429 ct. per kw-hr. The plant in 1917 showed a profit of $13,767.30 at a selling rate of 5.914 ct. per kw-hr.

Flint, Mich.—Lot owners on the new Flint Country Club voted to proceed immediately with the installation of water, sanitary sewers, storm sewers, gas, electricity, and telephones, the work to be done under the supervision of the city engineer and the public utilities company at an estimated cost of $226,000. The estimated cost of the various improvements are, gas, $25,000, electricity, $50,000, telephones, $30,000.

Adams, Minn.—The city will vote at special election for electric light plant. B. H. Carr, village clerk.

Alden, Minn.—At a special election held recently $8000 were voted and carried for electric light and power for village of Emmons. Contracts made with Minnesota Gas & Electric Co.

Jackson, Minn.—Jackson Light & Traction Co. will improve its railway and electric light plant. Address L. O. Gordon, general manager.

Minneapolis, Minn.—The new 33,000-hp. steam turbine which the engineering department of H. M. Byllesby & Co. has been installing in the Riverside Station of the Minneapolis General Electric Co. has been completed and turned over to the operating department. This generating unit brings the capacity of the Riverside Station up to 70,000 hp., or more than four times as great as in 1911. The business of the company has grown so rapidly that the peak load at the present time often exceeds the greatest peak in the company's history which occurred last December.

St. Paul, Minn.—It is reported that a $150,000 paint factory will be constructed by the Mutual Paint Co. on land recently purchased. The capacity of the plant will be about 5000 gals. daily.

La Crosse, Wis.—Western Wisconsin Telephone Co. will install copper metallic circuit from Centerville, Minn. to Winona, Minn., and contemplates extending lines to Trempealeau Valley and Beaver Creek Valley. Address L. H. Dodge, manager, 127 North Fourth street.

Racine, Wis.—Racine Auto Tire Co. will build a power house to generate current for its factory. Address Menzel & Becker, Baker building.

Grinnell, Iowa—Iowa Light, Heat & Power Co. will extend its electric transmission lines to points in O'-Brien county.

Ottumwa, Iowa—Agency, Iowa, has been added to the lines of the Ottumwa Railway & Light Co. The service was inaugurated on Aug. 28.

St. Charles, Iowa—Gibson Electric Co., Des Moines, will make improvements to its power plant. Three fuel-oil engines, three 10 hp. to 50 hp. generators, from 8 kw. to 35 kw. and four switchboard panels complete. Overhead material for 10 to 20 miles of overhead line. G. F. Gibson, Box 408, Des Moines, in charge.

Independence, Mo.—A special election was held recently to vote on the question of issuing $65,000 electric light bonds. Address city clerk.

Maryville, Mo.—The city will install two 600-gal. per min. motor-driven centrifugal pumps, one 700-gal. per min. low service pump and other equipment. E. E. Harper, Kansas City, Mo., engineer; A. D. Hewitt, clerk.

St. Louis, Mo.—United Railway Co. will ask bids for building and repairing 21 miles of line. R. Wells is receiver.

Auburn, Neb.—City will hold an election for a bond issue to enlarge municipal light plant. Address Mayor Dovel.

Lincoln, Neb.—The State Railway Commission has asked the Omaha & Council Bluffs Street Railway Co. to extend its lines eight blocks in South Omaha.

Omaha, Neb.—Omaha Flour Mills Co. will erect seven story concrete grain elevator to cost $600,000. The new elevator will put out 2500 bbls. of flour daily and has space capacity of 300,000 bu.

Gregory, S. D.—At a special election $122,000 bonds were voted and carried for electric light plant and sewerage system.

Mitchell, S. D.—City contemplates traffic lights at Main street. J. E. Wells, mayor.

Anamoose, N. D.—Anamoose Electric Light Co. burned. Loss, $25,000.

SOUTH CENTRAL STATES.

Carrollton, Ky.—City is considering plans for the issuance of bonds for $25,000 to provide for new municipal electric light and water systems. J. E. Gullion is mayor.

Newport, Ky.—City Commissioners are planning for the construction of a new local electric light plant to furnish electric energy for municipal service, as well as to Bellevue, Dayton, Ft. Thomas, Highlands District, Clifton and Southgate.

Dawson Springs, Ky.—United States Government has awarded a contract to the Brandenburg Construction Co., Chicago, Ill., for the installation of a new electric plant at the local Government hospital site.

Louisville, Ky.—During the week ended Aug. 29 the commercial department of the Louisville Gas & Electric Co. received contracts for 59 electric customers with 33 kw. of lighting and 216 hp. in motors and took orders for wiring 13 already built houses. Connected load gain (net) for the week included 43 customers with 23 kw. of lighting and 17 hp. in motors. Electric energy output for the week was 10.2% greater than for the same week of 1918.

DeRidder, La.—City has approved the issuance of bonds for $100,000 for the installation of new municipal electric light and water systems. C. C. Davis is mayor.

Natchez, Miss.—National Box Co. will install electric power and make improvements at its plant.

Yazoo City, Miss.—City Council is having plans prepared for the installation of a new double-unit electrical system for municipal service, estimated to cost $20,000.

Greenfield, Tenn.—A special election will be held to vote on the question of issuing $700,000 in bonds for water system and power house. Greenfield is supplied electric current and water by a private corporation.

Rutherford, Tenn.—Sept. 22 an election will be held to vote on the question of issuing $15,000 municipal light plant bonds. Address village clerk.

Afton, Okla.—$10,000 will be expended improving light plant. Address mayor.

Miami, Okla.—Additional light and water bonds have been authorized. Equipment will be purchased. Address mayor.

Minco, Okla.—City Council is considering plans for the issuance of bonds for $11,000 to provide for the installation of a municipal light and water plant.

Ponca City, Okla.—Plans are under consideration by the city for extensions in the municipal electric light plant. It is understood that bonds for $25,000 will be voted on to cover the cost of the proposed work. W. H. McFadden is mayor.

Sapulpa, Okla.—Sapulpa Electric Co. is supplying electric energy amounting to 100 hp. in motors to the Bartlett Collins glass plant which has just been opened for the season. This is double its former requirements.

Bryan, Tex.—City has voted a bond issue for $75,000 to provide for the purchase of the local electric light plant. It is proposed to make extensive improvements and alterations in the plant to increase the present capacity.

Houston, Tex.—Houston Lighting & Power Co. has awarded a contract to Horton & Horton, Houston, for the construction of a large new extension to its boiler plant, at estimated cost of $75,000.

Dallas, Tex.—The city secretary has been instructed to advertise for bids for incandescent lights for the city.

San Angelo, Tex.—The city commissioner has authorized the erection of an electric light, power and water plant for which $500,000 has been appropriated. Address mayor.

Wichita Falls, Tex.—Wichita Falls Electric Co. is having plans prepared for the construction of a new electric transmission line to the Burkburnett field.

WESTERN STATES.

Colorado Springs, Colo.—A large hotel capable of accommodating several hundred guests, a pavilion, costing approximately $25,000, electrical power, plant and lighting of the roadway and park, opening the park for cabin sites, and improvements to the auto road leading to the park, are planned for Crystal Park. W. C. Dotterer, president, Crystal Park Mountain Auto Road Co.

Pueblo, Colo.—During the week ended Aug. 29 the Arkansas Valley Railway, Light & Power Co. added 72 electric customers to its lines with 52 kw. of lighting and 911 hp. in motors; also 87 household electrical devices including 56 electric flat irons.

Millville, Utah.—The Town Council has perfected plans for the installation of a municipal electric light and power distributing system, covering all principal sections of the municipality. It is proposed to secure power at wholesale rates from the Utah Power & Light Co.

Hardin, Mont.—Mountain States Telephone & Telegraph Co. will construct telephone line from Billings to Hardin. Work will start soon.

Libby, Mont.—In connection with the construction of a proposed 200 concentrating works, the Lukens-Hazel Mining Co. is planning for the construction of an electric power plant for works operation. The proposed structure will be located in the vicinity of the local properties, with pipe line extending from Granite Creek for operation. The entire project is estimated to cost about $200,000.

Florence, Ore.—The electric plant burned. G. G. Bushman, Eugene, Ore., is owner.

Hoquiam, Wash.—Plans have been completed by the local Commercial Club for the installation of a new street-lighting system on Eighth and Ninth streets.

Seattle, Wash.—The City Council has approved an appropriation of $1,520.335 for the purchase of new equipment and supplies for the municipal lighting department.

Seattle, Wash.—Pacific Coast Coal Co. is planning for the construction of a new high-tension transmission line from a point near Renton, following along the Renton-Newcastle County Road. A permit for the work has been granted by the County Commissioners.

Seattle, Wash.—The City Council has authorized the preparation of plans and specifications for the construction of a new electric generating plant on Lake Union, adjoining the present power station of the city at this point. The plant will be of reinforced concrete, 80x120 ft., and with generating equipment and auxiliary operating machinery is estimated to cost $1,250,000. J. D. Ross is superintendent of lighting. Daniel Huntington, city architect, will be in charge of the work.

Avalon, Cal.—The Common Council is planning for the early construction of its proposed municipal electric light and power plant, and waterworks system, bonds aggregating $88,000 having recently been voted.

Fresno, Cal.—San Joaquin Light & Power Corp. has commenced the erection of its proposed new hydroelectric power plant at Auberry, Fresno county. The station is estimated to cost more than $1,200,000. The installation will comprise turbines, generators and other prime moving apparatus; transformers and other electrical equipment. A. D. Wishon is manager.

Marysville, Cal.—Marysville & Nevada Power & Water Co., with headquarters at Marysville, is planning for the construction of a new hydroelectric power plant at Bullard's Bar, with transmission and distributing system to furnish service to Marysville, Sacramento and other points in this district. The territory is now served by the Pacific Gas & Electric Co. and the Great Western Power Co.

Healdsburg, Cal.—The Common Council is planning for a bond issue of about $20,000 for improvements and extensions in the local lighting system.

Riverside, Cal.—Southern Sierras Power Co. has completed work on the "stepping up" of its high-tension transmission line from Bishop to San Bernardino, a distance of about 240 miles. The work has been under way for the past twelve months and represents a cost of about $250,000. A voltage of 2200 volts is maintained at the power plant and this is now increased to 87,000 volts for long-distance transmission. The change increases the horsepower from 25,000 to 60,000, or about 2¼ times.

San Francisco, Cal.—Great Western Power Co. is rushing construction work on its new Caribou electric generating plant, near Oroville, to insure the completion and operation of the plant in 1920. The company expects to inaugurate service at the station about six months in advance of the time initially anticipated. E. W. Beardsley is superintendent.

Stockton, Cal.—Western States Gas & Electric Co. is arranging to furnish increased power service to the National Paper Products Co. The company's present load aggregates about 1100 hp., and new motors and other electrically operated equipment will be installed.

Visalia, Cal.—The Commercial Club in co-operation with the local

Board of Trade is planning for the installation of a new ornamental street lighting system in the business section, to form a uniform system of electroliers. New lamps will be investigated for the proposed installation. J. D. Allen is secretary of the Board of Trade.

FOREIGN TRADE

[Addresses of firms referred to in these trade opportunities may be obtained by writing to the Bureau of Foreign and Domestic Commerce, Washington, D. C., or its branch and local co-operative offices. Request for each opportunity should be on a separate sheet and the file number given.]

Electrical Supplies (30,5663).—The electrical engineering department of a municipality in South Africa requires different kinds of electrical supplies, such as twin conductor lead-covered cable, triple concentric cable, boiler tubes, centrifugal pump and motor, recording ammeters, single-phase transformers, sundry supplies, etc. Inquiry forms and blue prints were forwarded and may be examined at the bureau of its district offices. (Refer to file No. 123150). Tenders should be forwarded by mail at the earliest possible moment, so that it may arrive by Oct. 1, 1919, if possible.

Electrical Articles. (30,567).—An agency is desired by a man in Italy for the sale of cameras and photographic supplies, cinema supplies, electrical articles and accessories, and general technical articles. Correspondence should be in Italian or French. References.

Friction Winches. (30,599).—Cable quotations f. o. b. New York are desired by a man in Australia on two steam hammers of 3000-lb. blow for driving wooden piles and two electric pile-driving friction winches for the same purpose.

Transmission Machinery. (30,609).—The development of new coal mines is planned by the government of a country in the Far East, and the chief engineer desires to receive catalogs of electrical transmission machinery, mining machinery, machine tools, etc. A complete list of what will be required may be obtained on application to the Bureau or its district offices.

Wireless Telegraphy Outfits. (30,614).—A commercial agent from Chile is in the United States and desires to secure agencies for the sale of artificial leather, wireless telegraphy outfits and supplies, and building and construction materials and supplies. Reference.

PROPOSALS

Wire, Generators, Etc.—Bids will be received at Flagler, Colo., on Sept. 29 for the construction of a municipal water system. The specifications include one carload of poles, 5000 lbs. No. 8 braided weatherproof wire, one 35-hp. oil engine, one 75-hp. oil engine, and suitable generators for above engines, one switchboard, etc. These are to be in accordance with plans and specifications prepared by Royal S. Salisbury, consulting engineer, 1415 East Colfax street, Denver, Colo. Address William Knies, clerk and recorder.

Power Plant.—Bids will be received at New Castle, Ind., Sept. 23 for a laundry and power house at the Indianapolis Building for Epileptics. Specifications include two 75-kw. generator. Address Dr. W. C. Van Nuys. Contracts wlil be let by Herbert Foltz, Indianapolis, architect.

NEW PUBLICATIONS

War Minerals, Nitrogen Fixation and Sodium Cyanide is the title of Bulletin 178-B by Van H. Manning, consisting of an advance chapter from Bulletin 178 War Work of the Bureau of Mines. The term war materials has been applied to those ores and minerals that were largely imported before the war, included in which are chromite for tool steel, for tanning leather, and as a refractory lining in furnaces; magnesite, for refractory linings; mica, as insulating material; platinum, for the manufacture of sulphuric acid and for electrical apparatus. When the United States entered the war it was clear that every ship would be needed and that the number available for importing minerals would be small, and hence a quick and thorough survey of domestic resources was necessary. In this publication are presented the results of the investigation conducted by the Bureau. The price of the paper is 5 cts. a copy and may be obtained by addressing a request to the Superintendent of Documents, Government Printing Office, Washington, D. C.

INCORPORATIONS

Logansport, Ind.—Logansport Utilities Co. has been incorporated with capital of $60,000 to supply light, heat and power by O. H. Binns, Frank B. Wilkinson, William R. Casparis and William O. Taylor.

Kyle, Tex.—Kyle Light & Power Co. has incorporated with a capital of $7000. Incorporators: C. F. Maindrich, J. D. Winder and others.

New York, N. Y.—S. G. V. Electrical Co. Capital, $10,000. To manufacture electrical supplies, etc. Incorporators: J. and M. Knapp, and J. Goldfarb, Jr., 136 Broadway.

New York, N. Y.—Eureka Lighting Supply Co. Capital, $8000. To manufacture electric and gas fixtures, etc. Incorporators: I. J. Shirmel, S. Geller, and H. M. Feuerstein, 11 Graham avenue, Brooklyn.

New York, N. Y.—United Electric Stores, Inc. Capital, $50,000. To deal in electrical goods, etc. Incorporators: P. McGeavy, K. R. Schuslstrom, and J. W. Flint, 947 Sixth avenue.

Syracuse, N. Y.—Doman Development Corp. Capital, $100,000. To engage in a general electrical engineering capacity. Incorporators: A. E. Doman, W. H. Fleisch, and L. Will.

East Orange, N. J.—Wizard Light Co. Capital, $500,000. To engage in a general electrical and mechanical engineering capacity. Incorporators: Albert K. Porter, William H. Wagner, and Arthur A. Fisher.

Newark, N. J.—American Consolidated Electric Co. Capital, $100,000. To manufacture incandescent electric lamps. Incorporafors: Frederick A. Schiller, John H. McCaulley and Davis Lesnik.

Washington, D. C.—Randall X-Ray Co. Capital, $100,000. To manufacture X-Ray equipment, etc. Incorporators: George T. Parker, William A. Randall, and Willis W. Parker, Washington.

Wilmington, Del.—Mohr Co. Capital, $55,000. To manufacture lighting, heating and power machinery. Incorporators: S. E. Dill, T. L. Croteau, and H. E. Knox, Wilmington.

New York, N. Y.—American Refrigeration & Insulation Co. Capital, $55,000. To manufacture refrigeration machinery and insulation equipment. Incorporators: R. H. Brenner, N. Dacimto, New York; and A. G. Concolte, Brooklyn.

Topeka, Kans.—The Pierson Co. Incorporated under Delaware law with a capital of $5,000,000. To manufacture telegraph transmitters and telegraph apparatus. Incorporators: Edwin H. Pierson, Topeka; C. H. Gaunt, Chicago, Ill.; and Paul P. Sweet, New York.

Indianapolis, Ind.—Federal Steel Products Co. has been incorporated with capital of $100,000 to manufacture steel articles by William A. Epperson, Joseph B. Wilkins and John Glava.

Indianapolis, Ind.—The F. & W. Manufacturing Co. has been incorporated with capital of $30,000 to manufacture mechanical devices by George F. Frisz, James D. Wiltshire and L. R. Zapf.

Norfolk, Va.—Hester Electric Co. Capital, $50,000. To manufacture electric fixtures, etc. Incorporators: H. H. Hester and J. G. Good.

New York, N. Y.—Matthews Lighting Co. of New York, Inc. Capital, $150,000. To operate a local light and power plant. Incorporators: J. Speer, and W. N. and C. F. Fabell, 706 Riverside Drive.

Buffalo, N. Y.—Carter-Hager Electric Corp. Capital, $10,000. To engage in a general electric construction and contracting capacity. Incorporators: L. E. Carter, Henry J. Hager, and John J. Askey, Buffalo.

Wilmington, Del.—Phix Light Co., Inc. Capital, $100,000. To manufacture electrical and power machinery, engines, etc. Incorporators: H. E. Knox, T. L. Croteau, and S. E. Dill.

Paterson, N. J.—Silk City Lighting Co. Capital, $15,000. To engage in the manufacture of electrical fixtures, etc. Incorporators: John Cooke, B. Clark, and Fred Braun, Paterson.

Personal

John Kelly New Sales Manager of Edison Storage Battery —W. D. A. Peaslee Joins Jeffery-Dewitt Insulator—Changes

O. A. JENNINGS has become connected with the Oklahoma Gas & Electric Co., in charge of the electrification of oil well pumping, with headquarters at Oklahoma City.

V. ST. C. MONTIETH, Martinsburg, W. Va., for the past two years superintendent of the local plant of the Potomac Light & Power Co., has been appointed general superintendent of the entire system of the company.

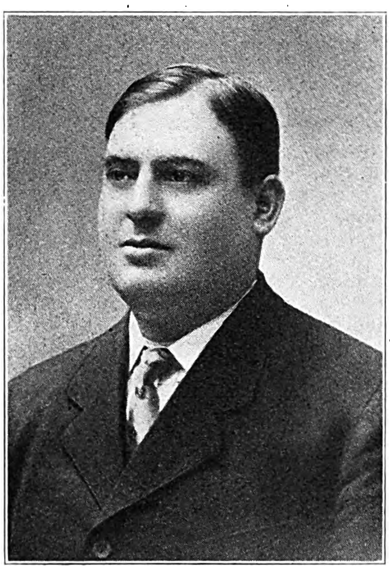
JOHN F. EAGAN, formerly superintendent of the eastern division of the subway and elevated lines of the Brooklyn Rapid Transit Co., Brooklyn, N. Y., has been appointed superintendent of transportation of the company. Mr. Eagan succeeds John J. Dempsey, formerly vice-president and superintendent of transportation, recently resigned.

F. H. VAN GORDER, power apparatus specialist at the New York office of the Western Electric Co., has been appointed manager of the Newark store. Mr. Van Gorder entered the employ of the company in the spring of 1907 as a salesman connected with the Chicago branch. In 1914 he became sales manager of the Detroit store and in June, 1918, took up the duties of power apparatus specialist, which position he held until his recent promotion.

A. A. GUARDIA, sales manager of the Pelouze Manufacturing Co., Chicago, has recently been appointed general manager and assistant to the president of the company. Mr. Guardia has been associated with the company for 15 years, beginning as a salesman and in this capacity made hosts of friends in the industry. He has taken a prominent part in the activities of the electrical industry and for three years has served as statesman-at-large of the Jovian Order.

BERNARD J. DILLON, who for the past year has been on the staff of the ELECTRICAL REVIEW, has resigned to enter the advertising department of the Hurley Machine Co., Chicago, manufacturer of electric washing machines, vacuum cleaners and other household appliances. Mr. Dillon has given particular study to contracting-construction problems and the merchandising of electrical appliances, and his intimate knowledge of these subjects will prove of considerable value to the Hurley company. Mr. Dillon is a native of Pittsfield, Mass., where he served in the works of the General Electric Co. in transformer tests for about three years. In 1912 he came to Chicago and joined the Commonwealth Edison Co. For several years he was a district inspector, later becoming supervising inspector of this central-station company. Leaving the Edison company he became assistant editor of the ELECTRICAL REVIEW, taking charge of the Contractor-Dealer and Construction Departments. Mr. Dillon possesses a very pleasing personality, which has won for him many friends in this organization, and we trust this friendship will be established in the company with which he is now associated.

JOHN KELLY, who for a number of years was New York district manager of the Edison Storage Battery Co., has been appointed general sales manager of the company, with headquarters at Orange, N. J. This promotion for Mr. Kelly follows closely upon his promotion, on July 1 of this year, to the



John Kelly.

position of assistant general sales manager. Mr. Kelly brings to his new position the experience of a long and varied career in the storage battery, electric vehicle and accessory business. For nine and one-half years he was district manager of the New York office of the Edison Storage Battery Co. Prior to that time he had been a salesman for the Westinghouse Storage Battery Co. for two years, for the Swinehart Tire & Rubber Co. for three years, for the Firestone Tire & Rubber Co. for two years and for the New York Edison Co. for nearly four years.

W. D. A. PEASLEE, consulting engineer, and formerly assistant professor of electrical engineering at the Oregon Agricultural College, Corvallis, Ore., has become associated with the Jeffery-Dewitt Insulator Co., Huntington, W. Va. During the war Mr. Peaslee served with the Engineers in the trenches as liaison and reconnoissance officer with the rank of captain and later was on the staff of the First American Army as motor transportation officer, chief engineer. After the signing of the armistice Mr. Peaslee was appointed an executive officer of the information and liaison department of the American Peace Commission. He studied high voltage and ceramics in France and holds the degree of Deplome d' Etudes Superieurs from Sorbonne University, France. Mr. Peaslee has made extensive studies in high-voltage work and insulators, and his papers on this subject have been published in the A. I. E. E. Proceedings and other publications.

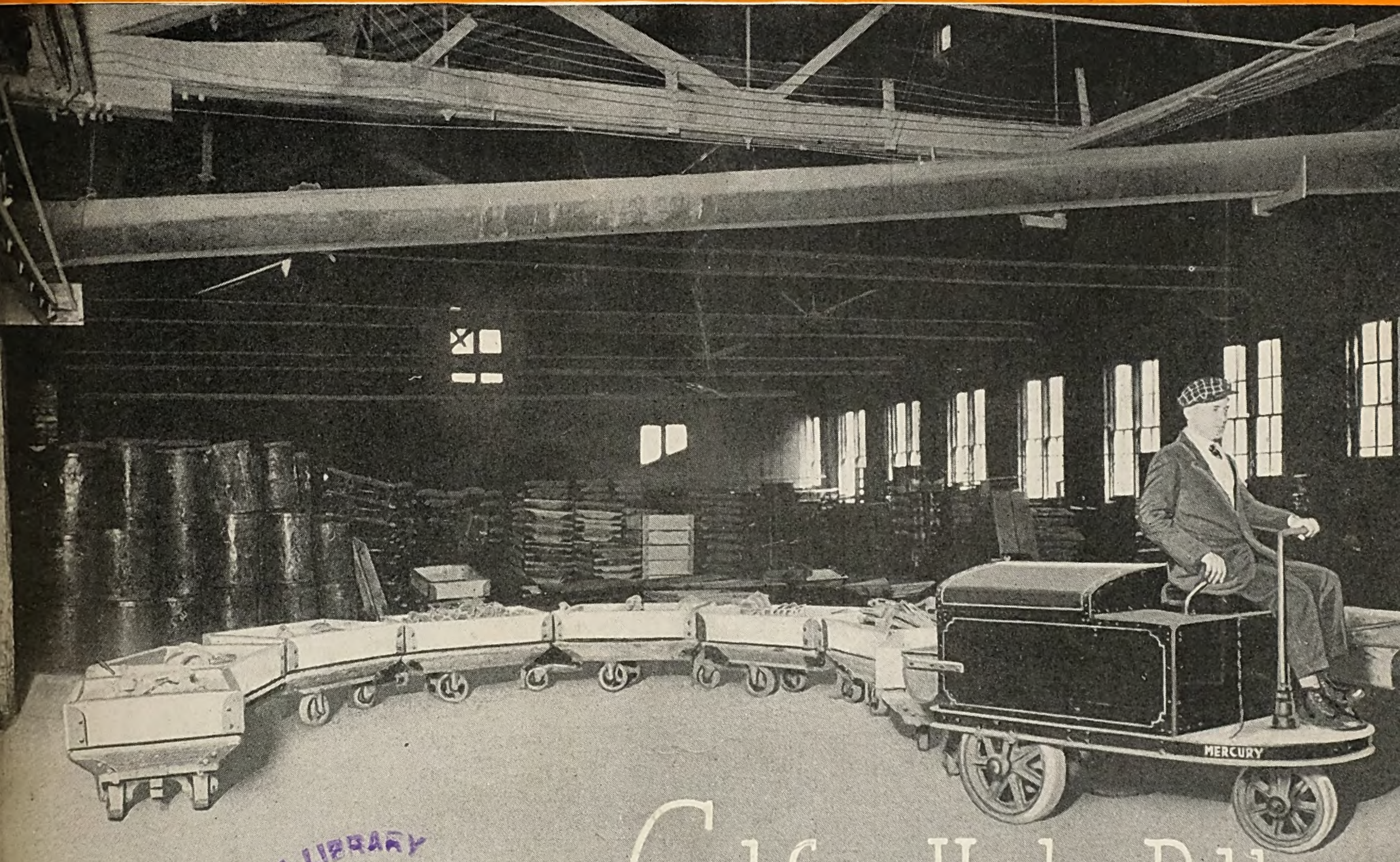
F. T. BANGS has left the advertising department of the Belden Manufacturing Co., Chicago, and rejoined the editorial staff of the ELECTRICAL REVIEW. Mr. Bangs is a graduate of Armour Institute of Technology course in electrical engineering, class of 1913. After spending three years in engineering work he joined the staff of the ELECTRICAL REVIEW, leaving a year and a half later to enter the advertising department of the George Cutter Co., South Bend, Ind., and last year that of the Belden Manufacturing Co.

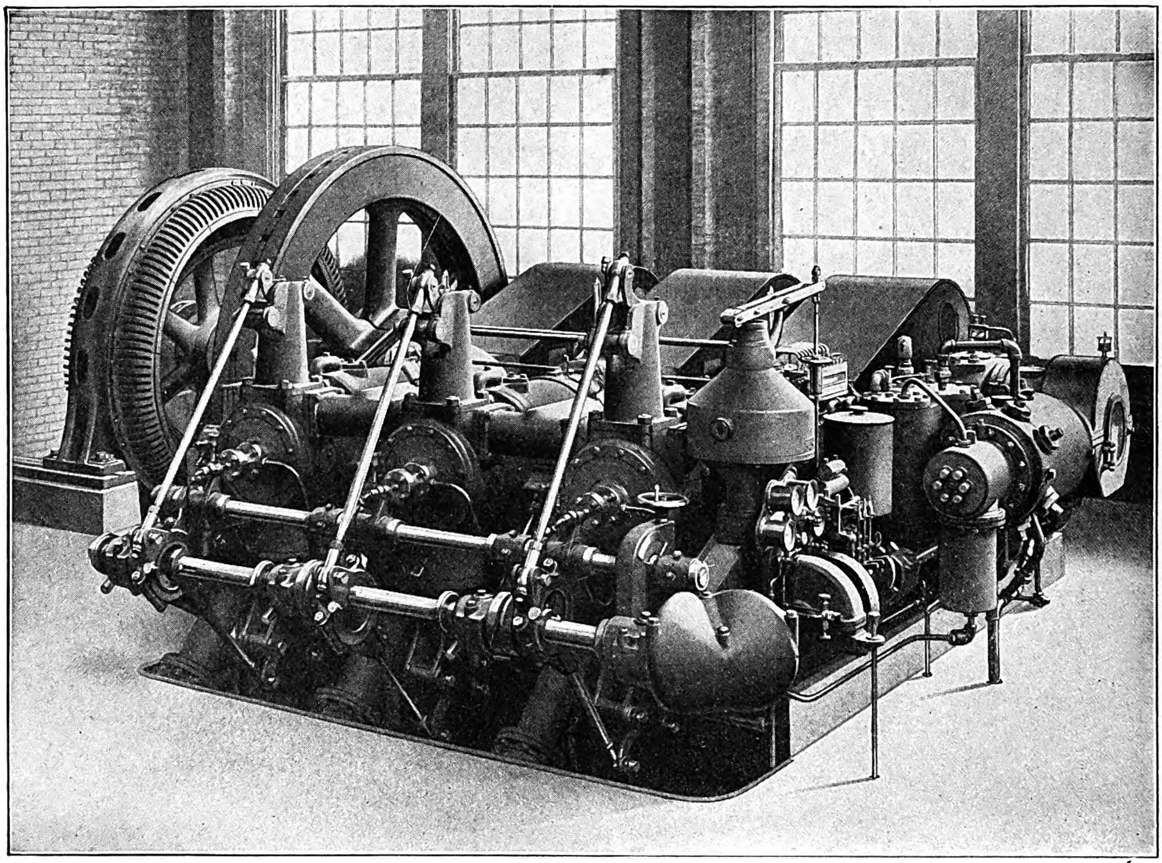
PETER JUNKERSFELD, formerly assistant to the vice-president in charge of contract, operating, construction and electrical departments of Commonwealth Edison Co., Chicago, and now engineering manager for Stone & Webster, Boston, was recently the recipient of a Distinguished Service Medal presented by the Secretary of War in his office in Washington. The following quotation is taken from the citation: "By his unremitting industry and energy, sound judgment, and knowledge of men he was of the most material assistance in the accomplishment of the construction program of the Army. He performed notable service as executive, organizer, and administrator."

H. P. HARRSEN has been appointed general superintendent of the Michigan Railway Co., an interurban railway, Grand Rapids, Mich., succeeding C. E. Morgan, resigned. Mr. Harrsen is a native of St. Louis, attended the Washington university and served apprenticeship in St. Louis. He later went to northern Mexico as assistant engineer in an extensive electrical development, and subsequently removed to Mexico City to accept the appointment of secretary to the manager of the Mexico Street Railway Co. Resigning this position, he became associated with the Toledo Railways & Light Co., with whom he remained for eight years. He then returned to Mexico City as general superintendent and later as general manager of the street railway system, and also was general manager of an extensive chemical works controlled by a Canadian syndicate. This syndicate undertook extensive hydroelectric developments at Barcelona, Spain, and Mr. Harrsen was sent to Spain to take charge of the work. In Spain his health failed and he returned to America.

Electrical Review

Vol. 75. No. 13. CHICAGO, SEPTEMBER 27, 1919 Three Dollars a Year





THE SUN NEVER SETS ON ALLIS-CHALMERS OIL ENGINES.

They are operating satisfactorily in the remotest parts of the world and were purchased because the many satisfactory installations had proved that the ALLIS-CHALMERS OIL ENGINE is not an experiment.

We furnish both engine and generator, insuring **UNDIVIDED RESPONSIBILITY.**

Write for Bulletin No. 1532-AB.

ALLIS-CHALMERS MILWAUKEE A-C

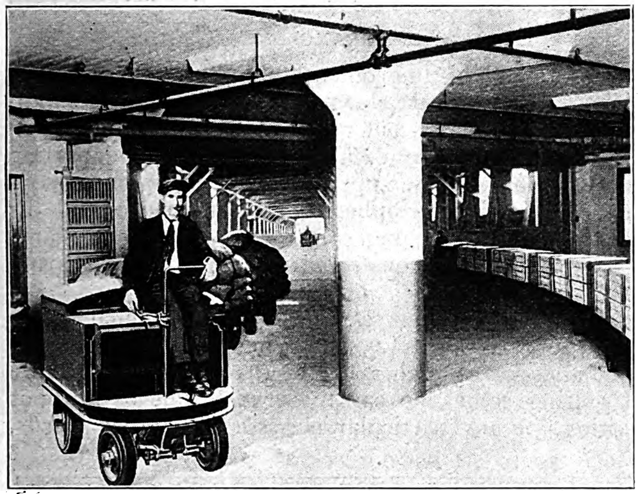
ALLIS-CHALMERS

Milwaukee, Wis. U.S.A.

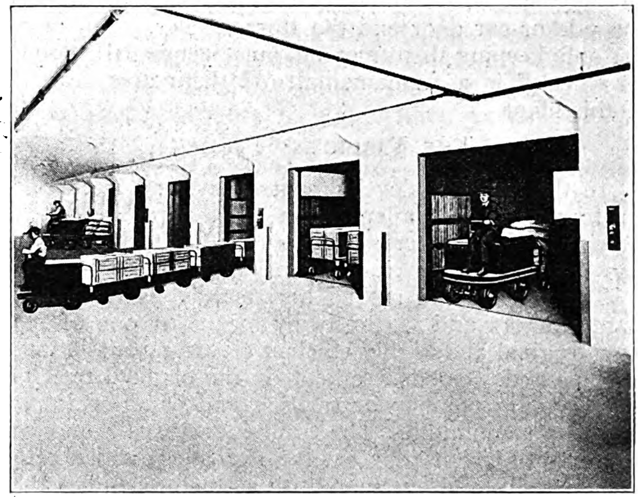
Electrical Review

WITH WHICH IS CONSOLIDATED WESTERN ELECTRICIAN AND ELECTROCRAFT.

VOL. 75—NO. 13. CHICAGO, SATURDAY, SEPT. 27, 1919. PAGE 509.



View of Runway and "Trackless Trains" in Operation at the Brooklyn Army Base.



View of Group of Ten "Operatorless" Elevators Which Are Controlled by Electricity at Central Point.

Electrical Features of the Brooklyn Army Supply Base

Utilization of Electric Tractors and of Group-Controlled Operatorless Elevators Form Important Links in Operation of World's Greatest Terminal and Distributing Warehouse

RISING in impressive magnitude on the waterfront of New York bay, constructed under the stress and secrecy of war, is the world's greatest single terminal and distributing warehouse plant. It is known as the U. S. army supply base, Brooklyn, and is the largest of the great receiving and distributing bases erected by the government.

These bases claim our attention as timely examples of what and must be done at our great coastal, lake and river ports and rail centers if not only the opportunities but the actual and urgent requirements of the very near future are to be all adequately met, and our new-born merchant marine properly supported.

Not only in size do they dwarf kindred commercial developments of the past, but in them have been incorporated the practical working out of so many of the latest and best ideas of architects, engineers, warehousemen and material-handling machinery manufacturers that they demand the closest scrutiny and consideration of those concerned with provisions for meeting commercial developments which the competent and keen visioned tell us are soon bound to far exceed anything in our previous experience.

The Brooklyn army base embraces about 100 acres from landward line to pierhead, over 15 miles of railroad tracks, which include storage for 1300 freight cars and 8000 ft. of available string-piece intended for loading simultaneously a dozen deep-draught ocean freight carriers.

There are two main warehouse buildings, "A," 200 ft. by 980 ft., and "B," 240 ft. by 980 ft., a mechanical and repair building, a four-story administration building, and three "transfer sheds" or pier houses, 150 ft. by 1350 ft. each, which function in the transfer of freight to and from the water carriers.

The warehouse floors contain over 4,000,000 ft. of floor space and the transfer sheds 1,250,000 ft., or a combined total of 116 acres. Including the transfer sheds for transient use, this affords actual storage space for about 15,000 carloads of goods.

Handling 15,000 carloads, or 300,000 to 400,000 tons of freight, on a 30-day turnover basis, particularly in these times of labor shortage, requires the utmost possible conservation of time and effort. The whole handling system of the Brooklyn plant is calculated to meet those big problems in freight and merchandise handling which begin and end at the shipside or car door and involve loading, unloading, plant movement, both horizontally and vertically, and tiering.

In addition to the size of the plant there are several outstanding features which mark a great advance in merchandise and freight-handling equipment as well as in methods employed, and the progress in the art of vertical transportation as applied thereto.

The utmost practical utilization is made of various devices for the reduction of manual handling. There are automatic elevators, cranes and derricks, lifting trucks for picking up whole loads with one single operation and shifting to other locations, trailer trucks and both gravity roller and portable power conveyors.

It is an old warehouse maxim to "keep the goods moving," and here too they are kept going between shipside or car door and the storage piles. However, not only keeping them moving, but "keeping the goods on wheels" is a fundamental and distinctive feature of this plant.

The Trackless Train.

In this modern development everything is carried on four-wheeled trailer trucks, and here the goods which are carried across country by the trainload are also handled by the truck trains through the plant.

The trailers are moved horizontally by industrial plant tractors and vertically by means of one of the most original and highly efficient elevator installations ever devised. Goods are kept on the original trailers from loading point to destination and handling is reduced to a minimum. The trailers are usually moved in trains of from four to five if loaded, and six to eight if light, and one man with a tractor handles the train. This should be contrasted with the string of handlers which would be necessary to move an equal tonnage with the old two-wheeled "baggage" trucks.

The tractors and trailer trucks are, of course, narrow gauge, and the trains are easily handled in the aisles and around the turns. For short trailer movements tractors are not used, as one man readily handles on a four-wheeled truck two or three times the average load of a two-wheeled hand truck.

The whole plant is laid out in definite one-way traffic lanes, carefully calculated to afford maximum access and minimum congestion.

In addition to the yard movement, this traffic system includes communication between the transfer sheds and warehouse "A" via three bridges which connect the second pier level with the third warehouse level, while additional bridges and subways under streets connect warehouses "A" and "B." This practically eliminates the necessity for tractors and trailers to cross the railroad tracks in the yard or streets, as the goods moving between the first pier shed level and the warehouse floors travel via the pier elevators, the bridges, subways and the warehouse elevators.

Ninety Operatorless Elevators.

Speeding up and controlling the horizontal movement on one level, however, is not the most serious problem confronting most plant and warehouse managers. Comparatively few executives conceive the extent to which indifferent elevator service affects plant turnover, but as a matter of fact as the number of levels or stories increases the elevators become more and more as the spout of the funnel and their efficiency the measure of the rate of the flow of goods.

This fact was given a great deal of consideration in planning the Brooklyn army base, with the result that an elevator plant with many original and ingenious features was devised.

There are in all 96 elevators, of which 90 are for freight and six for passenger service.

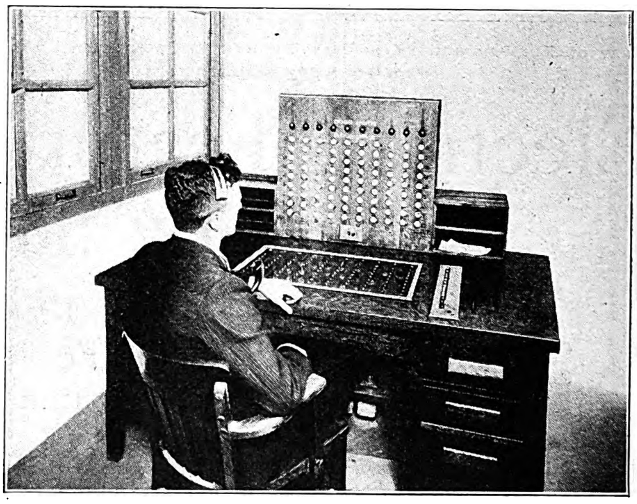
The 90 freight elevators are of 10,000 lbs. capacity; 18 are located in the pier sheds, serve two floors, and have a speed of 100 ft. per min. Seventy-two are located in the warehouses, serve nine floors, and have a speed of 150 ft. per min.

Each elevator platform is 9 ft. 4 in. by 17 ft. in the clear and intended to carry four trucks. Automatic stops are accomplished wherein the elevator platforms register accurately with the landing sills by means of automatic levelling devices, and the landing or hoistway doors are opened automatically when the elevator reaches the floor to which it has been dispatched. Operators on the cars are not used.

Elevators Arranged in Groups.

In a few old-time office buildings and hotels one finds the passenger elevators scattered about individually or in pairs, but modern practice groups them to secure the minimum waiting time between departing cars and to facilitate supervision. This same reasoning unquestionably applies to freight service, and the advantages of grouping elevators in industrial plants is conclusively demonstrated in the Brooklyn army base.

From seven to ten cars make a group which serves a "section," or some 325 ft. in length, of each building unit, and out of such a group one is reasonably sure of getting some one car to serve his needs without waiting for any particular elevator. In other words,



Dispatcher's Desk for "Operatorless" Elevator System. This One Man Operates Ten Elevators, Each Covering Eight Floors and Basement.

with ten cars in a group, the average waiting time will obviously be just one-tenth of what it would be if each car was placed separately.

Central Dispatch Control.

In the Brooklyn army base each group of elevators is handled entirely by a central dispatcher, who is located in a small office placed for convenience a short distance from the group. Before him is a table not unlike a telephone switchboard, with one upright and one horizontal panel. In the upright panel is a column of white lights for each elevator, each light representing a floor. At the top of each column is a colored light which indicates, when lighted, that all hatchway doors are closed and the elevator can be operated. The operating buttons are placed in rows in the horizontal panel.

The group system, in which the elevators are operated by a central dispatcher instead of each elevator being placed separately and operated individually, gives the least waiting time and maximum service out of a given number of elevators. A central dispatcher with a group of elevators under his control and knowing all the requirements can get better service than can be obtained from the same or even a greater number of elevators placed singly and subject to both the varying intelligences and the loading tendencies of as many individual operators.

In general or miscellaneous service, which is the most difficult to handle, the dispatcher receives calls for cars from the various floors. As an example, the dispatcher gets a call for a car from the seventh floor to take goods to the third floor. A quick glance at the vertical panel shows that car No. 5 is standing idle at the sixth floor, since its "6" white light is burning. The colored lamp at the top of the row is lighted, indicating that all doors are closed. The central dispatcher then touches "7" button and the white light disappears as the car leaves the sixth floor, and shortly signals arrival at the seventh floor by means of a light in bulb "7." As the doors open automatically the colored light is extinguished and the car is out of the control of the dispatcher and cannot be run until some one on the seventh floor touches one of the seventh floor "door closing" buttons, of which one is on either end of the car and two others alongside the opposite entrances. As soon as the load has been run on and the door button pushed the doors close and the colored light again appears, signaling to the dispatcher that all is clear to go ahead. He then touches "3" button, thereby dispatching the car to the third or destination floor.

When certain elevators have been assigned by the dispatcher to regular or fixed service for a time, such as handling a trainload of flour going from the first level to the seventh, individual calls are not needed, for the lights alone tell the story, the appearance of both a colored and a white light in the same panel then indicating that the car is loaded, the doors closed and the elevator ready to be dispatched.

The central dispatcher can readily detach any elevator of his group from the operating board. It then can be operated directly from the car switch provided therefor, and still retain its automatic door opening and automatic leveling features. Until disconnected from the central board, however, the car switch remains inoperative.

Excepting for convenience, or when goods are being sent to a floor where no one is working at the time, no one needs to ride on the elevators for the purpose of operating the elevator or its doors.

The Micro-Leveling Elevator.

The elevator equipment described in this article is an epoch-making development in the field of vertical transportation. It represents the product of years of experience in elevator design and manufacture, and is the result of the combined genius of engineers and inventors. It is a well-known fact that with an automatic push-button elevator, in order to be adaptable for freight service where trucks are used for handling goods, the car platform must be brought to an accurate level with the landing and maintained there under all conditions of loading and unloading.

A push-button-controlled elevator has recently been developed which stops the car automatically with any desired accuracy and with any load within its capacity. When the position of the car changes during the loading and unloading, due to the lengthening or shortening of the cables, the car is automatically and quickly restored to the landing level. This remarkable accomplishment made it not only possible but more advantageous in this case to operate the freight elevators by a central dispatcher than by individual operators on each car. This new automatic elevator is known as the "micro-leveling elevator."

The hoisting unit consists of the main driving machine and the micro-drive mechanism. In the Brooklyn army base the main machine is of the worm gear type and is driven by a two-speed alternating-current motor giving full and one-third speed. The "micro-drive" consists of motor, brake and worm gearing of about one-tenth of the speed and power of the main machine. The micro-drive is mechanically connected to the main machine through the revolving electro-mechanical main brake. The slow motion of the micro-drive through the final few inches of travel in connection with a novel system of control, results in the car stopping level with the landing with any load to the full capacity of 10,000 lbs. Since the leveling is accomplished at slow speed and by means of the small motor, there is less wear and tear of mechanical and electrical parts than with an elevator of the ordinary type and the amount of power required for leveling is reduced to a minimum.

Micro operation is applied to car switch as well as automatic push-button control. In this case the operator throws his switch to the stop position on approaching the floor just as in the operation of the ordinary car switch control. If the car is within the micro zone, the micro-drive functions and stops the car level with the floor. Although the micro or leveling zone extends 8 in. above and below floor levels, in actual service the average micro movement is usually not more than 3 in.

Selective Automatic Door-Opening and Closing Machines.

The doors are operated by an ingeniously arranged mechanism which automatically opens the doors at the floor to which the car has been dispatched and as the car approaches that floor. As the door-operating machine starts to open the doors when the leveling zone is reached by the car, it is obvious that the leveling is accomplished while the doors are being opened and therefore no additional time is required for leveling.

The door-closing operation can be initiated only by touching a closing button either on the car or alongside the door opening on the floor.

Hatchway Doors.

The doors themselves represent a radical development in elevator hatchway doors. Consideration of the trailer truck problem pointed the way to doors of maximum height and rising from fixed sills. Due to the high door openings and limited story height it was necessary that the door-operating mechanism be so arranged as to first move the door horizontally into the hatchway a sufficient distance to clear the sill and door above and then to raise the door vertically to clear the opening.

These doors are made of a steel frame with panels ¾-in. thick of sheet steel and asbestos composition.

In case of emergency the cars can be run with the doors open.

Piershed Elevators.

Ships are unloaded in part on both piershed levels and goods in transit between the warehouse and first transfer shed level reach or leave the latter on trailer trucks via the eighteen automatic elevators with which the sheds are equipped. These elevators are operated individually by means of buttons on each floor and in the car. In all other features they duplicate the warehouse elevators.

The army supply base was constructed for the traffic storage and purchase division of the War Department. Quartermaster General Goethals, director of this division, appointed Cass Gilbert as architect thereof, under whose direction and supervision the original conception was fostered and developed. The actual construction was carried on by the Turner Construction Co. under the construction division of the War Department, under the command of Brig. Gen. R. C. Marshall, Jr. Lt. Col. H. S. Crocker was constructing quartermaster.

Much credit is due both the Turner Construction Co., general contractor, and the many sub-contractors, who have made a wonderful record in bringing the plant to a state of practical completion in the limited time at their disposal. The elevator installation was made by the Otis Elevator Co.

While designed and built primarily for government service, a prominent warehouse and terminal operator who has been identified with the Brooklyn army supply base has recorded his belief that the solution of some of the most difficult problems confronting operators of commercial enterprises of this class lies in following the government lead here, inasmuch as he considers the Brooklyn base in every way an ideal plant.

WESTINGHOUSE WAR MEMORIAL SCHOLARSHIPS AWARDED.

Four Young Employes Win Competitive Tests for Memorial Scholarships and Select Engineering Courses at Prominent Technical Colleges.

The awards of the four annual War Memorial Scholarships of $500 each, established by the Westinghouse Electric & Mfg. Co., have just been announced. These awards were made by competitive examinations and the following men were successful:

Herbert S. Pahren, Cincinnati, O., employed as order clerk in the Cincinnati office of the Westinghouse company, and a graduate of the Hughes High School, who has selected for his scholarship a technical engineering course at the University of Wisconsin.

Arthur Marthens, of East Pittsburgh, began work as a messenger boy before completing his studies in the Turtle Creek schools. Mr. Marthens, while working in the cost department, prepared himself in the Casino Technical Night School to enter college. He has chosen a course in electrical engineering at the Carnegie Institute of Technology.

Paul O. Langguth, a graduate of the Wilkinsburg High School and employed as draftsman in the engineering department at East Pittsburgh, has selected as his award an electrical engineering course at the University of Pittsburgh.

Andrew P. Lesniak, a graduate of the Union High School, Tuttle Creek, Pa., and employed in the production department at East Pittsburgh, has selected a course in mechanical engineering at the University of Pittsburgh.

Two classes of scholarships are provided:

(a) For sons of employes of the company or its subsidiaries who have been employed for five years or longer. (b) For employes of the company and its subsidiaries who have been continuously employed for at least two years and who had not, on Sept. 1, exceeded the age of 23. Not more than two class B scholarships will be awarded in any year.

Each scholarship carries with it an annual payment of $500 for a period not to exceed four years, the payment to be applied toward an engineering education in any technical school or college selected by the successful candidate with the approval of the scholarship committee.

These scholarships have been established as a memorial to those employes of the company and its subsidiaries who entered the service of their country during the war. Four awards will be made each year, so that after three years this company will be maintaining 16 of these scholarships in the best technical schools of the United States.

CHICAGO'S NEW ENGINEERING ADVERTISING ASSOCIATION.

Advertising Managers of Engineering Manufacturers Form Body to Improve Advertising Methods.

The Engineering Advertisers' Association of Chicago is a new organization whose membership is limited to advertising and sales executives of concerns engaged in the manufacture of engineering products.

This association was organized by a group of men actively engaged in the production end of advertising work, including H. L. Delander of the Crane Co., P. A. Powers of the Benjamin Electric Manufacturing Co., Glenn H. Eddy of the Green Engineering Co., J. J. Arnsfield of Fairbanks, Morse & Co., and Albert H. Hopkins of the C. F. Pease Co.

It was the judgment of these men that the advertising activities of manufacturers of engineering products have assumed such magnitude as to necessitate an independent organization devoted exclusively to this special field.

P. A. Powers, one of the directors, outlined the purposes of the Association as follows:

"We seek to improve present methods of advertising and selling engineering products by trying to bring the truth to bear upon our problems; by each one laying down his own methods and submitting to friendly criticism; by co-operating in various active efforts and by the interchange of ideas and experiences."

The committee in charge of the winter program has arranged for a comprehensive series of lectures which will be delivered at the monthly meetings by men who are recognized authorities on the subjects assigned. Such questions as better typography in engineering advertising, the use of art in advertising technical products, markets and their analysis, the kind of data which should be accumulated by advertising managers, and other very practical topics will be discussed by experts.

The membership now includes a great many of the members of the advertising profession who are prominent in their work. The control of the association is vested entirely in advertising and sales directors as it is the intention to limit the membership to men actively engaged in advertising and selling engineering products.

GLASGOW CORPORATION ORDERS EIGHT ELECTRICS.

The Municipal Corporation of Glasgow has just ordered 6 two-ton electric vehicles at $6520 each from Edison Accumulators, Ltd., and 2 electric vehicles at $5600 each from Electric Vehicles, Ltd.

Central-Station Rates in Theory and Practice

Twelfth Article — Discussion of the Results of the Mathematical Study of Price Splitting—Comparison of Different Modifications of the Value-of-Service System

By H. E. EISENMENGER

This is the twelfth article of this series, which began in the issue of July 12. The first seven articles, constituting Part I, discussed the cost of central-station service, a knowledge of which is necessary before any rate system can be intelligently selected. In the two following articles were outlined the three general principles on which is determined the extent to which the different classes of customers shall contribute to the profit of the undertaking. Two and one-half articles were then devoted to Insert IX, which was a mathematical study of the relations between selling prices and earnings. The present article gives a summary of the conclusions derived from this study and shows some of their applications. This will be continued in the next article and then rate systems will be taken up in the remaining articles, which will continue throughout practically all this volume.

PART II—THE PRICE OF ELECTRIC SERVICE—Continued.

III.—The Value-of-Service Principle.

A. Advantages to the Public and to the Producers (Continued).

THE principal results of the investigations in Insert IX about price splitting are in brief words the following (Sections 81-86):

81. If we determine the prices for *every particle* of the service separately[1] in accordance with the value which the respective customer attaches to that particle, but with the restriction that the prices shall never be raised above the original price, this operation (price splitting downward) *must always* result in an increase of the earnings (whether gross income, net income or dividend), provided that no particle of service is sold at a price below a certain minimum. The amount of this minimum depends on the kind of earnings we have in view (gross income or net income or rate of return) and it is identical with the values given as lower limits in Section 74 (a), (b) and (c) for the "What-the-traffic-will-bear" system with the three kinds of earnings. These values are of necessity always lower than the original price, provided the latter has been chosen so that it does not result in negative earnings. (The above is proved in Sections 10-13 of Insert IX.) *Therefore profitable price splitting downwards will always be possible.*

This method of price determination would mean not only that the prices vary between different kinds of service and between different customers, but different particles of the same service would be charged differently to the same customer. For instance, every customer would have to be charged slightly differently for the first kilowatt-hour supplied to him for a certain kind of service than for the second one, and for the second differently from the third, etc. (see Section 73). The same would apply to the kilowatts of demand. The theory would, moreover, require that the kilowatt-hours used for kitchen lighting, for instance, be charged differently from those used for the lighting of the living room, and those used at 6 p. m. differently from those used at midnight because the valuation of these particles by the customer will probably be different.

[1]For instance every kilowatt, every kilowatt-hour and every individual customer, respectively.

82. As this theoretical method of charging is obviously impracticable we will in practice try to approximate it as closely as we can. We will combine into one group or class of service, or of customers, large numbers of such units of service of which we expect that there is approximately the same valuation on the part of the customer or customers. We then charge all units in the same class or group at a uniform price. Price splitting downwards will then mean lowering the prices for all units in one or more of the groups in such a manner that the prices remain equal amongst one another for all units in the same group, but they will differ between groups. We have therefore in this practical value-of-service system a hybrid between the theoretical value-of-service system and the cost-of-service system. We may, for illustration, charge all kilowatt-hours for heating service at the same price and differently from the kilowatt-hours for other than heating service. Or we may charge the first 50 kilowatts demand of wholesale power at certain fixed demand charges which are higher than those for the following kilowatts, etc. The more uniform the valuation is by the customer of the units within every group, that is, the more intelligently we select the groups and the larger we choose the number of the groups the more closely will this method and the results therefrom approximate the method of Section 81 and the results of that method.

This method of varying the prices, not between individual units but between groups, will be called "price splitting between groups."

83. The latter part of Insert IX (beginning with Section 15 of that Insert) contains a detailed investigation of the conditions under which price splitting downwards between groups is of advantage to the three different kinds of "earnings" (gross income, net income and rate of return).

The principal results of these investigations are the following:

1. The necessary and sufficient condition that

price-splitting downwards between groups shall increase the earnings is that the number of units sold in the group (or groups) for which the price is being lowered, increases more rapidly than the "profitable portion of the price" is being diminished by the price reduction[2]. The term "profitable portion of the price" means the excess of the price over the cost increment per unit[3] provided that the term "cost" (see Section 2) is defined in each case in the same way as in Section 75 (where we dealt with the lower limit of the prices permissible under the maximum earnings principle), that is:

Gross income...	Cost = 0; cost increment = 0.
Net income....	Cost excludes capital expenses.
Rate of return..	Cost includes capital expenses; cost increment includes the capital expenses of the increment capital figured at the same rate of gross interest which is obtained for the rest of the capital.

Other interesting and fundamentally different ways of stating the same law are found in Sections 16-19, 29-30 and 37-38 of Insert IX.

2. It follows from condition 1 of this Section that the prices can in no case be profitably reduced below the "cost" (as defined above), although we can find or construct special cases of sales curves[4] which bring the range of profitable price reductions as close down to that "cost" as we desire. In other words, the "cost" is the lower limit to which the price can profitably be reduced under any circumstances. With a given sales curve we can not reduce the price profitably lower than to a certain lowest limit which is greater than the "cost."

3. Condition 1 *must always* be fulfilled (this means price splitting downwards between groups is *always* of advantage to the earnings), if the price of the original cost-of-service system is at least as high as the price which results in a maximum of the respective aggregate earnings of all groups under the cost-of-service system. Condition 1, on the other hand, *may* be fulfilled if the price of the original cost-of-service system is lower than the above limit.

84. Stating the above laws in still shorter terms (which of course implies a corresponding further reduction of the accuracy) we can say: A lowering of the prices will improve the earnings if the price is lowered in those groups for which the sales rise sufficiently rapidly as the prices decrease. This means that price splitting downwards between groups is of advantage if one or certain ones of the groups show a comparatively heavy percentage of increase of sales in the range where the price is lowered. If the term "price splitting downwards" is to be understood in such a manner that the prices are reduced to one or more of the groups, whereas they are kept at the original value in at least one of the groups, we have to add the condition that at least one of the groups increases its sales only comparatively slightly for the price reduction in which the others show a heavy percentage of increase of sales. In other words, the groups must show a good differentiation between the shapes of their "sales curves," at least in the range of prices below the original price in which the price reduction will take effect. An instance of this kind is furnished by the two groups of lighting and heating service. If we reduce the price, the consumption of heating current and the heating demand will rise more rapidly than that for lighting service and therefore a reduction of the rates for heating current below those for lighting current will be proper, a thought which is borne out in a large number of rate schedules.

85. It will be the easier to classify the service and the customers into such well differentiated groups the more groups we have.

At the same time we can expect that under a cost-of-service system of charging, which has been intelligently devised from the producer's point of view, the price will be such as to furnish a maximum of earnings or at least that the price will not be far away from that value. With reference to Section 83, condition 3, we can therefore say that even under a system of price splitting by groups it will always be possible to increase the earnings by means of price splittings downwards.

It should be kept in mind that an ideal analysis of the total service into groups of service will be identical with a separate determination of the price for every particle of service and, as stated in Section 81, and proved in Insert IX, this will under any practical circumstances result in the possibility of increasing the earnings by price splitting downwards.

86. We can thus say generally: If the original cost-of-service system has been intelligently devised from the producer's point of view and if the classification into groups is intelligently made, *it will practically always be possible to raise the earnings by the introduction of price splitting downwards.*

87. Whereas we have seen (Sections 81 and 83) that price splitting can be carried out with advantage to the earnings as long as the prices do not reach below a certain lower limit, this must not be interpreted by any means to imply that we reach a maximum of the earnings by lowering the prices to that limit. On the contrary, carrying the prices down to that level would mean that we have lowered the prices so far that all the advantages gained by the reduction of the prices have been gradually reduced to zero and we are back at the same point—as far as the amount of the earnings is concerned—as before price splitting began. In order to obtain a maximum of the earnings the lowering of the prices must not be carried to that extreme but must be stopped earlier. (The exact amount to which the prices are to be lowered in order to procure the maximum of the earnings is discussed in Insert IX). In order to reach a maximum of the earnings the prices should in general be changed to a different level in every group. Where we are interested in price splitting downwards only, we effect a change of prices in those groups only where they should be lowered and in the other groups we leave the prices at their original level.

88. We go back now to our original problem of Section 78 and assume that we have had a system of charging under the cost-of-service system with the prices regulated in such a manner that the earnings are just what is considered fair, not so high that the public might be justified in demanding a reduction of the rates, nor so low that that part of the public which has invested its savings in the public service corporation finds the return for its capital and risks insufficient so that capital would be driven away to other more lucrative enterprises which would result in the ultimate damage to the consuming part of the

[2]If, for illustration, we contemplate a price reduction which reduces the profitable portion of the price to 2/3 of its original value, the number of units sold in the respective group must increase to at least 3/2 of the original amount (that is, to the reciprocal of 2/3) to make this price reduction advisable. The profitable portion of the price has then been reduced from 150% to 100% and therefore the amount of the sales must be increased from 100% to at least 150%. If the profitable portion of the price is reduced to 1/2 (200% to 100%), the number of sales must at least be doubled (100% to 200%), etc.

[3]See the first footnote of Section 75.

[4]For explanation of the term "sales curve" see Section 73.

public as well. Then we change over to the value-of-service principle by price splitting downwards only (and not upwards). According to what has been said in the preceding Sections (see Section 86) it will practically always be possible to do this in such a manner that the earnings are increased thereby[5]. We arrive thus at a system of charging which will be called for the sake of convenience "the first value-of-service system" or for short *"the first* system."

The upper part of Fig. 3 shows how the various consumers are affected by this change of charges. Fig. 3 refers to the sale of a certain particle or group of service, for instance to the first 50 kw-hr. of lighting service, or it might refer to the demand charges, for instance of the first 10 kw. of power service, or to any other reasonable subdivision of the service. This particle of service will be worth different amounts of money to different consumers, which means different consumers will be able and willing to pay different amounts for the respective particle of service. These amounts will be called hereafter the consumer's *"limiting price"* for that particle of service. This "limiting price" (in dollars or cents), which varies for the various consumers between zero and a certain maximum, is stepped off in horizontal direction in the various parts of Fig. 3 from the line *OO* to the right. Every consumer is charged a certain percentage of his "limiting price" and these percentages which the consumers are charged actually under the various systems represented in Fig. 3 and to be discussed presently, are stepped off upwards from the respective horizontal base line in vertical direction. Where that percentage is 100% or less the consumer will purchase the respective particle of service to which the diagram refers, otherwise he will stay away and not avail himself of the benefit of the central station's electric service. For those consumers who are buying the service under the various systems the area of the diagram is shaded, for all the others it is left empty, so that the shading shows at a glance how far the benefits of the electric service reach the different classes of the population.

In the cost-of-service system (top diagram) one price only is charged to all customers, therefore only one certain class of prospective customers will be charged just their limiting price (100%), all the others are charged either less (to the right of *PP*), or more than 100% of their limiting price (all prospects to the left of *PP*). The latter will stay away and not become customers under this system of charging.

If now price splitting is introduced within a certain range from the original price *OP* downwards, for instance in such a manner that the lowest price to be split off reaches as far down as P_1P_1, all customers whose limiting price is in that range will be charged their limiting price. Thus (see the second diagram from the top in Fig. 3), all customers whose limiting price is large enough as to reach beyond the line P_1P_1 but not large enough to reach beyond the line *PP* are charged just their limiting price (100%), those to the right of P_1P_1 are charged a smaller percentage, and the prospects to the left of P_1P_1 would be charged more than 100% of their limiting price and will therefore not be customers. Under this system which will be called *"the first value-of-service system"* we have added as customers all prospects whose limiting prices are in the range between P_1P_1 and *PP* (compare the shaded ranges of the two top diagrams in Fig. 3).

[5]It will be shown later (last sentence of Section 92) that this fact, though helpful for the understanding of the evolution of the value-of-service principle, is not altogether essential.

If now the splitting of prices for the "first value-of-service system" has been made in such a manner that the total earnings of the company are increased thereby (see Section 86) and if, on the other hand, we want to preserve the amount or percentage of earnings which has been considered fair before price splitting was put into effect, we will have to modify this "first value-of-service system" by introducing price reductions.

89. We might reduce *all* prices in the same fixed ratio so long until the excess of earnings has disappeared. In that way every one of the consumers would be positively benefited by the introduction of the value-of-service system. Let this be called the *"second system."*

This reduction would mean that certain customers at the lower end of the scale would be added which could not be reached under the former prices. The customers added will be those whose limiting price is greater than the lowest one of the new prices, but smaller than the lowest price of the first value-of-service system (see Fig. 3, System 2, shaded portion to the left of P_1P_1).

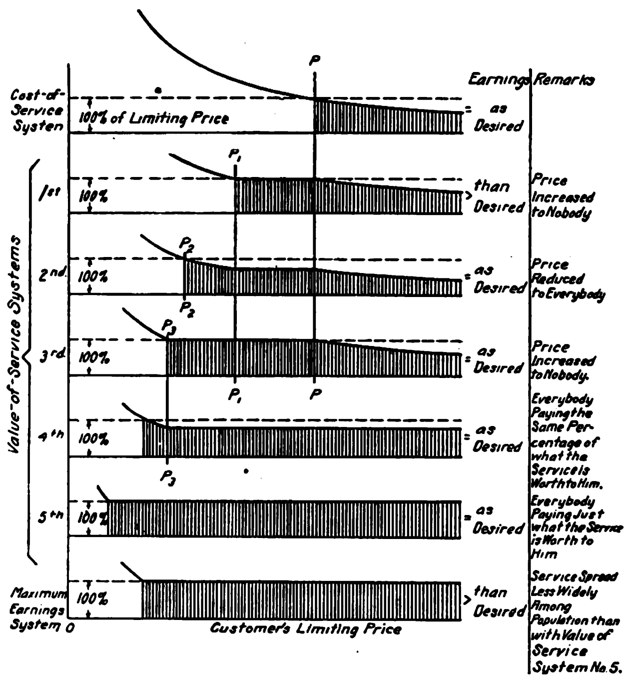


Fig. 3.—Comparison Between Cost-of-Service System, Value-of-Service Systems, and Maximum Earnings System.

90. Or *("third system")* we might leave unchanged the prices that are charged to the existing customers under the "first system" and add new lower prices for those customers only who have not been able and willing to pay the prices of the first system for the respective service. This means that those consumers who had been customers under the cost-of-service system (that is, the customers to the right of *PP*) are not benefited by the introduction of this (third) value-of-service system, but neither do they lose. They simply continue to pay the price they were charged under the original cost-of-service system (and under the first value-of-service system). This is the disadvantage of the third system compared to the second where all customers are positively benefited by being allowed a price reduction. The advantage over the second system is that a certain por-

tion of the public can be supplied with service that had to forego the benefits of electric service under the second system[6] (between P_2P_2 and P_3P_3 in Fig. 3).

In this third system all consumers pay for their service just as much as they are able and willing to pay, with the exception of those consumers who are charged the highest price, that is the price of the original cost-of-service system. These customers pay less than 100% of their "limiting price." (See Fig. 3, to the right of PP.)

91. Unless we insist that the changeover to the value-of-service system shall avoid raising the price to any customer over the price paid under the original cost-of-service system there is no logical reason why those customers who are reaching up to that arbitrary dividing line PP of the original "cost-of-service price" should be exempted from the rule which applies to all other consumers, namely that each consumer shall pay not more and not less than what the service is worth to him. Under the "third system" those customers who would be willing and able to pay the highest prices of all are charged less than their limit (whereas all the others are charged just their limit). We can therefore go another step forward and *raise* the prices to that class of consumers so that every customer has to pay just what the service is worth to him. This permits of a subsequent further reduction of the prices and, if the earnings are, as assumed, to be kept constant, such a reduction is even necessary.

We can again choose two methods for this subsequent reduction, in analogy to the two methods applied in developing the second and the third system. Either we reduce all prices by the same percentage, so that each customer[7] pays the same percentage of what the service is worth to him *("fourth system")* or we add another set of prices at the lower end of the scale extending this set downwards so long until the excess of the earnings has been swallowed *("fifth system")*. This means new consumers are taken on for the service in question for whom even the lowest prices charged heretofore have been prohibitive.

It should be noted that if we carry the value-of-service principle in this manner to its ultimate consequences (fourth and fifth systems) this amounts to a "maximum-earnings system" (see Section 65) with these modifications (compare Fig. 3):

(a) In the fourth system the prices are reduced to all consumers[8] by a certain fixed percentage below the price charged under the maximum-earnings system. This percentage applies alike to all customers so that every customer has to pay the same percentage of what the service is worth to him. The minimum price must not be identical with that of the maximum-earnings system; it may be higher or lower.

(b) In the fifth system every customer has to pay 100% of what the service is worth to him, but the prices reach further down than with the maximum-earnings system. Under the maximum-earnings system we must refuse to make any sales at prices so low that they would reduce the total earnings (see Sections 72 and 74), whereas under the fifth system we go deliberately below that limit with the intention of reducing the earnings to the desired limit.

92. It is of interest that with none of the five systems are we bound in any way by considerations of the cost, as far as the individual price is concerned. The individual price may reach down even below the increment cost; with the fifth system the prices are even bound to reach below that limit. The consumers for whom the service is of higher value make up for the reduced profit or even loss caused by others.

Each one of the six systems (original cost-of-service system and five value-of-service systems) in the order named carries the benefit of electric service further into the population than the preceding system.

We see also from the above deductions and from the diagram Fig. 3 that, unless we want to avoid raising the prices to any customers (Systems 1 to 3) we arrive at the same ultimate systems (4 or 5) regardless of whether it is possible to employ price splitting downwards with an increase of the earnings, or not.

93. The beginner should clearly understand that the above is a theoretical investigation based on the assumption that we have a full and definite knowledge of how the sales vary with the prices. Its object is to get an insight into the general effect and the possibilities of an intelligent value-of-service system (see Section 67). The five systems are five steps or stopping points, chosen with a certain degree of arbitrariness to explain the evolution and the effects of the value-of-service principle. But in practice the knowledge referred to above is a thing not to be thought of. We can therefore in practice not distinguish between the five systems as clearly as we can in theory. Practical price-making in general is necessarily always based on business instinct and even guesswork, and so is the practical application of price splitting in particular.

All we can do in practice is to grant lower prices to those groups of service which, as for instance heating and cooking service, can be expected to increase their sales with decreasing prices much more rapidly than others, for instance lighting service. At the present average price which is charged for general lighting we have reached a certain degree of saturation of lighting service. Although a reduction of the price for lighting current to one-half or one-quarter of its present average value would undoubtedly increase the use of electric light, yet it would not increase it by nearly as much as a reduction to the same price would increase the use of electric heating because the present *lighting* rates are almost prohibitive for electric heating and cooking, except for some small appliances, largely as a luxury or convenience rather than a necessity. Therefore we will conclude that a reduction of the price—or rather of the percentage profit—for heating and cooking below that charged for lighting service is generally advisable. There are of course other considerations, such as the complication of the rates or the necessity of a separate meter, which may make it undesirable to create a separate rate for heating and cooking (to remain at the example chosen) and all this requires good judgment on the part of the rate maker to decide whether he should use under the given local conditions a separate rate or one of the other methods for the same purpose (Wright rate, number-of-rooms rate, etc.) to be described and discussed in the following

[6] That System 3 must actually bring service to such customers as have lower limiting prices than the lowest served under System 2 (in other words that P_3P_3 must be situated to the left of P_2P_2) becomes evident if we imagine System 3 to be developed out of System 2 by raising all prices between P_2P_2 and PP to 100% of the limiting price and raising all prices to the right of PP accordingly until they reach the corresponding prices of System 3. These increases of prices without any accompanying reductions must necessarily result in an increase of the earnings because none of these price increases has been carried beyond the 100% limit so that all the consumers who have been customers under System 2 will remain customers under System 3. To offset this increase of earnings and to bring the earnings down to the desired normal height we have to add new customers to the left of P_2P_2. by offering prices to them which are low enough to attract them.

[7] With the exception of those added at the lower end of the scale by the last reduction. (See Fig. 3. System 4.) Those customers pay a higher percentage.

[8] With the exception of those who are paying the very lowest prices (see diagram).

ones of this series of articles, or whether it might not be better to entirely forego a diversification of the profits. The latter practice is found as a rule more in smaller companies where simplicity of the rates is paramount, but as the knowledge of the principles of rate making is spreading this practice has a tendency to disappear.

B. Factors Determining the Customer's Valuation of the Service.

94. It has been said above that the value-of-service principle distinguishes between different kinds of service according to the monetary value attached to the service by the customer. This monetary value constitutes the upper limiting value for the price, and the value-of-service principle endeavors to make the charges with due consideration of this limiting value for the various parts of the service and the various customers.

Now this limit of the monetary value beyond which the customer will not purchase the respective part of the service depends on two factors: (1) The value he places on the service, that is the degree in which the service is necessary, useful, profitable or convenient to him; and (2) the value he places on money.

The first factor is determined by a variety of circumstances, among which the possibility of obtaining a similar service from some other source and the quality and price of such competitive service are prominent. This factor can vary for the same customer between different parts of the same service. Thus, for instance, a customer will generally value artificial heating service more in winter than in summer. (In the latter case he will even place a negative value on it as he would pay for having heat removed.)

The second factor is to a large degree determined by the amount of money which the customer is able to spend (and is willing to spend). That is, it depends—apart from the customer's ecónomic inclinations—on the degree in which the customer (or the class of customers) is blessed with worldly goods.

(To be continued.)

PUMPING WATER FOR IRRIGATION MAKES IMPORTANT POWER LOAD.

Hundreds of Orchards in Washington Watered by Pumping Plants Supplied by Hydroelectric Power—Types of Pumps Used.

By W. A. Scott.

The Wenatchee Valley Gas & Electric Co., of Wenatchee, Wash., operates a 2-unit 1500-kw. hydroelectric plant on the Wenatchee river at Dryden, and a similar plant of 1025 kw. on the Entiat river. Its system is supplemented by the 800-kw. hydroelectric plant of the Chelan Falls Power Co., on the Chelan river at a point above where that stream empties into the Columbia.

The Dryden plant is equipped with S. Morgan Smith water turbines and Westinghouse generators, operating under a head of 55 ft., the water being delivered through 6100 ft. of canal and two penstocks 100 ft. long. The Entiat plant has two units; this plant operates under a 78-ft. head, the water being carried to the turbines by 6800 ft. of canal and through a penstock 1750 ft. long. The Chelan Falls plant contains an Allis-Chalmers generating unit, driven by a turbine of the same type as the others. The 800 kw. here is developed by water pressure at 35 ft. head. The transmission line by which the Chelan Falls energy is tied in with that of the Wenatchee system is 20 miles long, the connection being made at Entiat. The three plants have a combined capacity of 3125 kw.

This output appears to be fully consumed, especially during the five months from May to September, inclusive. During the spring and summer seasons there is a load of about 1200 hp. in electric centrifugal and triplex pumps to raise water from the rivers and canals for irrigating land. There are at least 150 pumps on the company's lines, of which 36 take irrigating water from the Columbia river. Pumps on that stream make an average lift of about 125 ft., and some of them are of a capacity to deliver 1000 g.p.m. In a river installation the pump has to be set in a pit inclosed by a concrete wall to protect it from being submerged during high water, and so that the suction will not average greater than 15 ft.

Besides the pumping and lighting service, the company has a connected load on its lines of 200 hp. for motors in shops and small factories in Wenatchee.

Relative to pumping service for irrigation in the Columbia, Wenatchee, Entiat and Chelan valleys, in Chelan and Douglas counties, it may be observed, of course, that such service is for benches of land not under gravity canal systems. The orchards thus irrigated contain from 50 to 100 acres each, and with the permanent water supply afforded by a river it is considered that pumping water to a maximum height of 400 ft. is economically permissible. But the electric power lines by no means cover this field. There are a great many triplex and centrifugal pumps being driven by oil and distillate engines in upriver localities outside the range of the electric power lines. Hydroelectric possibilities on all the streams which enter the Columbia between Wenatchee and the international border are practically unlimited, and as such development goes on the use of motors for driving pumps will take the preference over other kinds of power as a matter of convenience and economy. Regardless of the installation of systems for delivering water by gravity canals, there will always be in this valley a great deal of pumping for irrigation to cover tracts of land on benches not reached by gravity supplies. Then, the orchardist who has his own pumping plant on a river enjoys a certain independence, even though the cost by pumping is greater.

Pumping requirements, whether with electric motors or oil engines, consist of a 500-gal. pump for a 50-acre tract and a 700 to 1000-gal. pump for a 100-acre tract. But, it is observed, the tendency is to use the centrifugal rather than the triplex pump for high-head operations. The triplex is belt-driven, whether operated by a motor or an oil engine; and among the great number of motor-driven centrifugal pumps in this field, those direct-connected and those belt-connected are about equal. On pumps requiring belt drive the balata belt is largely used. For installations in which the motors are direct-connected to centrifugal pumps the speed is about 800 r.p.m. on those of small capacity, while on larger units the speed is usually about 1200 r.p.m.

A motor-driven, belt-connected, 10 by 10-in. triplex pump of the capacity of 500 g.p.m., delivering water against a head of 350 ft. through a 10-in. discharge pipe, requires a 50-hp. 2200-volt motor. These specifications apply to an installation considered typical. Another installation, considered typical, is one in which a 40-hp. 2200-volt motor is direct-connected to a 600-g.p.m. centrifugal pump operating against a 127-ft. head through a one-mile line of 10-in. pipe.

Electric Trucks and Tractors in the Iron and Steel Industry

Industrial Electrical Apparatus Offers Many Advantages for Use in Smelting Plants, Foundries, Etc.—Handling Problems of This Industry — Need for Employing Good Operators

By BERNARD J. DILLON

THIS is the fourth of a series of articles dealing with the application of electric industrial trucks and tractors in representative industries. In this their application in foundries, smelters, etc., is described. This is generally regarded as the greatest of all industries and its widespread adoption of electric handling apparatus indicates the reliability and desirability of such devices. Although the operating conditions are unusually severe and exacting, practically every installation has proven successful and resulted in substantial savings. On account of the present disturbed labor conditions of this industry the problem of increasing the use of labor-saving appliances takes on special timely importance.

THE use of electric industrial trucks and tractors by the iron and steel industry began when this apparatus was first introduced and has grown rapidly ever since. Beginning with the application of a single machine, in most cases its reliability and the advantages which it offered for this class of work were quickly recognized and now many of the largest and most successful installations are in use by this trade.

Growth of the use of this apparatus has, of course, been particularly rapid during the past few years. During this period the iron and steel industry was called upon to produce to its utmost capacity in spite of the extreme labor shortage that existed. As a result, electric apparatus was introduced into practically every kind of handling by concerns in this industry and the results have exceeded all expectations. At present it is largely a matter of the extent of their possible application rather than a question of whether or not they should be employed.

The general handling problems of this industry are especially adaptable to the use of electric trucks or tractors. The plants usually are composed of a number of long one or two-story buildings and cover a large area. This greatly increases the average hauling distance, which gives the electric a decided advantage.

The class of material handled also adds to the desirability of the electric. Generally, it is very heavy and cumbersome and cannot be readily loaded on the ordinary two-wheel hand truck. Nor can dollies or flat trucks be used due to the rough passages and the great weight of the loads. For the smaller pieces a wheelbarrow is usually used as a carrier. This is, of course, a very strenuous and tiresome method and it is difficult to get labor to perform it. For the larger and heavier pieces cranes or hoists are used, but it has been found their field is limited when compared with the truck or tractor for many classes of work. This phase of handling is discussed further on in this article.

Saving in labor and production cost, however, is the principal advantage offered by the electric apparatus. There is no question now but that this apparatus saves a large amount of labor which enables it to pay for itself in a short time. The labor problem generally has affected this industry more than any other. In the first place, a large amount of unskilled help is required for certain operations that cannot be replaced by mechanical devices. The scarcity of this class of labor has made it necessary to employ automatic machinery as extensively as possible and free as much of this help as could be obtained for this other work. In addition, the wages demanded by this labor have greatly increased, which has also been an important factor in stimulating the introduction of labor-saving devices. Moreover, the introduction of such apparatus has a certain moral effect which causes the employes to be more satisfied and contented, for it indicates a desire on the part of the management to make the work as easy as possible and the savings effected enable it to grant higher wages.

Handling Problems of Foundries, Smelting Plants, Etc.

The amount of handling and trucking entering into the operation of foundries, smelters, etc., is considerable. The raw material and fuel must be brought to the furnaces, taken from the furnaces to the moulds or mills and dumps, and from the moulds or mills through a series of mechanical operations to clean and finish it before it can be delivered to the machine shops or shipping room. Numerous other materials must also be handled, such as sand for the moulds.

Traveling cranes and hoists are used extensively for this work in many places. Where the materials handled are heavy and must be piled or placed upon machines or cars higher than the floor level, these are indispensable and their only competitor is the electric truck equipped with a gantry crane similar to the one shown in one of the accompanying illustrations, which can often be used to advantage for handling objects of medium weight. The operations of a crane or hoist, however, are generally confined to one building or area and outside of that place some other method of handling must be employed. They are also limited by the fact that volume of handling cannot be increased beyond a certain amount and still handled efficiently. Moreover, they are expensive and not adaptable to all classes of buildings and cannot be moved to another building easily. As was stated, they are indispensable for certain classes of work in the performance of which the ordinary electric truck or tractor offers no competition. Before installing additional crane equipment, however, it is often advisable to study the situation and find out how much of the work now being handled by the crane can be handled by a truck or

Electric Truck and Trailers Hauling Materials in Foundry.

tractor. It has often been found that by using this apparatus for as much of the work as possible in conjunction with crane facilities, an extra crane will not be required.

The trucking conditions in the iron and steel industry are unusually severe. Passageways are narrow, congested and rough. Most of the material handled is by no means fragile, yet it cannot be subjected to unnecessary roughness, and in addition much of it, the moulds for example, must be handled with extreme care. Speed, of course, is an important factor in many of the operations and accurate running and spotting are also essential.

All these requirements and conditions can be met better by the electric than hand labor by reason of its greater power and better control. The laborer pushing a heavily loaded truck or even a wheelbarrow can not be expected to slow down and ease its load over a bad spot in the passage nor can he guide it accurately through a difficult narrow passage. The electric truck or tractor operator, however, has perfect control of his machine and its load at all times and has all its power at his disposal. He can slow down at a bad spot and start up again without exerting any extra effort and by means of the flexible steering arrangements now installed on such machines can negotiate narrow passageways easily and quickly. In addition, the congestion and confusion caused by the use of large number of hand-operated trucks is considerably relieved when all the work is done by hand.

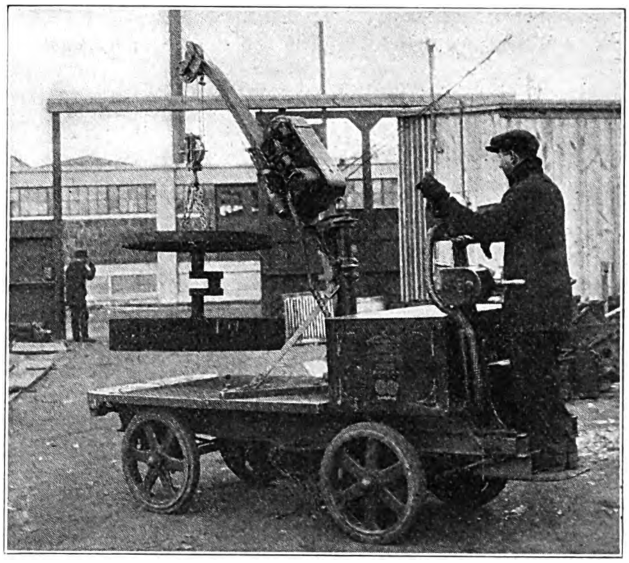
Advantages of Electric Industrial Apparatus for Various Handling Operations.

The raw material or ore and the fuel for the furnaces is usually dumped directly from cars or boats onto piles or into a suitable storage place. This is usually quite a distance from the furnaces, and for transferring it to the furnaces the electric tractor and trailers offer many advantages. Trains of trailers can be loaded at the storage piles, picked up by the tractor and taken to the furnace. When they are unloaded they can be taken back to the fuel piles again or loaded with by-products or ashes to be taken to the dumps. In the meantime other trailers can be loaded. In this way the loading or unloading operation is continuous and the tractor can be employed all the time.

Trailers can also be equipped with metal ladles for carrying the hot metal from the furnace to the moulds. These can be hauled by the tractor to the different places and the pouring operation completed quickly and efficiently. This method is also very safe for the operator can stop and start very quickly and is able to avoid obstacles much easier than a crane.

For hauling the castings from one operation or department to another, except in the larger plants where this distance between the departments is very great, the elevating platform or lift truck is generally preferred. The moulds when they are formed are set upon suitable skids. After the metal is poured these skids are lifted up by the elevating platform and taken to the point where the sand is knocked off. As the sand is removed, the casting is placed upon another skid which in turn is taken to the next operation, usually a saw. Here the process is repeated—that is, casting is taken from one skid, the necessary work done and either placed upon another skid or replaced upon the same skid. If the castings are not small, two skids are used in order that the operator will not have any extra handling. This process is repeated through the tumbling, polishing, finishing and other operations until the casting is ready for shipping or machining.

The advantages of the lift truck for such work can be readily appreciated. Not only is the trucking cost greatly reduced but the maximum manufacturing efficiency can be obtained. The operators can be kept constantly supplied with material and no time is lost by the operators in getting or waiting for work. The machines can also be kept in constant operation. As the skids can be placed in the most advantageous position by the truck, all unnecessary handling is elim-



Combination Electric Truck and Hoist for Handling Heavy Materials, Such as Large Castings.

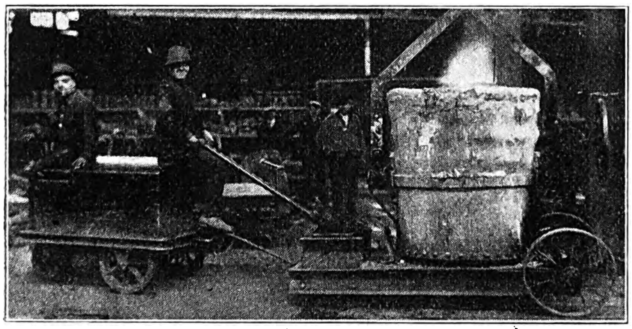
inated. Electric tractors can also be used with trailers in place of skids but a certain amount of extra handling is involved as the trailers cannot be spotted as accurately as the skids.

The amount of actual savings effected by either the truck or tractor will, of course, vary, depending upon local conditions. Even in the smaller plants, however, this saving is considerable. In many plants the saving in increased production alone is sufficient to more than cover the expense of the apparatus, leaving the entire labor saving as profit.

In the handling of moulds, etc., where special care must be taken to avoid any unnecessary jars, a special skid has been designed which is in use by many concerns. This skid is equipped with springs which relieve the mould of all the jarring and make it comparatively easy and safe to transport them.

Good Operators Especially Desirable for Such Work.

It is particularly desirable that good operators be employed to handle the trucks or tractors used in this industry. As has been stated, the handling conditions are unusually exacting and severe. A careless, inefficient operator not only reduces the value of the machine but he is unsafe and apt to cause more damage than can be saved by its use. Moreover, the management of concerns in this industry must realize that although the machines are easy and simple to use and their operation can be learned by anyone in a short time, they are nevertheless valuable machinery and proper results can only be obtained by employing conscientious, careful, reliable operators. The operators should be carefully selected and the entire responsibility of the apparatus should be assumed by them. In return, they should be given a satisfactory wage. In addition, there should be a rigid rule enforced prohibiting anyone, except the operator, to use the truck or tractor.



Electric Tractors Prove Useful In Handling Foundry Ladles.

It should be remembered that these machines replace a large amount of hand labor but in any case this handling must be done. If the operator through carelessness puts his truck out of commission, the old handling methods must be resorted to, which is not always easy because such laborers have usually been discharged or put upon other work. It is also advisable to keep on hand a supply of extra parts and have someone in the plant who is familiar with the operation and construction of the apparatus in order that no time may be lost in making the necessary repairs.

MODERN SHINGLE MILL REQUIRES MOTOR DRIVE THROUGHOUT.

Features of a Seattle Plant in Which Electric Power Is Produced—Machines of Rapid Speed and High Capacity.

The modern shingle mill in the Northwest is characterized by electric drive, rapid speed and high capacity. The machines employed are easily adapted to motor drive and in the case of a number of such mills the electrical energy is produced at the plant by steam-driven generators.

A good example of the up-to-date shingle mill is found in that of the Phoenix Shingle Co., situated on Washington ship canal, Seattle, in which there are 12 Sumner upright shingle machines of a total capacity of nearly 400,000 shingles in 8 hours.

The power house contains two horizontal, tubular boilers of 150 hp. each, in which mill refuse is used as fuel. The steam produced is utilized in driving the turbogenerators and for seasoning shingles in the dry kilns. A General Electric 300-kw. turbogenerator, operating at 3600 r.p.m., produces energy at 480 volts, which is transmitted through overhead cable to a junction box in the shingle mill, and is distributed thence to 440-volt motors. In addition to this, the turbine room contains a 35-kw. turbine and a small motor-generator set, for excitation of the large generator and to supply direct-current energy for a motor that drives an air pump. The 300-kw. turbogenerator runs condensing, the exciter unit running noncondensing.

The 260 motors in the mill represent a connected load of 501 hp. The largest motor is of a 75-hp. machine which operates an 86-in. cutoff saw at 600 r.p.m., and the chain-belt log-haul by which the logs are brought from the canal up to the mill deck. The motor is belted to a lineshaft which is belt-connected to the cutoff saw, with another belt connecting with the log-haul mechanism. The cutoff saw and log-haul are not operated in unison, but alternately. A system of conveyors for moving shingles and disposing of mill refuse requires four belt-connected motors, the belt pulleys being of sizes to reduce the speed of conveyors. Practically all other motors are direct-connected to the driven machines by means of flexible couplings.

Following the cutoff saw in proper sequence is the bolter saw, or splitter, driven by a 35-hp. motor, and knee-bolter, driven by a 25-hp. motor. The material thus prepared goes to the shingle mills, each machine consisting of a shingle saw driven at 1800 r.p.m. by a 20-hp. direct-coupled motor, and a clipper saw driven at like speed by a 3-hp. motor. Both motors in the unit are controlled by one starter. The 12 machines arranged in a row and running in unison at this high speed give an interesting demonstration of their capacity for turning out shingles.

Each shingle machine produces a considerable amount of fine wood dust, which if not disposed of becomes very injurious to the operators. The dust generated by all the machines is drawn away through 4-in. metal ducts by a 72-in. suction fan, driven at 500 r.p.m. by a 20-hp. motor, the latter having a speed of 1200 r.p.m. The fan discharges the dust into a conveyor through which it passes to the refuse burners under the boilers.

The file room is served by a 5-hp. motor, belt-connected to a lineshaft from which one large machine for filing the cutoff saw and two smaller shingle-saw machines are operated, an emery wheel on each machine being driven at high speed in filing operations. The mechanism and automatic action of these machines in filing one sawtooth after another in rapid succession are examples of ingenuity which the needs of this industry has developed. All electrical equipment was furnished by the General Electric Co.

The red cedar shingles, which are the products of this mill, are kiln-dried for 10 to 12 hours prior to marketing them, the kilns in this case consisting of four compartments of brick construction, each 124 ft. long and 17 ft. wide.

Phoenix Shingle Co. is controlled by F. E. Ward, W. A. Batley and J. L. Batley.

Editorial Comment

Era of the Electric Furnace

THIS is the era of the electric furnace and the present is only the beginning of that era. During the World War the electric furnace for the making and refining of steel came apace in every country making steel for bellicose purposes because steel so made enables difficult conditions to be met more readily than steel made in any other way. It was likewise during the war that the electric furnace for brass melting made its appearance upon a practical scale. Considerable work had, of course, been prosecuted for many years previously on electric brass-melting furnaces, but it was during the war that this work culminated in the development of a furnace that could be called practical enough for commercial application.

When the war came, the price of zinc soared many hundred per cent, and the large waste of this metal as volatile matter gave great impetus to the perfection of a suitable electric furnace because of the very much smaller loss of zinc as compared to other methods of melting. In some quarters the high price of oil was also a factor. Today, the activity in the electric brass-melting field is as great as ever. Whereas, the steel industry—hence the electric steel furnace—is suffering somewhat from the reaction of its former activity, and the unsettled labor conditions, the electric brass furnace is still in such demand that that demand can not be filled. This is a form of load that central stations should find easy to acquire today. And it is a form of load that is usually well worth while.

Apart from those furnaces employing the higher temperatures, there are furnaces that might perhaps properly be called ovens, where the temperature is high, but not so high as that required for melting of steel. For example, there are the soaking pits and the annealing ovens of the steel mill, some of which are already heated electrically. Here is another phase of the electric furnace that is predestined to play a large part in the central-station industry and the steel industry in time to come.

Another opportunity that awaits the electric furnace is that for the melting and refining of glass. In such a furnace the difficulties would seem to be those of refractories and contamination of the glass charge rather than of anything else. When the urgent need for pure glass for optical purposes came with the coming of war and the supply of German and Austrian optical glass was interrupted, Great Britain, and later this country, turned to the electric furnace as one of the possible solutions to the problem of pure glass. Experiments are still being carried on in many different quarters, but it may probably be safely said that to date no practical form of electric glass-melting furnace has made its appearance for commercial use. Meanwhile, the work of inventing and investigating still goes on and will go on until the electric furnace for melting and refining of glass can be classed with the electric furnace for the making of brass and steel. This is but the beginning of the electric-furnace era.

The Storage Battery for Stand-by Service

VISITORS to the vast systems of the large central-station companies are shown the boilers and their stokers, the turbogenerators and the aisles of their control apparatus, the manholes and the steel towers and the substations of converting equipment. But it is not often, unless special request is made, that the storage battery for stand-by service is seen. And yet the stand-by storage battery is the watchdog of many a system, safeguarding a direct-current network or an exciter system.

Every large city with its congestion and dense population and buildings operating Edison three-wire networks has its stand-by batteries. Every large generating station has its batteries, a last reserve should their exciters fail. They are indispensable. Yet one hears little of this important piece of apparatus, although on a unit cost basis it is an expensive one. The reason for this is probably that the stand-by storage battery does its work without noise, without commotion and directly it is called upon to do so. Moreover, those that know are often not anxious that it be known that anything had happened to necessitate falling back on the stand-by capacity. It is not spectacular, even if it comes to the rescue stupendously. The storage battery is to the direct-current network or the exciter system what the reserve troops are to the attacking army. It saves the day, however unexpected it be, when the need arises.

All the large cities have their storage batteries for stand-by service. Detroit, with its largest storage battery in the world; Chicago, Brooklyn, New York, Philadelphia, Boston, Baltimore, Rochester, Cleveland, and in far-off Los Angeles and Spokane, all having direct-current networks have stand-by batteries. In checking up the capacity of these batteries, on the basis of percentage of maximum direct-current peak, it is found that there is a great difference in the different installations. In one case it may be that the battery is intended to take the place of an entire station taken out of service. In another it may be that the battery or batteries are sufficient to carry load that might be served over cables traveling a certain route. In other cases attempt is made to have even a higher factor of safety. In all cases the battery capacity, amperes discharged for one hour, is only a small percentage of the total capacity it would be called upon to replace.

Just what percentage of stand-by capacity is justified depends of course upon conditions of transmission, of distribution, of generation, the importance of the load served, and the estimated time and magnitude of the shutdown during which the battery would be called upon to play its part. However, something happens somewhere every now and again that emphasizes the soundness of the investment in a stand-by storage battery. Because an emergency may appear remote there may be a natural tendency to reduce the investment in batteries; as deterioration occurs the factor of safety originally existing is lowered. Such a policy may be a very unwise one from every aspect.

Many power contracts include a forfeiture clause in case of cessation of service. An extended cessation may easily approach if not exceed in this item of cost alone the investment for one year upon a stand-by battery. The storage battery for stand-by service is really an emergency investment.

The stand-by battery may be an emergency measure. But it is doubtful if under conditions as they exist in many of our largest cities a central station would be justified in foregoing such a reserve capacity, however remote might be the emergency. It is not a question of prestige. It is not simply a matter of agreement to maintain uninterrupted service. It is not merely a matter of dollars and cents. It is the moral responsibility for safeguarding public safety. When the lights go out, when the ventilating fans and the elevators cease to move, and the fire pumps become useless things in the department store with its several hundred employes and its several thousand patrons, fire hazards threaten and the horrors of panic come nearer. A storage battery may save all these things and more.

Low Rates for Electric Cooking Found Profitable

It has long been known that to make electric cooking on a large scale economical to the average residence customer of central-station companies the latter must offer a much lower rate for cooking service than for lighting service. Those companies that have been lukewarm in their support of electric cooking have contended that the low rates that were evidently necessary could not be profitable and that a very considerable portion of the cooking load would overlap the lighting load in winter and therefore make the peak load still more formidable. If these contentions were true, they would warrant the companies in going slowly and justify their Missourian attitude of "Show me."

There has just come to hand copy of a paper on electric cookery presented last week before the convention of the Colorado Electric Light, Power and Railway Association by Mr. Pierre L. Miles, who has devoted many years to actively pushing electric range sales and studying the possibilities of cooking service as a central-station load. As the result of extended investigations he finds that the diversity-factor and load-factor of the electric range load are far better than those of the residence lighting load and that only 10 to 15% of the total connected range load will fall on the present station peak in the winter months. Further he finds that a certain station generating capacity will serve ten times as large a connected range load; likewise a distributing transformer of 15 kv.-a. will serve a group of 20 ranges having a total connected load of 120 kw. These figures show extraordinarily favorable diversity-factors and lead him to assert that 200 electric ranges can be installed in nearly every small town without increasing the present generating capacity. The investment to serve a range customer is not as great as that required for a lighting customer.

As regards the profitability of this load, Mr. Miles finds that it is much more profitable than residence lighting and that the yearly revenue per kilowatt of generating capacity for range service is also greater than that serving a small-motor load. He states that there is more profit in selling cooking service at a profit of one-half cent per kilowatt-hour than in a profit eight times as great per kilowatt-hour for residence lighting service. He also says that a three-cent cooking rate can be justified against a five-cent small-motor rate on the basis of being more profitable.

These statements are such striking refutation of the arguments often advanced against the range load that we repeat them here because we know they were not made without careful investigation. They show conclusively that it will pay every central-station company to give renewed consideration to the advisability of pushing the electric cooking business. We believe that there are but few companies that will not find it a profitable load, these including combination gas and electric companies and those forced to compete with natural gas or cheap artificial gas. We have discussed herein only the question of economy to the range user and profitability to the central station. The other benefits of electric cooking of course add to its value very greatly, but cannot be readily evaluated when the question resolves itself exclusively to one of relative economy and profit.

Incidentally the findings of Mr. Miles bear out very strikingly also the conclusions of Mr. H. E. Eisennenger in his articles on "Central-Station Rates in Theory and Practice," that are appearing weekly in our columns. He shows mathematically that it is often profitable for a central station to reduce rates for one class of service without raising them for any other class and that all classes are decidedly benefited thereby. His conclusions in this regard are explained more in detail (and in simpler language than the mathmatics of his last few articles) in the article appearing this week.

Current Events

Municipal Electricians, Electrochemists, Central-Station Managers and Steel Industry Electrical Engineers Convene

MUNICIPAL ELECTRICIANS HAVE SUCCESSFUL CONVENTION.

Timely Papers, Interesting Addresses and Inspection Trips Make Meeting Very Profitable to Delegates.

An attractive program taken with the fact that after-the-war conditions permitted a large attendance of delegates resulted in making the twenty-fourth annual convention of the International Association of Municipal Electricians, held at Chicago Sept. 23-26, one of the most successful ever held by that organization. Papers of timely interest to their profession, interesting inspection trips and good entertainment formed the program, the feature of which was an address by Dr. Charles P. Steinmetz and an illustrated talk by W. D'A. Ryan.

The title of Dr. Steinmetz's address was "Municipal Electricians in Relation to Electric Power Engineering." He stated that a municipality has a great deal in common with its public utilities, that its interest in the central station or the street railway system is akin to that of the stockholders because the city loans part of its property to the utilities and because their success is necessary for the progress of the community. It is necessary for municipal electricians to study this situation, especially in view of the fact that specialization is becoming more distinct in electrical matters in order to gain efficiency. For this reason electric power generation is becoming a separate industry. Civilization demands materials and their distribution. These will be secured by electricity and the outcome will be vast networks for electric power distribution and of railways. In the discussion Dr. Steinmetz indicated the Bureau of Standards would be greatly instrumental in drawing up rules for standard electrical construction and operating practice since the generation and distribution of electric power was assuming national and in some cases even international characteristics.

W. D'A. Ryan illustrated his address on "History of Illumination" with several hundred colored stereopticon slides which gave a picturization of the art of lighting from primitive to modern times. The development in illuminating methods and facilities was illustrated by a group of pictures taken at the Panama-Pacific Exposition, Mr. Ryan explaining the means employed to obtain the many different lighting effects produced there. These are noteworthy because they show the possibilities that exist for using artificial light in conjunction with art. Slides showing the street-lighting systems at San Francisco and other cities were also shown, and stress was laid upon the point that municipalities should endeavor to have their street lighting beautify the community as well as illuminate it. He concluded with the statement that cities having systems of luminous arc lamps should not be hasty in displacing this equipment because of its utility and efficiency. The address was warmly received and at its close Mr. Ryan was made an honorary member of the organization.

In his presidential address, C. E. Diehl reviewed in detail the work of the organization during the year and congratulated the membership on its loyalty during the war-time period.

Dr. M. G. Lloyd, electrical engineer, Bureau of Standards, Washington, D. C., in speaking on "High-Voltage Pole-Line Construction for City Streets," stated that there is undoubtedly a tendency toward the use of higher voltages because of the manifest economies resulting therefrom, some of which, however, are offset by the necessity for more expensive construction. City authorities are likely to receive more frequently requests for permission to have high-tension lines of 11,000 volts or higher pass through city streets. Such permission may well be granted on account of the economic advantages, provided that proper measures are taken in the construction of these lines to safeguard against their attendant hazards. Careful provision must be made against contact with persons, with low-tension circuits, such as telephone, signal and lifting circuits, and with grounded metallic structures of any kind.

Dr. Lloyd said that the types of construction called for in Part 2 of the National Electrical Safety Code meet all these requirements, and this part contains a mass of information that city electricians can well afford to make themselves familiar with when called upon to pass on any proposed line. He worked out in detail the method of determining the stresses on a typical heavily loaded pole, this having been taken from actual data from a line in one of the Chicago suburbs. Not only must the pole be of ample strength to withstand the wind and storm stresses under the most unfavorable conditions, but guy wires must have ample strength to carry the entire strain. In all cases the stress must not exceed one-half of the ultimate strength of the pole or wire. Dr. Lloyd also referred to the survey conducted this summer on typical heavily loaded poles in many parts of the country; this was made jointly by an engineer of the Bureau of Standards and one representing the National Electric Light Association, and secured data covering conditions as they actually exist prior to the revision of Part 2 of the Safety Code. Many poles were found overloaded, many underloaded, but in general the construction seemed to be well proportioned for the loads imposed.

In the report of the Standardization Committee, Chairman R. A. Smith, Norfolk, Va., resubmitted the revised reports on Class A standards dealing with fire-alarm telegraph systems and Class B on police signaling systems. The committee has found that 85% of American and Canadian cities are using equipments as described in the reports on these two classes, which had been reported at the convention last year. He, therefore, urged that the association accept these standards as recommended or good practice. On motion this was done. Mr. Smith also submitted standards for Class C—being regulations covering the construction and repair of installations for heat, light and power. This consisted chiefly of a summary of important features that should be included in municipal ordinances covering these matters. Under rules for inspections, it is recommended that the National Electrical Code be followed respecting fire hazard, and the National Electrical Safety Code followed as to life and accident hazard. The committee has in mind the preparation for standards for Class D dealing with electric lighting, and Class E dealing with electrolysis and metering.

In presenting a paper on "Electricity in Police Work," W. L. Potts, Detroit, outlined the important functions of electrical apparatus in police signaling and told of methods used in his city.

The paper on "Chicago's Novel Fire Alarm System," by W. G. Keith, commissioner of gas and electricity, Chicago, disclosed that the system is very antiquated, some of the apparatus in use having been installed just after the fire of 1871. It is proposed that the old system will be displaced by a dual system of police and fire-alarm apparatus, the principal features of which were outlined. The discussion was concerned with the construction and operation of the boxes, which will be of special design to accommodate both police and fire-alarm signals.

R. J. Gaskill, Fort Wayne, Ind., past-president of the association and a captain in the Signal Corps, A. E. F., read a paper giving first-hand statistics regarding the work of the Signal Corps during the war. He emphasized the importance of signal work in the winning of the war.

Inspection trips included visits to the Underwriters Laboratories and to the plant of the Kellogg Switchboard & Supply Co. Fire pump tests were conducted at the municipal pier for the benefit of the delegates.

A report of the concluding sessions of the convention will be made in next week's issue.

ELECTROCHEMICAL ENGINEERS HOLD THIRTY-SIXTH GENERAL MEETING IN CHICAGO.

Large Attendance and Pleasing Blending of Business and Pleasure Mark Convention.

The thirty-sixth general meeting of the American Electrochemical Society was held at the Congress Hotel, Chicago, during September 23 to 26 inclusive. The society held several joint meetings with the American Institute of Mining and Metallurgical Engineers, also convening at the Congress Hotel where the Electric Furnace Association also had a meeting.

A number of interesting inspection trips to steel mills in the vicinity of Chicago were postponed on account of the situation created by the strike of steel workers. On the afternoon of September 23 the A. E. S. held a joint meeting with the A. I. M. & M. E. at which was taken up matters pertaining to iron and steel. The papers presented were those on "Blast-furnace Refractories" by Raymond M. Howe, "Determining Gases in Steel and the Deoxidation of Steel" by J. R. Cain, "Effect of Time and Low Temperature on Physical Properties of Medium-carbon Steel" by G. A. Reinhardt and H. L. Curtis. Papers by H. D. Hibbard, Albert Sauveur, A. E. Bellis and G. F. Butterworth on "Effervescing Steel," "Aircraft Steel," "Erosion Tests of Rifle Barrels," and "Metallography of Rifle-barrel Steel" respectively, were read by title only.

In the evening a joint session was also held when papers by T. W. Robinson on "Industries of the Chicago District," "Manufacture of Steel Rails" by Robert W. Hunt, and "The World's Largest Plate Mill" by C. L. Huston, all of the A. I. M. & M. E., were presented.

Wednesday morning a meeting was held at the Exposition Auditorium at which several papers were presented. These consisted of a paper on "Manganin" by M. A. Hunter and J. W. Bacon; "Depreciation of Small Dry Cells with Age," by A. J. Helfrecht; "The Effect of Amalgamation Upon the Single Potential of Aluminum," by Louis Kahlenberg and J. A. Montgomery; and "The Effect of Amalgamation Upon the Single Potentials of the Binary Alloys of Aluminum with Copper, Zinc and Nickel," by Louis Kahlenberg and J. A. Montgomery.

The Wednesday afternoon session was devoted to a joint session with the A. I. M. & M. E. devoted to the general subject of ferrous and non-ferrous metallurgy. Of the A. E. S., F. A. J. Fitzgerald presented a paper entitled "Radiant Resistor Furnace," and "Electric Furnace for Experimental Work"; A. M. Clark one on "Electric Heat" and H. G. Weidenthal on "A Square Deal for the Electric Furnace." C. H. Fulton and G. P. Hulst, of the A. I. M. & M. E. presented papers entitled respectively "Electric-resistance Furnace of Large Capacity for Zinc Ores" and "Treating Antimony Ores." A number of other papers were presented by title only. Abstracts of the above articles on electric furnaces and dry cells will appear in the ELECTRICAL REVIEW at an early date.

Wednesday evening was devoted to an inspection of electric furnace exhibits at the Coliseum where the Fifth National Exposition of Chemical Industries was held during the week. At the Auditorium a moving picture show was a feature of the evening. One series of pictures showed the resistance type of electric furnace melting non-ferrous metal. Another reel supplied by the Electric Furnace Co. showed the electric furnace in the heat treatment of essential war materials, while another film furnished by the Detroit Electric Furnace Co. depicted the Detroit rocking furnace in operation melting brass. Still another film showed the power development and industries that have sprung up around the system of the Shawinigan Water & Power Co., Canada.

SYSTEM TROUBLES CAUSE UNPRECEDENTED SHUTDOWN IN CHICAGO.

Series of Troubles Cause Extensive Damage and Derangement to Vast Network.

What was the most serious shutdown in the history of the Commonwealth Edison Co. occurred on the afternoon of Sept. 18. The exact cause of the origination of the trouble has not been given out, if it is definitely known. Indications are, however, that line trouble caused a surge to start, which persisted for considerable time until it had assumed such magnitude as to necessitate taking out of service what generating units had not already tripped out on the section of bus affected.

At 3:45 p. m. a severe disturbance occurred on the 25-cycle system. Three 9000-volt transmission lines opened automatically at the Fisk Street station, and three 10,000-kw. turbogenerators tripped out. The behavior of another 10,000-kw. unit and a 20,000-kw. unit operating on the same bus section was such that they were taken off the bus by the operator. Two 25,000-kw. turbogenerators at the Northwest station also tripped out and a 35,000-kw., 60-cycle unit at the Fisk Street station then had to be taken off the system because its 25-cycle auxiliaries had dropped out following the loss of the machines previously placed *hors de combat.*

The severe jolt to the 25-cycle system and the loss of 25-cycle generating capacity resulted in practically all the synchronous converters supplying the "loop" or downtown territory with direct current shutting down. What machines did not fall out of step due to the severe jolt, shut down because of lack of alternating-current supply. The shifting of load from station to station, voltage drop and current surging in the direct-current network caused a very large number of fuses to blow. At Randolph Street substation one converter failed to open automatically and its armature was burnt up, causing a fire and such quantities of smoke that the operator was unable to resume operation again until 5 p. m., while fire fighters had to wear gas masks in fighting the fire. At the Plymouth Court substation one converter regulator burnt up and converters at the East Madison Street, West Division Street and Ohio Street substations were slightly damaged. During this time a number of railway substations were shut down from 2 to 14 minutes. Several manholes in the downtown district caught fire, in one case the cover being blown off with considerable concussion. The tie lines and several feeders between the Adams Court and East Madison Street substations were burnt open.

Service in the "loop" or downtown district was interrupted in some places where fuses had blown. In others the voltage was low and very badly unbalanced. The 23 standby storage batteries installed in the Commonwealth Edison Co.'s various downtown substations were called upon for high rate of discharge, in an emergency unprecedented in the history of the company. These batteries, having a rating exceeding 95,210 amperes for 1 hour at 250 volts, saved the day until those stations shut down only because of the system disturbance could start their synchronous apparatus again or obtain transmission lines. However, the storage battery capacity was only a drop in the bucket and low pressure could not be prevented entirely. Nevertheless they prevented complete interruption of service where fuses held intact.

At about 5:30 p. m. another disturbance occurred when three high-tension underground transmission lines opened automatically at Fisk Street. A number of railway substations were shut down at this time until they could get started again, while three distant substations served by 20,000-volt underground cables were shut down about three hours. After this second trouble occurred it was found that two underground lines had broken down in a manhole close to Fisk Street station and that one of these and another line had also broken down between the generator bus and their current transformers, a condition which prevented the circuit-breakers from functioning, and it was necessary to open these lines by hand. The breakdown in the manhole was so severe that all the 18 transmission lines passing through it had to be taken out of service. It was later found that several bus insulators at Fisk Street were cracked.

None of the generators were damaged. Synchronous converters, as already mentioned, suffered somewhat. A number of high-tension lines and direct-current feeders were burnt and a large number of fuses had to be replaced. The derangement of service was surprisingly small, likewise the damage suffered to equipment. The trouble or series of troubles gave the severest test to the company's relay protection system, its distributing system and also to its efficiency in personnel. All met the test and it is this fact that enabled service interruptions to be localized, the time of interruption minimized and practically all apparatus to be placed back in service again.

TIMELY TOPICS DISCUSSED AT EDISON ILLUMINATING COMPANIES' MEETING.

Many Important Questions Brought Up at Annual Convention of Association at New London, Sept. 16-18.

As announced in our last issue, the 38th convention of the Association of Edison Illuminating Companies was very successfully conducted at New London, Conn., on Sept. 16-18 of last week. Being the first gathering of this body since the close of the war, a large attendance was present and took active part in the proceedings.

In opening the convention on Tuesday morning, President L. L. Elden, of Boston, made an address reviewing the work of the association and commenting on the importance of the principal topics to be presented at the convention. He dwelt especially on the present chaotic condition of rates with their various coal clauses and surcharges to cover increased operating costs, and on the advisability of offering off-peak rates for secondary service. Other features mentioned by Mr. Elden were the labor situation, interconnection, water-power legislation and development, and standardization of equipment.

After the reports of the Executive Committee and treasurer were presented, Wm. C. L. Eglin, of Philadelphia, read the report of the Committee on Standards, of which he was chairman. This discussed chiefly the pending revision of the National Electrical Safety Code and advocated delay therein to give those interested a better opportunity to study the proposed changes. The conference on industrial safety codes held at the Bureau of Standards last January was also reviewed, together with the two proposed methods of drawing up safety codes for different industries. The report of the Committee on Metering and Service Methods, O. J. Bushnell, Chicago, chairman, was presented. It dwelt principally on some new developments in demand meters; the desirability of issuing more complete customers' handbooks or service leaflets was also pointed out and an outline of subjects therefor suggested.

D. S. Boyden, of Boston, presented a paper on "A Uniform Policy for Making Distribution Circuit Extensions and Service Connections to Consumers." This gave a summary of a questionnaire among member companies as to their practices and showed widely differing policies and procedure in this regard. The tenor of all replies indicates that the policy in making extensions and service connections is much less liberal than before the war, and that at the present time they are passing through a transition period and, with few exceptions, have not yet reached any definite policy for normal times. It therefore seems psychological that there should at this time be advocated a uniform policy covering extensions and service connections to consumers. The foregoing does not apply to street lighting or large consumers supplied from unregulated transmission lines. Development of good will should result from a more uniform policy in this regard.

"Dielectric Power Loss and Ionization Voltage in Underground Cables," was the title of a paper presented by F. M. Farmer, of New York City. The origin and significance of dielectric losses were discussed, also conditions affecting this loss and methods of measuring it. Similar treatment was given to the subject of ionization voltage. The power loss should be as low as feasible, since this permits a higher rating. Change of the dielectric loss with temperature should be a minimum in order that the critical temperature where the normal conditions become unstable will be as high as possible to permit of emergency overloads. The ionization voltage marks the limit of the voltage at which a cable can be operated without risk.

Tuesday evening was devoted to a discussion of lamps and central-station lamp practice. The report of the Lamp Committee, J. W. Lieb, chairman, was the annual compilation rich in original data of the quality and performance characteristics of incandescent lamps, large quantities of which are purchased by members of the association under test. Following the report there was a symposium on central-station lamp-renewal practice participated in by the following: Louis A. Ferguson, vice-president, Commonwealth Edison Co., Chicago; J. T. Hutchings, president, Rochester Railway & Light Co.; Robert Lindsay, vice-president and general manager, Cleveland Illuminating Co. (presented by Dr. McClellan); W. F. Wells, vice-president, Brooklyn Edison Co. The four companies represented by executives in this symposium have adopted different attitudes toward the supply of lamps to their customers. These papers were discussed by J. W. Lieb, Walter H. Johnson, T. I. Jones, C. L. Law, Alex Dow, C. L. Edgar, John W. Howell and others. The advantages and disadvantages of the several plans of lamp handling were put forward in the course of these discussions which extended until the midnight hour. There was a practical consensus, however, in favor of vigorous educational activity with a view to demonstrating the advantages to the public as well as to central stations of the more intelligent and liberal use of light, and it was emphasized that whatever the practice of the company in the handling of lamps, considerable advance can be made along this line.

At the Wednesday morning session the report of the Committee on Rates, Alex Dow, of Detroit, chairman, was presented and discussed. This report covered chiefly power rates, rates for interchange of power between companies and rates for resale of power by customers. A supplementary paper was presented at the request of the committee by James V. Oxtoby, of Detroit, on "Status of the Customer Whose Service Requires Large Investment," this dealing with the legal phases of the question and commenting on court and commission decisions on this matter.

Wm. C. L. Eglin, of Philadelphia, read a paper on "The Personnel of the Industry." A plea was made for more systematic development of all plans relating to the compensation and general welfare of the personnel. Among topics discussed were hours of labor, wage rates, collective bargaining, trade unions, employment of women and minors. Establishment by each company of a personnel bureau was advocated.

The report of the Committee on Electricity Distribution and Use, R. F. Schuchardt, Chicago, chairman, discussed in a general way possibilities for development of the industry along these lines. Among subjects commented on were interconnection to secure conservation of resources, the necessity for a single frequency for this purpose (the committee finds no real objection to making 60 cycles standard), preference of alternating-current extensions instead of direct current, timeliness of taking up power-factor correction seriously, application of electric supply to electric vehicle and railroad service, to industrial, domestic, and agricultural service, and the necessity for industrial research.

On Wednesday evening a session was held at which three papers of general interest were presented. The first was "Lessons of the War in the Conduct of Government Business," by M. O. Leighton of Washington, D. C. This paper dwelt at length first on the gross inefficiency of our Federal Government in normal times with its numerous duplications of work by different departments and bureaus, general inertia and lack of modern business methods. When we entered the war in April, 1917, not only were we unprepared but the Government machinery was utterly unadapted to handle the big emergency and the extraordinary work it involved. After a few months of chaotic floundering, the necessity for calling on the American business men familiar with handling large affairs was realized and the War Industries Board and other similar bodies presently began to function, building up an efficient and co-ordinated organization capable of doing the work promptly and economically. Mr. Leighton mentioned instances, notably the Construction Division of the Army, wherein civilian engineers housed a million men in three months although the military men said it was utterly impossible. Since close of the war, the departments and bureaus are languishing back to their former inertia and inefficiency and the lessons of the war are apparently being forgotten. In closing, Mr. Leighton made a strong plea for support of the proposed Department of Public Works, which should take over all of the engineering and scientific activities of the present Federal departments.

An address on "War Undertakings and Developments in the Industry During the Past Three Years" was presented by Francis Pratt, vice-president of the General Electric Co., in which were reviewed the principal developments and contributions of that company. On account of lack of space this address will be summarized in an early issue.

F. Darlington, of the Westinghouse Electric & Manufacturing Co., presented an address on "Vision in Power Development and the Test of War." This dealt with the National Government war-time point of view regarding utilization of power, which was that the expansion of centralized electric power systems was the only effective and efficient way of securing increased power. Central-station development has reached a stage where the best and most economical method of supplying power for practically all purposes is by large interconnected central electric systems covering interstate areas which constitute natural power-service districts. The Government vision of unified power supply does not contemplate radical departures from latest technical practice but rather a new view of the utilization of power. The paper also considered financial, political and social conditions resulting from such a unified plan.

At the concluding session on Thursday there was presented the report of the Committee on Steam Plant, H. P. Liversidge, chairman. This included an extended discussion on steam-turbine reliability and considerable matter dealing with boiler-room practice. A paper by Geo. A. Orrok on "Some Phases of the Fuel Problem" was presented, also one on "The Supply and Distribution of the Fuel of the World, Particularly of the United States," by Prof. L. P. Breckenridge; one on "Fuel Oil," by C. R. Weymouth, and one on "Pulverized Fuel," by Fred A. Scheffler of the Fuller Engineering Co. The latter discussed the use of pulverized coal by central station and other power plants and clearly demonstrated the fact that there is nothing mysterious about such applications. There are now in daily operation over 100 boilers in the United States using pulverized coal and the same equipment can use and has used such different fuels as Texas and Colorado lignite, Wyoming Oklahoma and British Columbia coals, Illinois screenings, bituminous and anthracite slack.

The election of officers of the association for the ensuing year resulted in the choice of the following:

President, W. H. Johnson, vice-president Philadelphia Electric Co., Philadelphia, Pa.

Vice-president, M. S. Sloane, Brooklyn, N. Y.

Secretary, Percy Miller, New York, N. Y.

Treasurer, Ernest A. Edkins, Chicago, Ill.

Executive Committee; Charles L. Edgar, Boston, Mass; W. W. Freeman, Cincinnati, Ohio; Samuel Insull, Chicago, Ill.; John W. Lieb, New York, N. Y.; Joseph B. McCall, Philadelphia, Pa.; and the president, vice-president, secretary and treasurer, ex-officio.

PRESIDENT BALLARD ON ACTIVITIES OF THE N. E. L. A.

In Letter to Northwest Association He Reviews Current Central-Station Problems and What N. E. L. A. Is Doing to Help Solve Them.

President R. H. Ballard of the National Electric Light Association on Sept. 6 sent to H. J. Gille, president of the Northwest Electric Light and Power Association, a letter regretting his inability to attend the annual convention of the latter organization at Seattle, Wash., this week and incidentally discussing what the N. E. L. A. is doing to help solve present-day central-station problems. The Northwest Electric Light and Power Association is a geographic section of the N. E. L. A., and Mr. Ballard's letter, which was read before the Seattle meeting, was in line with his policy of having the national association represented directly, if possible, at each of the geographic gatherings so that the latter may know what is being done by the national organization. Mr. Ballard's letter contains so much of interest that it is reproduced below substantially in full.

Mr. Ballard's Letter.

It is with keen regret that I am compelled to advise you of my inability to be present at the annual convention of the Northwest Electric Light and Power Association to be held in Seattle, Sept. 24 to 27.

Conventions of geographic sections are of particular interest to me and I had looked forward to an instructive and enjoyable visit with you all at your meeting, especially in this, the Pacific Coast year of our National Association. We are pulling so strongly together to assist in solving some of the big national problems confronting our industry that a personal visit would have given me the keenest pleasure.

Engagements to attend the conventions of the Southeastern Section at Asheville, N. C., and the New England Section at New London, Conn., both of which are scheduled for this month, together with meetings of the Executive and Public Policy Committees in New York require my presence in the eastern part of our country for the next six weeks.

President A. Emory Wishon of our Pacific Coast Section and some other prominent Californians are planning to be with you at your convention, and I am asking Mr. Wishon to represent me officially.

It has been said that the reconstruction period through which we are now passing is even more trying than the five years of actual world warfare. The effects of the war are being felt now from both economic and psychological standpoints. Economically the operation of the law of supply and demand would work out the situation were it not that this law is obstructed by certain unpatriotic action, familiarly known as profiteering. Psychologically, the public mind is still affected by five years of anxiety and it is but natural for it under these circumstances to react to all kinds of extremes. It seems to me that the need of the time is for us all to go forward with courage in the regular pursuit of our business, laying stress upon the necessity for more production, more economic saving and more conservation.

Water-Power Development.—One of the big conservation measures is the development and use of water power, thus serving the double purpose of securing an additional and inexhaustible supply of electric energy for new industries and releasing for other purposes an exhaustible supply of fuel.

Our Association has appointed a new general committee to deal with this question of water-power development. Mr. Franklin T. Griffith, president of the Portland Railway, Light & Power Co., has accepted the chairmanship of this committee.

Electrification of Railroads.—Another conservation measure which will come more gradually is the partial electrification of steam railroads, especially over mountain passes. Our central stations must be prepared for this when it comes, in order that the best economy may be attained by combining the electrical demands of the railroads with the regular commercial demands of central stations, thus securing the maximum benefits of diversity and putting the generating stations to their greatest use during all hours of the day. A strong committee is being organized to deal with this subject.

Municipal Ownership.—Interconnections of transmission systems traversing large areas irrespective of political subdivisions, cities, or even counties, has demonstrated the fallacy of municipal ownership of electric systems with their lines confined to single municipal areas. It is this broad distribution and these conditions of diversity which make possible the substantially lower average rates to consumers from large privately owned systems, and in a measure account for the development and use of electric energy from privately owned systems being some twenty times that consumed from municipally owned systems in our country.

Reliable statistics of these conditions will be compiled by a committee of our national organization, and this service should be of great value to members of the Association.

Service and Public Information.—With the regulation of electric utility rates to provide only sufficient return on capital investment to attract new capital to meet the constant demands for expansion and development, and with a courageous attitude on the part of state regulating bodies to see that such reasonable return is allowed to utility companies, the electric industry is free from politics and may devote its entire energies to its duty of adequate and comprehensive service to the public. Broad, honest and courteous service at every point of contact with the public makes for contented and satisfied consumers. We all know that a sound, substantial income, as the result of good service to contented patrons, is much more to be desired than income based on unnecessary consumption of energy and indifference to the real interests of our consumers.

That the general public may be better informed regarding this attitude of electric utility companies, a Committee on Public Information is being organized. Mr. John F. Gilchrist, vice-president of the Commonwealth Edison Co., of Chicago, has accepted the chairmanship of this committee.

Mr. S. M. Kennedy, general agent of Southern California Edison Co., will contribute much to the year's work in the capacity of chairman of the Committee on Service.

Co-operation in the Industry.—There never was a time in the history of our industry when harmony and earnest co-operation between all of its branches was more to be desired than now. Mr. Lee H. Newbert, commercial manager of the Pacific Gas & Electric Co., of San Francisco, has accepted the appointment as chairman of the Committee on Co-operation in the Industry, and will associate with him on this committee representatives from all branches of the business to outline a plan under which the maximum results of general co-operation may be obtained.

Welfare of Employes.—Employes' participation and the possibility of the workers becoming part owners in our industry is now a recognized fact in the electrical business as well as in the industrial life of America. No general plan or universal scheme of participation seems possible or practical for the reason that the conditions of no two undertakings are identical. A plan which has been very effective in practice provides for the purchase by employes on small installments of capital stock or securities of the properties with which they are identified. Interest on deferred payments is generally carried by the concern at ordinary interest rates, but the employes receive dividends at a higher rate in proportion to the earnings of the properties and consequently acquire a vital interest in the success of the business. In this wav thrift is combined with ownership and participation and a strong incentive is given for increased production, accompanied by saving. Enduring benefits resulting from the participation of workers in the business in which they are engaged cannot go beyond the sharing of profits or earnings. To place the management of the industries in the control of those untrained in the administration of such affairs would result in disaster, frustrating the very ends which co-operation is seeking to achieve.

The granting of pensions on retirement of the workers in old age, and for disability benefits to those who have served well, but may have become disqualified for service, is another great feature of employes' welfare.

Geographic Sections.—In our Geographic Sections, the greatest opportunity is offered for personal contact and interchange of ideas between executives and employes and all others interested in the electrical industry within a given territory where conditions are frequently identical and usually similar. From these, ideas naturally germinate and spread to the National Association, which are becoming transcontinental policies and aims. In the Geographic Section opportunity is offered men to think in broader terms, and for cementing all branches of the industry in one harmonious whole by a complete understanding between central stations, manufacturers, jobbers and contractor-dealers, as to the rightful place occupied by each group, and especially the relations of one branch of the industry to the other. The Geographic Section is the place where misunderstandings, frictions, petty jealousies and fancied injuries can be ironed out and adjusted. It also opens ample opportunity for constructive initiative and a medium of crystallization, demonstrating and applying locally when local, and making universal when universal, all of the constructive and creative forces that exist in the minds of the great membership of the National Electric Light Association.

SOUTHEASTERN SECTION, N. E. L. A., HOLDS MEETING AT ASHEVILLE.

Addresses, Papers and Trips Make Pleasing Convention for Delegates.

During Sept. 17, 18 and 19, the Southeastern Section of the National Electric Light Association held its annual convention at Asheville, N. C. About 200 members were in attendance.

The convention opened its first session with about 100 present. A feature of this session was the address of Mayor Gallatin Roberts, who reviewed the history of transportation and lighting, going on to relate the manner in which Asheville and the local power and light company had grown up together. He laid special emphasis upon the friendly co-operation accorded the city by H. W. Plummer, manager of the Asheville Power & Light Co. C. D. Flanigen, president of the association, then reviewed the work of the association during the last year, stressing the importance of labor policies and other public policy questions.

C. Murphy Candler, chairman, Georgia Railroad Commission, in a very clever manner told of what utility supply really means and some of the difficulties under which utilities may have to operate. He emphasized two points—that it is the solemn obligation and high duty of a public utility to render good service and that the public should accord the utility fair treatment and just compensation. The very object of a utility is to serve. Tact, courtesy, discretion are virtues. Good service is more important than low rates, and there is less objection to rate increases when the service is good. Mr. Candler then explained that his commission had fixed maximum rates and minimum service, leaving leeway for the utilities to lower rates and improve service when they can.

"The servant is worthy of his hire," said Mr. Candler, as proving that every utility is entitled to a reasonable return upon its service—what it accomplishes. That means that the charge must not exceed the value of service rendered. Some of the difficulties in rate making were outlined, as some of the reasons why rates have had to be changed because of unprecedented and unforeseen conditions that have arisen. Efficient and adequate service goes hand in hand with reasonable and just rates, and together they mean a satisfied public, a fairly compensated and contented force of employes and a fair return upon the value of property dedicated to public use.

T. F. Johnson then presented a paper entitled "Live Line Maintenance." This paper was accompanied by a supplement showing the various tools and methods discussed. The buzz stick method of locating defective multiple-part pin-type insulators, how to feel out an insulator, testing out suspension insulators, feeling out a string of insulators, method of determining number of insulators required in a string for any voltage, number of men in crew for testing a line, various tools and their use, were each taken up in turn. Methods of changing insulators, making ties on live lines, etc., were also described.

In the evening the report of the Public Policy Committee was represented by W. H. Glenn, chairman. This was followed by F. G. R. Gordon's able and sensational address upon "The World Menace of State Socialism."

At the Thursday morning session, R. H. Ballard, president of the N. E. L. A., made an address upon the pensioning of retiring employes when they have qualified by long service and loyal effort. Mr. Ballard said that action taken by the California Railroad Commission had annunciated a new principle in the jurisprudence of the country. One of the largest electrical companies in that state had applied to the regulating body for authority to put into effect a pension contract, granting pensions to all of its employes upon reaching the age of 60 years, after a 20-year period of continuous service. The commission in confirming this application gave the pension plan the force and effect of a contract binding and collectible at law, and permanent beyond the power of any future management of the corporation to eliminate and beyond the power of any future regulating body to abrogate.

After quoting to some length the ruling of the commission, Mr. Ballard said: "Such a pension plan as has been given legal status by the Railroad Commission of California is the best thought-out plan of which I can conceive to drive away from our minds the goblins of dread, and give to the loyal worker the fullest opportunity to develop his initiative and achieve his highest potentialities."

Following Mr. Ballard, F. C. Hamilton presented a paper entitled "Rate Reduction in the Last Three Years," in which it was shown that after considering the lack of a standard measuring stick of value, the intrinsic value has not changed the depreciation of the purchasing power of money, that a reduction in utility rates has actually occurred. The necessity of rate restoration instead of rate increase was advanced by Mr. Hamilton, he then pointing out that labor unions appreciate fundamentals that utility men neglect and why electric utilities have been late to suffer from time lag of rate change to care for conditions as they exist today. A number of court decisions are given bearing upon property value of public utilities. It is stated that the trend of prices upward is permanent and that with the purchasing power of money declining, there is no choice but to raise the selling price of the finished product or face bankruptcy.

"Safeguarding the Employe" was the title of the next paper, presented by H. L. Parish, Durham Traction Co. Mr. Parish discussed the past and future safety movement and explained the manner in which this work should be taken up by companies. General points for safety are then given, safety records are reviewed and the awarding of prices advocated, as are also medical examination, physical exercises, lectures and meetings.

J. Prince Webster then gave his interesting talk on "The Smiling Complaint Man," a talk that contained from beginning to end pithy and sound advice as to the manner of handling complaints. Several different methods of handling complaints by different companies were described and the morals pointed out. This paper will be abstracted in a future issue of the Electrical Review.

Thursday afternoon and evening were devoted to recreation, there being wide choice in the way of golf, a visit to the Country Club, a tea dance, a band concert and an airplane trip for those that wished to go. In the evening there were moving pictures and a dance.

On Friday morning the business and final session was held. A paper on "The Grounding of Secondaries" was read by L. V. Sutton, Carolina Power & Light Co., who explained the present status of grounding secondaries, why it is done and how it should be done. Comparative advantage of different ways of grounding, the copper plate, iron pipes, etc., and methods of testing the resistance of grounds were given. Specifications for making and maintaining grounds were presented. W. M. Stearns then read a paper upon "The Marsh Patent and Its Effect on the Heating Appliance Industry" in which the litigation, the agreements between the Hoskins and the General Electric interests and their influence upon the heating industry were explained.

A meeting of Class A members and of the Executive Committee was then held, after which the session was adjourned and the convention came to an end.

ACTIVATED-SLUDGE SEWAGE-TREATING PLANT TO REQUIRE MUCH POWER.

Langdon Pearse Describes Problem of Treating Chicago Packing-House Wastes and Plans Proposed for Its Solution.

A general summary and details of one of the most acute problems in sewage disposal were explained to the Western Society of Engineers, at a meeting in Chicago on Sept. 22, by Langdon Pearse, engineer of the Sanitary District of Chicago. Mr. Pearse's talk was entitled "The Packingtown Waste Problem" and dealt with the very aggravated situation in the Union Stock Yards of Chicago where in an area of a little over one square mile there is formed as much sewage as by a city of over 1,000,000 inhabitants. The solution proposed is a treating plant to be operated exclusively by electric power and involving a connected load of about 12,000 hp. and using approximately 38,500,000 kw-hr. annually.

Mr. Pearse stated that the Chicago stock yards had been established in 1865, growing steadily until now over 12,000,000 cattle, hogs and sheep are slaughtered annually. From the cattle pens and slaughtering houses from 50 to 75 tons of solid organic matter are discharged into the sewers daily, consequently the sewage is very "strong." Up to the present time the scheme of diluting this sewage on its discharge into the Chicago river and Sanitary canal has been followed, but on account of national and international questions involving control of the levels of the Great Lakes, it is anticipated that the dilution method has reached the limit of its capacity and, therefore, sewage treatment must be inaugurated. The stock yards area constitutes the most difficult problem in the entire Chicago district if not in the country. Study of this problem was begun in 1911 when a testing station was established. Investigations were made of the discharge from each of the principal packing plants to find out its quantity, nature and variation from time to time. It was found that the sewage was about eight times as "strong" as domestic sewage. Various schemes of treatment were tried on an experimental scale, including the Imhoff tank method, sprinkling filters and the recently developed activated-sludge method. The latter was looked upon with much interest and extended experiments carried on. It depends on the property of the depositing sludge of oxygenizing and nitrifying the dissolved organic matter as air is blown through the sewage. Part of the sludge is used over and over again. The experiments were continued with various types of tanks, quantities of air and time of treatment. It was found that the process could be employed both in summer and winter, but was more efficient in summer.

As the result of these studies a plant was designed to consist of fine screens (20 to 30 mesh per inch), a grit chamber to remove grease, aeration and settling tanks besides sludge dryers, power house, etc. It was found that the sludge at the end of the process ran about 98.5% water, so that filter presses would be required to reduce this to about 75% water and form a cake. Further treatment of this material by dehydrating and finally grinding would convert it into a commercial fertilizer of a fair value depending on market prices, but offsetting a considerable part of the operating costs. The plant is proposed to have a capacity of handling about 50,000,000 gal. a day and would include the domestic sewage of the 60,000 employes as well as the industrial sewage of the district. The sewage will enter the plant through coarse bar screens followed by fine screens in the grit chamber, which should remove about 25% of the suspended matter. It will then pass through the grease-skimming tanks, from which it is expected that over 1000 lb. of grease should be collected daily. It then enters the aeration tanks where about 4 cu. ft. of air per gallon of sewage is blown through continuously for about eight hours, this being the active part of the process. From these tanks it passes into settling tanks where the sludge slowly settles. The effluent is clear and almost sparkling, entirely free from odor and stable in character. The tanks will be built of concrete.

For power equipment there will be needed a number of air compressors, pumps, filter presses, dryers and cranes, for all of which it is proposed to use electric motors. Assuming a power rate of 0.7 cent per kw-hr., the power cost for the year will be about $270,000. The labor cost is estimated at about $75,400, supplies and repairs $98,000, superintendence, etc., making the total operating $455,700 per year. Adding interest and depreciation, the total annual cost figures out about $822,000. The first cost of the plant is estimated at about $3,750,000 on 1917 prices. Recoveries, depending upon the quantity and market price, should range from $192,000 to $462,000 annually, thus reducing the net operating cost in a very substantial degree.

At the present time this project, which was held up on account of the war, is being revived and its execution is delayed only by the negotiations between the Sanitary District and the stock yards interests as to the proportion of the initial and annual cost to be borne by each of these parties. Early agreement on this matter is anticipated so that the work may proceed. It is planned to erect the plant in unit sections so that the experience gained in operating on a large scale in some of the earlier sections may be used before deciding on the details for the remaining sections. The plant will be unique in being the largest one yet operated on the activated-sludge process and also in being the largest sewage-treating plant using electric power.

PROGRAM FOR CONVENTION OF ILLUMINATING ENGINEERING SOCIETY.

Papers Are Grouped so That Each Session Has Special Appeal to a Definite Division of the Lighting Profession.

It is the plan of the Papers Committee of the Illuminating Engineering Society to have each of the five sessions of the 1919 convention at Chicago, Oct. 20 to 23 inclusive, so arranged that all topics discussed at the session will have a bearing on some particular phase of the lighting industry. Monday afternoon's session will be devoted entirely to opening addresses and reports of committees; Tuesday morning's session to street lighting, searchlighting and photometry; Wednesday morning to glare, and industrial code symposium; Wednesday afternoon to papers of interest to commercial men, and Thursday morning session to papers on the design of interior illumination. Visits to the Chicago Electrical Trade Exposition and other entertainment features will occupy the time not taken up by covenant sessions and inspections.

The program as arranged by George H. Stickney, Harrison, N. J., chairman of the Papers Committee, is as follows: Presidential address, Dr. George A. Hoadley, Swarthmore, Pa.; report of Committee on Automobile Headlighting Specifications, Dr. C. H. Sharp, chairman, Electrical Testing Laboratories, New York City; report of Committee on Lighting Progress, F. E. Cady, chairman, National Lamp Works, Cleveland, Ohio; paper on "Lighting in England," by F. W. Willcox, British Thomson-Houston Co., London, England.

Paper on "Street Lighting with Low-Mounted Units, Kensico Dam Drive," by J. Howard Williams, former engineer New York Department of Water Supply, New York City, and C. A. B. Halvorson, engineer, General Electric Co., West Lynn, Mass.; "Recent Developments in Electric Street Lighting," by C. A. B. Halvorson, West Lynn, Mass.; "Recent Developments in Gas Street Lighting," by F. V. Westermaier, engineer, Welsbach Street Lighting Co., Philadelphia, Pa.; "Searchlights in the War," by Capt. Chester Lichtenberg, office of the chief of engineers, War Department, Washington, D. C.; "A Universal Photometric Integrator," by F. A. Bendford, illuminating engineering laboratory, General Electric Co., Schenectady, N. Y.; "Photoelectric Photometry," by Dr. A. H. Compton, Westinghouse Electric & Manufacturing Co., East Pittsburgh, Pa.

"Glare," by Ward Harrison, illuminating engineer, National Lamp Works, Cleveland, Ohio; Symposium on Industrial Lighting Codes: (a) "Introduction," by L. B. Marks, consulting engineer, New York City; (b) "The Code in Wisconsin," by J. A. Hoeveler, electrical engineer, Wisconsin Industrial Commission, Madison, Wis.; (c) "The Code in New York," by J. H. Vogt, director of industrial hygiene, State Industrial Commission, New York City; (d) "The Code in New Jersey," by R. H. Leveridge, chief of Bureau of Electrical and Mechanical Equipment, Department of Labor, Trenton, N. J.; (e) "The Code in Pennsylvania," by J. S. Spicer, Department of Labor, Harrisburg, Pa.; (f) "Insurance Inspectors and the Code," by R. E. Simpson, engineer, Travelers Insurance Indemnity Co., Hartford, Conn.

"Opportunities for Extending Lighting Through New Applications," by R. M. Searle, vice-president, Rochester Railway & Light Co., Rochester, N. Y.; "Factory Lighting as a Central-Station Problem," by O. R. Hogue, head lighting agent, and J. J. Kirk, illuminating engineer, Commonwealth Edison Co., Chicago; "A Survey of Industrial Lighting in Fifteen States," by R. O. Eastman, of Fuller & Smith, Cleveland, Ohio.

"Artistic Illumination of Interiors Without Use of Pendent Ceiling Fixtures," by A. D. Curtis, president, and J. L. Stair, illuminating engineer, National X-Ray Reflector Co., Chicago; "Principles of Interior Illumination," by Bassett Jones, consulting engineer, New York City; "Co-efficients of Lighting Utilization," by Ward Harrison and E. A. Anderson, Cleveland, Ohio; "Tests of Lighting Units," by Van-Rensselaer Lansingh, engineer, Cincinnati, Ohio.

IRON AND STEEL ELECTRICAL ENGINEERS DISCUSS VITAL PROBLEMS.

Thirteenth Annual Convention Held in St. Louis Sept. 22-26 Brings Good Collection of Papers and Active Discussion.

A very successful convention was held by the Association of Iron and Steel Electrical Engineers at St. Louis, Mo., on Monday to Friday of this week. The program was somewhat ambitious in the number of subjects presented, but each of these received careful attention and many of the papers were actively discussed. The attendance was about 250, this being slightly under expectations but due somewhat to the disturbed conditions in the industry.

President Petty in his annual address outlined the work of the association during the past year, laying special emphasis on the work of the sections and committees of the association, particularly the Standardization Committee. There are now five sections at Birmingham, Chicago, Cleveland, Philadelphia and Pittsburgh, all of which are very active in the work for which they were organized. Mr. Petty referred to the satisfactory growth of the association from 28 members in 1907 to 1020 in 1917, and expressed the belief that at the end of the present year the membership would be 1200, as there had been a gain of 206 in the first eight months of 1919.

Space does not permit review of the papers and discussions, which will be presented in our next issue.

The newly elected officers for the ensuing year are:

President—B. W. Gilson, Youngstown, Ohio.

First vice-president—H. C. Cronk, Cleveland, Ohio.

Second vice-president—F. G. Wiley, Chicago, Ill.

Treasurer—James Farrington, Steubenville, Ohio.

Secretary—John F. Kelly, Pittsburgh, Pa.

Directors—R. F. Gale, Philadelphia, Pa.; J. E. Fries, Birmingham, Ala.; W. S. Hall, Chicago, Ill., and C. E. Bedell, Wheeling, W. Va.

RED CROSS TAKES UP FIRST AID AND ACCIDENT PREVENTION WORK.

American Red Cross Ready to Loan First-Aid Specialists to Utility and Industrial Companies.

It is stated that accidents cause 9.3% of the deaths in the United States. Part of these occur in industrial plants, and again part of these occur in electrical industrial plants. Looking at the situation from a humanitarian viewpoint and also from an economic standpoint it would seem that methods and systems should be devised and utilized to reduce the number of accidents to a minimum and to provide more ready medical means to relieve those who are injured.

With the latter as an object the American Red Cross has organized a first-aid division which employs a staff of field representatives trained in accident prevention and first-aid to the injured, the members of which are loaned, under virtually agreeable conditions, to factories, mills, mines, railroads, etc., for the purpose of instructing their employes in this important work.

SEATTLE SECTION A. I. E. E. CONVENES.

Annual Meeting and Dinner Devoted to Organization Problems of the Institute.

The annual meeting and dinner of the Seattle Section of American Institute of Electrical Engineers was held Sept. 16 at Hotel Butler. One of the principal features was the report of Chairman John Harisberger of his trip to Lake Placid, in attendance at the national convention of the Institute. He reported in detail on the work of the development committee, which he thought would be adopted by the board of directors.

On motion, the section proposed Dr. Magnusson as vice-president for the coming year of the Pacific Coast association, the recommendation having been wired to the convention which met in Los Angeles Sept. 18.

Much discussion followed relative to the report of the development committee. There was also discussion of the proposal of G. E. Quinan to have associate members transferred to higher grades. It was brought out by F. D. Nims that many associate members could not meet the qualifications required for higher rating. A committee was appointed to deal with this subject and report to the executive committee.

A. J. HIXON SPEAKS AT MEETING OF MASSACHUSETTS CONTRACTORS.

At a meeting of the Boston district of the Massachusetts State Association of Electrical Contractors and Dealers held Sept. 18 at Boston, A. J. Hixon, state committeeman of the national organization, was the principal speaker. He took up the formation of the national association and showed its progress step by step to the adoption of the Goodwin plan at New Orleans, and then explained in detail the resolutions adopted at the Milwaukee convention. He made the statement that that meeting was to the electrical industry what the Declaration of Independence was to the counry.

ELECTRICAL MANUFACTURERS SCHEDULE SECTION MEETINGS.

Many of the Sections to Meet in New York and Chicago On Oct. 14-16.

The Associated Manufacturers of Electrical Supplies will hold the following section meetings at its rooms, 30 East 42nd street, New York City: Oct. 14—Signalling Apparatus Section, Lamp Receptacle and Socket Section, Industrial Lighting Fixture Section, Snap Switch Section, and Attachment Plug Section. Oct. 15—Outlet Box Section, Fuse Section, Knife Switch Section, Insulating Materials Section, and a meeting of chairmen of Section Tariff Committees. Oct. 16—Panelboard and Switchboard Section, Moulded or Formed Insulation Section, Line Material Section, and Air Circuit Breaker Section. A meeting of the Heating Appliance Section will be held in Chicago, Oct. 14.

CHICAGO CONTRACTORS DISCUSS COST SYSTEMS AND HOUSE WIRING.

At a meeting of the Chicago district of the Illinois State Electrical Contractors' Association, held in Chicago, Sept. 19, A. R. Nordlie was elected chairman; F. L. Butler, vice-chairman; G. G. Pedley, secretary, and L. M. Kahn, treasurer. The feature of the meeting was a blackboard analysis and discussion of cost systems, with J. W. Collins at the blackboard. It was announced arrangements had been made with a Chicago bank whereby contractors completing house-wiring contracts could obtain full payments for their contracts at a discount of 6%, the bank to make the collections on the part-payment plan.

JOINT MEETING OF A. I. E. E. AND I. R. E. AT NEW YORK.

A joint meeting of the American Institute of Electrical Engineers and the Institute of Radio Engineers will be held in the auditorium of the Engineering Societies Building, 33 West 39th street, New York, on Oct. 1, at 8:15 p. m. The following papers will be presented: "Trans-Oceanic Radio Telegraphy," by E. F. W. Alexanderson, General Electric Co.; "Telephone Repeaters," by F. B. Jewett and B. Gherardi, Western Electric Co., and "Principles of Radio Transmission and Reception with Antenna and Coil Aerials," by J. H. Dellinger, Bureau of Standards.

CENTRAL STATION ESTABLISHES LIBRARY.

The Rochester (N. Y.) Railway & Light Co. is planning the establishment of a new library consisting of books, reports, etc., issued by engineering and technical societies, and pamphlets, publications and literature in general relating to electric and gas lighting, for the use of its employes. The library will be located in the offices of the company, 34 Clinton avenue, North, and will be in charge of a competent librarian.

Commercial Practice

Electro-Culture for Fruit—Value of the Electric Range as Central-Station Load—Advantage of Off-Peak Rates

EFFECT OF ULTRA-VIOLET RAYS UPON BANANAS, SUGAR CANE, ETC.

Experiments Indicate Increased Yield from Use of Ultra-Violet Rays.

Experiments carried on in Hawaii upon the effects of darkness, sunlight and quartz-lamp light upon bananas, pineapples and sugar cane have brought out some interesting facts, according to a recent issue of Louisiana Planter and Sugar Manufacturer.

Normal sugar-canes kept in the dark in Hawaii at 22° grew, but became pale; exposed to the light from a quartz-mercury lamp they turned green in 2½ hours, while sunlight had no effect. Of three other lots, one was grown under colored glass, the second in normal sunlight, the third exposed to sunlight and to the quartz-lamp light rays; the second gave 30% more sugar than the first, the third 8% more than the second, and therefore 38% more than the first. Pineapples exposed to the ultra-violet rays for 40 minutes every morning were found to give riper and superior fruit. The same effect was obtained with bananas; cut banana-leaves and stalks, moreover, kept fresh in water for two weeks, after having been radiated upon by the quartz-mercury lamp; without this treatment they faded in one week. Thus fruit might be preserved for export, but great care is required to secure the proper radiation treatment. Mention is made of experiments with arc-light carbons, impregnated with sodium tungstate, uranium nitrate, ammonium molybdate, and titanium chloride, for the production of ultra-violet rays.

VALUE OF ELECTRIC COOKING AS CENTRAL-STATION LOAD.

Striking Summary of Its Profitableness Presented by Pierce L. Miles Before Colorado Central-Station Men.

The advantages of electric cooking have frequently been presented and are fairly well known among progressive central-station men. Many of these are still far from being convinced as to its practicability and profitability as a central-station load, however. Of special interest, therefore, to such men should be a paper on "Electric Cookery" presented last week before the Glenwood Springs, Colo., convention of the Colorado Electric Light, Power and Railway Association by Pierre L. Miles, of the Edison Electric Appliance Co. His paper consisted almost entirely of the following terse statements summarizing his conclusions as to the electric range, cooking rates and range-modernizing methods, based on many years' experience and investigation among central-station men, who are today successfully exploiting the sale of electric ranges.

The Electric Range.

The electric range is the best cooking apparatus on the market. It will (a) boil, (b) fry, (c) roast, (d) bake, (e) broil, better than any fuel.

The initial cost of the range is not retarding the rapid introduction of electric cookery, as is sometimes claimed.

The cost of operating an electric range is purely a matter of educating your customers to the proper use of the range. All the cooking for a family of five may be done with 100 kw-hr. per month, and current in excess of this amount is unnecessary.

Electric range is *not* slow and if properly employed compares favorably with other fuels wherever speed is necessary.

Even though the heating of a large amount of water for bath purposes is not practical on an electric range, this will not be a deterrent to the sale of ranges if the subject is properly handled.

The fact that the electric range will not heat the kitchen in the winter months is an advantage rather than a disadvantage.

The electric range has more points of superiority (talking points) than has electric lighting.

The Rate for Electric Cooking Service.

There is more profit in the electric cooking load than in the lighting business.

Only 600 watts of station generating capacity is necessary to serve a 6000-watt range.

The electric range load is sometimes more profitable in a small town than in a large one.

With a 3-cent cooking rate and with fuel costs of 1 cent per kw-hr., lighting companies can afford to spend at least $100 in order to connect a range to their lines.

A 3-cent electric cooking rate can be justified against a 5-cent small-motor rate on the basis of being a more profitable load.

The electric range load should not bear the same expense of distributing current as does the present lighting load.

A 15-kv-a. transformer will serve a group of 20 ranges, having a connected load of 120 kw., because of the high diversity-factor.

The yearly revenue per kilowatt of generating capacity serving the electric range load is greater than that serving a small motor load.

The investment required to serve a range customer is not as great as originally required to serve a lighting customer.

There is more profit in selling 1500 kw-hr. per year at a profit of ½ cent per kw-hr. (your range load) than in a profit eight times as great per kw-hr. for the lighting load.

There is more profit in a 1½-cent water-heating rate than in a 3-cent cooking rate.

Two hundred electric ranges can be installed in nearly every small town, without having to increase the present generating capacity.

Only 10 to 15% of the total connected range load will fall on present station peak.

The diversity-factor and load factor of the electric range load is far better than that of the lighting load.

Electric Range Merchandising Method.

It is not necessary for a lighting company to make any investment for the selling or advertising of electric ranges.

With proper methods between 3 and 5% of residential customers may be sold an electric range during the first year of electric range sales work.

Advertising alone will not sell electric ranges.

A low rate for electric current will not in itself sell electric ranges.

A display and description of what the electric range is will not sell ranges.

Even a small-town company can employ an electric range salesman, as well as a range demonstrator, at no expense to itself.

The campaign on electric ranges should consist of two parts, educational and sales.

The cost of the inside wiring should be included in the selling price of the range.

Time payments are an esential part of a successful electric range business.

The manufacturer's system of discounts provides for compensating the central-station man for the cost of retailing.

If the lighting company does not engage in the water-heating business, it should be in a position to offer suggestions to its customers regarding the best method of doing this work, as well as that of heating the kitchen in the winter time.

The sale of an apartment-house installation offers one of the most profitable loads for the central station at the least sales expense.

Mr. Miles said in conclusion: The time is coming, and it is not so very far distant, when the central-station man responsible for sales will be called upon to show a yearly increase in kilowatt-hours delivered. The electric range load offers the golden opportunity to meet this demand.

Now is the time when farsighted men are breaking the ground for this future business. They are placing their quota for the coming year. They intend to jump in and by aggressive sales and advertising methods reach their goal. They have carefully considered the following two basic factors in this field of central-station activity.

First, is the electric range a satisfactory article to recommend to the public? Will the purchaser be compensated and fully satisfied with his investment?

Secondly, is a rate for cooking profitable to the central station? A comprehensive study of the question will reveal that it is.

Once these two points have been settled the sales manager must not allow any of the annoying details, incident to any new business, to swerve him from the purpose of building up this phase of his business.

Water heating, initial cost, installation expense, time payments, heating of the kitchen, costs of selling, maintenance, are some few of the problems which are bothering central-station men today. They are merely the details of the two basic facts. With earnest application they can and will be solved. But not by sitting back and hopelessly repeating "Electric ranges cannot be sold, because of this or that reason."

The building of the range load is hard—sometimes very hard. But it can be done. It takes both brains and live sales energy. It takes the pioneer quality of stick-to-it-iveness, which made a success of the telephone, the automobile, the electric light, and every other new device brought onto the market.

First, be sure you are right in the first two points. Then go ahead, assured of success in the knowledge that if your fundamentals are correct, all other questions and conditions are capable of being solved and overcome. Serious as they may sometimes appear to be, they are relatively unimportant, and require only serious application in order to find the way through, over, around, or under.

VALUE OF OFF-PEAK RATES IN IMPROVING LOAD-FACTOR.

President Elden of Association of Edison Illuminating Companies Recommends Greater Use of Off-Peak Service.

At the annual convention of the Association of Edison Illuminating Companies held at New London, Conn., Sept. 16-18, L. L. Elden, of Boston, in his presidential address had this to say on off-peak rates and service:

"Two years' experience in the application of an 'off-peak rate' for secondary service has clearly demonstrated the economic value of such a rate, if service is supplied under suitable restrictions. Broadly speaking, with a rate based upon supplying service only when available, it is usually possible to secure nearly 90% of a consumer's total business on a secondary rate without incurring an expenditure in excess of a small fraction of that required to supply his total service requirements. The effect of such business on the investment, income and operating accounts is obvious, increasing, as it does, the income, while reducing the average amount of capital required per kilowatt of capacity or consumer served, and further reducing the cost per kilowatt-hour delivered through improvement in load-factor."

DEVELOPING GOOD WILL THROUGH NEWSPAPER ADVERTISEMENTS.

Nebraska Power Co. Presents Some of Its Central-Station Problems for Consideration by the Public.

The Nebraska Power Co., of Omaha, Neb., is appealing to its customers through well written newspaper advertisements for careful consideration of the problems of the company. Facts are stated in a plain manner, with every appeal to the better business judgment of the customer and no appeal whatever to sympathy. In its "Talk to Our Customers No. 1" the company asks consideration of the load equivalent to 75,000 electric lamps being suddenly thrown upon the company on account of a thunderstorm which practically darkened the skies on the afternoon of Monday, April 21, 1919. If one person turned on the lights in his home, office or store, it is only probable that in a city the size of Omaha that thousands did the same. For that reason many thousand dollars' worth of machinery, with its attendant labor, fuel and other supplies, must be held continuously in reserve to care for storms which may occur only two or three times a year, so that when a consumer presses a switch, electric service will instantly be available.

Operating Practice

Suspension Insulator Failure—Reducing Converter Flash-Overs—Generating Switchgear—Substation Temperatures

PUNCTURE OF SUSPENSION INSULATORS.

From Paper on "Symposium of Operating Difficulties," Before Pacific Coast Section, A. I. E. E.

By Clem A. Copeland,

Technical Assistant, Bureau of Light and Power, Los Angeles.

The trouble dealt with here occurred on a 110,000-volt, 3-phase, 50-cycle line with neutral of transformers grounded at both ends, and two vertical circuits of 300,000-cir. mil., 19-strand copper cable, steel towers, 44.13 mi., with no branches, at a point 29 miles from San Francisquito Power Plant No. 1 on the summit of the Newhall Hills, at an altitude of 2350 ft. The weather was foggy and wet but calm. The temperature was about 55° F.

The single suspension middle crossarm string on the east circuit of 7 insulators failed by the 6 lower insulators puncturing between pin and cap forming a crater from ½ to ¾-in. in diameter, all craters being approximately in the same vertical plane at right angles to line direction on the leeward side of the string away from the tower. The tower is at a sharp vertical angle, therefore the strain is great. The six lower insulators which failed were manufactured in 1912, but were not put in service until February, 1917. The top insulator was made in 1915 and put in service in February, 1916.

The same tower on July 17, 1919, the top strings on the same circuit failed in a similar manner at 4:30 a. m. during a heavy wet fog. On April 1 and on July 19 the same trouble happened on single dead-end strain strings of two of the same kind of insulators on 33,000-volt lines of No. 2 solid wire in Los Angeles.

The cause of the trouble is obscure, but several theories have been advanced:

(a) Sharp ridged corrugation on pin form rings of high electrostatic density and strain.

(b) Unyielding cement between metal of one coefficient, in conjunction with

(c) Heavy strain due to vertical angles in line.
((c) does not seem to be borne out in the case of 33,000-volt lines.)

(d) Flat top of insulator under cap and flat top of pin cavity may be of a form to introduce shrinkage strains in cooling.

The remedy is implied in the above analysis of causes.

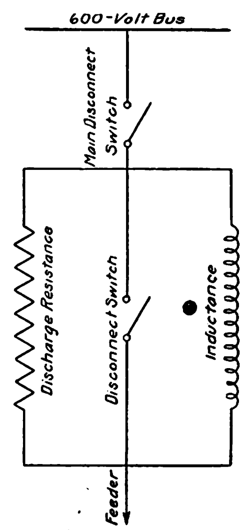
ARRANGEMENT OF FEEDER INDUCTANCE TO REDUCE CONVERTER FLASH-OVERS.

Selective Action Enables Feeder Breakers to Open Before Machine Breaker.

In a substation supplying 600-volt direct-current power to a railway terminal by about 6000-kw. in synchronous converters, considerable trouble was being caused on account of short circuits on the third rail in the terminal yard. Many of the feeders between station and third rail were of very short length and of large cross section, hence a short circuit on the third rail was almost equivalent to a short on the station 600-volt bus.

When two synchronous converters were operating and pulling a heavy load due to many of the feeders being well loaded, it often happened that one machine breaker would open, shifting the total load to the other machine which likewise immediately dropped its load. Another form of trouble was that when one machine was operating alone, as during the early morning and later evening hours, a short circuit in the terminal yard usually caused the machine breaker to open up.

The accompanying diagram shows the method proposed, by which nearly all such trouble as mentioned above would be eliminated. This diagram shows that an inductance has been inserted in the short feeder between substation and third rail. Reactance so located reduces the severity of the short circuit, thus preventing the machine and station bus from receiving as severe a jolt as they otherwise would.



Arrangement of Reactance and Discharge Resistance by Which Flash-Overs and Opening of Machine Breakers on Short Circuits Was Overcome.

Apart from the cushioning effect of the inductance, the time lag or time constant of the circuit or feeder enables the feeder breaker to open before the main or machine breaker has time to function. Such an arrangement therefore not only tends to reduce interruption of service that may follow the opening of a machine breaker but also reduces the likelihood of flashover of the synchronous converter when a heavy load suddenly ceases.

In the installation it will be noted that a disconnect switch has been installed so as to permit short-circuiting or eliminating the influence of the reactance during such times as more than one machine is in service.

This was done because it had been found that it was when one machine was on the bus alone that flash-overs and opening of the main breaker occurred. A discharge resistance is also inserted in parallel with the reactance to prevent piling up of voltage due to sudden current rush. The discharge resistance was made up of several sections of cast-iron railway grids. The reactance was composed of 400 ft. of 500,000 cir. mil, lead-covered cable. This length of cable was wound upon its reel, the reel being fastened in place. The cable was connected up in circuit through lugs, an arrangement that would permit removing the cable, undamaged, on short notice, should it be necessary to use this length of cable elsewhere.

CHOICE OF SWITCHGEAR FOR MEDIUM-SIZED GENERATING STATION.

Reasons for Choice of Truck Type Switches by Lycoming Edison Co. Are Given.

The Lycoming Edison Co., Williamsport, Pa., found it necessary to enlarge its generating capacity by installing two 6600-volt, 7500-kw., 3-phase generators and one 2500-kw., 2300-volt, 4-phase generator in a station designed for an ultimate capacity of 30,000 kw. These sources of power are interconnected by means of 6600-volt 3-phase and 2300-volt 4-phase transformers. In a paper read before the Pennsylvania Electric Association at Bedford Springs, Pa., recently, G. E. Wendle discussed the selection of switchgear for power plants of moderate size, his experience and remarks being based upon the installation of the above station.

As a necessary preliminary, the ultimate station capacity, the maximum size and voltage of generating unit, and the probable number of feeders were carefully estimated upon the operating data of the present equipment and the anticipated development of our tributary territory. The figures assumed for these several items were as follows: 30,000 kw.; 7500 to 10,000 kv-a., at 11,000 volts; and 16 3-phase and 10 single-phase feeders in addition to the present lines. These estimated additions actually provided for three times the present capacity and between four and five times the present output. The choice of switchboard and control was confined to three systems, namely, the usual panel type, consisting of a pipe framework which supported the various apparatus, etc., and on which was mounted the marble or slate panels with operating handles, instruments, etc.; the cell type with bench board control; and the safety enclosed removable truck type with remote control of all main or master trucks.

After a short study of the panel type, it was eliminated because of the large number of exposed high voltage parts, difficulty in meeting the present and anticipating the future requirements in the state safety code in the matter of isolation of dangerous parts.

The matter of selection was thus reduced to the cell and the safety enclosed truck types, and as these two types were available in units of ample size and were practically equal in cost for equal number and subdivision of units, the final choice was made after careful consideration of the relative merits of these types under local conditions in favor of the truck type.

The cell and the truck types of switches appeared to have about the same reliability, taking into consideration the investment warranted by revenue. Regarding safety the truck type was considered preferable, since it is absolutely safe. Facility of installation was entirely in favor of the truck type switch, while facility of inspection and maintenance between the two types is on a par with the former and in favor of the latter for maintenance. The truck type was thought to have somewhat the advantage as regards operating economy. Localization of faults and isolation of trouble seemed about the same with the switch in a cell and the one on a truck.

Tests were made to determine the time required to remove a truck type switch as follows with men of ordinary physique and average intelligence but without special drilling or experience in handling the trucks. The series of operations were as follows:

(a) Go to a designated faulty truck and remove that truck from its cell.

(b) Go to the spare truck, remove it from its usual cell, move it into proper position to enter the faulty truck's cell, and push the truck home.

(c) Close the oil switch, thereby locking the truck in place and resuming service.

The time required for the smaller feeder truck, 30 seconds; and for the main trucks, 1 minute 45 seconds. These tests indicated clearly the great advantage of the truck type when emergency conditions must be handled quickly and surely by men of average capacity.

For the same number and subdivision of generating and distributing units, the cell and truck types were estimated as approximately equal in cost. The cell type cost was definite as far as the apparatus and appliances, but there was a large estimated portion which was subject to considerable doubt because of the fluctuating labor and material costs and existing uncertainties. It was concluded that a cell type installation would certainly cost as much and probably would cost more than a truck type.

INFLUENCE OF SUB-BASEMENT SUB-STATION TEMPERATURES UPON MACHINE INSULATION.

Mica Insulation Advocated Where High Summer Temperatures Exist.

It is a fact long since appreciated by operating engineers that the ambient temperatures of sub-basement substations may be very high. This condition may exist the year round, but it is more marked during the summer months. In sub-basement substations 35 ft. below the sidewalk and containing two or more 2000-kw. synchronous converters or units of 4000-kw. it is a difficult matter to carry off the large heat losses and the temperature tends to be high regardless of practical precautions.

The loads on sub-basement substations is often such that the load-factor on individual machine is high, and this coupled with high operating temperatures results in shortened life of the insulation of machines so operated. In fact it has been the experience of several companies that the insulation of machines in sub-basement substations becomes cooked and frequent rewinding is necessary. In one recent case, a 2000-kw. synchronous converter had been subjected to heavy loads for long periods, with resulting high internal and ambient temperatures, with the result that it was necessary to re-insulate it about every fifteen months. The company in question aims to overcome this objection, not of cost alone, but loss of capacity also, by adopting mica insulation for machines that are to operate in their sub-basement substations.

Contracting-Construction

Contracts on Fee Basis, Developing Repair Service, Cost Accounting and Other Points on Squire Co. Organization

BUILDING UP A LARGE CONTRACTING AND REPAIR BUSINESS.

Progressive Methods Used by Kansas City Contractor to Establish Growing Institution.

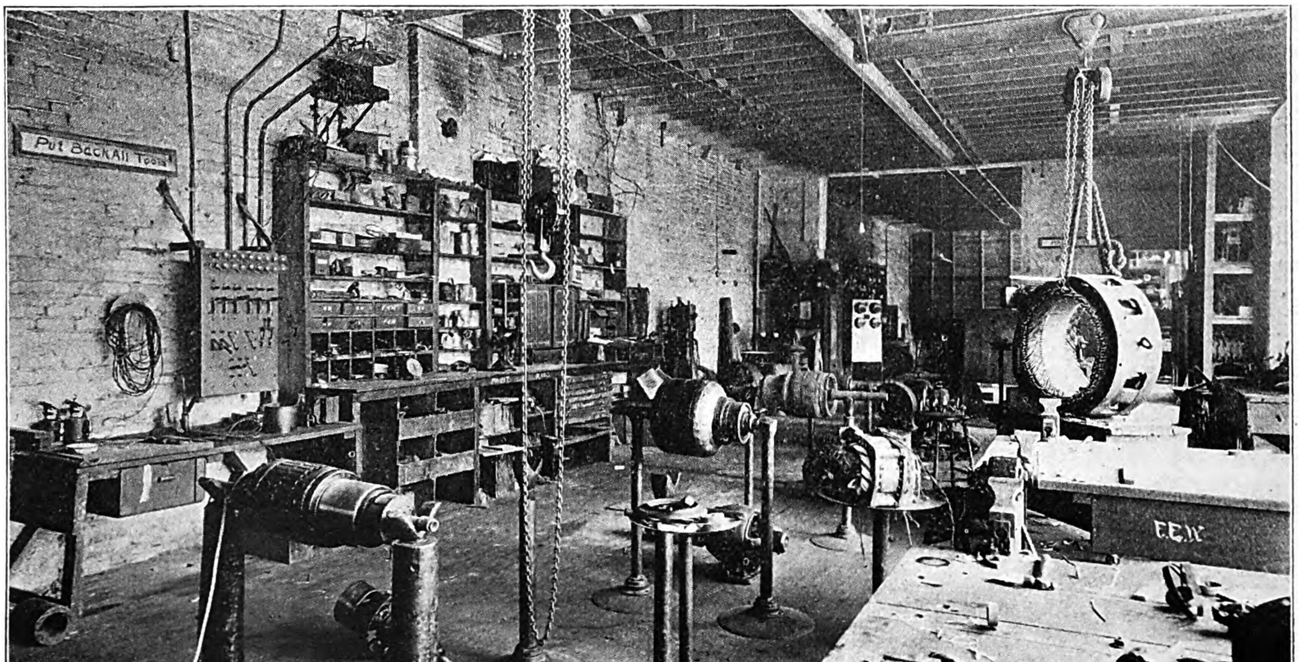
Developing co-ordinately a large construction and a large repair business has been the aim of the Squire Electric Co., of Kansas City, Mo. Some of the methods employed in building up the present volume of business may be interesting and helpful to other contractors and repair shop managers.

The plan of taking contracts on the basis of a flat bid for the engineering, the customer to pay all labor and material costs, has been used by the company to a great extent. "The letting of contracts on the engineering fee basis, which is cost plus a definite amount, puts the contractor on the same basis as the owner with reference to the job," said Mr. Squire, president of the company. "The owner sees clearly that it is to the interest of the contractor to shorten the time, the chief element of cost, as much as possible. Under this plan, the controversies over extras are avoided, since the contractor is not compelled to fight against elements that will reduce his profit. Our experience has been that owners work with far better co-operation with the contractor under this plan. And we, knowing closely what the overhead on a job should be, are sure we are going to get it."

An instance of the operation of this plan was the installation of conduits, wiring, converters, auxiliary motors and switchboard and like items, in the new plant of the Kansas City Light & Power Co. The plant was erected to meet an emergency; time was the chief factor. The company was willing to pay for overtime, and the Squire organization therefore worked under high pressure. Foremen and some workmen got in 81 hours a week, counting time and a half and double time on nights and Sundays. The extra time chargeable to overhead was absorbed by the reduction in the total time consumed on the job.

During the past summer the Squire Electric Co. has had 80 to 100 men on its payroll. The conduit, wiring and switchboard installation in the new Western Union Building in Kansas City, wiring and installation of motors for ice companies and mills, the half-million dollar job of the St. Joseph central station, and similar contracts in the past year or so have enabled the company to build up its large organization and hold it together.

The basis of the organization, however, developed during the war period when construction work was lacking, has been repair work. Having facilities and workmen, the company was able to extend valuable aid to electric railway companies in the repair of equipment, winding of armatures, rebuilding of generators and motors. The company has devised and built special machines, such as one for the making of coils of uneven legs, for the handling of such work. This service to electric railways was the more welcome, since many railway companies found it impossible to maintain their own shop organizations at the



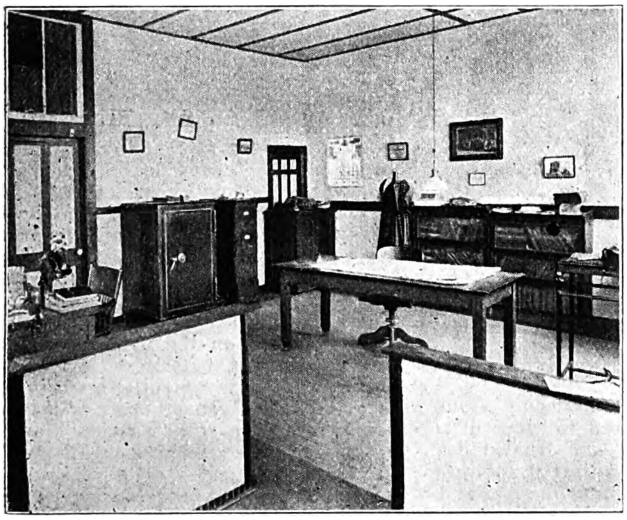
View of Squire Electric Co. Shop, Kansas City, Mo., Showing Longitudinal Overhead Hoist Track, in the Path of Which Are Set the Winding Racks. At the Left Is a Testing Rack of 5000-Volt Capacity.

desired level of efficiency. Many of the smaller electric railway shops lacked expert electrical mechanics; the expense of handling repair jobs in such plants was only less troublesome than the inability to get the work done properly.

The success of Mr. Squire in holding his organization together through those trying times is noteworthy. Several of his employes have been with him since he went into business ten years ago. A majority of his regular men have never worked in any other shops. This result surely has a reason; there are, in fact, two or three reasons. One is the fact that Mr. Squire has so painstakingly maintained a high standard of workmanship; this is appreciated by the better workmen, who take pride in their efforts and have a permanent satisfaction in knowing that the good work they do will not be disparaged by the poor work of a fellow employe. In a plant where high standards of product are maintained each workman is keyed to his best efforts, and in consequence his ideals are dominant; he is not led into complaints and dissatisfaction by handicaps to his professional advancement.

Another factor is the complete equipment of the plant. There are all the incidental as well as the principal items for facilitating work—overhead tracks, hoists, well built furnaces, drills, lathes, etc. The workman is not handicapped by the need of getting along with inferior tools of his trade. Encouragement has resulted in devising new methods and machinery for performing regular tasks, and these, in turn, have enabled the workmen to bring about a more satisfactory result on each job in hand.

A factor which operates less directly—though quite as surely—for maintaining the integrity of the organization is the cost accounting system, including the system of estimating and of figuring prices on supplies which has been developed. There is no guesswork as to the price at which stock should be

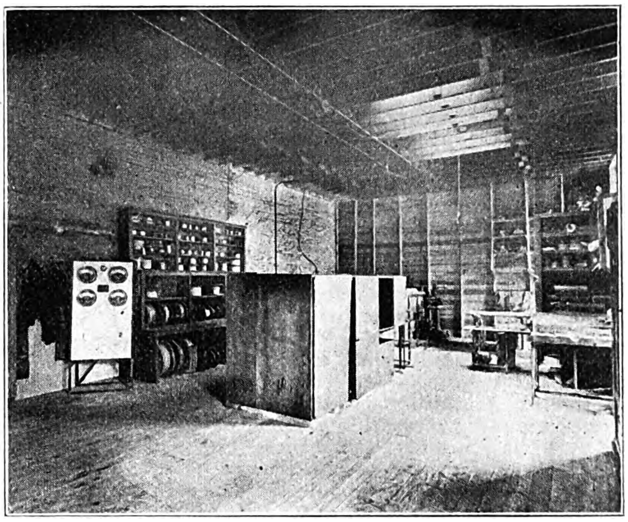


Office of the Squire Electric Co.

entered in a contract or estimated on a repair job; price lists are prepared in a simplified form which has proved so useful that many contractors have adopted it.

The effect of this certainty as to costs on the morale is more important than may sometimes be realized. There is an atmosphere of honesty and square dealing which the workmen are convinced extends to appreciation of their own services. Aside from their own judgment as to whether they are getting a square deal they feel a confidence in the fidelity of the employer. This confidence is, of course, augmented by the obvious confidence of the customer who seems to be turning his affairs over to the contractor, making the latter his full agent in the performance of the contract.

The large variety of work received is also an incentive to the electricians to remain with the company.



Electrical Oven and Coil-Winding Department, Squire Electric Co.

The motors and generators received for repair and rebuilding range from the tiniest to the largest. The repair work on electric railway equipment has also been a factor in maintaining the organization. The work turned out has been similar to much work that heretofore has been done only at the plants of manufacturers. The employes realize, therefore, that they are getting the opportunity for advancement in expertness in their trade that they would get only at the big factories.

It may be said that the present large business is due directly to the ambition to serve when service was most needed. Mr. Squire built most energetically and patiently, when building was most difficult, during the war period. He evidently had taken to heart the appeal for unusual effort to keep the wheels of industry moving. Hundreds of electrical repair shops in the vicinity of Kansas City have been able to keep the motors in their communities operating because they could send the motors to the Squire shop and receive prompt service.

Incidentally, Mr. Squire has always been a leading member of the Kansas City and the state electrical contractors' associations, and has steadily passed along to other contractors ideas and methods that have been helpful to him.

PENNSYLVANIA ASSOCIATION OF CONTRACTORS AND DEALERS TO MEET.

The next quarterly meeting of the Pennsylvania State Association of Electrical Contractors and Dealers will be held in Scranton, Pa., Oct. 7, with headquarters at the Hotel Casey. The program includes business sessions, noon-day "Howdy" luncheon, entertainment, and banquet. An invitation is being extended to representatives from all branches of the industry to attend. M. G. Sellers, 1518 Sansom Street, Philadelphia, is secretary.

New Appliances

Volt-Ammeter—Armature-Winding Machine—Light Steel Transformer Case—Reel-Type Fixture—Motor Generator

Handy Direct-Current Volt-Ammeter for Railroad Signal Testing.

The electrically controlled and operated signal apparatus which is installed on modern railroads inevitably involves the employment of a considerable number of elements which must be maintained in proper adjustment and for each of which there must be an appropriate current source. In order that the correctness of adjustments and readiness of current supply may be properly determined, it is necessary to have accurate means of measuring resistances and electric currents and potentials. Electrical instruments having the required accuracy may be obtained from a variety of sources, but ones which combine with accuracy the ability to withstand the extremely rough handling which is encountered in this field and ones which combine in a reasonable bulk and weight the large number of different ranges which are likewise requisite are a different matter.

Roller-Smith Co., 233 Broadway, New York City, has developed a number of portable instruments for this work, of which what is known as the "Handy S. S." type volt-ammeter is a recently added instrument. It is especially suited for maintenance work. With the exception of one particular pattern including a 0-300 volt range, these instruments are self-contained; they are compact, to be put in the pocket or in a small tool kit, and meet in a satisfactory manner the needs of this service.

The mechanism is of the same D'Arsonval type as in the portable standard instrument made by the company, so that scale divisions are uniform and indications dead beat. The case is a brass stamping, or black enamel finish, and of waterproof construction. There is a wood plate on the bottom of the base for insulation purposes. Terminals take the form of appropriately numbered binding posts with nonremovable tops. Each instrument has a convenient zero adjuster. A leather carrying case can be furnished if desired.

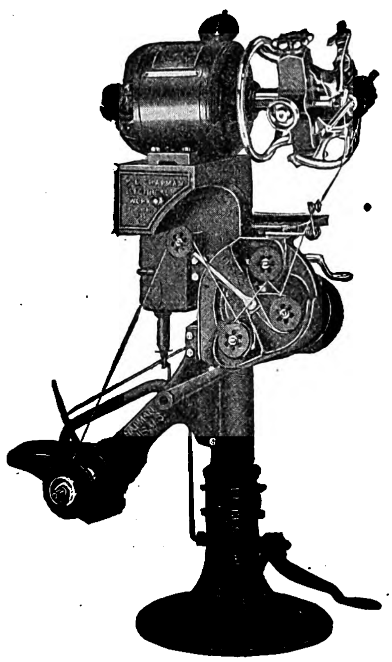
These instruments are made with two or three current and voltage ranges each. Current ranges from 0-0.03 up to 0-30 amperes are obtainable and voltage ranges from 0-1.5 up to 0-300 volts. Six ranges is the largest in a single instrument.

New Style Chapman Adjustable Armature-Winding Machine.

The P. E. Chapman Electrical Works, St. Louis, Mo., announces a much more complete model of the Chapman adjustable bipolar drum armature-winding machine, in style 3 as shown herewith. This model, in addition to being adjustable in a few minutes for any style and size of random wound bipolar drum armatures and any size of wire from No. 20 to No. 36, has some special features enabling it to wind a very great amount of wire into armature slots without pounding the wire, and also has some unique lead forming and handling features reducing the labor on this part of armature winding.

Driving motor, controller, turn counter and other necessary parts are all integral parts of the machine, in fact, the machine is complete in itself.

A new automatic dynamometer-controlled reel holder and tension device has been perfected, which it is claimed stops all spool troubles and enables quick starting, high speed, great tension and quick stops, so that only about five seconds are required to wind in a coil. This reel holder and tension device is simultaneously adjusted for any sizes of wire by a simple crank, and once adjusted needs no further attention until the reel is empty. It is said that the announcement of this device has been held back long enough to prove the machine a success in actual practice. In one case an output of nearly 600 per day was obtained where the estimate was 200 to 250. It is claimed that the output of the machine runs into hundreds of armatures per day on many sizes and kinds of armatures; that the saving over hand winding is usually anywhere from 10 up to 30 to 1 or even better. It is claimed that the machine is easy to operate, well and strongly built: that it is useful both in the job shop and in the factory. The machine is also useful for winding field coils, smaller armature coils, etc.



Chapman Style 3 Armature and Field-Coil Winding Machine.

Steel-Clad Transformers—An Important Development in Transformer-Case Construction.

Announcement is made of an improved line of distribution transformers, the chief advantage claimed being a reduction in weight of over one-third by the substitution of a welded sheet-steel case for one of cast iron.

This new line is designed as the steel-clad type S transformer and is manufactured by the Westinghouse Electric & Manufacturing Co., East Pittsburgh, Pa. No change has been made in the coil construction and insulation of the type S design, which has been on the market for many years, but an improvement has been effected in the tank construction which is the result of seven years' experimentation and development and it is claimed that a construction has been achieved which combines the light weight desired with the requisite degree of strength and rigidity and, furthermore, includes a treatment and finish of the tank surface which renders it thoroughly weatherproof.

The ease and cheapness with which distribution transformers can be shipped, handled and installed, is to a large degree a question of weight. Further, since distribution transformers are usually mounted on the line poles, heavy transformers are particularly objectionable, not only because of the difficulty involved in raising them into position for hanger-iron mounting, but also because of the strain that is put upon the pole and crossarms. The distance from the center of gravity of the transformer to the center of the pole is a matter of almost as much importance from the point of strain on the pole and crossarms as the weight itself.

The reduction in weight effected in the steel-clad transformers permits of mounting larger transformers directly on poles without building a platform. The new 10, 15 and 50-kv-a. transformers are about the same weight as the old 5, 7½ and 25-kv-a. transformers, respectively, which shows that between these limits of capacity with the same strength of support the transformer capacity can be doubled with the new line of transformers.

Desirability of reducing the weight of the transformer suggested the use of the sheet-metal cases and end frames, but while the advantages of such a construction were apparent, it is claimed that it has been adopted only after very thorough tests have demonstrated its suitability.

The material selected for the manufacture of the tanks, covers, and end frames of the steel-clad type S transformers is a special grade of sheet-steel particularly adopted to the conditions of manufacture and service. It can be readily drawn, and in addition it has inherent rust-resisting qualities. This, combined with an extremely good finish, is claimed to have resulted in the production of a tank which is permanently weatherproof.

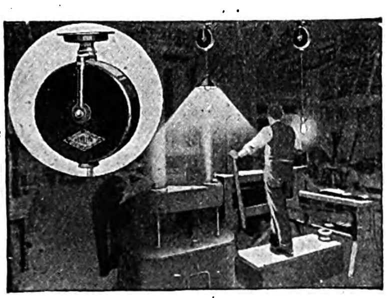
Weatherproofing of the steel-clad type S transformer cases consists of the following operation: (1) Sandblasting to remove the scale and dirt and to roughen the surface; (2) applying and baking on a coat of priming paint; (3) applying and baking on a finishing paint. The priming coat is a special grade of paint which it is claimed, when applied to clean metal, forms one of the most effective coatings known for its preservation. The finishing coat is heavy in oil and is designed to withstand the wear of the elements. Its function is to protect the first coat which is adjacent to the metal and which gives the real protection to the tank surface.

The color of the finishing coat is a battleship gray, giving a smooth attractive finish. This pleasing gray color from the standpoint of civic pride is an improvement, it is claimed, over the former black that has hitherto been used for distribution transformers and has contributed to the unsightly appearance of streets and alleys.

A complete steel-clad transformer case is made from five different parts. The rim and base of the tank are drawn and cut from a single piece of sheet steel. The tank wall is formed from two sides which are drawn and welded and the rim and base are welded to the tank wall. Thus, four parts complete the tank and one part the cover. Much heavy equipment in the way of shears, braces, molds and dies is employed in the manufacture of the case. It is claimed that no expense has been spared to secure a transformer tank which is satisfactory, even to the smallest detail, and the manufacturers claim that the steel-clad type S transformer represents the last word in modern distribution transformer construction.

Anderson Reel-Type Extension Fixtures.

Occasions frequently arise in machine shops, erecting shops, assembling plants, garages, etc., where light is needed locally to permit examining the inside of some machine or casting, or the underside thereof. A new type of fixture has been developed to supply this need.



Anderson Reelite Fixture in Use in a Machine Shop.

The Anderson "Reelite" consists of a reel unit carrying approved portable reinforced cord. The cord-winder is of the four-spring type insuring long life even under severe usage. The base of the device is designed to attach to any 4-in. outlet box, or direct to the ceiling. To operate it is necessary merely to raise or lower like an ordinary window-shade.

This "Reelite" fixture is made in two types: The drop-cord type, with 12 ft. of cord and a 660-watt key socket, for

Anderson Reelite Fixture—A Hand Portable Trouble or Inspection Lamp—Can Be Used in Place of the Key Socket.

use in machine shops, providing flexible lighting to a degree impossible with ordinary local lighting fixtures; the portable type, with 25 ft. of cord and a hand portable, making it invaluable in garages, erecting shops and the like. It is said the outfit saves its cost even in a few months as with the Reelite only the actual length of cord required is unreeled so that it does not lie on the floor subject to the abuse ordinary portables receive. A suitable reflector can be attached to the socket to prevent glare from the lamp.

These fixtures are made by the Anderson Electric Specialty Co., 118-24 South Clinton street, Chicago.

Motor-Generator Set for Electric Meter Testing.

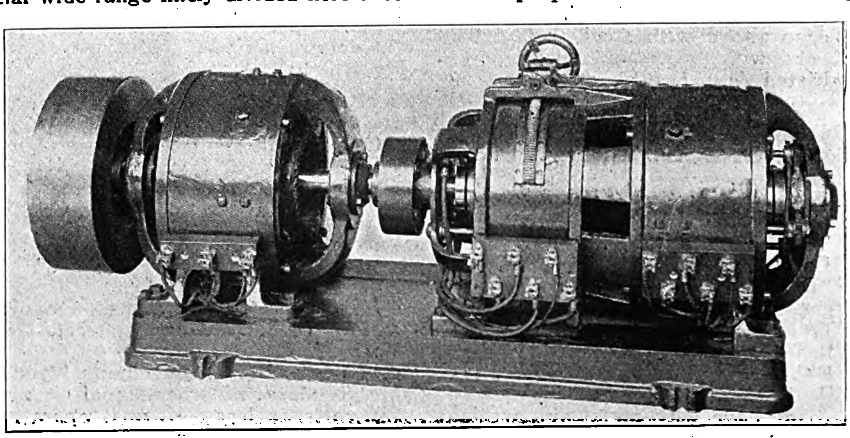
The three-unit motor-generator set illustrated herewith is manufactured by Roth Brothers & Co., 1400 West Adams street, Chicago, Ill., for use in meter-testing laboratories and for other alternating-current testing. This set consists of a direct-current motor driving two alternating-current generators. The motor has a speed range of 1750 to 1850 rpm., and is provided with a special wide-range finely divided field rheostat to obtain very close speed regulation. The use of ball bearings throughout in connection with the heavy fly-wheel insures steady speed, despite fluctuations in the supply voltage. Each of the two generators is of the four-pole, four-ring type, giving single-phase and three-phase current at 60 cycles.

The larger generator has a stationary field frame, and is wound to furnish current at any voltage between 110 volts and 240 volts, the special field rheostats provided giving this voltage range with a large number of steps. This generator is rated 7½ kva., 240 volts, 1800 rpm., 60 cycles. The smaller generators, that is the one next the motor, is provided with a movable field frame that may be rotated through a distance of 180 electrical degrees to either side of the center position relative to the position of the field poles of the larger generator. This adjustment is made by means of a wormgear operated by the handwheel shown. This smaller generator is rated 24 to 28 volts, 80 amperes, and it is furnished with a separate, noninductive loading resistance with 12 switches by means of which the current output can be varied by fine increments from 1/20 ampere to 85.9 amperes. This generator is also provided with a concentric type, finely divided field rheostat.

In testing meters, either single-phase or three-phase, current is supplied to the voltage coils of the meter from the larger generator, while the current coils of the meter are supplied from the smaller generator. Then the wormgear handwheel is operated to give any desired phase relation between the voltage and the current; in this way a load of any power-factor may be simulated.

In designing this set, certain limitations were observed, based on the latest standardization rules of the American Institute of Electrical Engineers. The wave shape of either generator at full noninductive load may vary from the sinusoidal by not more than 5%. The full-load efficiencies are as follows: motor 87%; each generator 80%. The generator field windings are excited from 230 volts direct current, and are tested at 1500 volts alternating current. The motor and the armature of the larger generator are tested at 1500 volts alternating current and the armature of the smaller generator at 1100 volts alternating current.

This type of set has so far been developed in only one size, which has proven satisfactory in two important laboratories where it is used for other purposes besides meter testing.



Roth Three-Unit Motor-Generator Set for Meter Testing and Other Similar Service.

Lately Approved Appliances

Attachment Plug, Fuseless.—The Yost Electric Manufacturing Co., Toledo, Ohio.
"Lockfast" nonseparable attachment plug, 660 watts, 250 volts.
Listed July 21, 1919.

Cabinet and Cutout Boxes, Sheet-Metal.—Sprague Electric Works of General Electric Co., 527-531 West 34th street, New York, N. Y.
Listed July 8, 1919.

Circuit-Breakers — The Automatic Reclosing Circuit Breaker Co., Columbus, Ohio.
Single-pole automatic circuit-breakers for protection of low-potential circuits and arranged for automatic reclosing of circuit under certain conditions. All capacities 600 volts or less. Types ARL, CRL, DRL, LRL.
Listed Aug. 6, 1919.

Conduit Boxes.—The Adapti Manufacturing Co., 919-25 West street, Cleveland, Ohio.
"Adapti." Pressed-steel and cast-iron conduit fittings for use in concrete construction, Catalog Nos. 2CO, 3CO.
Box extension, Catalogs Nos. 498 and 499.
For use with flexible tubing, with or without clamps, Catalog No. 0260.
Covers, Catalog Nos. 17-19 inclusive, 25, 46-49 incl., 86-89 incl.
Also above with steel or porcelain covers, with or without bushings.
Listed July 31, 1919.

Conduit Boxes.—The Adapti Manufacturing Co., 919-25 West street, Cleveland, Ohio.
"Adapti." Cast-iron conduit fittings for use as outlet and junction boxes. Types 7113-15 inclusive, 7223-25 incl., 7263-65 incl., 7333-35 incl., 7273-75 incl., 7443-45 incl., 32170, 33170, 34170, 53202-292 incl., 53303-393 incl., 53404-494 incl., 53505-595 incl., 53606-696 incl., 72373-75 incl., 72383-85 incl., 73393-95 incl., 74493-95 incl., 541010, 542020, 542121, 543030-3232 incl., 544040-4343 incl., 545050-5454 incl., 546060-6565 incl., 547070-7676 incl., 548080-8787 incl., 549090-9898 incl.
Also above with steel or porcelain covers, with or without bushings.
Listed Aug. 1, 1919.

Conduit Boxes.—Electrical Fittings Co., Ltd., 331 King street, West, Toronto, Ont.
Pressed-steel conduit boxes and cast-iron conduit fittings.
"Diamond B" boxes.
Catalog No. 6359D.
"Diamond R" conduit fittings, Types DF, HA, LBA, LBV, LF, PL, PT, PM, PMC, PML, PMT, S, SC, TB, TL, TR, V, VA, VC, VH, VHA, VHC, VHL, VHT, VL, VT, W, WC, WL, WT.
Also above with metal or porcelain covers with or without bushings.
Listed Aug. 6, 1919.

Underwriters' Laboratories, established and maintained by the National Board of Fire Underwriters (for service—not profit), have examined, tested and listed these electrical appliances in accordance with the Laboratories' Code for Construction and Test of Electrical Appliances. Copies of complete lists of standard applances may be obtained from local inspection departments or from offices of the Laboratories in the principal cities.

Conduit Boxes.—The Pratt Chuck Co., Frankfort, N. Y.
Pressed-steel conduit boxes. Types AA, BBA, DAO, WA, YA, ZA, 100 and telephone box. Also above types with steel covers or covers with smooth, well-rounded outlets for flexible cords.
Listed July 18, 1919.

Conduit Boxes.—The Toledo Metal Products Co., 956 Spitzer building, Toledo, Ohio.
"B-G." Pressed-steel conduit boxes for use with steel conduit.
Catalog Nos. 900-0, 901-0, 906-0.
For use with flexible tubing and steel conduit, Catalog Nos. 902-R, 902-RW, 903-R, 903-RW.
Above provided with depression to admit of special fixture stud, Catalog No. 1001, which may or may not be used.
Covers, Catalog Nos. 800-807 incl., and brass covers, Catalog Nos. 800-B-807-B incl.
Listed Aug. 9, 1919.

Conduit Boxes, Service-Entrance.—Electrical Fittings Co., Ltd., 331 King street, West, Toronto, Ont.
"Diamond-B." Cast-iron service-entrance fittings with porcelain bushings. Types F, FE.
Listed Aug. 6, 1919.

Current Taps.—The Bryant Electric Co., Bridgeport, Conn.
"Bryant" or "Perkins." Multiple type.
Keyless, 660 watts, 250 volts, Catalog No. 102.
Listed July 2, 1919.

Current Taps.—Harvey Hubbell, Inc., Bridgeport, Conn.
"Hubbell." Multiple type.
Pull, 250 watts, 250 volts, Catalog No. 3190.
Listed July 10, 1919.

Electromechanical Gongs.—Stanley & Patterson, 23 Murray street, New York, N. Y.
"Faraday" electromechanical gongs for fire-alarm or other signal circuits, 125 volts or less. Normal operating current 100 milliamperes.
Listed April 9, 1919.

Fixtures.—The Cohen Co., Inc., 9-17 East Broad street, Richmond, Va.
Listed June 28, 1919.

Fixtures—W. F. Mahoney, 523 East Main street, Richmond, Va.
Listed June 28, 1919.

Fixtures, Show-Window.—Pittsburgh Reflector & Illuminating Co., 3117 Penn avenue, Pittsburgh, Pa.
Listed June 24, 1919.

Fixture Fittings. — George Cutter Co., South Bend, Ind.
Holder sockets and receptacles for "Sol-Lux" and other standard heel-reflector fixtures.
Medium base, porcelain shell, keyless, "Cutter." Catalog Nos. 30684-85, 30693-94.
Mogul base, porcelain shell, keyless, "Cutter," Catalog Nos. 30772-73, 30980-81.
Listed May 13, 1919.

Fuses, Cartridge.—Commercial Enclosed Fuse Co., 1317 Willow avenue, Hoboken, N. J.
Cartridge enclosed fuses, 0-600 amperes, 600 volts.
Listed May 21, 1919.

Lamp Adapters.—Pass & Seymour, Inc., Solvay, N. Y.
"P. & S." Medium to candelabra, 75 watts, 125 volts, Catalog No. 1262.
Listed April 29, 1919.

Lamp Guards. — Flexible Steel Lacing Co., 522 South Clinton street, Chicago, Ill.
Portable split wooden handle for "Flexco" or "Flexco-Lok" lamp guards. "Flexco Split Handle."
Listed May 14, 1919.

Motion-Picture Machine, Miniature.—The Pathescope Co. of American, 33-35 West 42nd street, New York, N. Y.
Portable miniature motion-picture machine, with incandescent lamp for illuminating element, 4.75 amperes, 110-120 volts.
For use only with slow-burning film supplied by manufacturer.
Listed May 21, 1919.

Outlet Plates.—Cameron Overbagh & Co., 231 North Wells street, Chicago, Ill.
Catalog Nos. 401, 403.
Listed June 24, 1919.

Panelboards. — Large-Dail Manufacturing Co., 114 North 13th street, Philadelphia, Pa.
Consisting of assembly of busbars, with or without standard cutout parts, of with or without standard switches mounted on insulating bases. Designed for use on low-potential circuits.
Listed June 23, 1919.

Trade Activities

Worthington Pump Acquires Epping-Carpenter Interests —Westinghouse Exhibits—Signal Electric Organized

S. V. George, electrical contractor-dealer, 8416 18th avenue, Brooklyn, N. Y., after an absence of a year and a half in Government service, has resumed business at the above address. In addition to general electrical work Mr. George will handle electrical household appliances and also repair appliances.

Ivanhoe-Regent Works of General Electric Co., Cleveland, Ohio, is sending out to the trade, a new discount sheet (Form 299). The discounts shown apply on Ivanhoe metal reflectors and fittings (Schedule R) and Anderson self-adjusting arms (Schedule T). The discounts on Schedule R are effective Sept. 5, and those on Schedule T effective Aug. 15.

Western Electric Co., New York City, according to official advices from Denmark, has received orders for two automatic telephone exchanges from the Copenhagen Telephone Co. It is stated that this will be the first introduction of an American telephone system into northern Europe, where Germany and Sweden formerly enjoyed a monopoly in this trade.

Jeffrey Manufacturing Co., Columbus, Ohio, manufacturer of coal-mining machinery, electric locomotives, etc., is sending out Bulletin No. 270 comprising eight pages. It is well illustrated and is descriptive of ventilating fans, giving tables of dimensions and capacities. Particular emphasis is placed on the subject of mine ventilation, one of the most important considerations in mining.

Worthington Pump & Machinery Corp., 115 Broadway, New York City, has purchased the plant and other assets of the Epping-Carpenter Pump Co., Pittsburgh, Pa., and will operate it as the Epping-Carpenter Works. Orders and contracts now on hand will be completed, and the regular business of the company continued. All correspondence should be addressed to the Worthington Pump & Machinery Corp. at the Epping-Carpenter Works, 10 43rd street, Pittsburgh.

General Electric Co. has sold to the White River Lumber Co., Enumclaw, Wash., a 2000-kw. turbogenerator and other equipment for installation in the latter's lumber mill, which is being rebuilt in accordance with plans requiring complete electrification. Another lumber mill order placed with the General Electric Co., recently, was for two turbogenerators of 750-kw. each and one of 1500-kw. for installation at the mill of the Unalaska Lumber Co., at Unalaska, Wash., in the vicinity of Napavine. The plant is being rebuilt for electric drive, which will require 3000 hp. in motors.

The McCord Manufacturing Co., Detroit, Mich., has published a catalog completely describing and giving the specifications for all the various copper-asbestos gaskets which it manufactures. Included are spark plug gaskets, exhaust and flange type gaskets, exhaust manifold gaskets, cylinder head gaskets for passenger cars, cylinder head gaskets for trucks, valve plate gaskets and Ford gaskets. An assortment of shim stock is also shown as well as miscellaneous gaskets of open and closed types.

Electric Furnace Construction Co., Philadelphia, Pa., has received from the Vancouver Engineering Works, Ltd., Vancouver, B. C., an order for a "Greaves-Etchells" furnace. The Vancouver company made an extensive investigation of the various types of electric furnaces and after a visit to the U. S. Navy Yard at Puget Sound, where a six-ton "Greaves-Etchells" furnace is in operation, made its decision in favor of that type of furnace.

McGill Manufacturing Co., Valparaiso, Ind., announces the purchase of the Despard & Gordon Co., Chicago, manufacturer of the "Levolier" pull-chain socket and other electrical wiring devices. The two companies will be merged into one organization whose personnel will be composed of the following: J. H. McGill, president; V. R. Despard, vice-president, and H. W. Harrold, secretary-treasurer. The main sales office and factory will be located at Valparaiso, Ind. Plans for increasing production are already under way, as it is stated that orders are coming in far in excess of its present output.

The Milliken Brothers Manufacturing Co., Inc., Woolworth Building, New York, has published a new catalog (No. 10) descriptive of Milliken buildings. Structures of this type are built under the Standardized Truss Unit System, designed by the company. It makes use of a small, interchangeable, standardized structural steel unit, and the buildings are all-steel, permanent and fireproof; they are furnished complete with sash, doors, skylights, etc. These buildings are suitable for all classes of industrial and manufacturing structures, plantation buildings, warehouses, etc. The system makes possible low transportation and erection costs, allowing the choice of a thousand buildings, all constructed under the same unit type. The catalog is 8½x11 ins. and profusely illustrated with buildings of this character erected for the United States Government and other important interests. Space is also given to the transmission towers, radio towers and special poles built by the company. A companion book of like size, known as catalog No. 11, has been issued as an erection handbook; this forms a complete guide to the construction of any Milliken building from foundation to roof. Copies of these catalogs may be obtained free from the company by those interested.

Interstate Electric Co., New Orleans, La., reports that it will establish a branch in Shreveport which it claims will represent the largest jobbing house of its kind in the South, exclusive of New Orleans. A stock of automobile and electrical accessories valued at $200,000 will be carried at the Shreveport branch. The firm will supply the accessory trade of north Louisiana, half of Texas, southern Oklahoma and Arkansas.

Cutler-Hammer Manufacturing Co., Milwaukee, Wis., in addition to other dealer's helps, has prepared for use in connection with the national advertising on the C-H 70-50 switch, two new four-color display cards. One shows an electric iron and cord with a young woman in the act of pushing the switch "on." The other carries a striking illustration of a toaster and cord equipped with one of the switches as part of a typical breakfast setting. Each has a prominent legend stating that "the buttons tell when the current is on or off." When used solely for street car advertising, these cards are imprinted with the dealer's name and address, and whenever they are desired for use as window or wall display cards, a suitable legend is imprinted in the space provided for the dealer's name and address.

Westinghouse Electric & Manufacturing Co., East Pittsburgh, Pa., is planning for the comfort of its 20,000 employes a modern cafeteria and restaurant, seating over three thousand persons and providing well prepared food on a "service at cost" basis. The three-story, buff brick building that will house the new eating place is already under construction. The first and second floors, seating 2500 people, will be devoted solely to cafeteria service while the third floor will have a modern table service restaurant, as well as the kitchens and an auditorium seating over 1000, which will be used for meetings of the various organizations and committees. Only the most modern conveniences of culinary art will be employed. The cafeteria counters will have moving belts to carry the trays of food placed on them, allowing the passing diner to have his hands free to select food. A huge refrigerating plant on the first floor will not only cool all foodstuffs in the refrigerators, but will also provide cold drinking water at the numerous fountains scattered through the cafeterias as well as manufacture ice and make the frozen dainties appearing on the menu. Work on the new structure is progressing rapidly under the direction of Bernard H. Prack, the architect in charge of the job, and it is expected the new restaurant will be opened by the first of the year.

Pittsburgh Transformer Co., Pittsburgh, Pa., is distributing a 23-page bulletin (No. 2000) devoted exclusively to excellent views of installations of Pittsburgh transformers, many of which are operating on the largest and best managed transmission systems in the United States, others are in large steel mills and industrial plants. The development of the Pittsburgh mill-type transformer has resulted in one of the strongest mechanical structures yet produced, and together with the high efficiency inherent in these transformers, the great mechanical strength of the Pittsburgh mill-type transformer has given them the prominent position they occupy today.

Edison Electric Appliance Co., Inc., Hotpoint Division, 5660 West Taylor street, Chicago, is sending to its customers its first Fall Hotpoint broadside, in which are reproduced two of its October advertisements on Hotpoint appliances, appearing in the *Ladies' Home Journal* and *Saturday Evening Post.* These are very attractive advertisements and are certain to increase the already marked demand for these electrical appliances. Included in this broadside is a letter which will acquaint dealers with the critical situation in which the company finds itself in an effort to meet the unusual demand for its products. In many instances the company has trebled its output and has made every possible plan to take care of its Fall and Holiday trade. It is strongly urged that dealers of Hotpoint appliances anticipate their requirements and place their orders sufficiently in advance to enable the company to produce the goods in time for early delivery.

Signal Electric Manufacturing Co., Menominee, Mich., with a capitalization of $150,000, has been incorporated to take over the Menominee interests of the Tideman Electric Manufacturing Co. Henry Tideman, president of the Tideman organization, will devote his attention to the Cairo works, which the company just recently completed. His sons, Harold and William Tideman, in association with Fred A. Roper, Charles D. Hammond and George Fussner have organized the Signal Electric Manufacturing Co. as a separate enterprise and will continue operation of the plant at Menominee. Included in the products of the new organization are electric fans, blowers, and other industrial and domestic appliances and devices. Ralph W. Wells is president of the company; John E. Henes, Jr., vice-president, and Charles E. Hammond, secretary and treasurer.

Robbins & Myers Co., manufacturer of electric motors, generators and fans, Springfield, Ohio, has inaugurated operations in its new branch factory at Xenia, Ohio. The new plant consists of buildings leased from the Aetna Explosives Co., and constitutes a highly desirable location for the plant. It is under the supervision of L. W. McIntire, formerly assistant superintendent of Plant One. The first work at the Xenia plant will consist of alternating current stator winding, and will take care of only the production which cannot be obtained at the Springfield factories. The leasing of these quarters has been necessitated by the fact that it proved impossible to obtain sufficient female help at the Springfield plants to take care of the rapidly expanding business and the constant need for greater production. The company will begin construction shortly on its new office building at Springfield. An extension of the switch track to the Robbins & Myers property is now being built, preparatory to transporting materials for the building.

Bussman Manufacturing Co., St. Louis, Mo., has issued the second edition of the valuable booklet called "Fuse-ology." This is a 24-page pubication of which ten pages are devoted to valuable information in regard to what fuses are used for, how they operate, where they should be used and similar information that electricians and electrical men in general often do not know too much about. There is no doubt but that a great deal of misinformation exists in the minds of electrical men respecting the matter of fuses, and this booklet is of special value in pointing out features that every electrical man should know regarding the use of fuses. For instance, there is a discussion of exactly what takes place when a fuse blows, a similar one on the danger and expense of using fuses of unreliable type. Suggestions are made as to when it becomes desirable to use renewable fuses, and finally, information is given on the much disputed subject of fuse protection for motors. The remainder of the booklet is devoted to data, descriptions and illustrations of the company's renewable and non-renewable cartridge fuses.

Westinghouse Exhibits at Important Conventions.—One of the very interesting features at the Inter-Allied Foundrymen's Congress and Exhibit to be held at Philadelphia, Sept. 29 to Oct. 3, will be the splendid exhibit of electrical apparatus of the Westinghouse Electric & Manufacturing Co., East Pittsburgh, Pa. This will include the latest scientific development in the art of arc welding, which relates directly to the foundrymen's business. The arc welding equipment consists of one 500 amp. arc welding motor generator set and is made up of three-phase, 440-volt, 60-cycle Westinghouse type "CS" motor mounted on a common shaft and bedplate with a 500-amp., 60-volt arc welding generator, which is large enough to supply energy for several electrode welding circuits if no carbon electrode welding is performed. The accessories exhibited consist of operator's hood and shield, graphite electrode holder, metal electrode holder and an adapter for equipping the metal electrode holder for light graphite electrode welding. A feature of the graphite electrode holder is its ability to remain in continuous service for long periods of time without heating up to a degree uncomfortable to the operator. The exhibit further includes electrically heated metal pattern plates on molding machines, which provide one of the most convenient, up-to-date methods of heating; also standard a. c. and d. c. industrial motors, starters and controllers, outdoor fuse boxes, type A and C knife switches, oil and carbon break circuit-breakers, Frankel connectors, standard line of meters, stationary and oscillating fans, bayonet immersion heater, glue pots, solder pots, steel clad heater, type C, oven heater, rectangular electric stove, electric range, domestic heating devices.

The Westinghouse Company will exhibit at the congress of the National Safety Council to be held in Gray's Armory, Cleveland, Ohio, Sept. 29 to Oct. 4, safety devices or models designed by men of that company for use in the various departments of the Westinghouse works where over 30,000 men and women are regularly employed. The exhibit includes such items as rip and crosscut saw guards, punch press guards, safety tongs, cable connectors, acid jugs, screw drivers, ladles, belts, vacuum lifter and pickers for punched sheet metal, glass lamp reflector guards, floor mats, locking devices for belt shifter, milling cutter guards, low-head room elevator guards and other devices of a similar nature. Certain products which contain safety features will also be exhibited, among them being arc welding helmets and shields, elevator safety devices, auto lock switches, motor starting switches, multiple circuit safety lighting panels, safety car panels, safety platform panels and auto starters. W. G. Mayer, supervisor of safety appliances for the Westinghouse company, will be in charge of the exhibit, and in addition C. B. Auel, director of standards, processes and materials for the company will be in attendance at the congress.

Beardslee Chandelier Manufacturing Co., 216 South Jefferson street, Chicago, is sending to department stores all over the country a well illustrated folder emphasizing the great improvement in illumination which modern light sources and lighting units can bring about in department stores and other stores. The store-lighting field is one to which few electrical dealers devote sufficient attention. Every intelligent merchant knows the importance of having his store well lighted, but many do not realize the surprising improvement which has been made in lamps and lighting fixtures. If dealers would take the trouble to bring this to their attention, they would find in many instances that the merchant is glad to avail himself of the opportunity to secure better illumination in his store. Denzar, the lighting unit manufactured by the Beardslee company, has proved especially efficient in store lighting, and dealers are urged to put a little intelligent effort back of it and secure the profits which are to be made in this productive field. Copies of the folder are also available to electrical contractor-dealers.

Current News

Weekly Record of Construction Activities—Conventions

EASTERN STATES.

Rutland, Vt.—Rutland Railway Light & Power Co. is understood to be negotiating with the Clarendon Marble Co., West Rutland, for the furnishing of increased electric service in connection with the proposed expansion program of the Clarendon company. It is said that several large additions to the mill are proposed, including the opening of another marble quarry and additions to the marble finishing department.

Springfield, Vt.—Colonial Power & Light Co. has completed the erection of its new substation at Springfield, and it is planned to remove headquarters to the new location. It is understood that practically the entire distribution system of the company will be changed to provide for the furnishing of electric energy to the municipality by the new substation.

Bridgeport, Conn.—Bryant Electric Co. will build a four-story addition to its plant to cost $125,000.

East Norwalk, Conn.—Crofut & Knapp Co., South Norwalk, plans the erection of two plant additions, five stories, 60x300 ft., and three stories, 210x300 ft. A power plant, 60x150 ft. will also be erected.

New Britain, Conn.—Trumbull Electric Co., Plainville, has awarded a contract to Louis A. Miller, 68 Wilcox street, Meriden, for the erection of two new additions to its plant at Plainville, for increased capacity. The structures will be four-story, about 50x106 ft., and one-story, 50x100 ft.

Belmont, Mass.—New England Telephone & Telegraph Co., 50 Oliver street, Boston, has broken ground for the construction of a new two-story and basement telephone building on Leonard street, Belmont, about 36x 56 ft., for increased operations. D. L. Shepard, 46 Cornhill street, Boston, is the contractor.

Albany, N. Y.—Henry Ford, of the Ford Motor Co., is understood to be negotiating with the Government officials for the purchase of electric power from the Government power project near Albany for the operation of his local plant.

Canandaigua, N. Y.—Steps are being taken by the Canandaigua Business Men's Association for the installation of a new and improved lighting system throughout the business section of the city.

Cuba, N. Y.—Cuba Electric Light Co. has filed application with the Public Service Commission for permission to acquire the local power plant for increased service.

Hudson Falls, N. Y.—Max Kurtzrook Co., 12 Maple street, Glens Falls, has awarded a contract to the Glens Falls Electric Installation Co., 2 Maple street, Glens Falls, for the installation of a new lighting system in its local plant in connection with other alterations and improvements, the entire work to cost about $10,000.

New York, N. Y.—New York Central Railroad Co. has had plans prepared for alterations and improvements in its one-story brick power house, about 166x236 ft., located on 149th street, near Long Island Sound, to facilitate operations.

New York, N. Y.—New York Edison Co., 30 East 15th street, has commenced active work in connection with the construction of a large new administration building, at Hester and Norfolk streets. Contracts for erection has been awarded to the George Sykes Co., 70 East 45th street.

Utica, N. Y.—Utica Heater Co., manufacturer of heaters, heating equipment, etc., has awarded a contract to John U. Schmidt, 1505 Weston avenue, Utica, for the erection of three new one-story additions to its plant at Whitesboro, to provide for increased capacity. The structures will cost about $20,000.

Watertown, N. Y.—Engineer Sam M. Green, of Springfield, Mass., has prepared plans for a $600,000 municipal power plant to be built here in spring.

Dover, N. J.—New Jersey Power & Light Co. has completed negotiations for the sale of its old Rockaway electric plant to the Standard Oil Co.

Newark, N. J.—American Transformer Co., 178 Emmet street, has awarded a contract to the Salmond Brothers Co., 526 Elm street, Arlington, for the erection of a new one-story extension to its plant. The structure will cost about $5700.

Newark, N. J.—Battery & Electric Service, Inc., 487 Washington street. has filed a voluntary petition in bankruptcy. Alexander Lion heads the company.

Newark, N. J.—Public Service Railway Co. has filed application with the Board of Public Utility Commissioners for permission to purchase a tract of land in Warren street, Trenton, for a consideration of about $45,-000, to be used as a site for the construction of a new terminal.

South Plainfield, N. J.—In connection with the construction of a new one-story addition to the plant of the Spicer Manufacturing Co., estimated to cost about $75,000, considerable new electrical and mechanical equipment will be required. Contract for construction has been awarded to Levering & Garrigues, 552 West 23rd street, New York.

Summit, N. J.—Commonwealth Electric Co. has made application to the Board of Public Utility Commissioners to place into effect a new schedule of increased rates for service. The company, in mailing out its monthly bills, attached a circular letter requesting the views of its patrons as regards an increased rate, setting forth that "the Commonwealth company believes that its patrons desire that the company maintain a first-class quality of electric service and that they are willing to pay for that service whatever may be a just and reasonable charge."

Bath, Pa.—A new power plant and waste heat boiler will be installed by the Pennsylvania Cement Co. The Republic Engineers, Inc., 60 Broadway, New York City, engineers.

Carbondale, Pa.—Considerable new electrical and mechanical equipment will be required by the Carbondale Machine Co. in connection with the construction of its proposed one-story machine shop, about 20x220 ft., estimated to cost $60,000. Contract for erection has been awarded to the Hughes Foulkrod Co., Commonwealth building, Philadelphia.

Easton, Pa.—Easton Hospital Association has taken bids for the erection of a new brick and concrete hospital building, nurses' home and power plant for general operation at Lehigh, 20th and 22nd streets, estimated to cost approximately $150,000. William M. Michler, Drake building, is architect; Mrs. Mary Illick, 248 Spring Garden street, is president.

Philadelphia, Pa.—Notaseme Hosiery Co., Mascher and Oxford streets, Germantown, near Philadelphia, has awarded a contract to the Turner Construction Co., 1713 Sansom street, for the erection of the new power house in connection with a new addition to its mill and dye works at Atlantic and I streets.

Philadelphia, Pa. — Philadelphia Suburban Gas & Electric Co. has been awarded a contract for furnishing lighting service to Pottstown for a period of five years. The contract has been approved by the Public Service Commission.

Pittsburgh, Pa. — Westinghouse Electric & Manufacturing Co. has completed the establishment of a new service station on Susquehanna street for the repair of motors and generators both small and large running as large as 40,000 kw. R. M. Rumbel is district service manager.

Pittsburgh, Pa.—H. Kerr Co., 2565 Fifth avenue, has the contract to erect a $45,000 substation for the Duquesne Light Co.

Springdale, Pa.—Progress is being made by the West Penn Power Co. on the construction of its large new local power plant, estimated to cost about $6,000,000. When completed the development of about 16,000 hp. will be the capacity of the plant, which is expected to be in complete operation some time next spring.

Beech Bottom, W. Va.—American Gas & Electric Co. has completed negotiations for the purchase of a large tract of coal properties near Wheeling from the Richland Coal Co., comprising about 4000 acres, to be used by the new owner for the furnishing of fuel for the operation of the large electric power station of the company at Beech Bottom. It is said that the property has an annual production of about 400,000 tons.

Norfolk, Va.—Norfolk Electric Manufacturing Co., 215 Cumberland street, is considering plans for the erection of a new plant to be devoted to the manufacture of induction motors of one to five horsepower rating. Porter O. Sutton is general manager.

Richmond, Va.—Tower-Binford Electric & Manufacturing Co. plans the erection of a one-story building, 90x116 ft., to cost $35,000.

Baltimore, Md.—Bids are being taken by the Consolidated Gas, Electric Light & Power Co., Baltimore, for the erection of a new two-story addition to its Westport service station, about 53x58 ft.

Baltimore, Md.—Maryland Casualty Co., Baltimore street, will build an electric light plant.

Simpsonville, S. C.—Election will be held Oct. 3 to vote on the question of issuing $10,000 municipal bonds for establishing an electric light plant. Address L. L. Richardson, mayor.

Augusta, Ga.—Hulse Steam Laundry Co. will purchase electrical equipment.

Plains, Ga.—Election will be held Oct. 14 to vote on the question of issuing $6500 municipal bonds for establishing electric light plant. Address H. R. McGee, mayor.

NORTH CENTRAL STATES.

Findlay, Ohio—Electric Motor & Construction Co. will shortly commence the erection of a two-story plant, 50x200 ft.

Lebanon, Ohio—$120,000 municipal light bonds will be offered for sale Oct. 3. M. E. Gusten, city clerk.

Norwood, Ohio—Norwood's municipal electric light plant and waterworks, Pine and Harris avenue, was damaged to the extent of approximately $50,000 by fire caused by the explosion of a gas engine used as a power generator in the light plant.

Youngstown, Ohio—Youngstown Sheet & Tube Co. contemplates erecting a high-tension power plant at Alikanna so as to be near the proposed coal fields and in case such plant is built, the coal road will be built up Wills Creek and not up from Reeds Mills to Richmond.

Anderson, Ind.—Union Traction Co. will expend $100,000 on its central power plant, installing boilers and overhauling electric turbogenerators.

DATES AHEAD.

National Association of Electrical Inspectors. Annual meeting, Springfield, Mass., Oct. 13 and 14. Secretary, W. L. Smith, Concord, Mass.

Illuminating Engineering Society. Annual convention, Chicago, Ill., Oct. 20-23. General secretary, Clarence L. Law, 29 West 39th street, New York City.

Illinois State Electric Association. Annual convention, Chicago, Oct. 22 and 23. Secretary-treasurer, R. V. Prather, Springfield, Ill.

Empire State Gas and Electric Association. Annual meeting, Buffalo, N. Y., Oct. 24. Secretary, Charles H. B. Chapin, 29 West 39th street, New York City.

American Society of Mechanical Engineers. Annual meeting, New York City, Dec. 2-5. Secretary, Calvin W. Rice, 29 West 39th street, New York City.

National Council of Lighting Fixture Manufacturers. Annual convention, Detroit, February, 1920. Secretary-treasurer, Charles H. Hofrichter, Cleveland, Ohio.

Auburn, Ind.—Auburn school board will issue bonds in the amount of $70,000 for completing McIntosh high school and for installing a heating plant therein.

Bluffton, Ind.—Indiana Public Service Commission has granted authority to the city of Bluffton to issue bonds in the amount of $15,000 to apply on the purchase of a new 1000-kw. turbine for the municipal light plant.

Evansville, Ind.—Globe Bosse World Furniture Co. will erect an addition to its factory to cost between $150,000 and $200,000.

Evansville, Ind.—Crown Chair Co. will build factory building to cost $75,000.

Hammond, Ind.—The second battery of 60 coke ovens of the Mark Manufacturing Co., Indiana Harbor, Ind., has begun production with capacity of 1200 tons of coal daily. This makes a total of 120 ovens in operation and two additional batteries of sixty ovens each are planned.

Indianapolis, Ind.—Wheeler-Schebler Carburetor Co. will erect three factory buildings at an estimated cost of $100,000. One building will be 132 x108 ft., and two smaller buildings 20x50 ft. each.

Indianapolis, Ind.—Stickney Color Co. will erect a three-story factory building, brick and concrete over hollow tile, 50x100 ft.

Indianapolis, Ind.—F. J. Groth, Toledo, Ohio, manufacturer of leaf springs for automobiles, will erect a one-story, fireproof building, 500x60 ft., to cost $100,000. The lower part of the building will be of concrete and brick and the upper part of steel construction. Oil burning forges will be used.

Laporte, Ind.—Wanatah Electric Co. has changed its name to the Wanatah-LaCrosse Electric Co.

Logansport, Ind. — Logansport Utilities Co., which has taken over the plant of the Logansport Heat & Power Co. from the receiver, will make improvements costing about $25,000 this fall.

Muncie, Ind.—Ground has been broken for the first of a series of factory buildings for the General Motors Corporation. This building will be 300x500 ft. The corporation is equipping the Interstate automobile factory buildings with machinery and will begin work Nov. 1 with a force of 2000 men.

Shelbyville, Ind.—St. Paul Electric Light & Power Co. has been organized by a number of residents of the town and community. The company will investigate the advisability of constructing a dam across Flat Rock River at St. Paul and the construction of an electric light plant at that point to provide power and light for Shelbyville and Greensburg and towns and farms along the route between the two towns. John T. Guskedon is the president. The directors are L. A. Eckhart, F. M. Howard, George Boliny and Raymond Pleak.

Amboy, Ill.—The city is considering the matter of a new contract with the Northern Illinois Utilities Co. for electric power for pumping city water.

Bement, Ill.—J. R. Boers, T. E. Hughes and J. M. Capel of Champaign, Ill., and Roscoe Lewis and George Neusome of Carbondale, Ill., have purchased the plant of the Bement Electric Light & Power Co. Service will be extended to Sadorus, Ill., 10 miles distant.

Blue Island, Ill.—American Wire Fabric Co. has commenced the erection of an addition to its works. This will involve an expenditure of about $1,000,000 including machinery.

Chicago, Ill.—Arthur Jones Electrical Co., manufacturer of electrical equipment for automobiles, 2837 South State street, has engaged the F. M. Barton Co., architect, to prepare plans for a one and two-story factory, 125x125 ft., to be erected at the northeast corner of Calumet avenue and 29th place. The new structure is to cost $60,000.

Chicago, Ill.—Federal Electric Co. has retained George C. Nimmons & Co., architects, to prepare plans for a one-story factory and boiler house to be erected at the southwest corner of State and 87th streets.

Chicago, Ill.—H. G. Fisher & Co., 2341 Wabansia avenue, manufacturer of X-ray machinery, have arranged for the immediate construction of a three-story plant, 60x110 ft., involving an expenditure of about $70,000.

New Athens, Ill.—East St. Louis, Columbia & Waterloo Railway Co. has been asked to extend its electric lines to New Athens.

Pekin, Ill.—It is proposed to establish an electric lighting plant here.

Rock Island, Ill.—Coe Light & Power Co. will construct and operate electric distribution line in Coe township, Rock Island county.

Detroit, Mich.—Detroit Edison Co. has had plans prepared for the construction of a two-story substation, 25x113 ft., at Connor's Creek, near Six Mile Road. Estimated cost, $40,000.

Peshtigo, Wis.—Contract has been awarded to the Jorgenson Construction Co., Denmark, Wis., for the erection of a two-story brick and concrete mill and factory building by the Peshtigo Pulp & Paper Co. The structure will be 70x242 ft. and cost about $64,000. The paper and pulp machinery will cost about $75,000.

Bucks Grove, Iowa—$6000 in bonds have been voted to secure electric current from Denison.

Dubuque, Iowa—Eastern Iowa Electric Co. wishes to extend its lines from Peosta to points in Vernon, Prairie Creek, Whitewater and New Wine townships.

Palmyra, Mo.—City is having plans prepared for the construction of a new municipal electric light and power plant. Bonds for $10,000 for the proposed work were recently authorized.

Auburn, Neb.—Engineers Archer & Stevens, 609 New England building, Kansas City, Mo., are preparing plans for $100,000 electric light plant. The specifications include generators, transformers, engines, tanks and starters.

Douglas, Neb.—Nebraska Telephone Co., 18th and Douglas streets, is reconstructing line from Holdrege to Elwood.

Guide Rock, Neb.—This town has approved a bond issue for electric lights and power. Address clerk of village board.

McCook, Neb.—Citizens are signing a petition asking the Nebraska Telephone Co., 18th and Douglas streets, Omaha, to place wires underground in paving district.

Plainview, Neb.—At a special election the vote was strongly in favor of issuing $12,000 bonds for an ice plant and $24,000 for the extension of electric light plant, and a new unit.

Parker, S. D.—A new lighting system is necessary. It would cost $40,000 to install a two-unit steam engine outfit. The expense of getting power to the city wires by the Hartford Light & Power Co. would be $25,000. Address City Auditor C. S. Jones.

Wakonda, S. D.—Arrangements are being made for the city to purchase the local electric light plant and operate it as a municipal system. The necessary improvements will be made and the scope of the plant enlarged.

Carrington, N. D.—Mercantile Co. will install a private electric lighting plant to be installed here.

Oneida, S. D.—An election will be held to vote on the question of issuing $30,000 in bonds for municipal light and water system. Address village clerk.

SOUTH CENTRAL STATES.

Gadsden, Ala.—Alabama Power Co., Birmingham, has awarded a contract to the Dixie Construction Co., Birmingham, for the construction of a new 110-kv. line to extend from Gadsden to Huntsville: and a 44-kv. line from Huntsville to Decatur, Ala.

Sheffield, Ala.—Fire has destroyed Warehouse No. 4 of the J. G. White Engineering Corp. at Muscle Shoals, the loss being $2,000,000, mainly on electrical equipment.

Sheffield, Ala.—Permission has been granted the government by the city authorities to erect transmission lines through the city's corporate limits between Nitrate Plant No. 2 in East Sheffield, and Nitrate Plant No. 1 in West Sheffield. The lines will be used to transmit power at the large power plant at Plant No. 1 to Plant No. 2, and the two plants to be operated from one station instead of using the stations at both plants. A 90-day test is in progress at Nitrate Plant No. 2 to determine the actual cost of the production of electrical energy by steam through the medium of one of the largest steam driven turbines.

Paducah, Ky.—City commissioners have called a special election in November for the purpose of voting on the issuance of bonds for $100,000, the proceeds to be used for improvements in the municipal electric light plant.

Campti, La.—The electric plant and garage of J. E. Clontier were destroyed by fire. There was no insurance to cover total loss of $2400.

Lexington, Miss.—City council, which recently voted $20,000 additional bonds, has awarded a contract to Williams & Lebby, Yazoo City, for the installation of a new municipal electric light system. W. L. Jordan is city clerk.

Little Rock, Ark.—Arkansas Hydroelectric Co. has increased the scope of the project to include two dams instead of one, providing a much larger output of electrical energy.

Eufaula, Okla.—City has awarded a contract to Cornstock & Hanson, Tulsa, for extensions in the municipal electric light and water systems. The city recently authorized a bond issue for $25,000 to cover the cost of the proposed work.

Sulphur, Okla.—Sulphur Ice, Light & Power Co. is understood to be considering plans for the installation of a quantity of new machinery in its local plant to provide for increased operations. The work is estimated to cost about $30,000.

Bryan, Tex.—It is stated by City Manager J. W. Greer that he will purchase about $30,000 worth of machinery for the electric power plant here which was recently purchased by the municipal government from the proceeds of a $75,000 bond issue.

Galveston, Tex.—The city commission has instructed W. D. Masterson, city electrician, to compile data and draw plans for a proposed municipal electric light and power plant here. Construction of the proposed plant will be submitted to the people in the form of a charter amendment at the election to be held during the early part of next year.

Houston, Tex.—Houston Light & Power Co., one of the properties of the American Cities Co., has awarded contract to Horton & Horton, Houston, for extensive additions to its plant for increased capacity, estimated to cost in excess of $400,000, including equipment. It is proposed to install a new Westinghouse turbine with oil auxiliaries, new water-tube boilers, steam piping, water screens, etc. Harry E. Badger is engineer for the company.

Lufkin, Tex.—An ornamental lighting system is to be installed here under the direction of City Manager Mitchell.

WESTERN STATES.

Benson, Ariz.—Arizona Smelting & Power Co. will soon install the generators and other equipment for its new electric power plant here. The company has contracted to furnish power for the town of Benson.

Loveland, Colo.—The city will construct a power plant where there will be sufficient water fall to run the plant. Water power with new modern machinery will be used for the distribution of electricity. Address Lewellen Osborne, city engineer.

Missoula, Mont.—Missoula Light & Water Co. will remodel its power dam, this work to cost approximately $85,000. The extensive improvements which are now in progress will make the plant more modern, provide a greater water storage and more power and will furnish a means of regulating the flow of water through the dam.

Brandon, Ore.—The council is considering ways and means to secure an electric power plant. Address mayor.

Florence, Ore.—The Florence electric plant owned by G. G. Bushman of Eugene was destroyed by fire. The plant may be rebuilt.

Everett, Wash.—The commissioners are considering ways and means to secure electric light and power plant, Engineer R. E. McDonnell of Burns & McDonnell, Kansas City, having been instructed to collect data regarding the local holdings of the Puget Sound Power Co. This will be submitted to voters at the November election. Address city clerk.

Montesano, Wash.—The electric generator plant of Northwestern Electric & Water Works, supplying electric energy for this plant and Elma, exploded recently.

Spokane, Wash.—It is probable that the citizens will vote in November on a proposal to amend the city charter to allow the city to purchase the power plants and traction lines of the Spokane & Inland Empire Railway Co. The Great Northern, in such event, may undertake the operation of the Inland Empire's interurban car lines.

Pasadena, Cal.—Warnerlite Co., Davenport, Iowa, manufacturer of lighting plants and electric automobile equipment, is having plans prepared for the erection of a new plant on South Marengo avenue, Pasadena. It will be of reinforced concrete and for initial operation will comprise a one-story factory, 260x300 ft., and administration building, 80x100 ft., with two wings, each 60x80 ft. The cost will be about $100,000.

Richmond, Cal.—Pacific Oil & Lead Co. will install new electric motors and operating machinery at its work to provide increased capacity.

San Diego, Cal.—Electrical apparatus installed in the new stadium provided means for 50,000 persons to hear President Wilson distinctly when he spoke in this city Sept. 19. It was expected that the San Diego crowd would be the largest which would hear President Wilson at any point on his tour.

FOREIGN TRADE

[Addresses of firms referred to in these trade opportunities may be obtained by writing to the Bureau of Foreign and Domestic Commerce, Washington, D. C., or its branch and local co-operative offices. Request for each opportunity should be on a separate sheet and the file number given.]

Electrical Apparatus (30,633).—A commercial agent in Czechoslovakia desires to purchase and secure an agency for the sale of electrical measuring instruments, electrical meters, installation material, telephone equipment, bells, etc. Payment United States currency. Correspondence may be in English. Reference.

Electrical Apparatus (30,679).—A firm in Roumania desires to purchase technical articles, such as asbestos packings, hemp packings, rubber articles, transmission belts, cast iron water pipe and ventilators and articles for blacksmiths; articles for cellars and breweries; pumps, agricultural and flour-mill machinery; oil-well supplies, motor machinery; electrical apparatus; machinery and tools for wood working; laundry machinery; ice-making machines, etc. Correspondence may be in English. References.

PROPOSALS

Power Plant Equipment.—Bids will be received until Oct. 22 by the Bureau of Yards and Docks, Navy Department, Washington, D. C., for power plant equipment at Pearl Harbor.

Electric Lighting System.—Bids will be received by the Bureau of Yards and Docks, Navy Department, Washington, D. C., until Oct. 1 for installing electric light, water supply and fire protection systems at Charleston, S. C. Estimated cost $30,000. A deposit of $10 is required for plans and specifications. (Specification 3977A).

Electric Work.—Bids will be opened in the office of the Supervising Architect, Treasury Department, Washington, D. C., at 3 p. m., Oct. 6 for furnishing materials for the construction of the United States Post Office at Marianna, Ark., including materials for concrete, reinforced concrete, stone, granite, brick, structural terra cotta, structural steel, miscellaneous iron and steel work, composition roofing, slate roofing, sheet-metal work, skylights, plastering, interior marble, sanitary slate, lumber, millwork, plumbing, heating, electric work, etc., in accordance with drawings, specifications and bills of quantities attached thereto. Copies of these may be obtained from the custodian of the site at Marianna, Ark., or at the above office, in the discretion of the Supervising Architect. James A. Wetmore, acting supervising architect.

Boilers, Turbogenerators, Etc.—The Board of Public Works of Seattle, Wash., is asking for sealed bids up to 10 a. m., Oct. 3, 1919, for the furnishing of all labor and material for the construction and installation of an additional unit in the Seattle steam-electric plant at Lake Union, in accordance with plans and specifications on file in the office of secretary of Board. The requirements are as follows: Six water-tube boilers to be set in batteries of two boilers to each battery, each boiler to have approximately 8250 sq. ft. of water-heating surface, and is to be equipped with feed-water regulator, an oil-burning furnace, superheater, and all the specified fixtures and instruments, feed-water heaters and other equipment for a complete installation; also, a steam turbogenerator and exciter, the commercial rating of the generator to be 10,000 kw. at 80% power factor, to operate at 2500 volts alternating current, 60 cycle, 2 phase; the exciter potential is to be 125 volts, and is to be a horizontal, direct-connected unit, consisting of an induction motor, steam turbine and direct-current generator.

INCORPORATIONS

Dixon, Ill.—Lee Power & Light Co. has been incorporated with capital of $10,000 to provide lights for the village of Lee, near this city. The incorporators are David L. Heburg, James E. Johnson and Emanuel Anderson.

Elizabethtown, N. C.—Bullard Telephone Co. has incorporated with a capital of $20,000 to operate a system in Blaiden, Robeson, Sampson, Cumberland and Pender counties.

Ashley, Ind.—Farmers Light & Power Co. has been incorporated with capital of $10,000 to distribute light and power in Ashley and rural districts surrounding. Address I. D. Deller, Ashley, Ind.

New York, N. Y.—Empire Repair & Electric Welding Co. Capital, $1,000,000. To operate a general electirc repair and welding establishment. Incorporators: E. F. Luckenback, R. C. Thackhara, and C. Kuhne, 44 Whitehall street.

New York, N. Y.—Endurance Battery Co. Capital, $25,000. To manufacture electric batteries. Incorporators: J. H. Sweiback, R. Guinzburg. and A. G. Meinecke, 3920 Broadway.

Mountaindale, N. Y.—Subscribers Service Telephone Co., Inc. Capital, $50,000. To operate a telephone system through Sullivan and Ulster counties. Incorporators: P. H. Groginsky, M. Kaplan, Woodridge, and G. Culligan, Mountaindale.

Syracuse, N. Y.—Syracuse Electric Service, Inc. Capital, $50,000. To engage in general electrical contracting, etc. Incorporators: D. F. Costello, G. E. Poseo, and C. E. Cooney, Syracuse.

Syracuse, N. Y.—Myrtle-Siegel, Inc. Capital, $15,000. To manufacture electric lamp shades. Incorporators: F. L. Siegel, H. B. and G. E. Myrtle, Syracuse.

Dover, Del.—Electric Auto Lite Corp., 244 West 49th street, New York, incorporated under Delaware laws with a capital of $100,000.

Philadelphia, Pa.—Fairchance Stove Co. incorporated under Delaware laws with a capital of $200,000. To manufacture electric and gas stoves of all kinds, etc. Incorporators: F. R. Hansell, E. MacFarland, and J. V. Pimm, Philadelphia.

Knoxville, Tenn.—Alamo Knoxville Farm Light Co. Capital, $25,000. To manufacture electrical specialties, etc. Frank O'Connor is the principal incorporator.

Portland, Ore.—Portland, Astoria & Pacific Ry Co. has incorporated with a capital of $5,000,000. David C. Eccles is president of the new company and the bulk of the financial backing of the concern is supplied by the Eccles timber interests. Headquarters have been established at Ogden, Utah, and Charles T. Early, secretary of the company, will have charge of the Portland office. The company proposes to build and operate railroads, telegraph and telephone lines. It has now under construction a line 32 miles in length extending from Wilkesboro.

Dover, Del.—Automobile Burglar Alarm Co. Capital, $1,000,000. To manufacture electrically operated burglar alarm systems for automobile service. W. I. N. Lofland, Frank Jackson, and Charles H. Jones are the incorportaors.

Greensboro, N. C.—Guilford Storage Battery Co. Capital, $25,000. To manufacture storage batteries. J. U. Lindsay is the principal incorporator.

New York, N. Y.—R. W. Lillie Corp. Capital, $25,000. To engage in a general electrical and mechanical engineering capacity. Incorporators: R. W. Lille, Greenwich, Conn.; L. Skipwith, and R. J. Knoeppel, 5 Beekman street, New York.

Sisterville, W. Va.—West Virginia Light, Heat & Power Co. has incorporated with a capital of $75,000. Incorporators: A. R. Lord, T. C. Davidson and others.

New Brunswick, N. J.—Perth Amboy Storage Battery & Electric Co. Capital, $25,000. To manufacture storage batteries, electrical goods, etc. Incorporators: John J. Orsoe, Joseph H. Copeland, and Frederick C. Schreiber, Perth Amboy.

Martinsburg, W. Va.—Martinsburg Heat & Light Co. Capital, $100,000. To operate a local plant. Incorporators: A. H. Ritter, J. Gates, Carl W. Fenninger, Philadelphia; H. W. Comfort, Falsington, Sir John Franklin, and Wilbert R. Goodwin, Millsville.

Personals

W. H. Johnson New President of Association of Edison Companies—E. H. Martindale Leaves National Carbon

ROMAN PODSKI has been appointed recently by the Polish Government to journey to the United States to make a close study of the electrification of railroads in this country.

D. J. KERR, electrical engineer at the Canton (N. C.) plant of the Champion Fibre Co., has been appointed superintendent of the power department in connection with the electrical department.

PROF. ROY KEGERREIS, formerly instructor in electrical engineering at the University of Pennsylvania, has been appointed professor of electrical engineering at the local college at Newark, Del.

WALTER HOWARD JOHNSON, president of the Association of Edison Illuminating Companies, is vice-president of the Philadelphia Electric Co.

Walter H. Johnson.

Mr. Johnson was born Aug. 1863, at Philadelphia and received his education in the public schools of that city. He gained his early business experience in the local mercantile field, and before engaging in electrical work was in the service of the Philadelphia, Wilmington & Baltimore Railroad and later with the Pennsylvania Railroad Co. On Nov. 7, 1887, he accepted a position with the Edison Electric Light Co. of Philadelphia, and has since been continuously active in the affairs of the public utilities enterprises serving Philadelphia and surrounding territory, subsequently becoming secretary of that corporation. In 1898 the company was acquired by the Pennsylvania Manufacturing Light & Power Co., which was taken over by the Philadelphia Electric Co. when the latter was incorporated, Oct. 6, 1899, and it is of this organization that Mr. Johnson is a director and vice-president. He is a member of the Pennsylvania Society of the Sons of the Revolution, a life member of the Navy League of the United States, and a member of the Franklin Institute of Pennsylvania.

H. H. HARDING has been appointed superintendent of the Hudson (Wis.) division of Northern States Power Co., succeeding F. Hardwick, who was transferred to the Stillwater division.

CHARLES H. LEATHAN, Frostburg, Md., formerly manager of the plant of the Frostburg Illuminating & Manufacturing Co., a subsidiary of the Hagerstown & Frederick Electric Co., has been appointed assistant manager of the parent company.

GEORGE W. HARRIS, for the past fourteen years connected with the Bartels Brewing Co. as electrical engineer, has become associated with the Syracuse Cold Storage Co., Syracuse, N. Y., in the capacity of electrical engineer. The latter company expects shortly to electrify its plant and install new equipment.

ARTHUR E. LUBECK, until recently manager of the Detroit office of the Benjamin Electric Manufacturing Co., Chicago, has become associated with the Hart & Hegeman Manufacturing Co., Chicago, manufacturer of electric switches, receptacles and accessories, in the capacity of assistant western sales manager. Mr. Lubeck was for eight years in the service of the Benjamin company, during which time he covered all the central west jobbing territory. For the past two years he has been manager of the Detroit office resigning that position to join the Hart & Hegeman organization.

L. E. STROTHMAN, for several years manager of the steam turbine and pumping engine department of the Allis-Chalmers Manufacturing Co., Milwaukee, Wis., has resigned to become vice-president and general manager of the Richardson-Phenix Co. Prior to his connection with the Allis-Chalmers company he was associated with the Filer & Stowell Co. and the Nordberg Manufacturing Co. Mr. Strothman is well known in manufacturing circles and is prominently identified with various engineering societies.

C. F. UHDEN, Spokane, Wash., formerly chief engineer for Washington Water Power Co., has been appointed to the position of construction engineer for Seattle, to supervise the building of that city's hydroelectric power plant on the Skagit river. The appointment, made by A. H. Dimock, city engineer, and approved by Mayor Fitzgerald, has been accepted by Mr. Uhden, whose salary will probably be $7500 per year. Mr. Uhden was graduated from the State College of Washington in 1903, and soon thereafter entered the employ of Washington Water Power Co., advancing steadily until he reached the position of chief engineer. While serving in that capacity, he supervised the construction of that company's Long Lake hydroelectric plant, which ranks among the best of those in the Northwest.

CAPT. H. G. DAVIS, recently returned from overseas, has joined the staff of Davis & Armstrong, Inc., Minneapolis, Minn., where he will succeed S. L. Sholley, now advertising manager of the Babson Statistical Organization, Wellesley Hills, Mass. Captain Davis was connected with the W. E. Davis Advertising Service before going overseas. He took part in important artillery engagements of the American forces and was decorated by the French government with the Croix de Guerre.

E. H. MARTINDALE has resigned as sales engineer of the National Carbon Co. to accept the position of president and general manager of the Handy Supply & Manufacturing Co., Cleveland, Ohio, in which he has been interested in an advisory capacity for three or four years. Following Mr.

E. H. Martindale.

Martindale's graduation from Case School of Applied Science in 1908, he entered the employ of the Indiana Steel Co., Gary, Ind. In October, 1909, he joined the staff of the National Carbon Co. and has become one of the best brush engineers in the country. He has been a frequent contributor to the technical press, and was the author of a series of articles on the care and operation of motors and generators, which appeared in the ELECTRICAL REVIEW a number of years ago. For two years he was chairman of the Industrial and Domestic Power Committee of the American Institute of Electrical Engineers and is at present a member of the board of directors of that association. During the war Mr. Martin served as a captain of Engineers and spent one year in France. The Handy Supply & Manufacturing Co. handles a line of commutator stones, commutator slotting files, insulating varnishes and other electrical specialties. Its products are used in nine foreign countries as well as in every state in the Union.

NEXT CONFERENCE, CHICAGO, ILL., OCTOBER 30-31, 1919

C. A. TUPPER, Chairman of Conference H. EHRLICH, Secretary

INTERNATIONAL POWER ECONOMY CONFERENCE

OFFICE OF THE EXECUTIVE COMMITTEE

1547 MARQUETTE BUILDING

CHICAGO

SEPTEMBER 23, 1919.

MY DEAR SIR:

During the war, under the whip of stern necessity and moved by a staunchly patriotic impulse, the industrial forces of America joined hands with the Government to co-operate with the representatives of the United States Fuel Administration in conserving the fuel resources of the nation.

Diminution of labor at the mines, through enlistment and the draft, tremendous demand for fuel for industrial power and for ship and rail transportation, congestion of rail and waterway transportation and a winter of unusual severity, all combined to bring about an unprecedented situation as it affected power resources. Out of this emergency was born the United States Fuel Administration, to the personnel of which were drawn many of the most prominent and able fuel engineers and economists of the times.

Study of resources, fuel production, transportation and the operation of power plants brought out volumes of invaluable information, resulting in many suggestions for stimulating production, for regulating transportation, and most important of all, for increasing the efficiency of power plant operations. While the recommendations of the United States Fuel Administration were at all times advisory, they were, for the greater part, complied with the same fidelity as if they were clothed with official authority and therefore mandatory. They were war measures, and the power plant managers of the nation were "for them."

With the signing of the armistice reaction set in. Fuel production was being well maintained, transportation difficulties were being ameliorated, intensive industrial production was being tapered off, measures looking to increased efficiency had been applied, the men who had given freely of their time and energies to the work of the Government were required in office and factory to gather together again the broken threads of their own business—to put their houses in order and to begin again the routine of business and industrial life.

The United States Fuel Administration was a war product. With the coming of peace all signs pointed to its passing. What was to become of the mass of information

Executive Committee
JOSEPH HARRINGTON, Chairman,
James A. Brady Foundry Co.
AINSLIE A. GRAY, Vice-Chairman,
A. A. Gray & Co.
H. C. SHIELDS,
Fuller Engineering Co.
JOSEPH W. HAYS,
Joseph W. Hays Co.
A. P. PECK,
Consulting Engineer.
A. W. PATTERSON,
Engineer Co.
I. L. KENTISH-RANKIN,
Electrical Review.

Committee to Co-operate with Fuel Administration
F. A. MORELAND,
Vulcan Fuel Economy Co.
JOSEPH W. HAYS,
Joseph W. Hays Co.
C. E. BRAINARD,
Brainard-Fairchild Engineering Co.
DAVID MOFFAT MYERS,
Griggs & Myers.

Committee on Foreign Trade
F. H. C. COPPUS,
Coppus Engineering & Equipment Co.
H. W. DOW,
Nordberg Mfg. Co.

Committee on Combustion
G. S. CARRICK,
Carrick Engineering Co.

Committee on Solid Fuels
H. J. MEYER,
Administrative Engineer,
U. S. Fuel Administration,
Minneapolis, Minn.
O. P. HOOD,
Bureau of Mines,
Washington, D. C.
CARL SCHOLZ,
Valier Coal Company.

Committee on Washed and Pulverized Fuel
B. J. ROBERTS,
Deister Concentrator Co.
FREDERICK SEYMOUR,
Aero Pulverizer Co.
H. C. SHIELDS,
Fuller Engineering Co.
E. C. BRAINARD,
Brainard-Fairchild Engineering Co.

Committee on Oil Fuels
W. G. WILLIAMS,
Oklahoma City Oil Co.
W. T. DEAN,
General Combustion Co.
MAX SKLOVSKY,
Deere & Co.

Committee on Steam Engines
B. V. E. NORDBERG,
Nordberg Mfg. Co.
H. J. GEBHARDT,
Consulting Engineer.

Committee on Steam Turbines
H. W. CROSS,
General Electric Co.
ERWIN DRYER,
Allis-Chalmers Mfg. Co.
S. WOLFF,
DeLaval Steam Turbine Co.

Committee on Boiler Settings.
ALBERT GOETZ,
Jointless Firebrick Co.
ARTHUR W. KNIGHT,
Celite Products Co.

Committee on Boiler Feed
A. SORGE, JR.
A. Sorge, Jr. & Co.
I. L. KENTISH-RANKIN,
Electrical Review.
W. F. SCHAPHORST,
Geo. H. Gibson Co.

Committee on Water Purification
M. F. NEWMAN,
W. B. Scaife Co.
H. W. WILDING,
Roberts Filter Mfg. Co.

Committee on Steam Superheating
L. B. NUTTING,
Power Specialty Co.

Committee on Cooling and Condensing Systems
B. H. COFFEY,
The Cooling Tower Co., Inc.
OSCAR J. WEST,
Spray Engineering Co.
J. J. BROWN,
Wheeler Condenser & Engineering Co.

Committee on Insulation and Boiler Covering
R. J. STEWART,
H. W. Johns-Manville Co.
LAWRENCE L. SHAILER,
Ehret Magnesia Mfg. Co.

Committee on Piping and Pipe Accessories
B. J. HAUSFELD,
Lunkenheimer Co.
A. S. WINTER,
William Powell Co.
R. C. McWANE,
Sec'y Cast-Iron Pipe Publicity Bureau.
M. B. SKINNER,
M. B. Skinner & Co.

Committee on Coal Storage and Handling
H. H. STOEK,
University of Illinois.
C. C. FORD,
Jeffrey Mfg. Co.
WM. H. LANG,
C. W. Hunt Company.

Committee on Ash Handling
L. A. GRIFFIN,
American Steam Conveyor Corp.
C. F. MESSINGER,
Chain Belt Co.

Committee on Recording Instruments
FRANCIS W. CARRET,
Foxboro Co.
J. W. LAZEAR,
Brown Instrument Co.
J. M. SPITZGLASS,
Republic Flow Meter Co.
W. D. HESS,
Builders' Iron Foundry.
E. G. BAILEY,
Bailey Meter Co.

Committee on Lubricants
R. M. SHATTUCK,
Acheson Graphite Co.
DUDLEY K. FRENCH,
Dearborn Chemical Co.

that had been gathered? Were the gains in efficiency to be discounted by slipping back into unscientific and wasteful methods? Was all this good work to stop with the demobilization of the United States Fuel Administration?

These were the questions that inspired the getting together at Chicago, Ill., on December 6, 1918, of a number of members of the United States Fuel Administration, power plant operators, manufacturers of power plant apparatus and accessories, and publishers of technical journals to discuss the problem and evolve, if possible, some means for perpetuating the work started by the Fuel Administration.

The meeting resulted in the International Power Economy Conference. Resolutions were adopted, recommending such action by Congress as would result in giving to some Federal bureau sufficient funds and authority to continue the work of the United States Fuel Administration, to the end that the enormous savings in the production and utilization of the fuel resources of the country which preliminary investigation has revealed as possible, might actually be accomplished through the mature study of the subject that a permanent Federal agency could undertake.

An Executive Committee was appointed to devise ways and means for developing interest in the International Power Economy Conference and subsequently committees were appointed to represent various phases of power plant economy. These committees were to analyze the relation of various apparatus and appliances to the general subject and to report in a tentative way upon the part each might play in co-ordinating the efforts of all to bring about a greater appreciation of the advantages which accrue from the scientific application of apparatus designed to increase power plant efficiency.

It has been a busy year for all of us; each has borne a burden which has tested to the limit mental and physical endurance But the ultimate reward for all effort will come only as the problem of increasing power plant efficiency is solved.

We are approaching another crisis in fuel production and utilization. Fuel economy bears a most important relation to the cost of living. And it is necessary now, as it was when war was upon us, to get together and talk it over.

But we must do more than that. Out of the changed conditions that now confront us; out of the experiences of the last ten months, we must determine whether this work shall go on. We must determine whether the International Power Economy Conference has a work to do. If it has a work to do, on what basis may a permanent organization be developed, what will be its affiliations and what measure of financial support may be expected from those in whose interests it will be fostered?

A conference is therefore called to meet at Chicago, Ill., October 30-31, to present reports from such committee chairmen as have had opportunity to complete their analysis of their division of power plant activity and to invite speakers conversant with the factors upon which fuel conservation and power plant economy are based.

Does the matter interest you? Will you come to the conference? Will you come, if only to listen? Will you come and make suggestions, if after listening in, the subject takes hold of you? The Executive Committee will be glad to have advance knowledge to the greatest extent possible of those who will be in attendance. And if you have any ideas on the subject they will be welcome in the formulating of the program.

The place of meeting will be determined and full particulars will be forwarded to you at an early date.

Cordially yours,

C. A. TUPPER,

Chairman of Conference.

Financial News

Effect of Unsettled Conditions on European Production and Credit.

Until peace is definitely concluded by the ratification of the peace treaty, European production will be held back and credit risks will be, to an extent, insecure. In certain parts of Europe, notably eastern and southeastern Europe, armies are not yet demobilized, crops are not up to a safe margin, and economic reconstruction is being postponed. The danger of this situation is cumulative. Bad conditions become worse. Political jealousy and social unrest feed upn idleness and hunger.

The solution of the problem presented by this zone of demoralized life is a definite political settlement and a return to work. You can not work and construct when there are no rules of the game. Reconstruction, moreover, involves raw material and machinery to work with. Most of these upset countries have only Government bonds to offer in payment for goods desired. Before bankers can safely underwrite such loans and offer them to American investors, these countries must have definite boundaries, definite obligations, and there must be a guarantee that the stronger nations will keep the peace in these regions, by moral influence and even by coercive measures if necessary.

The problem of credit to even the strongest nations is difficult until the peace settlement is concluded. Whatever one's views about the proper nature of the peace settlement, all may readily see and agree that foreign credit arrangements are being delayed until a peace settlement assures stabilized conditions. Without adequate provisions for foreign credits there can be no remedy for the exchange situation which is automatically increasing prices foreign purchasers have to pay for American goods. With foreign currencies depreciated as they are today, old-established American businesses abroad are finding in certain cases that they are confronted with lower prices from competing countries.

With the peace settled there is good reason for confidence that the credit situation can be so handled as to assist European nations to restore their production and at the same time assure an adequate market for American exports. Export trade is a source of national prosperity if payment can be secured, either in the form of imports or deferred payment in the form of safe foreign securities. If the unsettled period can be tided over, the United States is faced with a splendid opportunity for service and profit in the world's markets.

Robbins & Myers Note Issue.

An issue of $2,500,000 of 6% notes of the Robbins & Myers Co., Springfield, Ohio, are being offered by Kissel, Kinnicut & Co., New York, and the Maynard H. Murch Co., Cleveland. These notes, dated Sept. 1, 1919, mature $500,000 annually, on Sept. 1, 1920, to 1924, and yield from 6 to 6.35%. They are redeemable on any interest date prior to maturity upon 30 days' notice as a whole or in blocks of not less than $500,000, in which event the company must call for redemption notes of one or more of the series last maturing, upon payment of a premium of one-fourth of 1% for each six months between the date of redemption and the date of maturity, with a minimum redemption of one-half of 1%.

In addition to this issue the company has outstanding $2,395,000 out of $2,500,000 authorized preferred stock and $1,250,000 authorized common stock. The estimated sales in 1919 were $9,000,000, as compared with $6,961,076 in 1918 and $5,758,335 in 1917. The proceeds of the note issue will be used in reduction of floating debt. Average net earnings for the six years ended Dec. 31, 1918, before federal taxes, amounted to five and one-third times and for the calendar year 1918 amounted to over eight times the largest annual interest requirements on the notes. Based on earnings of the first six months of 1919, the estimated earnings for the year before federal taxes will amount to ten times the largest annual interest requirements. Net earnings for 1918 after federal taxes amounted to over five times and estimated net earnings for 1919 are nearly seven times the largest annual interest requirements.

Hurley Machine Plans Capital Increase.

The Hurley Machine Co. of Chicago proposes to increase its common capital stock from the present 15,000 shares of $100 par value to 200,000 shares of no par value, the new capital thus derived to be used in enlarging its plant at West 22nd street and South 54th avenue. It also is proposed to increase the number of directors from five to nine.

Notice of the plan has been given in a call for a special meeting of stockholders on Oct. 2. It is stated that of the new common stock, 100,000 shares will be presently issued, part in exchange for the old common stock and the rest at a price presumably below the current market. The old common stock was quoted recently at $190 bid, with none offered. The subscription rights to the new stock will go to stockholders and a public offering is not contemplated.

The Hurley company at present has outstanding $1,119,900 common stock and $500,000 7% cumulative preferred stock, which was publicly offered in January, 1918, at $100 for each share and 15% of common stock. The preferred stock eventually will be retired through a cumulative sinking fund of 3% of the outstanding issue for each year beginning next January; and also 15% of the net earnings applicable to the common stock beginning Jan. 1, 1918. The company has bought in $14,330 of the preferred. The company has $200,000 bonds outstanding.

The present common stock is on an 8% dividend basis. The company's report as of Dec. 21, 1918, shows current assets of $1,380,654, current liabilities of $519,323, and surplus of $746,938. The value of plant, etc., is placed at $669,472.

The business of the company, which manufactures the "Thor" products, including electric wash.ng machines, ironing machines and vacuum cleaners, is running at a record breaking rate. Proceeds of the stock will be used to erect additional plants.

Eastern Dakota Electric Bond Issue.

The Chicago Trust Co. is offering in denominations of $1000, $500 and $100, $450,000 first mortgage 6% gold bonds of the Eastern Dakota Electric Co. at 97 and interest. These bonds are dated Nov. 1, 1917, become due Nov. 1, 1927, and yield about 6½%. They are a direct first mortgage against all property owned by the company. The company owns and operates under favorable franchises the electric light and power business in Watertown and Yankton, S. D., two of the oldest and most prosperous cities in that state.

Byllesby Bond Department Opens Evansville Office.

The bond department of H. M. Byllesby & Co. announces the opening of an office in Evansville, Ind., in charge of F. W. Lauenstein, who has been connected with banking interests in that city for more than fifteen years. The office is located in the Citizens Bank building. This is one of a number of branch offices which will be opened by the bond department as part of its expansion program and for the purpose of better serving its clientele.

Utah Power & Light Co. has declared the regular quarterly dividend of 1¾% on preferred stock, payable Oct. 1, 1919, to stockholders of record Sept. 16.

Michigan State Telephone Co. has declared a quarterly dividend of $1.50 on preferred stock, payable Sept. 30 to stock of record Sept. 22.

WEEKLY COMPARISON OF CLOSING-BID PRICES OF SECURITIES OF LEADING ELECTRICAL COMPANIES.

Quotations furnished by F. M. Zeiler & Co., Rookery Bldg., Chicago.

Public Utilities.	Div. rate. Per cent.	Bid Sep. 16.	Bid Sep. 23.
Adirondack Electric Power of Glens Falls, common	6	14	14
Adirondack Electric Power of Glens Falls, preferred	6	77	77
American Gas & Electric of New York, common	10+extra	120	118
American Gas & Electric of New York, preferred	6	40	40
American Light & Traction of New York, common	..	230	225
American Light & Traction of New York, preferred	6	94	94
American Power & Light of New York, common	4	..	..
American Power & Light of New York, preferred	6	..	..
American Public Utilities of Grand Rapids, common	..	5	5
American Public Utilities of Grand Rapids, preferred	7	24	20
American Telephone & Telegraph of New York	..	101⅜	101½
American Water Works & Elec. of New York, common	..	5	5
American Water Works & Elec. of New York, particip	7	10	10
American Water Works & Elec. of New York, first preferred	..	57	57
Appalachian Power, common	..	4	4
Appalachian Power, preferred	7	22	22
Cities Service of New York, common	+extra	483	487
Cities Service of New York, preferred	6	77¾	77
Commonwealth Edison of Chicago	8	110	107¼
Comm. Power, Railway & Light of Jackson, common	..	22	23
Comm. Power, Railway & Light of Jackson, preferred	6	45	50
Federal Light & Traction of New York, common	..	9	9
Federal Light & Traction of New York, preferred	..	47	47
Illinois Northern Utilities of Dixon	6	78	75
Middle West Utilities of Chicago, common	2+extra	30	30
Middle West Utilities of Chicago, preferred	6	50	50
Northern States Power of Chicago, common	..	65½	65
Northern States Power of Chicago, preferred	ex.div.7	90	90
Pacific Gas & Electric of San Francisco, common	..	67½	67½
Pacific Gas & Electric of San Francisco, preferred	6	88	88
Public Service of Northern Illinois, Chicago, common	7	83	85
Public Service of Northern Illinois, Chicago, preferred	6	90	87
Republic Railway & Light of Youngstown, common	4	10	12
Republic Railway & Light of Youngstown, preferred	6	45	48
Standard Gas & Elecric of Chicago, common	..	34	32½
Standard Gas & Electric of Chicago, preferred	8	41½	41
Tennessee Railway, Light & Power of Chattanooga, common	..	4	5
Tennessee Railway, Light & Power of Chattanooga, preferred	6	13	13
United Light & Railways of Grand Rapids, common	4	42	41
United Light & Railways of Grand Rapids, preferred	6	70	70
Western Power of San Francisco, common	..	24	24
Western Union Telegraph of New York	extra	85⅛	85½
Industries.			
Electric Storage of Philadelphia, common	4	97	97
General Electric of Schenectady	8	168½	164
Westinghouse Electric & Mfg. of Pittsburgh, common	7	54¾	54⅛

Electrical Review

Vol. 75. No. 14. CHICAGO, OCTOBER 4, 1919 Three Dollars a

Electrical Review

WITH WHICH IS CONSOLIDATED WESTERN ELECTRICIAN AND ELECTROCRAFT

VOL. 75—No. 14. CHICAGO, SATURDAY, OCTOBER 4, 1919. PAGE 551.

General View of Pacific Mills, Ltd., Ocean Falls, B. C., Showing Power House, Paper Mill, Pulp Mills and Saw Mill.

Hydroelectric Plant and Paper Mill at Ocean Falls, B. C.

Interesting Features in the Canadian Properties of the Pacific Mills, Ltd.—Power Generated from Hydroelectric Plant—Unique Electric Drive of Large Paper Machines

By W. A. SCOTT

THE paper manufacturing industry in the Pacific Northwest has grown to important proportions within the last ten years. It is represented by four mills in Oregon, five in Washington, and four in British Columbia. Four plants of the larger capacity are those of the Crown Willamette Paper Co., at West Linn, Ore., and Camas, Wash., and the Powell River and Ocean Falls mills in British Columbia. The Crown Willamette mills at West Linn have a capacity of 400,000 lbs. of paper per day, that of the Camas mills being about 350,000 lbs.

Other smaller, but successful, plants are operated at Oregon City, Lebanon and Astoria, Ore., and at Spokane, Everett, Steilacoom and Port Angeles, Wash., while on the Canadian side there are two other mills and a sulphate plant in operation, in addition to the larger mills referred to. There is a new mill under construction at Salem, Ore., which will be completed within a short time.

All the larger mills use wood in the manufacture of paper, which involves logging and saw-mill operations. The woods mostly used consist of spruce and hemlock, of which the culls and lower grades are selected. While sound timber is required, it may be stated that the pulp and paper manufacturer consumes a good part of that which is rejected by the manufacturer of the first-grade lumber of commerce. The industry is one requiring a heavy consumption of electric and steam power, and provision for an abundant water supply.

POWER PLANT AND MILL AT OCEAN FALLS.

The plant at Ocean Falls, B. C., which was completed late in 1917, is the property of the Pacific Mills, Ltd., and undoubtedly exemplifies the most modern development in paper manufacturing in the Northwest. It consists of hydroelectric and steam-power equipment, paper and pulp mills, with sulphite and sulphate departments, a sawmill, and facilities on the townsite for housing 500 employes. This plant has a producing capacity of close to 200 tons of paper per day, of which about 140 tons consists of news print, the rest being mostly a kraft wrapping paper made from sulphate pulp.

Ocean Falls is situated on the British Columbia coast, about 380 miles north of Vancouver, and depends wholly upon water transportation for receiving supplies and the shipment of its products. Closely accessible are vast forests of spruce and hemlock. The plant was built on a stream that flows into Cousin's inlet from a lake that is situated upon a higher bench farther east.

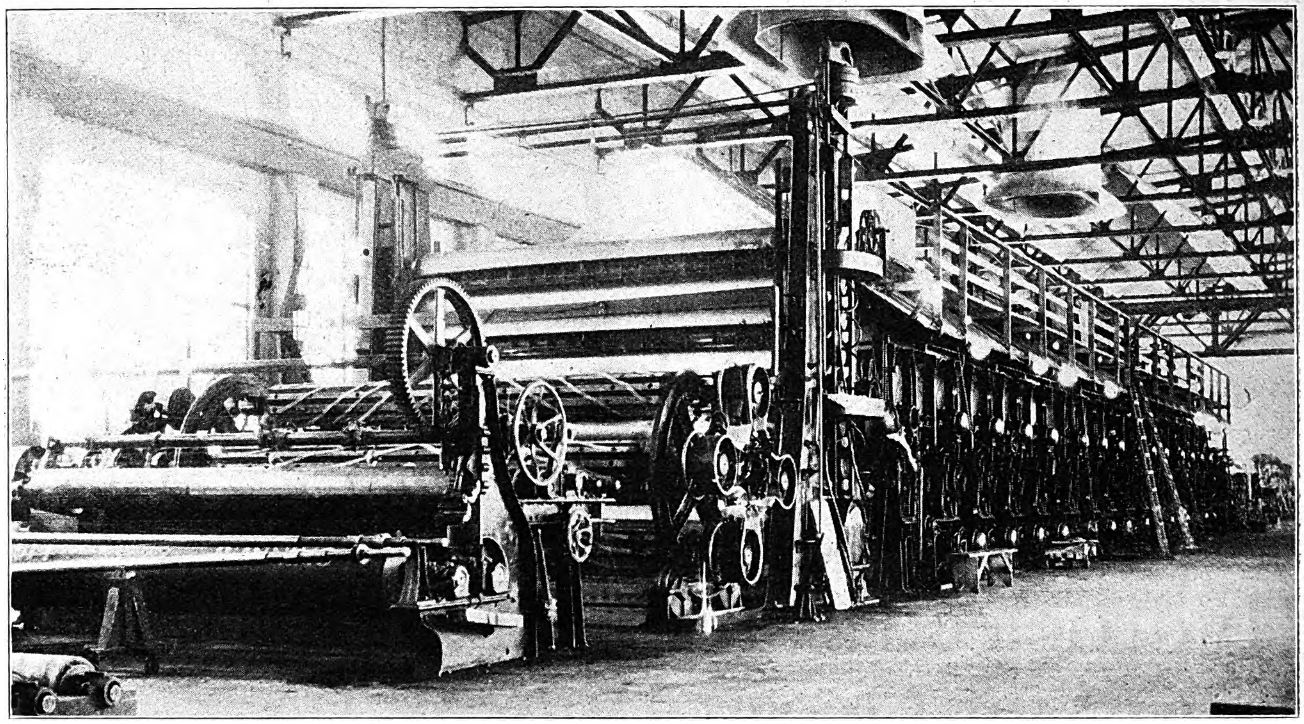
There was an original plant here which was acquired by Pacific Mills, Ltd. It consists of a small hydroelectric development, a saw-mill and a groundwood pulp mill that was operated to utilize the sawmill refuse. The original hydroelectric units were retained intact and they became a part of the larger plant subsequently built by Pacific Mills, Ltd.

The equipment of the old hydroelectric plant consists of three Westinghouse 600-kw., 440-volt generators with which the Francis type of water turbines are used, all operating under a 110-ft. head from penstocks that lead from the original dam. This system of 440-volt energy is tied in with the new 2300-volt system through a bank of transformers by which 2300-volt current is delivered. The 440-volt motors of the original pulp mill, however, were retained and are still in use.

New Hydroelectric Plant.

Construction of the new power plant involved the building of a concrete dam, 650 ft. long and 50 ft. high, giving an average head of 140 ft. at the turbines. It also involved the construction of a reinforced-concrete power house for housing the three new generating units, consisting of two Canadian General Electric 1850-kv-a., 2300-volt generators, each direct-connected to a Pelton waterwheel of the speed of 225 r.p.m.; also, a 3750-kv-a., 2300-volt generator of same make, but driven by a Pelton wheel of the speed of 350 r.p.m. Provision is made in the building for an additional 3750-kv-a. unit. The generators in the new power house are served by a penstock of 12-ft. diameter and approximately 800 ft. long. The three generators in the old power house and six water turbines which drive grinders are served by another penstock 1000 ft. long.

The new paper mill is of reinforced-concrete construction. It houses four paper machines and other accessory equipment. These consist of two 204-in. Bagley & Sewell news machines, a 174-in. machine of same make for producing kraft paper, and a smaller machine of 122-in. size. Within the same building is the sulphite mill for producing pulp from which kraft paper is made. The mill structure, power house and other buildings rest upon foundations of cluster piling, capped at the water-line with heavy concrete blocks.

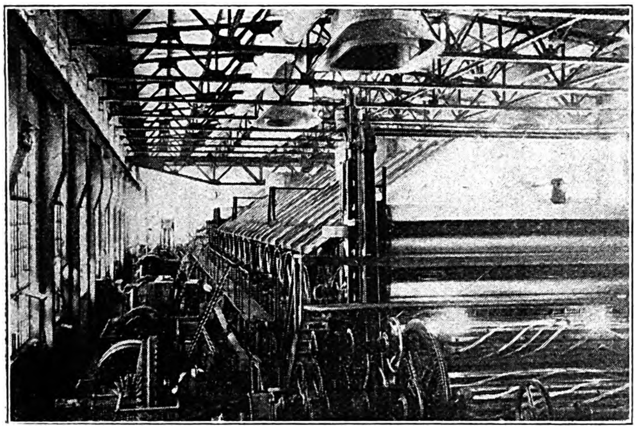


Front of 174-in. Paper Machine, Driven by 600-hp. Motor.

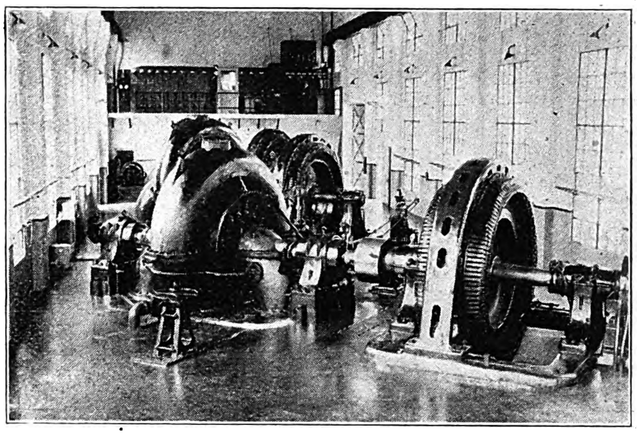
Feeder cables from the power house are carried overhead to the main group of mill buildings, and at this point lead-covered distributing cables are run in conduit. The main feeders, which consist of two three-conductor cables, of 350,000 cir. mil. area, run in parallel, lead to buses in distributing boards from which the circuits to the individual motors are run, each circuit where it leaves the distributing board being protected by a Canadian General Electric K-20 oil switch, equipped with overload protection. At the motors this oil switch, with ammeter in the cover, is cut in the line ahead of the compensator, or the drum controller in the case of wound-rotor motors.

Features of the Motor Drive.

This plant has a total connected motor load of approximately 10,000 hp., the motors varying in size



Driving Side of 174-in. Paper Machine.



View of Power Plant, Showing New Units and Switchboard.

from a 725-hp. synchronous motor down to fractional horsepower motors at low voltage. Practically all of the motor equipment is alternating-current type, except the motors on the roll grinder and the direct-current motors on two of the paper machines, namely, the 174-in. machine and the 122-in. machine, on which the kraft papers are made. These two machines are equipped with Canadian Westinghouse full automatic variable-speed drive, having a 7-to-1 speed ratio. This drive on the 174-in. machine is considered the largest drive of the kind in the world.

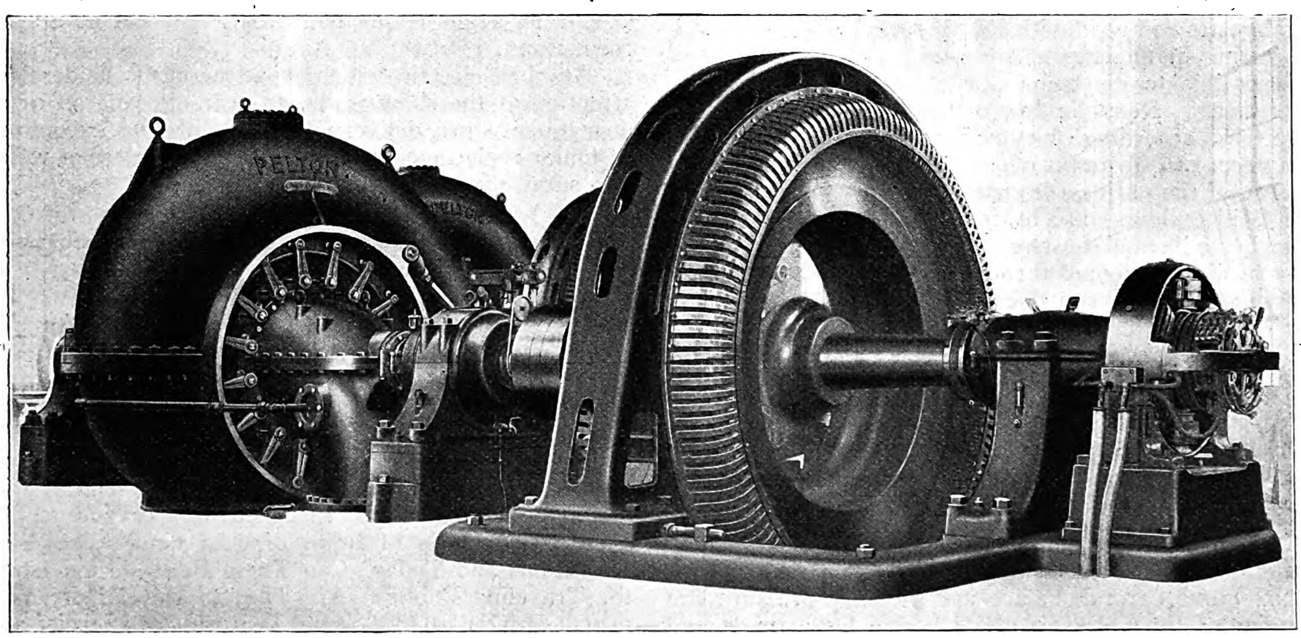
It consists of a 600-hp., variable-speed direct-current motor, direct-connected to the lineshaft, this motor having a speed range from 50 to 350 r.p.m. The direct-current supply for this motor is furnished by a motor-generator set driven by a 725-hp., 2300-volt synchronous motor. Automatic push-button control is obtained by the use of a Westinghouse control panel provided with start and stop contactors, and a motor-operated speed-controlling rheostat, which automatically varies the field excitation of the generator, as well as that of the motor, so as to obtain the total speed range of from 50 to 350 r.p.m. A motor-generator set was used for obtaining the direct current, in view of the fact that steam turbines could not be procured at the time that this installation was being put in.

On the 122-in. kraft machine there is a similar automatic speed control, the direct-current motor of which has a rating of 400 hp. This motor is also direct-connected to the variable-speed lineshaft of the machine, and has the same speed range as the larger unit.

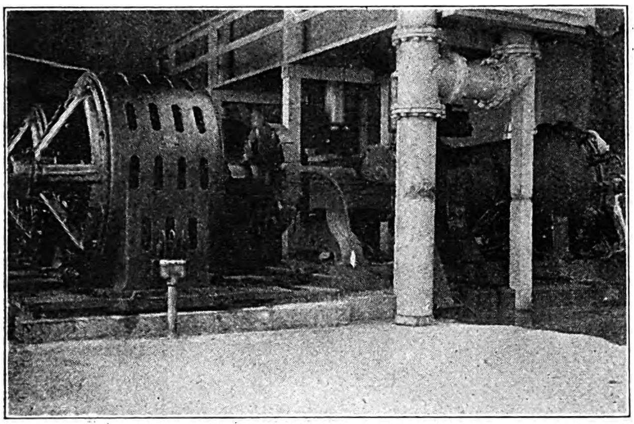
Other interesting motor applications about the plant are the use of 300-hp., 2300-volt, direct-connected motors for paper-machine jordans. These motors are mounted on the same base with the jordan, and are arranged so that the whole motor can move lengthwise of the base along with the jordan plug, as this plug is screwed in or out of its shell. There are three of these jordans on each of the kraft machines and two on each of the 204-in. news machines.

In the beater room the lineshafts are operated by 350-hp., 2300-volt motors, direct-connected to the line, these motors being of wound-rotor type, on account of the better starting characteristics.

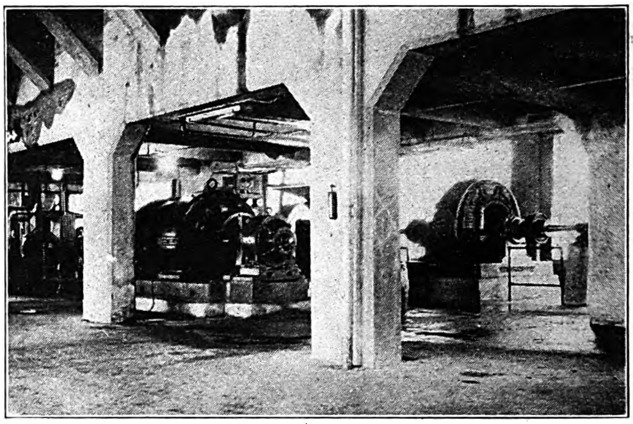
Larger sizes of centrifugal pumps about the plant, used for handling white water, together with groundwood sulphite and sulphate pulp, are driven by direct-connected motors in sizes from 50 to 75 hp., at 900 r.p.m., these pumps being of the paper mill's own design, providing a high-speed, high-efficiency pump, and having ready means for cleaning and unrestricted



Pelton Water Wheel Driving Canadian General Electric 3750-kv-a., 2300-volt at 350 r.p.m. at Plant of Pacific Mills, Ltd., Ocean Falls, B. C.



Motor-Generator Set, the Driving Unit of Which Is a 725-hp. Synchronous Motor.



Three 300-hp., 2300-volt Motors Direct Connected to Paper Machine Jordans.

passages through the pump in order to reduce to a minimum the liability for stoppages when handling pulp.

STEAM-BOILER PLANT.

In addition to the extensive electrical equipment, a modern paper mill requires a large steam power plant, the steam being used in the cooking operations incidental to the manufacture of sulphite and sulphate pulp and for the drying of the paper on the steam-heated dryer rolls of the paper machines.

At Ocean Falls there is a total of about 4500 boiler horsepower installed, twelve of the units being 150-hp. return-tubular boilers, which were a part of the original installation, the new units being 500-hp. units of Badenhausen and Babcock & Wilcox make. Oil fuel is burned in the paper-mill boiler house, while at the sawmill boiler house mill refuse is burned. There is some surplus steam at this house, to take advantage of which a steam line approximately 1800 ft. long is run from the sawmill boiler house to that of the paper mill. This boiler plant was originally laid out so that coal could be burned if necessary, and during the war emergency the prospect of not getting fuel oil became so serious that equipment was bought and installed to enable this plant to burn coal.

This boiler plant is equipped with a 200-ft., 12-ft. diameter Custodis radial-brick stack. All the new boilers are equipped with Foster superheaters. Steam-metering arrangements are very complete, so that it is possible to determine the steam usage in all departments. Republic flow meters of the long-distance electrical recording type are installed so that the chief engineer can, from his office, tell at any time the steam usage of the various departments.

Mill buildings are heated by a hot-air system, the air being heated at two central heating points and warm air distributed throughout the mill buildings in large galvanized-iron ducts.

ELECTRIC TRUCKS MAKE LONG TRIPS TO REACH NEW YORK SHOW.

One from Philadelphia, the Other from Danbury, Conn. Make Journey Under Own Power—Practicability of Electrics Demonstrated.

Two electric trucks which are attracting unusual attention at the New York Electrical Exposition at the Grand Central Palace are the high-pressure fire engine of the Paterson (N. J.) Fire Department and a five-ton vehicle which has been purchased by a concern in Norway. As soon as the show closes the one will go into active fire service and the other will be shipped abroad.

These two trucks were run from their respective factories to New York under their own power, the fire engine covering 90 miles from Philadelphia while the vehicle for Norway made the 69-mile run from Danbury, Conn.

The fire engine is of the high-pressure type and was purchased by the City of Paterson after tests which included speed, hill climbing, speed out of the station, mileage, and general dependability. It is the twenty-first electric that the New Jersey municipality has added to its fire-fighting fleet. The engine is equipped with a chemical tank, carries a complement of ladders, has high-pressure connections and the necessary hose and mounts a searchlight on the dash. Taken all in all it is a combination engine, chemical wagon, hose cart, ladder truck, and searchlight wagon—practically a whole department in itself. It derives its power from an 80-cell battery, and is driven by four powerful motors, one on each wheel. It has a speed of 22 miles an hour and made the trip from Philadelphia at an average speed of 12 miles per hour with two battery boosts, one at Trenton and one at New Brunswick.

The export truck is a five-ton standard chassis. It left Danbury in the morning and reached New York at 4 p. m. after having had a battery boost at Stamford, Conn.

Another electric which is attracting considerable attention at the show is the 15-year old veteran of a department-store delivery fleet. With the exception of minor replacements, it is the same vehicle that went into service in 1904.

AMERICAN ELECTRIC RAILWAY ASSOCIATION TO CONVENE.

The thirty-eighth annual convention of the American Electric Railway Association will be held at Atlantic City Oct. 6-10. The program includes addresses and discussion on the following subjects: "The Public Service Railway Co.'s Zone System," "What Must Be Done with the Electric Railways Before They Can Again Find a Market for Their Securities?" "Labor and the Electric Railway Industry," "The Relationship of Items of Cost Under Pre-War Conditions and Today; Can These Be Collected from the Traveling Public? Are They to Develop Permanent Competition?" "Some Features of Service-at-Cost Plans," and reports of committees on valuation, zone systems and federal investigation.

Central-Station Rates in Theory and Practice

Thirteenth Article—Differentiating Between Classes of Service —Value of Service According to Size of Customers and Use— Isolated Plants and Other Competition in Light, Power and Heat

By H. E. EISENMENGER

This is the thirteenth article of this series, which began in the issue of July 12. Part I consisted of seven articles on the cost of electric service. Part II, which is concluded this week, consists of six articles dealing with the general policy that is to influence selection and preparation of a rate system suitable as to the relative profit contributed by different classes of customers. In Part III, to begin next week, will be taken up consideration of different systems of rates. Other future parts of the series will discuss rate analysis, accuracy of rates, regulation and related topics, the articles continuing throughout the remainder of the volume.

PART II—THE PRICE OF ELECTRIC SERVICE—Continued.

III.—THE VALUE-OF-SERVICE PRINCIPLE (CONTINUED).

C. APPLICATION TO INDIVIDUAL CUSTOMERS AND TO CLASSES OF CUSTOMERS.

SECTION 95. Now obviously we cannot shade prices for each individual customer by determining or estimating the monetary value he attaches to the respective part of a service. This method of applying the value-of-service principle between individual customers is generally considered unfair in commercial practice[1] and respectable retail merchants, for instance, charge the same price for certain goods on a certain day for all customers without exception.[2] Discrimination between individual customers is forbidden to public service corporations by the public utility commissions.

But we can and should make our prices so that different percentage profits are obtained from different *classes* of customers and from different *kinds* of goods or *classes* of service. This kind of differentiation or "discrimination" is recognized as perfectly legitimate by the public utilities commissions and is also probably felt as being fair by the majority of the general public. It is, in fact, fairer than the apparent lack of discrimination, as expressed by charging equal percentages of profit from everybody, whether rich or poor (cost-of-service principle).

In practice we apply the *value-of-service principle* between classes of customers and classes of goods, whereas the strict *cost-of-service principle* is applied to the customers and goods within each class.

As an example of the differentiation of profits between classes of *customers* remember the regular "sales" in department stores on certain *days* of the week. On these days extra low prices or extra high discounts ("double stamp days") are allowed which apply chiefly to those classes of customers to whom the difference in price is important enough so that they are willing to take upon themselves the inconvenience of planning their shopping and delaying their purchases until that particular day arrives, and then of shopping in the crowd. The excursion and holiday rates on railways, etc., are a similar example.

As regards the differentiation between classes of the *commodity* or service we have a well-known example in the discrimination of the post-office charges between letters and printed matter ("first class," "second class" and "third class" mail). It costs the Post Office Department practically the same to transport and deliver a sealed written letter as it costs for printed matter of the same weight from the same sender to the same addressee and yet the charges are 3 to 12 times as high. The chief reason is that senders of a "first-class" letter are able and willing to pay the higher charges, whereas only a small percentage of the newspapers, printed advertising circulars, etc., which are now being sent by mail would be transported that way if the charges were raised to the same amount as the first-class letters, or even to the average between the first, second and third classes. Another example of discrimination between classes of commodities is furnished by the price reduction to every customer (in sales or permanently) of certain *goods* in department stores and other stores (which is not identical with the reduced prices on certain days mentioned above) when it is found out that these goods are not selling rapidly enough.

D. THE VALUE-OF-SERVICE PRINCIPLE IN CENTRAL-STATION SERVICE.

1. General Principles.

96. In determining the cost of central-station service we have found (see Section 10 et seq.) that the cost of production of service consists of three separate items. The lowering or raising, respectively, of the profits from different customers as required by the value-of-service principle should therefore apply theoretically to every one of these three items of cost. We have seen, however, (see Section 57) that the customer cost is of importance only with the smaller customers and is negligible with the large and even with the medium-sized customers. We might there-

[1] There are exceptions, however. For instance, the practice of physicians to make lower charges (or none at all) to indigent people and to indemnify themselves for their time from the pocketbooks of their wealthier patients, is generally not objected against. The amounts expected from the individual as contributions towards charitable and other public purposes (also tips) which, although supposedly voluntary contributions, still frequently are collected and given under a certain pressure, are also in proportion to the individual contributor's assumed financial standing.

[2] The orient has different ideas on this subject. Haggling may go on for hours until the proper adjustment is found between the respective customer's valuation of the goods and his valuation of his money, and this is considered perfectly correct.

fore determine the customer charge of the rate by adding the profit to be collected from the small customers and apply it to all sizes of customers alike.

It will be shown, however, (Part III) that the rates generally do not follow the three-charge system inasmuch as the customer charge is frequently left out altogether. Not even the two-charge system (energy charge and demand charge) is universal, though it is applied in the great majority of rates. We come to the conclusion, therefore, that an exact mathematical application of the value-of-service principle is not feasible—even if we could have the exact foundations for the same in the form of exact data of the valuation of the service on the part of the various customers or classes of customers. We will, in general, have to be satisfied with selecting those of the three charges as we choose to embody in the rates, at such amounts that the average profit is larger or smaller according to what the following investigations (Section 97 et seq.) will show to be desirable.

As the principle of differentiating the percentages of profit refers to classes of consumers or service only and not to individual consumers, the prices must be laid down in hard and fast rules in schedules which leave no room for personal interpretation or for preference to individual customers. If, for instance, we find that the electric light company ought to draw a smaller profit from residential consumers than from commercial lighting consumers (see later, Sections 97 and 98) we will have to have one schedule for residential consumers and another one for commercial lighting.

As regards the raising or lowering of the profits for different classes of consumers and classes of service in the central-station business, we will have to be guided by the same two factors which have previously been mentioned (see Section 94) as being determinative for that discrimination in general business, viz.: (a) the customer's valuation of the service he receives, (b) the customer's valuation of the money he has to give in return for the service. These two factors do not necessarily work in the same direction, one factor may indicate a lowering of the profit to a certain class, the other one a raise.

The classification of the customers for a rate diversification in general and for application of the value-of-service principle in particular is made under two main headings, the "size" of the consumer and the purpose to which electricity is being put. The size of the customer is usually determined by the number of kilowatt-hours consumed per month or sometimes by his maximum demand, or by both. The schedules distinguish accordingly wholesale and retail customers, or the character of the business as such brings the respective customer under a certain class of size. For instance, residential customers are naturally small customers, street railways large ones.

2. *Classification According to the Size of the Consumer.*

a. The Small Consumers.

97. The smallest consumers generally value their dollar higher than the medium-sized and large customers and therefore we must be satisfied with a smaller profit from the smallest customers, otherwise they will turn to other illuminants. This does *not* mean that we will have to charge them lower average *prices* per kilowatt-hour, since the *cost* per kilowatt-hour is very much higher for this class of customers, chiefly on account of the "customer cost" (see Section 57).

b. The Medium-Sized Consumers.

98. Calling medium-sized consumers such consumers as have a connected load somewhere between 5 and 10 kw. as a lower limit and perhaps 30 to 50 kw. as the upper limit, such as medium-sized stores, restaurants, small factories, etc., we find that we cannot claim any special reason why this class should pay especially low profits, whereas such reasons do exist for the small and the large consumer. (See Sections 97 and 99.) The natural inference is that this class of customers must pay a larger profit than the average.

Let it be emphasized again that charging prices to the medium-sized customer which involve higher profits than the average will be of advantage not only to the electric light company, but also to the community of electric light users, possibly including the medium-sized customers themselves. The higher profits from the medium-sized customers do not necessarily mean that these customers have to pay for the others. If we would not grant prices with lower profits to the other customers, for instance the small ones, they would drop out and the profit derived from them would be lost. The prices to the remaining, that is the medium-sized, customers would have to be raised because the cost would have to be so much higher owing to the reduced size of the plant.

c. The Large Consumers—Central Station vs. Isolated Plant.

99. Proceeding now to the third class, the large consumers (for instance, large hotels, department stores, office buildings, theaters, etc.) we find that they too like many medium-sized customers would have to use electricity as a matter of necessity, but here another element enters in. The large consumer is in a position to build his own generating plant and under certain conditions may be able to generate his electricity cheaper than what the electric light company would charge him if it applied average profits in making his prices.

The selling price of the service from the central station is therefore in competition with the output cost of the service from the isolated power plant. This is not *necessarily* a disadvantage to the central station, but it may be so. The central station has the advantage of the bigger plant, which reduces the operating expenses per kilowatt-hour and the capital invested per kilowatt capacity of the power station. The central station further has the big advantage of a diversity-factor larger than unity, which means, as we have seen in Section 45, it can use the same kilowatt of power-house capacity several times over for different customers, one after the other. Also the reserve capacity of the isolated plant is generally a larger percentage.[3]

[3] To illustrate these points: If the isolated plant has a peak load of 1000 kw. we would have to install perhaps two 500-kw. generators to carry the load, whereas if we supplant the service from the isolated plant by central-station service the central station will have to increase its capacity for that purpose by perhaps only 700 or 500 kw. or less, according to the size of the diversity-factor, so that the capital invested per kilowatt of maximum demand is so much smaller. These 500 or 700 kw. are not furnished from 500-kw. generators but from large ones of 5000 or 10.000 or more kw.; this means the capital per kilowatt capacity is still further reduced in case of the central station. Moreover, if the isolated plant is to furnish the service, we will have to install a third generator of 500 kw. there as a reserve for breakdowns, that is 50% of the total capacity, whereas in the central station, where we have a larger number of generators, the size of the reserve generator is a smaller percentage of the total capacity. If we have, for instance, five large generators of 10.000 kw. each, installed in the central station for regular service, the sixth unit of the same size, installed as reserve, will be but 20% of the capacity. (Of course, we might also subdivide the 1000 kw. of the isolated plant into five units of 200 kw. each with a sixth one in reserve, but this would not only fail to bring about a reduction of the capital cost but would also increase the operating cost.)

The difference in the quality of service should not be forgotten in this connection. In many of the hotels and other places which are still operating an isolated plant we can, for instance, notice a rhythmical flicker of the electric light, which is not only annoying, but also very injurious to the eyes.

These are the chief (but not all) of the advantages of the central station over the isolated plant. On the other hand, the isolated plant has a number of economic advantages over the central station. It is not burdened with a high-voltage transmission and a distribution system since the house wiring generally is connected directly to the power-plant switchboard. The advantage sometimes quoted that the isolated plant can in winter be run with the steam from the heating system of the building and with the attendance provided for the heating plant is of questionable nature, since both heating steam and labor are inferior to that desirable for operating a good electric plant.

The question of the relative cost of providing electric power from the central station or from an isolated plant involves too many factors to permit of a general answer which applies to every individual case. But the scrapping of existing isolating plants in favor of central-station service is a frequent occurrence, whereas the opposite is rarely, if ever, heard of in the territory of supply of a well managed central station. This demonstrates that the central station generally has the economic advantage over the isolated plant. This is the consequence of the progress of the central-station business, chiefly of the accomplishments of recent years in filling in the valleys of the central-station load curve, thereby increasing the load-factor and the diversity-factor, and it is also the consequence of the progress made in central-station rates, chiefly brought about by the clear recognition of the value-of-service principle, particularly in its application to the large consumer.

The relative merits of the central station and the isolated plant to the public are clearly brought out to the engineer if he considers the following hypothetical problem: What would we do if we had to supply most economically a large city, where electricity was hitherto unknown, with light and power on a large scale? It would certainly be very, very unusual conditions which would bring the construction of isolated plants even within consideration.

3. *Classification According to the Purpose for Which Electricity Is Being Used.*

100. Whereas we have thus to discriminate between the different sizes of the customers in the application of the value-of-service principle, we must also, according to Section 96, pay due regard in this connection to the purpose for which electricity is being used.

The main uses to which electric central-station service can be put are (a) lighting, (b) motor service[4] and (c) heating[5].

The value-of-service principle requires that the price of electric service be in general not essentially higher than the price of competitive service (competitive sources of illumination, power and heat) because the customer's valuation of the service is largely determined, or rather limited, by the amount of money for which he can get a similar service from other sources. But considering the convenience, cleanliness, relative fire-safety and other advantages of the electric service its price may in many cases be somewhat higher than that of competitive service.

In the following an investigation is attempted of how the valuations of the three main services (light, power and heating) compare with each other.

101. Electricity for power will be valued slightly lower than electricity for light, at least in case of consumers who are not among the smallest. We can easily understand this from the fact that if these consumers would have to make their own light or power it would cost them almost the same amount to furnish a certain load curve for power or for light. The cost for power load will be slightly smaller than for lighting load because the speed regulation need not be as close, both as regards the regulation between full load and no load (governor) and the fluctuations of speed during each revolution (flywheel). Also in those instances where for power load a purely mechanical drive is preferable over electric power transmission, that is, where we have only one power-consuming device, or a very few of them close to each other and to the prime mover, a further relative saving may be made in the generation of power vs. generation of light, because then the electric equipment becomes unnecessary and the operator need have no training in electricity. Power rates should therefore generally be calculated with the same or a slightly smaller profit than lighting rates.[6]

For very small customers who have so little demand for power that they cannot think of installing gasoline or gas engines, conditions are different. The mechanical power they require can be furnished by hand or foot and the electric motor is frequently more or less of a luxury for them (household motors, dentists' motors, etc.).

Where the motor is used as a money-earning element, for instance in workshops of small trades people, the valuation of electric power will vary between different trades with its earning power. The price of electric power will not be of such importance to the jeweler who uses it for polishing jewels as to the man who uses electric power for pumping water or crushing stones. Moreover, in one trade electric power will be more of a luxury whereas in another one it will be a necessity.

The valuation of electric light, as far as the influence of the competitive illuminants goes, will be determined by the price of gas and kerosene. The advantages of the electric light, such as convenience, cleanliness, reduction of fire hazard, absence of pollution of the air, etc., will play a greater part in the customer's valuation if he is well-to-do than if he is poorer, because a wealthier man will generally be more willing to lay out a little extra money for these advantages than the man who has to be careful how he spends his pennies.

For all these reasons no general rules can be laid down for the relative valuation of light and power for smaller consumers. But these small power users receive their power under the lighting rates anyway so that this question is not of great importance.

102. A decided difference in the valuation on the part of the customer is seen when we compare heating service with lighting (or power). This will

[4] Industrial motors, railways, elevators, refrigerating, pumping and irrigating, ventilating, motor-generators for electroplating or telephones, etc. Also battery charging for automobiles as this energy is ultimately consumed in motors.

[5] Industrial heating, such as ovens, and domestic heating, such as cooking, flatirons, radiators, etc. "Heating" may also include electric welding, also electric steel making and other electrochemical processes.

[6] Here again the reader is warned against confusing the question of profit-adding with the question of the price per kilowatt-hour. Power consumers generally are charged much lower prices per kilowatt-hour because they are long-hour users.

be understood from the following. A steam engine or steam turbine, even of the largest and most economical type, utilizes certainly not more than 20% of the heat energy generated in the boiler furnace. The remaining 80% is not converted into mechanical energy and is lost. About one-fourth or one-third of the mechanical energy at the turbine shaft is then lost in the course of converting it into electrical energy and of transforming and transmitting the same, so that even in the most economic cases certainly not more than about 12 or 15% of the energy contained in the coal arrives at the customer's installation. Further conversion from electricity into useful heat then takes place at a very high efficiency, generally near 100%.

Assuming now that a competitive direct-heating device—stove, furnace, etc.—utilizes only one-seventh of the heat contained in the coal and lets the rest escape into the flue, we can see that we use just as much coal for electric heating as for direct heating by fire. If the electric light company under these conditions would charge the heating customer nothing but the bare cost of coal, the consumer would find that the cost to him of heating from both sources is about the same.[7] Now electric heating has not only the ordinary advantages of electric service, such as convenience, etc., mentioned above several times, but also others, such as easy temperature regulation, concentration of the heat at the point where it is needed, or uniform heat distribution, as the requirements of the case may be, absence of contamination by combustion gases, possibility of reaching extremely high temperatures, etc. These advantages make electric heating superior to other methods, for instance in electric steel making. Electric heating can therefore in certain cases compete with direct heating by fire even though the price per heat unit utilized is higher. But even then the above reflections show that we have generally to be satisfied with an extra low profit on heating service if we want to get the business.

(To be continued.)

INTERESTING SAFETY EXHIBITS AT CLEVELAND SAFETY CONGRESS.

Exhibits from Far and Near—Electrical Companies Among the Many Exhibitors.

Safety exhibits from Japan, England and Canada, in addition to commercial and noncommercial exhibits from all parts of the United States, are being shown in Gray's Armory, Cleveland, Ohio, during this week in connection with the eighth annual congress of the National Safety Council.

Though the safety movement originated in England, America has made much greater progress in accident prevent work that the Britishers now acknowledge the leadership of America in this respect and are looking to this country for guidance in organized safety work.

Among the exhibits shown at the Cleveland Safety Exposition is one brought to the general office of the National Safety Council at Chicago recently by Baron K. Uchida, former governor of Formosa, Japan; this exhibit includes pamphlets, posters, bulletins, flags and other advertising matter used during Safety Week which was conducted in Tokio in June of this year almost identically along the lines of the Cleveland Safety Week. It is significant that although this was the first attempt at organized safety work in Japan, Tokio's Safety Week proved to be a "No Accident Week" in fact as well as in name. Tokio has a population of approximately 3,000,000 persons.

It is interesting to note also that the British exhibit at Cleveland defines the safety movement in the words of an American: "This is what 'Safety First,' or being careful, means . . . . and the end is, that the workman shall live to enjoy the fruits of his labor; that his mother shall have the support of his arm in her age; that his wife shall not prematurely become a widow or his children fatherless; that cripples and helpless wrecks, who were once strong men, shall no longer be a by-product of industry."

The exhibits are largely educational and include also many displays of safety devices, guards, safety inclosed switches, lighting equipment to promote safety. etc. Electrical manufacturing companies are quite well represented among the exhibitors as follows:

Benjamin Electric Manufacturing Co., Chicago.
Central Electric Co., Chicago.
General Electric Co., Schenectady, N. Y.
National Lamp Works of General Electric Co., Cleveland, Ohio.
John A. Roebling's Sons Co., Trenton, N. J.
Square D Co., Detroit, Mich.
The Buda Co., Chicago.
The Trumbull Electric Manufacturing Co., Plainsville, Conn.
Thompson Electric Co., Cleveland, Ohio.
Westinghouse Electric & Manufacturing Co., East Pittsburgh, Pa.

ELECTRIFICATION OF RAILWAY FROM CHRISTIANIA TO DRAMMEN.

The Norwegian Government has recently accepted the bids submitted by three Norwegian firms for the electrification of the railway from Christiania to Drammen. The three companies are: A/S Norsk Elictrisk & Brown Boveri; Norsk Maskinindustri, A/S; A/S Per Kure.

The bids include 18 normal gage electric locomotives, which are to be built at Thunes Mekaniske Verksted at Christiania. This is the first definite step to be taken in the plan for the electrification of the entire Norwegian railway system. The power is to be obtained from the Hakavik power station, which is located not far from Kongsberg, Norway, where can be produced about 25,000 hp.

POWER PLANT DEVELOPMENT ON THE RHONE RIVER PLANNED.

A scheme for the utilization of the water power of the Rhone and other rivers in central France is under consideration by the French Ministry of Public Works. A canal will be constructed which will make the Rhone navigable for ships of 1200 tons capacity from the sea to Switzerland and a number of power stations will be constructed on the river. Concessions for the development will be given to a company which is capitalized at $40,000,000. It is anticipated that 200,000 kw. of the power generated by the Rhone power stations will be supplied to the city of Paris.

[7] In hydroelectric central stations we would likewise have to charge prices with much lower profits than the average for the same reasons, because the total cost of hydroelectric service is of the same order of magnitude as steam-electric service, though the energy cost frequently is lower. Where we have generation from water power in a region where fuel is expensive, such as in certain parts of the West in the United States or in Sweden, the field for electric heating is better than where fuel is cheaper, especially where the heating load is essentially off-peak, so that the increment demand cost is zero.

Development of the Chicago Street-Lighting System

Progress Made by Chicago Department of Electricity — Metallic Flame Lamps—Installation and Operation of Series Group Systems — Paper Before International Association of Municipal Electricians

By WILLIAM G. KEITH
Commissioner of Gas and Electricity, Chicago, Ill.

DURING the year 1887 the first municipal electric light plant for lighting the city's streets was established in the basement of a fire engine house and 105 open arc lamps were placed in service on the river front and downtown streets. Each year thereafter additions were made both in lamps and equipment, until in 1897 a total of 1440 lamps operated from three stations, constituted the municipal electric light plant. This plant was operated as a bureau of the fire department.

In January, 1898, the city council created by ordinance the department of electricity. The report of the city electrician for that year shows that a total of 1710 lamps were maintained at a total cash cost of $68.52 each.

From this time on progress was made as regards extensions to the system and decreased cost of maintenance. The 1908 annual report showed a total of 8602 lamps maintained at a total cost of $45.86 per lamp. During that year the power generated by the Sanitary District at Lockport was made use of to displace the steam engines as a source of energy for street lighting. Extensive alterations were made necessary by this change and the way was opened for future extensions of a magnitude hardly thought possible before.

City Installs 10,000 Additional Lamps.

In October, 1910, a contract was made with the Sanitary District whereby it was to furnish and install on the streets of the city 10,000 arc lamps in addition to those in service at that time (approximately 12,200). They were also to build the necessary substations, conduits and pole lines and supply the energy necessary to operate the total number of lamps. The energy was to be furnished on the basis of $15 per hp-year of 4000 hrs., or ½ cent per kw-hr. In addition, the Sanitary District undertook to operate the substations and plants at a cost to the city of $1 per arc lamp per year. The reason for this last undertaking on its part was that it desired the use of the station buildings and the transmission lines to furnish electrical power and light to private consumers during the time such buildings and lines were not required for city lighting purposes.

The construction contract was mutually advantageous in that the city came into possession of an electric street-lighting system second to none in the world at a cost per lamp as low as any contracting firm could make, and the payments were so arranged that they spread over a period of seven years. The Sanitary District developed a load for the waterpower and equipment then installed and perfected their organization.

During the year 1911 the metallic flame lamp was improved and, as the most efficient source of illumination on the market, was adopted by the city for installation under the terms of the contract. At that time these lamps were the most suitable units for lighting open spaces, but the streets in residential districts with their overhanging trees made the selection of a small unit desirable. The 80-cp. incandescent lamp, operated in series circuits with armored cable laid in the parkway, made an ideal installation for this purpose.

As work on the contract progressed, the need for more lights to make an economical rearrangement of the existing lamps was made evident, and a supplemental contract similar to the original for 1000 lights was executed.

These two contracts for extending and changing the system were so worded as to be interpreted in terms of watts. Use was made of this interpretation to take advantage of the progress in the art of lamp manufacture and after approximately 10,000 flame lamps had been purchased and installed it was decided to adopt the 600-cp., 20-ampere, series, gas-filled lamp as a standard for open space lighting and continue the low candlepower units for residential streets, these units having been increased in candlepower to 100 and reduced in watts from 100 to 75.

All this required a great deal of money as well as careful engineering attention. To handle the contract obligations satisfactorily the city had to perfect an engineering organization. This force of men had to survey the city streets and definitely locate the position of each lamp. They made estimates and specifications for all the varied materials used, both in underground and aerial construction, and they compiled accurate maps and plans from which the Sanitary District did the work. While the work was in progress inspectors watched each detail and reported to their bureau chief.

Monthly reports of materials used and men employed were received by the city from the Sanitary District and these reports after being compared and checked with the inspectors' reports were approved and formed the basis on which payments were made.

To light one mile of street, using 23 flame or 600-cp. lamps, placing all wires underground, cost approximately $9000, while if the wires were placed aerially on steel poles the cost amounted to only $4000.

On some of the residence streets where the trees act as an obstruction to the light from arc lamps, the system of underground cables and tungsten lamps mounted in opalescent globes on the old gas posts has been installed. This type of construction costs $8000 per mile of street lighted, using 75 of the tungsten lamps spaced 140 feet apart on each side of the street.

Approve Bond Issue for Lighting Extensions.

The construction work during the previous years had provided adequate illumination in most of the older parts of the city, few extensions having been made in the newer parts of the city. It was necessary to do this because the system had not kept pace with the increasing need. The demands of the outlying districts for increased illumination were now to be met. To do this the voters, in June, 1916, approved a bond issue of $3,750,000. South Chicago, Englewood, Grand Crossing, Roseland, West Pullman and the Northwest Side north of Diversey avenue were still in comparative darkness and it was in these sections of the city that most of the proposed lights were to be placed.

The value of street lighting as a municipal asset is no longer questioned. Adequate lighting is necessary for the protection and convenience of citizens. Without it no city can attain the highest degree of success. That lights are needed is evidenced by the number of complaints which reach the department daily. In most cases little relief has been given because of the lack of facilities for operation and because of the insufficiency of funds for construction and operation.

An engineering survey of the city was made and it was decided to place low candlepower lights in residential districts mounted approximately 10 ft. above the street level. On those streets used by car lines and for fast moving vehicles, a 600-cp. unit mounted 22 ft. above the street was selected.

In all previous installations of low candlepower lamps a series circuit connecting over 200 of the lamps was laid from lamp to lamp in the parkways. Each lamp was in direct contact with the high-tension source of energy.

Installation of Series Group System Reduces Costs.

To continue placing high potential within reach of the public was not considered safe and to eliminate this hazard it was decided to use individual transformers at each lamp location. Further analysis showed that the placing of lamps in series groups of about 20 to the group and operating these from series transformers located in manholes would reduce the costs by over 13%. Plans were prepared to carry out the work in this way.

The typical circuit for street lighting in Chicago will consist of an impedance regulator in series with a 5050-volt, 60-cycle source of energy, and approximately 22,000 feet of underground conductor insulated for 5050-volt operation. Located in manholes central to the territory to be lighted, with their primaries in series with each other and the high-tension cable, will be series transformers of suitable capacity.

The secondary of each transformer, with a permanent connection to earth at the center of the winding, will be connected to a series circuit of approximately 3800 feet of conductor insulated for 600-volt operation. Approximately twenty 100-cp. 6.6-ampere, type "C" series lamps, equipped with 110-volt film cutouts, will be connected in series with each of these secondary circuits.

The large saving in cost over the individual transformer method is due to the use of low voltage cable in place of high voltage, and the centralizing of the transformer capacity. The transformer vaults tend to offset this saving, while labor is approximately the same, making a net saving of over 13%.

The substation transforms from 12,000-volts, 60-cycle, three-phase delta to 5050 volts to neutral, 60-cycle, three-phase Y, with neutral grounded. Group lighting circuits are run from each phase through a 6.6-ampere, constant-current impedance regulator through the series transformers and back to grounded neutral in the substation. A typical circuit consists of the following items:

(a) A source of 60-cycle, 5050-volt energy.

(b) One overload and underload automatic oil switch.

(c) One 6.6-ampere, constant-current regulator.

(d) 8000 feet No. 8 B. & S. solid copper conductor insulated with a 3/16-in. wall of saturated paper for 5000/8660-volt operation and surrounded by a 1/8-in. lead sheath.

(e) 16 (4 groups of 4) 6.6/6.6-ampere series transformers, each to operate twenty 100-cp., 6.6-ampere series type "C" lamps, in series with 3800 ft. of No. 8 B. & S. gauge solid copper conductor insulated and armored for 600-volt operation.

(f) 3000 feet (3 lengths of 1000 ft.) No. 8 B. & S. copper conductor, armored, 3/16-in. varnished cloth insulation for 5000-volt operation.

(g) 3000 feet of 5000 volt armored cable as item (f).

(h) 8000 feet of No. 8 B. & S. solid copper conductor as item (d). This conductor terminates through an air-brake switch on the grounded neutral bus.

This method of operating street lamps had never been tried on a large installation and several questions arose as to the operating difficulties that might be encountered. A thorough consideration of the subject, supplemented by tests, established the following facts:

Phenomena with Open Circuited Secondary of Series Transformer.

The first consideration is the effect on the operating circuit when from any cause the secondary circuit of any transformer opens.

Practically all the current drawn is due to resistance load, and a sine wave of e.m.f. would therefore send a sine wave of current over the circuit. In the event that one of the group transformer secondaries should open, a full 6.6-ampere sine wave current would be forced through the primary, with the result that a peaked e.m.f. wave would be induced in the secondary and impressed on the open group.

By a graphical method the magnitude of this e.m.f. has been found to be 1.95 volts per turn per sq. in. of core, and the root-mean-square value 0.568 volts per turn per sq. in. of core. As a transformer of this size will have approximately 182 turns secondary and 5¾ sq. in. of core, we can expect a maximum voltage of 2040, or a root-mean-square voltage of 595 volts to be impressed on the secondary circuit until such time as the short circuiting devices provided shall operate.

As the cables are tested for five minutes with a root-mean-square voltage of 1500 volts, or a maximum voltage of 2120 volts, there is no danger of cable failure.

To guard against this potential remaining on the secondary circuit during the period of open circuit each lamp is provided with a film cutout that will puncture and short-circuit the lamp at a potential of approximately 100 volts. In addition to this, each transformer is provided with a short-circuiting device that will operate to short-circuit the secondary when the potential reaches 400 volts. This protection is designed to operate when for any reason the secondary circuit is interrupted at some point not protected by the lamp cutouts, as, for example, a post falling and breaking the conductor.

Induction.—Tests on the cable to be used for the 5000-volt circuit show that the steel armor forms such a good path for the magnetic flux that little or no benefit can be expected by placing the sides of a circuit in the same trench, while the armor in places makes impossible the transmission of electrostatic disturbances from one cable to another.

Charging Current.—When the original series tungsten circuits were placed in service a marked difference in the value of the current at the two ends of the circuit was observed. This difference was due tc a charging current combining with the line current and it was found necessary to correct the difference by inserting reactance at the point where the circuit connected to its return conductor.

A diagram of the various currents in the different parts of the proposed circuit combined in their vector relationship shows that while there is a difference in current value of 0.07 of an ampere between the two station ends of the circuit, the actual difference of current between the first and last transformers is only 0.033 of an ampere and is negligible.

Power Factor.—The transformers with their lamp load have a power-factor better than 98.5%; the cable has a power-factor of 95.8% as against 91.2 for that used in former installations. The regulator power-factor is very slow, making a combined power-factor of 81.3. The charging current combines to correct this to 89%. This is 1% better than that of straight series tungsten lighting and 1.5% better than 600-cp. series compensator circuits, and in addition has the advantage over straight series tungstens of localizing lamp outages when post failures occur.

Size of Conductors.—The wire sizes selected for the group lighting circuits were determined by equating the interest and depreciation on the cost of cable against the cost of losses when using such cable. These calculations resulted in sizes considerably smaller than the No. 8 selected, but the latter size was chosen rather than the small size for mechanical reasons.

PENETRATION OF MOISTURE IN INSULATING MATERIALS.

Many samples of standard insulating materials have been tested for penetrability of moisture. A large variation in penetration is shown. Untreated papers show immediate penetration, whereas paper impregnated with various insulating compounds, treated cloth or condensation products like bakelite micarta, show very small penetration. None of the standard insulating materials may be called moisture proof.

Where the penetration of moisture is slow, little difference is noticed whether the sheet is in contact with water or the saturated vapor. Several thicknesses of bakelite micarta were used, the penetration in this case being nearly independent of the thickness up to 1/64-in., which is 1.5×10^{-6} gms. H_2O cm.^{2} per hour. Plotting gms. H_2O against time a small rapid increase in water is first observed followed by a much longer period, with practically no increase in water (time of penetration and dependent upon thickness), and then a gradually increasing amount of water, the slope of the curve remaining almost constant, which value is representative of the rate of penetration.

Several qualitative methods were first tried: (1) Colormetrically, by placing anhyd. $CuSO_4$ or $CoCl_2$ on glass plate upon which is placed the insulating material. Wet blotting paper is weighted down upon the sample and change in color noted upon penetration. Certain dyes soluble in water may be also used with good results. (2) Electrically, by conductivity change with increase of moisture measured when insulating material is placed between Hg. surface and weak salt solution. (3) Quantitatively, by collection of moisture in P_2O_5 tube, or difference in pressure of penetration water vapor when released from liquid air trap by sensitive optical manometer method.

The method now in use may be briefly described as follows: Two 100-c.c. bulbs with stopcocks at necks and common connector for high vacuum system, each having flanged tube 1.5 cm. diameter leading from the side, are so arranged that the ground flanged surfaces fit together so that the apparatus is gas-tight. Through a ground joint in one bulb a weighed P_2O_5 tube is introduced. The opposite bulb contains a small amount of H_2O and the whole apparatus may be placed in a position so that the water will come in contact with the insulating material sheet which is held as a diaphragm between the bulb chambers. It is sometimes necessary to use rubber gaskets to make a tight joint between the sample and ground surfaces of the flanged side tubes.

The whole apparatus may be placed so that the water or water vapor in one bulb may come in contact with the diaphragm. Dry air is admitted each time a weighing is made.

Where rate of penetration of H_2O is small, and to eliminate the weighing errors, a pressure difference due to penetrated moisture is measured. In this case a trap attached to the lower end of the dry bulb is used to freeze out the penetrated water vapor. When freezing mixture is taken away the difference in pressure is measured by means of the Shrader optical manometer gage.

The above is gleaned from the September issue of the *Journal of the Franklin Institute*, in which appears at frequent intervals a number of notes from the research department of the Westinghouse Electric & Manufacturing Co.

CINCINNATI UNIVERSITY AFFILIATES WITH NATIONAL SAFETY COUNCIL.

The National Safety Council has effected an affiliation with the University of Cincinnati for the purpose of carrying out a new program of education in the field of accident prevention. It includes the establishment of an industrial medicine division at the University of Cincinnati where medical students and graduate physicians will be given special training not only in industrial medicine, but in industrial relations, including sanitation and all the fundamentals of safety work as well. The plan is being carried out jointly by the college of medicine of the University of Cincinnati and the Cincinnati local council of the National Safety Council and is said to represent the first attempt in America to train doctors for industrial work. The Cincinnati plan is an outgrowth of the call during recent years for industrial physicians.

Methods of Increasing Capacity of Existing Transmission Lines

Line Limitations—Determining Relative Costs of Increasing Capacity —Considerations Involved — Paper Before Pennsylvania Association

By E. C. STONE
Duquesne Light Co.

DURING the war the problem of increasing the capacity of existing transmission and distribution lines was one of getting the increased capacity in the shortest possible time—availability was often of more importance than cost. Now it may be assumed that the problem is one of getting the additional capacity at the least cost consistent with reliability of service. More time may be taken to get the increased capacity at a lower cost. The rapid growth of the load on central station lines has been primarily in power, so that the discussion which follows will deal particularly with three-phase power circuits.

Line Limitations.

In order to intelligently attack the problem of increased capacity of existing lines, the factors which limit this capacity must first be studied. The carrying capacity of a given line is limited by

(*a*) Maximum number of amperes it can carry as determined by heating, voltage regulation or economy of operation.

(*b*) Maximum voltage at which it can be operated as determined by insulation.

(*c*) Power factor of load carried.

Since the power delivered by a line depends entirely on these three factors, it is obvious that the capacity of a line can be increased only by increasing one or more of these factors.

Increase in current carrying capacity is accomplished by increasing the line copper—the physical limitation being the weight of copper which the poles can carry. Increase in line voltage is accomplished by increasing the size of the insulators and if a great increase in voltage is made, by providing greater spacing between line wires. The limitations encountered are usually the practical ones of insufficient clearances along rights of way, municipal regulations and the like. Increase in power factor will be discussed in a later paragraph.

In a given case the factors which are to be increased—current, voltage or power factor—will be largely determined by the total cost involved. The subject of voltage regulation, however, should be very carefully considered in this connection. Voltage regulation is a quality of electric power service and must be maintained good at all times. Motors and other apparatus utilizing electric power, especially control equipment, will not operate satisfactorily over too wide a range of voltage; in fact, the lack of good voltage regulation is one of the commonest faults of electric service and is particularly annoying to the power user, because it reduces the torque which his motor can develop at just the time when he needs the greatest torque. In some cases when the line voltage is too low for the loads and distances involved, voltage regulation even limits the carrying capacity of a line to a current below that which the legitimate limits of heating or economy of operation would allow it to carry.

In Fig. 1 are shown the approximate relations between line capacity, costs and voltage regulation when increased capacity is obtained by increasing the copper and by increasing the insulation. The enormous difference of the cost of securing increased capacity of the line only by these two methods is vividly brought out. It will be seen that improvement in regulation by increasing line copper is prohibitive because of the enormous cost, but improvement in line regulation by raising the voltage usually brings an actual reduction in cost, for ordinarily when the regulation is excessive, a raise in voltage will mean material reduction in total distribution cost. In a general way, voltage regulation is not only a criterion of service but is also a criterion of line cost, and when it becomes excessive, it is pretty safe to say that money

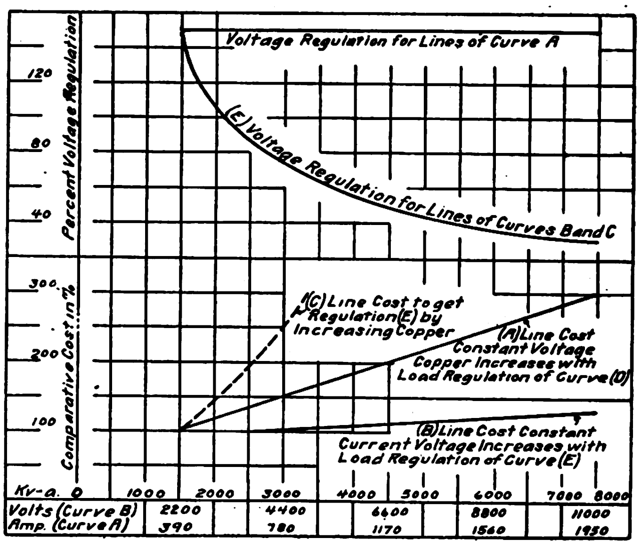


Fig. 1.—Approximate Relations Between Line Capacity, Costs, Voltage Regulation When Increased Capacity Is Obtained by Increasing Copper and Increasing Insulation.

can be saved both in investment and operating cost by increasing the line voltage.

In practice, the cost of consumers' installations connected to the line must be considered as well as the cost of the line itself. The cost per kv-a. of these installations decreases as their size increases, because of the smaller unit cost of transformers, fuses, lightning arresters, etc., for the larger capacities. Their cost also increases as the voltage at which they are to be operated increases, the increase in cost with increase in voltage being more rapid for small than for large installations. Usually, however, the insulation of equipment used on 2300-volt delta-connected transformer installations is sufficiently high to permit of operation on a line voltage of 4000, this being accomplished by changing the connections of the transformer primaries from 2300 volts delta to 4000 volts star. Under such circumstances no additional cost will be incurred in changing transformer installation

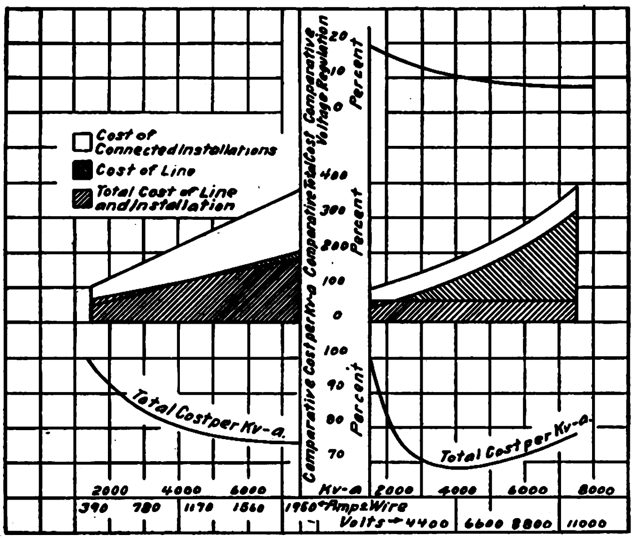


Fig. 2.—Relative Costs and Voltage Regulations for Increasing Capacity Including Lines, Connected Installations and Substations.

to 4000 volts. For a specific case, the extent to which copper or voltage will be increased depends on the cost of the line in relation to the cost of the connected installations. When the cost of the line is high compared to the cost of connected installations, increase in capacity will demand a considerable increase in voltage.

This condition exists when the connected installations are of large capacity and scattered, and the line copper already installed loads the poles heavily. When the cost of the line is low compared to the cost of connected installations, it will not be desirable to increase the voltage so much; it might prove more economical to increase the copper. This condition exists when the connected installations are small and close together and the poles are not already carrying much copper. In general, large connected installations, scattered load, long average transmission distance, make for more voltage and less copper; small connected installations, dense load, short average transmission distance make for less voltage and more copper.

In Fig. 2 the relative costs and voltage regulations are shown for increasing the capacity of a given 2200-volt distribution network by increasing the voltage and by increasing the copper, with lines, substation equipment and connected installations all taken into account. It will be seen that the least cost per kv-a. handled is obtained with voltages of between 4000 and 7000, while the regulation comes down, rapidly at first, from 20% at 2300 volts, to 8% at 11,000 volts. Going still farther, in Fig. 3, costs of line, sub-station and connected installations per kv-a. handled are shown for various capacities at each voltage. These curves indicate that for the case at hand, for any capacity up to about 4500 kv-a., 4000 volts gives the lowest cost, while for loads above 4500 kv-a., 6600 volts shows slightly lower cost than 4000 volts. In the matter of voltage regulation, 14% is obtained at 4000 volts, while 10% is gotten at 6600 volts as against 20% for 2300 volts. From the point of view only of cost, therefore, there is not much difference between 4000 and 6600 volts. If, however, the higher voltage were practicable, it would be desirable because of the better regulation.

Tabulated are shown the data required and method used for calculating the results on cost per kv-a. indicated in Figs. 2 and 3. By determining this data for a given distribution system whose capacity is to be increased, and calculating the cost per kv-a. of the greater capacity, as indicated in the table, the most economical voltage can be determined with a very fair degree of accuracy. Distribution losses are not taken account of in these figures, but it is a reasonable assumption that the increased losses of the higher voltage transformers will be more than offset by the decreased line losses at the higher voltage. In determining the voltage to be used, due weight should always be given to the better regulations obtainable at the higher voltages.

Influence of Power-Factor.

If the load carried by a line has a power-factor of less than unity, the capacity of the line can be increased by improving the power-factor, since the kilowatts of power which each ampere on the line will deliver is directly proportionate to the power-factor. If, for example, the power-factor of a given number of amperes on a given line is increased from 80% to 100%, the number of kilowatts will be increased in to 100%, the number of kilowatts will be increased in the ratio of 80 to 100, or 25%, without increasing the amperes on the line. The improvement of the

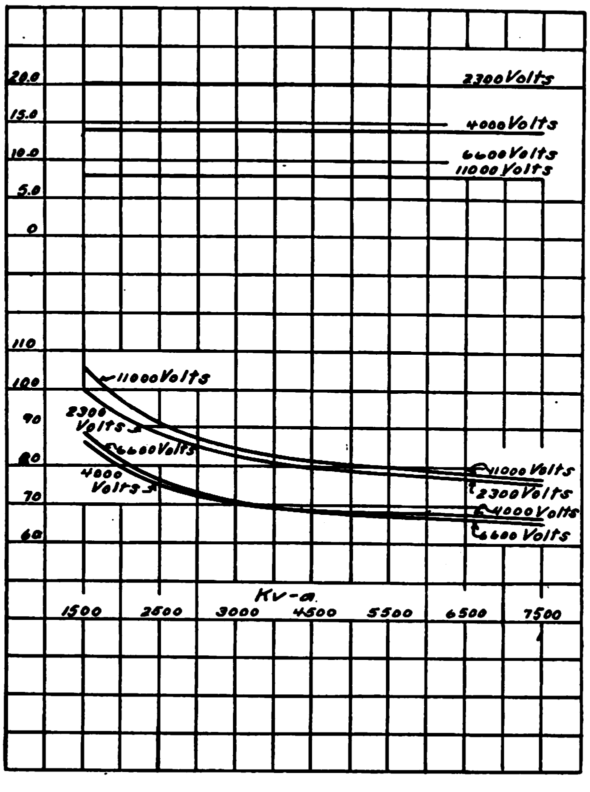


Fig. 3.—Costs of Line, Substation and Connected Installations Per Kv-a. for Various Capacities and Different Voltages.

power-factor not only decreases the cost of line per kilowatt by increasing the line capacity, but also decreases the cost of generating and transforming equipment. It, therefore, pays to spend money to improve power-factor as long as the total saving in line, transforming and generating equipment is greater than, or equal to, the cost of making the improvement.

DATA FOR DETERMINING VOLTAGE AND LINE COPPER TO SECURE INCREASE IN CAPACITY OF A DISTRIBUTION NETWORK AT MINIMUM COST.

	Existing system.	Required increase			
Kv-a. measured at substation	1,500	4,500	4,500	4,500	4,500
Line voltage	2,300	2,300	4,000	6,600	11,000
Cost of substation transformers	$ 5,000	$ 15,000	$ 15,000	$ 18,000	$ 20,000
Cost of present connected installations	15,000	15,000	15,000	18,000	25 300
Estimated cost of new installations sufficient to absorb increased capacity	.....	30,000	30,000	36,000	50,700
Cost of pole line	15,000	20,000	17,500	16,500	19,500
Cost of line copper	15,000	45,000	26,000	15,000	9,000
Total cost	$50,000	$125,000	$103,500	$103,500	$124,500
Total cost per kw.	$33.33	$27.80	$23.00	$23.00	$27.70
Voltage regulation, per cent	20	20	14	10	8

More money can be spent in improving the power-factor when the line costs are high, *i. e.*, in general when the voltage is too low for the loads and transmission distances involved and cannot be increased to the proper amount on account of external limitations.

The power-factor of the load also affects the voltage regulation. This is shown in Fig. 4. Where the line wires are large—No. 1/0 or No. 4/0, for example—voltage regulation improves very rapidly as the power-factor is raised. As the wires become smaller, the effect of power-factor on regulation grows less, and for No. 3, or smaller wire, becomes so slight as to be unimportant. Looking at this effect from another viewpoint, for a constant power-factor and load proportional to conductor cross-section, the voltage

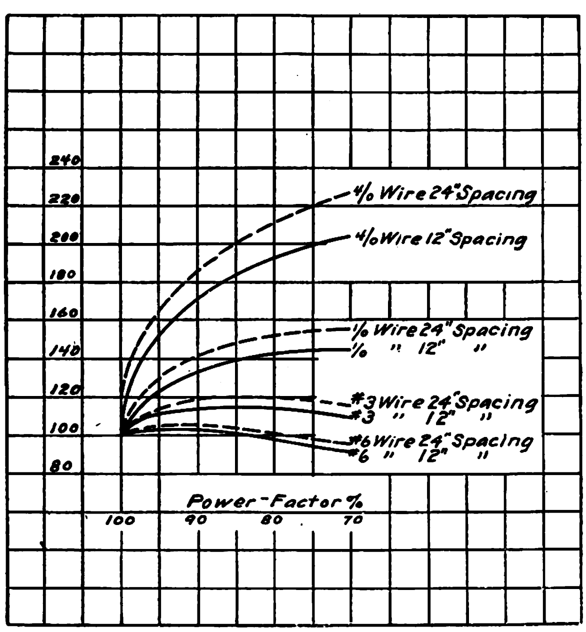


Fig. 4.—Effect of Power-Factor Upon Voltage Regulation.

regulation becomes rapidly poorer as the line wire becomes larger. This result must be watched when increasing the copper in a line by replacing a small line wire, such as No. 3, with a No. 1/0 or No. 4/0 wire.

Low power-factor on central-station systems is due chiefly to induction motors and can be improved by fitting the installed motor capacity more closely to the load, by replacing induction motors with synchronous motors where possible, or by installing corrective apparatus, such as synchronous or static condensers, phase advancers, etc. This apparatus should be installed as near as possible to the load which causes the low power-factor. Such corrective apparatus either may be installed by the customer or by the central station. If it is to be installed by customers, a power-

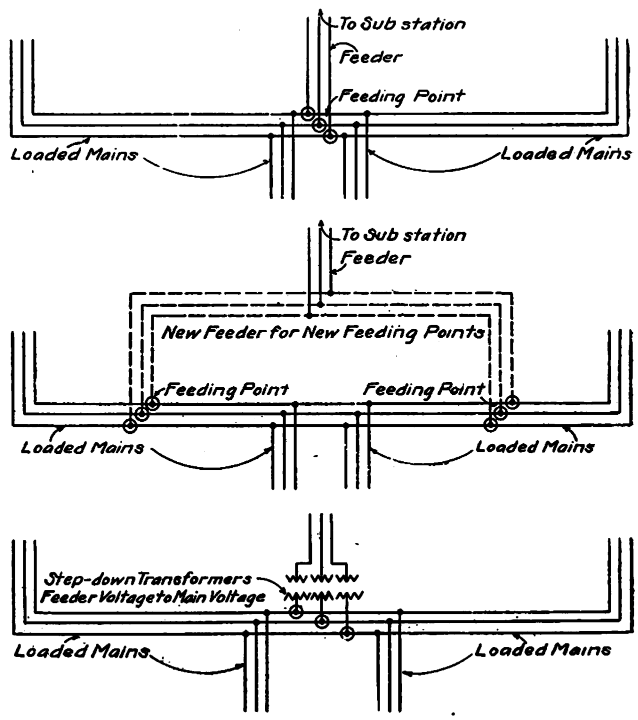


Fig. 5, A, B, C.

factor clause should be inserted in the rate schedule, by which the rate will be decreased as the power-factor is raised, in order that the customer may be compensated for the additional expense involved in improving his power factor.

Increasing Distribution Voltage.

In almost every actual power distribution network, where an existing 2300-volt system is sufficiently loaded to require an increase in capacity, it will be found desirable and economical to increase the line voltage from 2300 to 4000. Ordinarily, the insulation of line and connected installations on a 2300-volt system is heavy enough to stand 4000 volts, so that the only change necessary is to reconnect transformers from delta-delta to star-delta. In some cases it may be necessary to provide substation transformers with more insulation on the secondary windings or to modify somewhat the substation switchboard; if, for example, single-phase circuits are fed from the same substation transformers as the three-phase circuits, it will be necessary to install separate transformers for the two classes of circuits, or to run a fourth bus to the neutral of one star connected bank and connect the single-phase circuits between this neutral and the line busses. Or where single-phase installations are already connected between line wires, new transformers for 4000 volts primary may be required. These items are generally unimportant, so that by changing the voltage of a distribution network from 2300 to 4000, an additional 73% capacity and a materially better regulation can be obtained at practically no cost. On systems operated at more than 2300 volts, where the transformers are connected in delta-delta, a raise in voltage of 73% can be similarly accomplished by reconnecting the transformers for star primary, but transformer and line insulation will not be sufficient to stand the higher voltage, unless original conditions are retained by dead grounding the neutral of the substation transformers. When this is done, the potentials to ground with the star connections and higher voltage between line wires are held to the same values as existed with the lower line voltage and free neutral. There is, however, a serious objection to the dead grounding of the neutral, in that every time a line wire becomes grounded, a short circuit is produced and the circuit is interrupted. A distribution network with grounded neutral will always suffer more interruptions than will one with a free neutral.

If it becomes desirable to increase the line voltage by more than 73%, it will be necessary to reinsulate the lines and install new transformers throughout. To justify the latter requirement, some use must be found for the transformers discarded; on growing systems this is not difficult, for they will soon be used up in other localities where the load has not yet developed sufficiently to justify the higher voltage.

Where installations connected to a network are grouped in a system of mains supplied by a feeder connected in at a central point, increase in capacity can be obtained by increasing the number of feeding points and increasing the capacity of the feeder only by increasing its copper or raising its voltage. This scheme is shown diagrammatically in Figs. 5 b and d. The capacity of the mains will be in direct proportion to the number of feeding points, if these are properly placed. The proper placing is accomplished by dividing the network into as many parts as there are proposed feeding points, each part containing an equal load; the feeding point for each part will then be placed at the center of its load. Sometimes where a few large customers represent most of the load in a given network, but there are also connected a large number of small customers which constitute only a small part of the total load, it will pay to run two parallel mains from the same feeder—a high voltage main for the large installations and a low voltage main for the small ones. The feeder will be at the high voltage and will supply the low-voltage main through step-down transformers, see Fig. 5e.

In cases where voltage regulation is a limit to the

TABLE OF SCHEMES FOR INCREASING CAPACITY OF EXISTING LINES—SEE ALSO FIG. 5.

Explanation of Symbols:	Existing conditions.	Proposed conditions with increased capacity.
Line voltage	E1	E2
Numbers of feeding points	K1	K2
Cross-section of line wire	C1	C2
Power-factor	Pf1	Pf2

Scheme No.	Reference Fig. No.	Method of increasing capacity.	Changes required in line.	Changes required in substation and connected installations.	Line regulation reduced in ratio.	Capacity increased in ratio.	Availability.
1	5a	Original system.	....	....	......	......	....
2	5b	Increase cross section of line wires from C1 to C2	Increased copper.	None.	1	$\frac{C2}{C1}$	Very small and numerous connected installations. Short transmission distances. Not much copper on poles.
3	5a	Increase voltage from E1 to E2	New insulators throughout. Possibly more clearance between wires.	New transformers throughout.	$\frac{E1}{E2}$	$\frac{E2}{E1}$	Large connected installations. Long transmission distances, heavy copper on poles.
4	5a	Special case of No. 3—Increase voltage from E1 to $\sqrt{3}$ E1	None.	Connect all transformers star-delta. Ground neutral of substation transformer bank	$\frac{1}{\sqrt{3}}$	$\sqrt{3}$	See No. 3. Grounding of neutral may cause excessive interruptions to circuit.
5	5a	Special case of No. 4—Increase voltage from 2300 to 4000.	None.	Same as No. 4, except that neutral need not be grounded. Slight changes sometimes at substation.	$\frac{1}{\sqrt{3}}$	$\sqrt{3}$	Available in almost every case to obtain 73% increase in capacity. Very desirable.
6	5c	Increase cross section feeder and increase number of feeding points from K1 to K2.	Increase feeder copper in ratio $\frac{K2}{K1}$	None.	None	$\frac{K2}{K1}$	Short feeder lengths. Many connections. Average size small—grouped close together.
7	5d	Increase feeder voltage from E1 to E2 and feeding points in ratio $\frac{E2}{E1}$	New insulators on feeder only. Possibly additional clearance between wires. Step-down transformers between feeder and main at each feeding point.	New transformers at substation. No changes on connected installations.	$\frac{E1}{E2}$	$\frac{E2}{E1}$	Long feeders—heavy load. Many connections. Average size small—grouped close together.
8	5e	Increase feeder voltage from E1 to E2. Increase voltage on large connections to E2. Retain E1 on small connections.	New insulators on feeder and existing mains. Additional mains at existing voltage for small connections. Transformers between feeder and new mains.	New transformers at substation and on large connected installations. Small connections transferred to new mains.	......	$\frac{E1}{E2}$	May be used where greater part of load is on large connections, but remaining small part goes to very many small connections.
9	Any of above	Improve power factor of load.	None.	Install corrective apparatus at suitable locations as near as possible to origin of low p. f. May be done by customer of central station.	See Fig 5	$\frac{Pf2}{Pf1}$	Load largely induction motors or other low p. f. apparatus. Cost of line high, due to long transmission distance or too low voltage.
10	Any of above	Install voltage regulator at substation.	None.	None.	......	......	Desirable only when highest possible line voltage gives too poor regulation—regulator must be carefully adapted to load.

capacity of the line, even after line voltage and power-factor both have been raised as much as practicable, the capacity of the line may sometimes be brought up to the heating limit of the copper by the installation of voltage regulators at the sub-station. If this scheme is attempted, care must be taken that the regulators selected will operate satisfactorily on the particular load to which it is to be applied, for many types of regulators will be found impracticable when applied to loads having the rapid and wide fluctuations of the ordinary industrial power load.

In the foregoing discussion, it has been attempted to show how the need for increased capacity of power distribution lines and networks, brought about by the rapid growth of the central station power load, can best be met under different conditions. In general, power distribution systems are carrying at the original voltage for which they were designed, much greater loads than they were originally designed for, and their capacity can be best increased by increasing the voltage, both from the point of view of cost and quality of service as measured by voltage regulation. If the existing voltage is 2300, a raise to 4000 can generally be made very readily and in almost every case will be found desirable. By this means, an increase in capacity of 73% can be obtained with little

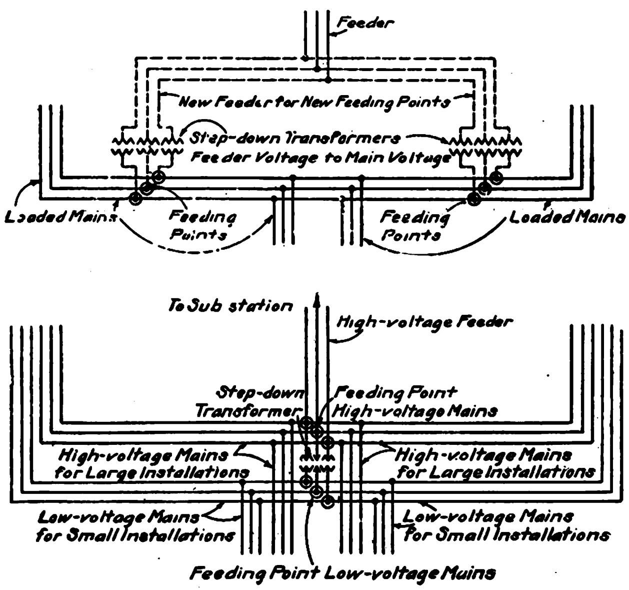


Fig. 5, D, E.

or no new equipment, and at very low cost. In some cases a greater increase in voltage will be desirable, in which case the reinsulation of lines and installation of new transformers will be required. Too high voltage, however, may prove as costly as too low voltage, because of the higher cost of connected installations, so that after the proper voltage is reached, further increase in capacity can best be obtained by increasing the copper. The highest voltage permissible is desirable, however, because of the better regulation which it gives. In some special cases, increased capacity of a distribution network may be obtained by increasing the feeder capacity only and providing additional feeding points for the mains, by raising the power-factor of the load carried, or by installing voltage regulators at the substation.

By way of conclusion, the accompanying tabulation is submitted, showing the various schemes which have been proposed above for increasing the capacity of existing lines.

PUBLIC UTILITIES LAW PROPOSED BY TEXAS MUNICIPALITIES.

League of Texas Municipalities Institutes Movement for Enactment of Law Governing Public Utilities in the State.

Many of the cities and towns of Texas, through their municipal officers, have joined in a movement to bring about the enactment of a public utilities law by the legislature at its next session. While a few of the members of the League of Texas Municipalities have voiced disapproval of the proposed law, the opposition from this source is not regarded as being of much moment.

It is announced that a business session of the League of Texas Municipalities will be held at Dallas on Oct. 18 for the purpose of receiving the report of a committee of its members which was appointed at a recent meeting held in Austin to draft a measure which would provide regulation of some nature of the public utility properties in Texas. At the Austin meeting the proposition was thoroughy discussed. Representatives of 52 cities were present and letters were received from many more who could not attend. At that time it was generally understood that a measure of some kind providing regulatory powers for the utilities was desirable, and the meeting finally agreed upon the appointment of a committee to draft tentative provisions. It was the plan to later call a meeting of the Texas mayors and submit the matter for their approval, after a copy of it has been sent to each for consideration and study.

In order to properly finance the league in its organization for the purpose of protection of the respective interests of the cities and towns, it was decided to levy an assessment upon each city on the basis of one cent per capita for each person, according to the 1910 census. The money to be collected will not be used for any purpose except the proper drafting of a bill to be presented to the legislature for the avowed curbing of the power of public utilities. It was specifically agreed that no paid lobby would be maintained to urge its passage. A number of state officials are reported favorable to such a regulatory measure.

LOSS FROM RUSTING OF STEEL.

It is now quite universally admitted that the rusting of iron and steel is one of the serious industrial problems. If we assume an average life of steel to be 33 years, the depreciation charge of 3% represents, according to the United States Bureau of Mines, a yearly loss of 1,000,000 tons of product in this country for the crude or semi-finished material alone, exclusive of correlated manufacturing costs. The inevitable rusting of steel may be justly claimed to be the mainstay of the zinc industry, as 60% of the metallic zinc used in the States is for galvanizing iron and steel articles, representing an annual outlay of $20,000,000 in an endeavor to protect metals from decay. Enormous amounts of paint are used in a like endeavor. About 5,000,000 tons of coal are needed in the production of steel to replace the annual waste, and 1,000,000 more for replacing the zinc that is annually lost. No estimate can be made of the value of the brass, bronze, copper, aluminum, nickel, tin and other metals and alloys used in machine parts, as sheathing, for plating, etc., to protect steel, or as a substitute for it in places where it would be used, but for its lack of resistance to atmospheric attack.

Editorial Comment

In the Cause of Safety

NO MORE important movement has taken place during recent years than the safety movement. It is one closely related to our industrial life, one interrelated to the well-being of every class, and one vitally affecting our economic and social welfare. During this week the largest convention ever held by the National Safety Council took place in Cleveland. The program presented was most extensive; every phase of industry was covered by papers on specialized subjects. The attendance was the largest in the short but successful history of the organization. It might be said that the rate at which the gospel of "safety" has spread has been phenomenal. The safety movement must be recognized as a factor in our industrial life.

The havoc wrought by death and suffering, the economic loss and the social and domestic problems created by accidents in the industries of this country are appalling. And this loss reacts throughout our national life in a thousand ways by creating widows and orphans, dependents and delinquents; causing poverty; breeding class bitterness and entailing economic loss. These are just a few of the phases of this vast problem of accident prevention that have been tackled so comparatively recently and that has progressed with such magnificent rapidity because of the justice of its cause and the urgency of its success.

If you have delayed so long, go over to the interests of the safety movement today. Affiliation with a recognized safety organization shows you realize your responsibilities; you have at least taken sides in this great issue of safety versus those tireless enemies—carelessness, thoughtlessness, recklessness and ignorance—that are taking an annual toll in this country exceeding that of the American army in the World War.

Each of us has done our part to make the world safe for democracy. Let each of us now do our best to make industry safe for humanity.

Increasing the Capacity of Existing Lines

VOLTAGE regulation is of paramount importance. It and continuity of service supply are the criteria of service. Upon voltage regulation depends revenue, since revenue from energy is based upon the product of current and potential.

However this is not all. Voltage regulation may also be said to be the criterion of line cost, and when voltage regulation becomes excessive it is a pretty safe statement to make that both operating costs and investment can be reduced by increasing line voltage and thereby improving voltage regulation. This matter of increasing the capacity of existing transmission and distributing lines by increasing the voltage is dealt with elsewhere in this issue in a very interesting and able manner by Mr. E. C. Stone.

In this article are pointed out the relative costs of increasing capacity of existing lines by increasing the cross-section of the copper on the one hand and increasing the pressure on the other. It is shown that when the cost of a line is high compared to the cost of the connected installations, increase in capacity will demand a considerable increase in voltage. This condition exists when the connected installations are of large capacity and are scattered, and the line copper already approaches the wise loading of the poles. When the cost of a line is low as compared to the cost of the connected installations, it is not desirable to increase voltage very much, but instead may be more economical to increase the cross-section of the conductors. When connected installations are of small unit capacity, when they are close together, and the conductors already strung are comparatively light, the above condition obtains, and increasing the conductivity rather than increasing the voltage is usually indicated.

As Mr. Stone ably points out, the current-carrying capacity of any line or circuit is limited by the maximum number of amperes it can carry as to heating, voltage regulation or economy of operation; by the maximum voltage at which it can be operated as determined by the properties of the insulation; and the power-factor of the load carried. Current, voltage or power-factor are therefore the three factors involved in determining the total cost involved. Power-factor affects current-carrying capacity of conductors; it affects voltage regulation, hence the importance of not allowing preventably low power-factors from occurring is obvious.

Voltage regulation, one of the criteria of service, and also the criterion of line cost may often be bettered, the capacity of a line increased, and service improved by installing voltage regulators in the feeders or lines. The use of voltage regulators in this way to increase the capacity of existing feeders is commonly resorted to, with all the other gains that accompany such an installation.

There is one phase of this matter of increasing the capacity of existing lines, touched upon by Mr. Stone, that deserves enlarging upon somewhat. In the article referred to it is pointed out that three-phase 2300-volt lines can advantageously be converted to 4000-volt three-phase lines by simply changing over from a delta to a star connection. In doing this the benefit of transmitting at 4000 volts and distributing at 2300 volts is obtained; such a method has been employed by several of the central stations operating large alternating-current distributing networks. The familiar three-phase four-wire system of distribution is the most flexible system possible, also probably the most economical from every aspect. There are many companies today who could advantageously change over from a delta 2300-volt system to a 4000-volt star.

Fire and Life Hazards and Electrical Codes

FIRE breaking out in any building is always a serious menace, not only to its property contents but also to the lives of its occupants. This fact is generally recognized by everyone, even by fire-insurance interests, although the latter have seldom any immediate business concern in the matter of life hazard. Early regulations of fire underwriters aiming to minimize the fire hazard seldom made any special mention of requirements to reduce the menace to life and this was usually left to the public authorities. The latter, however, seldom took definite steps until after some serious catastrophy that showed the necessity therefor.

In the first electrical code developed in this country (the National Electrical Code, now issued by the National Board of Fire Underwriters) the effort to minimize hazards to life was not strongly evident until the last few years. In the 1918 edition of this code this matter received greater attention than ever before.

In the National Electrical Safety Code, issued by the Bureau of Standards a few years ago and now in process of revision, the primary effort was to draft rules to minimize the life hazard as regards purely electrical causes since this had not yet been comprehensively covered in any previous set of rules of widely recognized standing. It is interesting to note that in the present revision much more extended rules covering the reduction of fire hazards is included, this being evidently due to the effort to minimize the danger to life that usually attends a fire. For instance, in the proposed revised rules of Part I, the principal changes in which are mentioned in another part of this issue, the matter of fire prevention in power houses and substations is given considerable attention. This is as it should be, especially in view of the fact that the rules covering this class of structures in the National Electrical Code are not comprehensive.

Mention is also made in this issue of the new electrical code just issued by the City of Chicago. In this provisions to safeguard against fire are also much more comprehensive than ever before, and special rules are introduced to cover assembly halls, exposition buildings and other places where people are likely to congregate in large numbers. These new rules, in addition to those already in force regarding theaters, make probably the most complete set of regulations aiming to minimize the life and fire hazards in places where they are most likely to cause the greatest danger on account of the large number of persons involved.

We are glad to see that the various electrical codes are gradually recognizing both of these serious hazards and we believe that after some years both the fire and the safety codes will necessarily approach each other in completeness in covering both these dangers. The ultimate outcome may be, in fact it is being hoped by many that it will be, a combination electrical code covering both fire and life hazards thoroughly.

Cost Data and Man-Hours

"HOW MUCH will it cost?" "What did it cost?" These are the questions the central-station manager, the contractor, the construction engineer and many more ask when inspecting a finished job of interest or when asked to sanction commencing a job.

Costs of work to be carried out may be determined either by piece by piece estimate, by calculation, or estimates may be based upon its similarity to previous jobs. Frequently both methods of determining what it will cost to do a job are employed—experience of others, of oneself and by estimate. Cost data are, therefore, of considerable value to the engineers, to contractors, structural engineers and executives, for they broaden one's experience, save time and are of general usefulness.

However, much of the cost data published is not of nearly the usefulness it might be were it presented in a form other than it is. Labor is often a large item, frequently the chief item, in the cost of a job. The cost of labor varies in different parts of the country; it varies from time to time. Obviously, therefore, it is desirable to reduce the item of labor to the least common denominator so that it may be applied anywhere. This can be done very simply by expressing labor in "man-hours" alone or in conjunction with the cost of labor. Both are most useful, and the latter more generally useful since more generally applicable than the former.

If it is known how many man-hours are required to erect a steel tower, to assemble a steam turbine, test the efficiency of a water turbine, or lay a run of conduit, it is an easy matter to charge off an expense equivalent to such a force divided into its constituent parts of supervision, inspection, etc.

One of the accusations brought against the unionization of labor and the closed shop is that production is lowered and the cost of production raised. Data on a basis of man-hours, distinguishing between union and non-union work of the same kind, would show immediately just to what extent unionism tends to curtail rate of work, hence cost of work, because, in man-hours, time and men are the factors, not money.

Current Events

More Electrical Conventions Held—New York Show a Success—Ambitious Plans of N.E.L.A. Publicity Service Bureau

PRESIDENT BALLARD'S VIEWS ON RELATIONS WITH EMPLOYES.

Excerpts from an Address Before Recent New England Section Convention at New London, Conn.

In addressing the convention of the New England Section of the National Electric Light Association, at New London, Conn., on Sept. 24, President R. H. Ballard dwelt in some detail upon the great profit-sharing or employes' participation movement which had its inception with the big industrial organizations of the United States previous to the war and is now being adopted by the smaller business groups. The following excerpts from his remarks convey the trend of his argument:

"It is desirable that wage earners shall have opportunity to earn sufficient to maintain themselves and their families at a reasonable standard of comfort; to protect their dependents against poverty in case of death and to provide against want in old age."

"Our constructive problem seems to shape itself along these lines: Can the millions of workmen in the United States be gradually brought into partnership in the business in which they are employed without nullifying the result of partnership by placing the management of the industries in the control of those untrained in the administration of such affairs?"

"What our workers want is opportunity—opportunity to take part in the world's industries, and to weld their work, their earnings, and their intelligence."

"This striving after individual opportunities has brought the world out of barbarism and imperialism and is blazing the way to participating co-operation."

"Participation preserves the vital spark of individualism—that intangible factor of success which has written the story of progress on every page of the world's recorded history."

"Centralizing is the parent of participation because in eliminating ruinous competition, it automatically takes men out of destructive pursuits and sets them at harmonious production."

"The great element of success in our present-day profit-sharing movement is that it is being worked out by some of the best and most constructive minds of our generation—the minds that guide these great industries are simply expanding the methods that have made their own enterprises successful, and extend to those who are engaged with them the opportunities to become partners, preserving to them the stimulus of the personal quality of success—Individualism."

"If the business itself is a success, that is proof conclusive that its organization is sufficient for those who participate in its benefits."

"Mutual interest is the basis of every enduring human structure. The big central thought of the participation idea finds expression in the slogan of Dumas, 'Three Guardsmen, One for all, all for one.'"

"In hectic denunciation what do we achieve? In constructive thought, what may we not achieve?"

"Bolshevism is an idea; Socialism is an idea. They can best be corrected by presenting better ideas."

"Participation is the American antidote to Anarchy."

ACTIVITY MARKS CONVENING OF IRON AND STEEL ELECTRICAL ENGINEERS.

Interesting Program, Animated Discussion and Light Attendance Features.

The Association of Iron and Steel Electrical Engineers held its thirteenth annual convention at the Hotel Statler, St. Louis, during Sept. 22 to 26, inclusive. The report of this convention was held out of the last issue of the ELECTRICAL REVIEW due to the fact that there were so many other conventions occurring at the same time and space was limited. The convention was a very live one as regards papers and discussions but somewhat light in attendance, there being about 250 present.

In the annual presidential address President Petty outlined the work of the association during the past year, laying special emphasis upon the work of the various sections and committees of the association. Special reference was made to the work of the Standardization Committee's work. The association can now boast of five sections, namely, Birmingham, Chicago, Cleveland, Philadelphia and Pittsburgh, all of which are actively engaged upon the work for which they were organized. Reference was made to the very satisfactory growth of the association, which had 28 members in 1907 and in 1918 had 1020 members, with every prospect that before the close of the present year there would be 1200 members. There has already been an increase of 206 members during the first eight months of this year.

The first morning of the convention was devoted to the transaction of business, the reading of the various committee reports and the election of officers. In the afternoon A. B. Holcomb, chairman, Educational Committee, presented his report, as did also Walter Greenwood, chairman of the Safety Committee.

The morning session on Sept. 23 was given up to the presentation of joint papers on "Organization of the Electrical Department in the Iron and Steel Industry." The papers presented were "Inspection and Operation of Electrical Apparatus," by J. A. Morgan and J. J. Booth; "Educational Training for Electrical Employes," by B. A. Cornwall; "Electrical Repair Shop," by C. A. Menk; "Storeroom and Spares," by T. E. Tynes, and "Records and Tests," by R. B. Gerhardt. These papers being of a practical nature and on such subjects as concern every steel mill, almost everyone present took part in the discussion. The afternoon was devoted to excursions to places of local interest.

Wednesday morning and afternoon were devoted to the presentation of papers and their discussion. The annual banquet was held in the evening. W. S. Hall presented a paper in the morning on the subject of "A. C. Versus D. C. Motors for Rolling Mill Table Drives," in which the characteristic curves of the different types of motors were pointed out and their bearing upon motor performance and mill table drive explained. It was stated that there is no reason why the a-c. motor could not readily replace the d-c. motor, providing that the maximum torque of the former is sufficient for the job. The fact that the alternating-current motor cannot be readily abused is a great advantage, while the fact that table load conditions change from time to time over a wide range makes the constant-speed characteristic of the induction motor quite an advantage. A number of typical motor drives are taken and comparisons made of cost, time of performance and horsepower required. H. D. James, Westinghouse Electric & Mfg. Co., then presented his paper on "Recent Improvements in Industrial Control."

In the afternoon two papers were presented. R. D. Nye, chairman of the Electric Furnace Committee, presenting his report on the "Present Status of Electric Furnaces in the Steel Industry," and C. A. Winder, General Electric Co., read a paper on "Electric Heat Treatment."

Thursday morning, Paul M. Lincoln read a paper on "Overload Protection for Motors." In the afternoon A. G. Place presented a paper on "Overload Protection of Cranes," and T. E. Tynes, chairman, Standardization Committee, presented his report.

On Friday morning a joint paper upon "Present Status of Arc-Welding in the Iron and Steel Industry" was taken part in by A. Churchward, Wilson Welder & Metals Co.; H. L. Unland, General Electric Co.; A. M. Bennett, C. & C. Electric & Manufacturing Co.; R. A. Kinkead, Lincoln Electric Co.; C. J. Holslag, Electric Arc-Cutting & Welding Co.; R. M. Rush, The Arcwell Corp., and A. M. Candy, Westinghouse Electric & Manufacturing Co.

The following officers were elected for the ensuing year: President, B. W. Gilson, Youngstown, O.; first vice-president, H. C. Cronk, Cleveland, O.; second vice-president, F. A. Wiley, Chicago, Ill.; treasurer, James Farrington, Steubenville, O.; secretary, John F. Kelly, Pittsburgh, Pa.; directors, R. F. Gale, Philadelphia, Pa.; J. E. Fries, Birmingham, Ala.; W. S. Hall, Chicago, Ill.; C. E. Bedell, Wheeling, W. Va.

CONVENTION DISCUSSES RELATION OF FUSES TO KNIFE SWITCHES.

Municipal Electricians at Chicago Meeting Approve Resolution Recommending Switches Protect Fuses—R. J. Gaskill Elected President.

The concluding sessions of the twenty-fourth annual convention of the International Association of Municipal Electricians, held at Chicago last week, were largely devoted to a discussion of a paper on "Relation of Fuses to Knife Switches and Service Wires," presented by Fred B. Adam of the Frank Adam Electric Co., St. Louis, Mo.

This paper brought out the fact that differences in practice exist as to placing fuses on the service and on the line sides of switches and this results in confusion to the manufacturers of switches and panelboards. In eastern states it is common practice to put the fuses on the line side in order to afford protection when re-fusing is done, while in central and western states it is customary to place the fuses so they will protect the switches. As an illustration, Mr. Adam cited a case where an eastern architect had specified panelboards for a western installation with fuses on the service side of the switches; it was only by chance that the manufacturer changed the specifications so it was possible to obtain approval of the inspector. In an effort to standardize practice Mr. Adam suggested the association pass a resolution to the effect that fuses be connected to the hinged or dead end of all switches. Objections to the suggested resolution were made by Joseph Sachs of the

Post-War Convention of International Association of Municipal Electricians, Held at Chicago, Johns-Manville Co., and A. McLaughlan of the Square D Co., the former stating action on the matter should be delayed because standardization of inclosed switches is now being made, and the latter recommending adoption of inclosed type switches arranged so fuse clips are dead when renewals are being made.

Dr. M. G. Lloyd, Bureau of Standards, said the question was in a transition stage. Some years ago it was the practice to put fuses on the live side of switches, but now many exceptions were being made to this practice. The National Electrical Code rules that in inclosed switch devices it is permissible to place the switch ahead of the fuse, while the Electrical Safety Code makes this practice compulsory.

The matter was finally referred to the association's standardization committee, which offered a resolution to the effect that the fuses on all switches except service switches should be installed so that when the switch is opened the fuses will be disconnected from the source of supply. The convention approved this resolution.

William G. Keith, commissioner of gas and electricity, Chicago, read a paper on street lighting which gave a review of the progress made in street-lighting practice in Chicago and gave data on installation and operation of the series group system. This paper is published in full in another part of this issue of ELECTRICAL REVIEW.

At a business meeting held Friday, New Orleans was selected as the next meeting place and the following officers were elected for the year: Robert J. Gaskill, Fort Wayne, president; C. P. Steinmetz, Schenectady, N. Y., first vice-president; R. C. Turner, Atlanta, Ga., second vice-president; W. P. Briggs, New Bedford, Mass., third vice-president; F. A. Cambridge, Winnipeg, Can., fourth vice-president; C. R. George, Houston, Tex., secretary, and John Berry, Indianapolis, Ind., treasurer. Members of the new executive committee are W. L. Potts, Detroit, chairman; William Gaffney, Watertown, N. Y.; A. L. Duckett, Asheville, N. C.; Frank Williams, Elizabeth, N. J.; D. R. Snider, Augusta, Ga.; J. P. Allen, Jacksonville, Fla.; J. W. Bleidt, Little Rock, Ark.; W. G. Dey, Louisville, Ky.; Claude Converse, San Antonio, Tex., and Zack Morrison, Minneapolis, Minn.

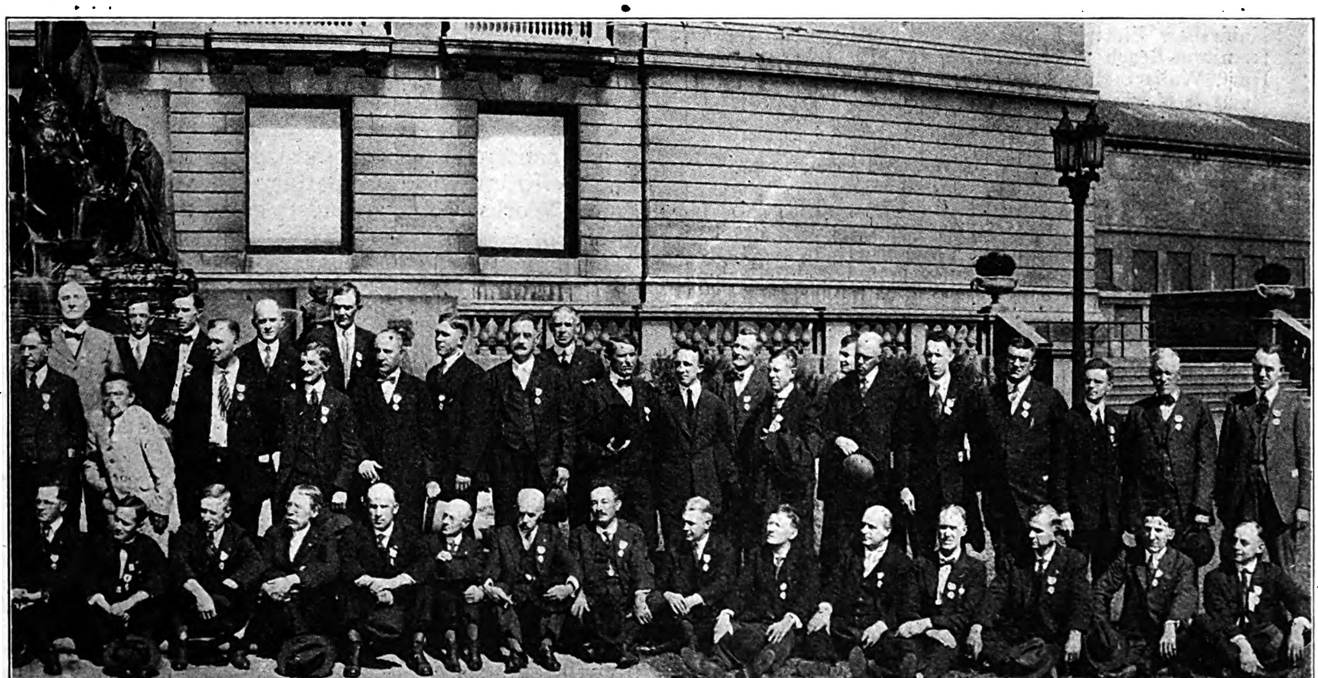
The feature of the entertainment program was the annual banquet, which was held in conjunction with the Bureau of Electrical Inspection, City of Chicago. The gathering marked the thirty-sixth anniversary of the latter organization, which took occasion to formally welcome home its returned soldiers.

NEW YORK ELECTRICAL EXPOSITION IS A BIG SUCCESS.

Unprecedented Attendance and Interest Rewards the Exhibitors—Many Buyers Among the Visitors.

The New York Electrical Show, of 1919, that began on Sept. 24 and will continue through Oct. 4, is one of the most successful shows ever held in our largest city. The excellent accommodations provided by the Grand Central Palace, the building in which the show is held, are ideal for exhibitions on a large scale, but they are none too large for the present show. All space on the first floor and most of that on the second floor is occupied by exhibits. Conversations with exhibitors reveals the fact that many of them underestimated their own needs for floor space and that they are making efforts to obtain additional space to accommodate the crowds of interested spectators that are visiting the exposition.

Exhibitors report that the interest shown by the crowds attending the exposition is larger this year than ever before. The audience is spoken of in fact as a buying audience. Nor is the interest confined to the male visitors only. The scarcity of domestic help in the home and the increasing number of labor-saving electrical devices has created an interest in the minds of the ladies that is revealed by the large numbers of them that are attending the exposition and are making inquiries about the devices exhibited. The ordinary comment of those having exhibits is that no



Ill., Sept. 23-26, Proves Noteworthy Because of Large Attendance and Interesting Program.

such interest on the part of women ever was discernible before, that the amount of floor space in the booths and the number of experienced demonstrators is inadequate, and that the visitors are essentially buying visitors. Most exhibitors report a larger number of sales than they ever made before in a similar interval of time.

The list of exhibitors is as follows:

Allen Sales Service, Inc., 347 Madison avenue
Alpha Electric Co., 149 West 30th street.
American Ironing Machine Co., 70 West 45th street.
American Bronze Products Co., 25 Third avenue.
Baker, R. & L., New York Corp., 17 Central Park West.
B & K Manufacturing Co., 200 Fifth avenue.
Bennage Co., New York Appliance Co., Times Building.
Bohn, C. C., Electric Co., 820 Sixth avenue.
Branden, Hedges, McLain, Inc., 80 Maiden Lane.
Brokaw, Eden Co., 50 East 42nd street.
Brooklyn Edison Co., Inc., 360 Pearl street, Brooklyn.
Buerkle, W. A., Sales Company, 212 Livingston street, Brooklyn.
Clements Manufacturing Co., 1472 Broadway.
Cockaday, L. M., & Co., 2674 Bailey avenue.
Commercial Electric Truck Co. of America, 405 Lexington avenue.
Comstock Household Service, 21 East 40th street.
Consolidated Telegraph & Electric Subway Co., 54 Lafayette street.
Contra-Pole Electric Co., 1227 Prospect place, Brooklyn.
Cooper-Hewitt Electrical Co., Hoboken, N. J.
Dayton Pump Manufacturing Co., 30 East 42nd street.
Delco Electric Laboratories Co., 18 West 62nd street.
Display Stage Lighting Co., 314 West 44th street.
Duntley Products Co., 295 Fifth avenue.
Duparquet, Huot & Moneuse Co., 110 West 22nd street.
Edison Electric Appliance Co., 147 Waverly place.
Electric Meter Corp., 55 Liberty street.
Electric Storage Battery Co., 19th and Alleghany streets, Philadelphia, Pa.
Electrical Testing Laboratories, East End avenue and 80th street.
Eureka Vacuum Cleaner Co., 12 East 42nd street.
Federal Sign System (Electric), 627 West 43rd street.
Federal Telephone & Telegraph Co., Buffalo, N. Y.
Fitzgerald Manufacturing Co., Torrington, Conn.
Fox Electrical Corporation, The, 119 West 42nd street.
General Electric Co., 120 Broadway.
Geyser Electric Co.
Goodwill Electric Co., 70 Fifth avenue.
Guarantee Electric Products Co., 110 West 40th street.
Habirshaw Electric Cable Co., Inc., 10 East 43rd street.
Hamilton-Beach Manufacturing Co., 114 Liberty street.
Hart, Wallace B., 46 East 41st street.
Hartt & Morison, 780 6th avenue.
Home Devices Corp., 11 East 42nd street.
Hooven Letter Service, Inc., 387 Fourth avenue.
Hoover Suction Sweeper Co., 47 West 34th street.
Hot-Flo Faucet Corp., 1400 Broadway.
Hurley Machine Co., 151 West 42nd street.
Illuminating Engineering Society, 29 West 39th street.
Jorgensen, John, 114 Liberty street.
Kimball Electrical Construction Co., 42 East 23rd street.
Landers, Frary & Clark, 200 Fifth avenue.
Lansden Co., Inc., Danbury, Conn.
Latham, E. B., & Co., 550 Pearl street.
Laun-dry-ette Sales Co., 34 West 37th street.
Lightoiler Co., 569 Broadway.
Livingston, J., & Co., 104 East 41st street.
Maimin, H., Co., Inc., 251 West 19th street.
Majestic Electric Development Co., 1705 Alleghany avenue, Philadelphia, Pa.
Manhattan Electrical Supply Co., 17 Park place.
Manning, Bowman & Co., 200 Fifth avenue.
Metropolitan Detroit Electric Auto Co., 20 Central Park West.
Metropolitan Engineering Co., 35 Vestry street.
National Lamp Works, Nela Park, Cleveland, Ohio.
New Home Sewing Machine Co., 45 East 17th street.
New York Appliance Co., Times Building, 42nd street.
New York Edison Co., Irving place and 15th street.
New York Electrical School, 39 West 17th street.
New York & Queens Electric Light & Power Co., Bridge Plaza, Long Island City.
Nicholas Power Co., 90 Gold street.
Ohio Electric Co., 145 West 45th street.
Pease, Behning Co., 22 East 40th street.
Pittsburgh Electric Specialty Co., 396 Broadway.
Pneuvac Co., Worcester, Mass.
Rawson Electrical Instrument Co., Cambridge, Mass.
Regina Co., 47 West 34th street.
Royal-Eastern Electric Supply Co., 114 West 27th street.
Shelton Electric Co., 16 East 42nd street.
Sibley-Pitman Electric Corp., 190 6th avenue.
Sloane, W. & J., Fifth avenue and 47th street.
Stodder, E. D., 6 Prospect street, New Rochelle, N. Y.
Strauss & Co., Inc., 302 West 52nd street.
Thompson, Albert, Jamaica, L. I.
Tri-City Electric Co., 18 Mechanic Street, Newark, N. J.
Truswell, Wm., & Sons, 16 Cedar street.
Tucker Electrical Construction Co., 114 West 30th street.
United Electric Light & Power Co., 130 East 15th street.
U. S. Cloth Cutting Machine Co., 414 West Broadway.
Viking Sign Co., 560 Seventh avenue.
Waite & Bartlett Manufacturing Co., 252 West 29th street.
Walker Vehicle Co., Grand Central Terminal.
Ward Vehicle Co., Mount Vernon, N. Y.
Western Electric Co., 195 Broadway.
Westinghouse Electric & Manufacturing Co., 165 Broadway.
Wireless Improvement Co., 47 West street.
Yonkers Electric Light & Power Co., Yonkers, N. Y.

Although the list of electrical equipment exhibited includes practically every device for converting electrical energy into useful work, the exposition is described as appealing largely to those interested in applying electricity to household uses. Perhaps those who are interested in the barn and barnyard should be included among those to whom the exposition has an urgent appeal, since some of the most popular exhibits are those of electric trucks, of milkers actually demonstrated by milking a herd of cows, of lighting and heating devices for outbuildings as well as for houses, and of many other labor-saving devices for all purposes.

A visit to the exhibition shows that three general classes of exhibits have been arranged. These classes are commercial, demonstrative, and educational. The classification into which an exhibit is grouped depends upon the apparatus shown. Several concerns, such as the Walker Electric Vehicle Co., the Commercial Truck Co. of America, the Ward Motor Vehicle Co., the Habirshaw Electric Cable Co., Inc., the Federal Electric Sign System (Electric), and many others have arranged demonstrational exhibits showing the operation of some peculiar feature of their apparatus. Other concerns, such as the Cooper Hewitt Electric Co., the Electric Storage Battery Co., and the National Lamp Works, have arranged exhibits that are historical or educational.

Although some exhibits are classified as commercial, they are also demonstrative or educational. The vacuum cleaner and electric washer exhibits, of which there are a large number, contain numerous demonstration machines showing their operating features and the work they will do. Naturally such booths are overcrowded. Many of the exhibitors that are not giving demonstrations have been compelled to close their booths. The Remmert Mfg. Co., maker of the Locomotive Washer, is endeavoring to secure larger floor space. Brokaw-Eden Co., manufacturers of electric washers reports business as wonderful, attendants and salesmen, of whom there are 25, working in four-hour shifts, and more help needed. The Home Devices Corp. reports business as excellent, many orders received, people satisfied and paying cash. Hurley Machine Co. reports great interest and good business. And so on from all booths prepared to take orders or sell their apparatus.

PLANS OF ADVERTISING AND PUBLICITY BUREAU, N. E. L. A.

Most Ambitious Publicity Work on Electric Service Ever Undertaken Will Be Conducted by Newly Enlarged Bureau.

Recently there has been organized the Advertising and Publicity Service Bureau of the Commercial Section, National Electric Light Association, which combines under one head work previously undertaken by the Publications Committee, the Committee on Coordinate Advertising and Sales Campaigns, and proposed work on many new lines.

The aim of the bureau will be to make electric service a household word, develop a conversational familiarity with its terms, and spread a knowledge of what it is and the part it plays in industrial, commercial and household life throughout our entire country. The work of this bureau if spread over only a few years will make electric service as much appreciated and as freely used as are any high-class commodities, like automobiles, pianos and talking machines. The bureau will endeavor to secure this result by both direct and indirect means.

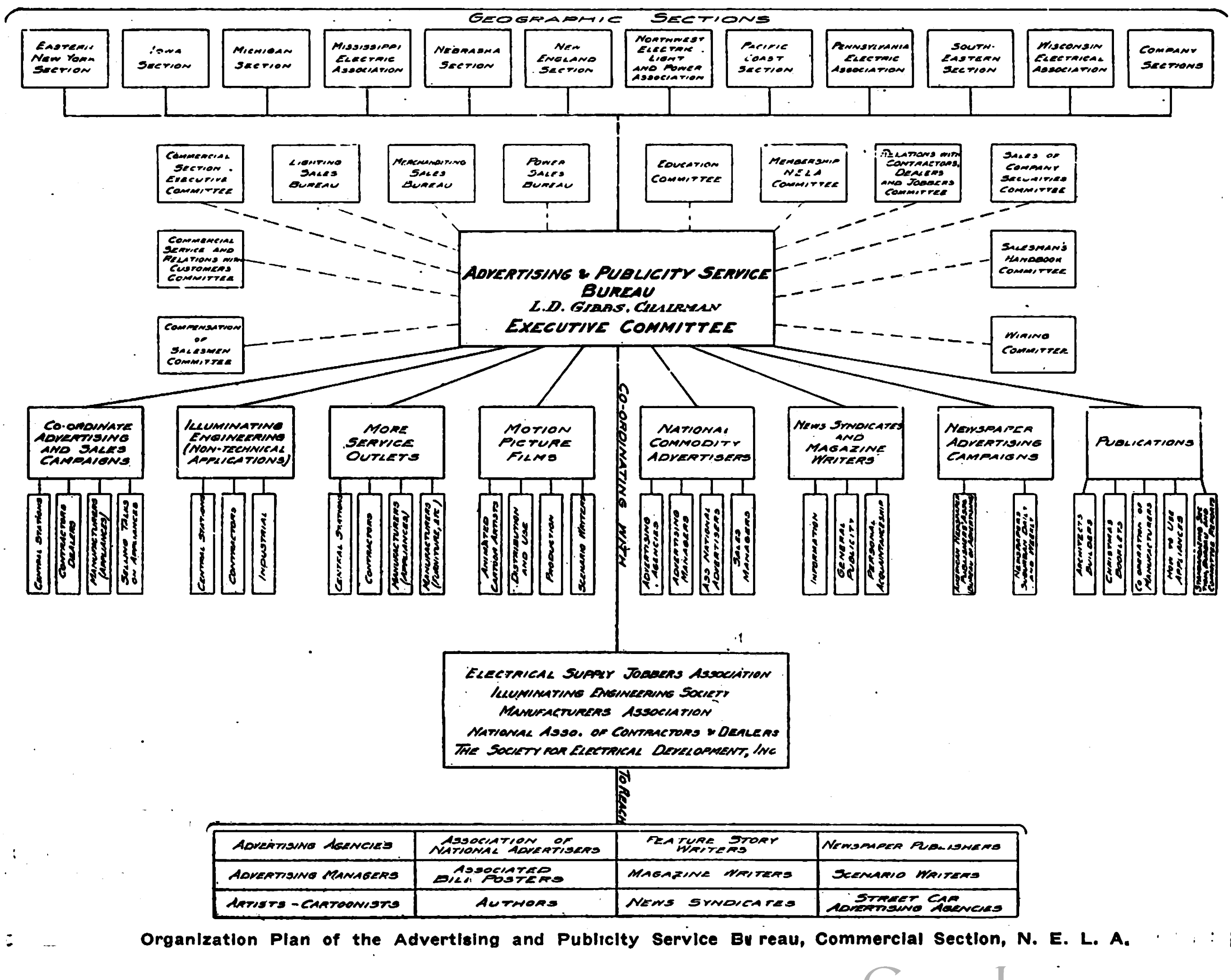
Following the lines already adopted by other bureaus, the membership in the Advertising and Publicity Service Bureau will be drawn from every state in the union, through the company and geographic sections, with cross-memberships in the other bureaus and independent committees of the Commercial Section, and through co-operation with co-ordinating associations.

These efforts will be directed toward reaching advertising agencies, advertising managers, artists, cartoonists, national advertisers, authors, feature-story and magazine writers, news-syndicate writers, newspaper publishers, scenario writers and street-car advertising agencies.

Appreciation of the plan and assurances of co-operation are already widespread. The presidents of the geographic sections are working enthusiastically along these lines; company sections are helping, and the managers of central stations are delegating their representative employes to serve in the bureau work.

The cross-membership idea will keep all other branches of Commercial Section activity informed on the bureau's work, members will keep in touch with all other activities, and duplication of effort and waste of time and money will be eliminated. Both the instinct and ability for promoting publicity will obviously dominate the activities of the bureau. For this reason, it ought to be possible to be of material assistance to other bureaus and committees in securing more general publicity for their work. Co-operation with other associations in related branches of the electrical industry will be made effective at every possible opportunity.

The Co-ordinate Advertising and Sales Campaigns Divisions will continue and extend the work already well begun. This work aims to systematize advertising campaigns and sales efforts to the end that: (1) Manufacturers may concentrate their advertising campaigns; (2) central stations, contractors and dealers may specialize in their selling efforts on the same appliances month by month throughout the year.



Organization Plan of the Advertising and Publicity Service Bureau, Commercial Section, N. E. L. A.

Definite co-operation in publicity work with the Illuminating Engineering Society is undertaken for the first time this year. The idea is to bring about a realization of the fact that the principles of good lighting can be applied nontechnically and so that, for instance, even an ordinary contractor can introduce these principles in his work and give his customers special service of lasting advantage.

The More Service Outlets Division will carry its educational work along far-reaching lines. For many years the importance of having installations fully provided with outlets has been realized and various committees have advanced the work. This new division will co-ordinate and stimulate these scattered efforts so as to bring the idea home to all branches of the industry as well as to the public in general.

An extension of activities into every branch of the field will be made by the Motion Picture Films Division, which will furnish advertising material to all connected with the motion-picture industry. The National Commodity Advertisers' Division will enter a new field for contact, this being the idea of illustration by means of electrical appliances or by showing applications where electric service plays the important part. Considerable work has already been done in making other industries realize that electrical appliances can be featured as part of their own advertising so as to show that the latter is thoroughly up-to-date.

The News-Syndicate and Magazine Writers' Division will reach into a new field. Here the development of appreciation for the timeliness of electricity and its service will result in more and better "copy." The aim will be to get in touch with the managements of news syndicates and their contributors such as furnish special articles to groups of Sunday magazines and Sunday newspapers; and also in touch with the writers of articles for magazines, such as the *Saturday Evening Post*, etc., with a view to having their names put on mailing lists so that they can receive up-to-date advertising material about electrical appliances and know where to write for information on electrical subjects which they may wish to use in articles they are preparing.

Newspaper campaigns are capable of great development. For a number of years efforts have been made to develop community of interest among central stations and electrical contractors and dealers so that so-called "electrical pages" could appear in the daily and weekly newspapers. If some plan can be devised that will be continuous and forcible in its action these pages can be maintained and the use of them extended. If pages cannot be developed, at least some plan for educating contractors and dealers to an appreciation of continuous advertising may be arranged which will result in ultimate good and greater increase of the business.

The Publications Division takes over the work that has been handled for many years under the Publications Committee. Through this division an effort will be made, first, through co-operation with manufacturers to get the most effective circulation of their advertising material. It is a foolish waste of money for the N. E. L. A. to prepare advertising literature that must be sold to the central stations, when the same field may be covered by manufacturers.

The organization plan of the bureau is shown herewith. L. D. Gibbs, 39 Boylston street, Boston, Mass., is chairman of the bureau; S. H. Gillerup, 130 East 15th street, New York City, is first vice-chairman, and I. W. Alexander, San Joaquin Light & Power Corp., Fresno, Calif., is second vice-chairman.

SPECIAL MEMBERSHIP CAMPAIGN FOR WESTERN SOCIETY OF ENGINEERS.

An intensive six-day membership drive is to be conducted by the Western Society of Engineers on Oct. 6 to 11, inclusive. This organization a few months ago celebrated its fiftieth anniversary and is one of the oldest engineering societies in the country. It is composed of engineers connected with the various branches of the engineering profession and has been since its modest beginnings in 1869 the engineering headquarters in Chicago. Its rooms and library on the seventeenth floor of the Monadnock block are the gathering place of a considerable number of engineering societies that hold either main or section meetings in Chicago.

The Western Society of Engineers has five sections devoted to electrical, mechanical, bridge and structural, sanitary, hydraulic and municipal, and gas engineering. Through the meetings of the main society and of its sections there are discussed a very wide range of technical problems at gatherings held practically every week, so that a member has the privilege of keeping in direct touch with the important developments in the principal lines of engineering and in personal contact with the leaders in the chief branches of the profession in the big district tributary to Chicago. At present the membership of the society is about 1200. It is believed that there are over 5000 engineers in and near Chicago that would derive great benefit from membership in this well established organization and from use of its facilites as the logical headquarters for the technical interests of the Chicago district. Many of these men are members of national engineering societies, but they also should have through membership in a strong local organization like the Western Society of Engineers means of keeping in contact with the engineering profession generally.

EIGHTH ANNUAL SAFETY CONGRESS OF NATIONAL SAFETY COUNCIL CONVENES IN CLEVELAND.

The Eighth Annual Safety Congress of the National Safety Council is meeting in Cleveland during October 1 to 4 inclusive. It is estimated that there are in the neighborhood of 4000 plant managers, safety engineers, employment supervisors, executives and others interested in accident prevention and the problems of industrial relations present. Nineteen different sectional meetings are being held, these being respectively automotive, cement, chemical, construction, electric railways, health service, local council officers, marine and navigation, metals, mining, packers, paper and pulp, public safety, public utilities, rubber, steam railroad, textile, women in industry and wood-working. In addition there are the general sessions and the round-tables where opinions can be voiced and general business transacted.

In the Public Utilities Sessions the following papers are being presented: "Preventing Accidents in Gas Plants" by J. F. Conner, "Inspection of Plants of Gas Companies" by Alvin E. Bliss, "Effective Means of Focusing the Responsibility for the Prevention of Accidents upon Foremen" by J. W. Easley, General Discussion, Questions and Answers, "Working Safely on Live High-Tension Lines" by H. J. Burton, "Practice of Operators and Tagging of Switches, Markings and Barriers" by Walter Wagner, "Spasmodic Safety Efforts and the Harmful Results" by H. M. Webber.

Commercial Practice

Turning Complaints Into an Asset—What One Utility Did Toward Closing Isolated Plants—Boston Flat Iron Sales

TURNING COMPLAINTS INTO AN ASSET—THE SMILING COMPLAINT MAN.

Excerpts from Paper Before Southeastern Section, N. E. L. A.

In a very able paper entitled "The Smiling Complaint Man" read before the Southeastern Section of the N. E. L. A. at their convention at Asheville, N. C., during the middle of last month, J. Prince Webster gave some good advice on how a utility may capitalize complaints, making them into an asset instead of a liability. To quote:

"Who, where and what represents your point of contact with the public? Is that point of contact sharp pointed—hard; or is it well oiled and greased and non-friction producing? The public, whose servant you are, forms its opinion as to the kind of servant you are from its point of contact with the company, with the employes of the company who it comes in contact with, and the public will let its complaints be known to and through such employes. Many small and trivial complaints, made by the public, are received with equally small and trivial attention, and the public goes on from day to day feeling that its complaints are not received with that degree of seriousness that attaches to the mind of the party making the complaint.

"Complaints, when made and received, should be received pleasantly, considerately and thankfully. The party to whom complaints are addressed should be courteous, conciliatory and helpful. Your average customer does not know the president of the company, the vice-president, the board of directors or other executive officials of the company, nor does he care who they are, but he does know the troubleman, your lineman, your cashier, your bookkeeper, your complaint man and such other of your employes as he comes in contact with; and it is by the conduct of these people that he does know the company, and it is by his contact with these people that the reputation of the company in the community is established—that is good or bad.

"Is your reputation in the community you serve good or bad? If it is not satisfactory to the public, not to you, then educate your points of contact with the public to the performance of their full duty to the public.

"The public is generally concerned only as to the character of service that you render, and embraced within the character of service rendered is, of course, the manner in which the public is handled and treated by your employes." Mr. Webster then went on to state that not more than 10% of the people who felt they had complaints to make made them, according to his experience with the U. S. Railroad Administration. It is important therefore that what complaints are made should be handled tactfully, that those making the complaints be shown courtesy and that their complaints be met and considered. He then went on to say that public relations could frequently be improved by more careful handling of complaints, thus bringing about a more satisfactory financial result to the company furnishing the service. A number of examples of different ways of handling complaints were presented, with their conclusions and morals.

"Which foot do you start out on in the handling of complaints? Is the company always right from the beginning, or is the customer sometimes right?" asks Mr. Webster.

"Satisfactory and friendly handling of complaints is one of the biggest assets a public servant has. The good will, aye, the good word spoken, as to the company's fairness in handling complaints means ever so much to the company; it increases the morale of its employes; it encourages growth in the community; it means sympathetic consideration in supplying increased revenue to meet increased costs of operation—all of which are vitally necessary in the successful operation of a public utility.

"Don't compromise just complaints and feel that you have served the company's interest; let the complainant himself suggest the solution and then gladly and freely and in a friendly way accept his decision; it means a friend in the community, a booster for the company's fairness; and additional money in the till at the end of the year.

"In conclusion: Make another study of your points of contact with the public; see if you have a friendly and smiley man or woman properly inoculated with the public point of view, handling your complaints; if you have not, make transfers until you do get one, and do it promptly.

"Receive complaints with a smile and with sympathetic consideration. Thank people for affording you an opportunity of making specific and special investigation as to matters affecting the operation of your organization. Assure them that their complaints will be handled promptly—then see that such handling is made.

"Don't compromise just complaints—go the whole route, and lastly lay all your cards on the table—face up—in explaining the result of your investigation; accept censure when due and promise to remedy the situation—then do so.

WHAT ONE UTILITY HAS DONE TOWARD SHUTTING DOWN ISOLATED PLANTS.

Experiences of Louisville Utility Make Interesting Reading.

Large electric light and power organizations continue year after year to increase their business at a rate far in advance of the growth of population and local industries. Just why this process should take place is not entirely clear to many observers and investors. The cause lies in the continuously multiplied uses to which electricity is being put as the result of its time, labor and money-saving abilities. There is no factory, industry, business house, municipality or residence in which a need for electric service does not exist.

A large part of the increased business still comes from the closing down of isolated, or individually operated power and lighting plants. What this means to the electric companies throughout the country, and how it comes about, is graphically illustrated by giving the facts over a period of years in an American city of about 250,000 population.

In 1913 the several electric companies which were operating uneconomically for themselves and the public in Louisville, Kentucky, were consolidated under Byllesby management. Louisville is a city of many small manufacturing enterprises and none of predominating size. Due to the activities of the Louisville Industrial Foundation 27 new industries were brought to the city during the last few years, and they are obviously, all users of electric service.

In the six years ended with June, 1919, the service of the Louisville Gas & Electric Co. was substituted for 91 previously established isolated and industrial steam-operated power plants. The amount of power business thus added to the central-station company was in round figures 18,000 hp., and the lighting business from these sources, 2000 hp., or an aggregate of 20,000 hp. transferred from 91 individually operated plants, to the large, modern power house of the company.

Of the 91 isolated plants closed down 11 were located in downtown office buildings and stores, the city hall, etc.; three were operated by railroads, four by tanneries, 18 by woodworking establishments, nine by tobacco companies, 8 in machine shops, four by flour and grain mills, two in brick and tile plants and 32 were in miscellaneous industries, including woolen and cotton mills, chemical and food products plants, soap factories, etc.

Reviewing the work of the commercial department of the Louisville Gas & Electric Co. in the conversion of steam plants to central station service, Walter D. Myers, sales engineer, states that many important questions have been settled once and for all time in favor of the centralized service. With reference to office buildings, municipal buildings and power plants serving a restricted district, Mr. Myers says they were all located in the heart of the city, with fairly well equipped direct-current plants, all supplying steam for building heating purposes. Three of the office buildings were equipped with hydraulic elevators. These obstacles had to be overcome:

(1) Changing equipment (fans and motor) to alternating current;

(2) Prove that the building could be heated and electric needs bought at a cost not to exceed the cost of operating power plant;

(3) Replace hydraulic elevators with electric elevators or install motor-driven pumps to replace steam-driven pumps. In either case the installation was expensive.

Mr. Myers says, "The second disadvantage was the most serious to handle, as to a building manager, the heating of an office building is an enigma, especially when he has been led to believe by his steam engineer that his plant is primarily a heating plant and that the electricity needed to light the building is merely a by-product and costs the management practically nothing.

"This was overcome to a great extent by obtaining the cost of heating similar buildings that were purchasing electric service from the outside, but in some instances this evidence was not sufficient, and on one of the largest plants the yearly expense for lighting and heating the building was estimated and a clause inserted in the contract that if the first year's bill exceeded a given amount the customers were to have the privilege of cancelling the contract. The result was that the building exceeded the estimate about $300.00 per year, but the management was so well satisfied with the superior service that they would not consider re-establishing the old service.

"Little trouble was experienced in changing over the plants of the three railroad companies, as their experience in operating plants, not only in Louisville, but at other points, brought them to the conclusion of purchasing electricity where it is available at reasonable rates.

"With few exceptions the Louisville tanneries are confined to the tanning of sole leather, and steam in large and consistent quantities is used for drying. From the standpoint of economy in plant operation compared with purchased service, the power company was at some disadvantage, but, with increased output and relief from power-plant troubles, the tannery customers are well satisfied with results.

"Wood-working is one of the principal Louisville industries, and is generally conceded, with its waste fuel and demand for steam for dry kilns, a problem for central stations but efforts were centered on two or three of the largest plants at first and the business secured on short-term contracts. Their experience and satisfaction permeated the whole industry, with the result that the power company is now operating 90% of the wood-working plants in Louisville."

BROOKLYN EDISON CONDUCTS MOST SUCCESSFUL IRON SALE.

Sells 2004 Irons in 26 Days of August, Breaking All Previous Monthly Records in This Line.

During the month of August of this year the Brooklyn Edison Co. conducted one of the most successful sales of electric irons ever put on in Brooklyn, N. Y.—2004 irons being sold in 26 working days, an average of over 77 orders a day.

The iron offered was of a well-known manufacture with the name-plate "Brooklyn Edison Special," and was sold at $4.98—$2.98 down and $1.00 a month to Brooklyn Edison customers.

Over 60,000 return postcards were sent out with the monthly bills to lighting customers and very satisfactory returns were received. In addition, each branch-office window was specially decorated where actual demonstrations were conducted throughout the entire month.

Two-column advertisements in preferred positions were carried periodically in all of the Brooklyn newspapers and local publications.

The lighting salesmen of the company were allowed a commission of 25 cents per order taken as an incentive. The illuminated billboards of the company were used as well as the billboards at the Brooklyn National Ball Park. All of the company's wagons carried a single sheet poster announcing the sale. These posters are most effective, inasmuch as they attract the attention of new customers. When a wagon drives up to the door to deliver material, such as meters, lamps, etc., the customer usually notices this advertisement on the wagon.

During September the Brooklyn Edison special is an electric washing machine on easy terms.

Operating Practice

Boiler-Room Instruments — Field Coil Troubles — Simple Location of Faults — Insulator Failure and Deterioration

BOILER INSTRUMENTS OF COUNTIES GAS & ELECTRIC CO.

Instruments Found Justified on Boilers of 520 B-Hp.

The Counties Gas & Electric Co., Norristown, Pa., applied to its boiler room its ability along efficiency lines to a greater extent than in other industries, but when the cost of coal soared during the war it concentrated its efforts toward greater efficiency. So when they built their new plant with an ultimate capacity of 53,000 kw. with an initial capacity of 17,250 kw. and containing 13 boilers of 5420 b-hp., they adopted the best modern methods in the way of equipment.

Some engineers maintain that it is only the largest plants that can install complete boiler-room instruments and find it financially worth while. But in a paper on "Economical Boiler Room Practice for Medium Size Plants" read before the Pennsylvania Electric Association, Henry B. Bryans, chief engineer of the Counties Gas & Electric Co., stated that the company aims to operate at about 200% rating at all times and 300% rating during peak loads. Each of his boilers has been equipped with the following equipment with good results:

1. Recording indicating steam flow meter.
2. Recording CO_2 meter.
3. Indicating gauge for determining pressure in wind box.
4. Indicating gauge for determining pressure over the fire.
5. Recording flue gas pyrometer at entrance to economizer.
6. Recording flue gas pyrometer at discharge from economizer.
7. Recording thermometer for feed water entering economizer.
8. Recording thermometer for feed water leaving economizer.
9. Automatic feed-water regulators.
10. Balanced draft control.

ACID FUMES CAUSE INSULATION DETERIORATION.

Storage Battery Ventilation, Defective Cause of Insulation Troubles.

By B. H. Smith.

A 1000-kw. synchronous motor driving a 1000-kw. three-phase generator was employed for changing the frequency of one system from 25 cycles to 60 cycles, thereby enabling the 25-cycle and the 60-cycle systems to interchange power between them.

The 1000-kw. motor operated at 9000 volts, and was called into service for about eight hours daily during the fall and spring, about four hours during the summer and about ten hours during the winter months. This synchronous motor had developed a sprung shaft thought to be due to previous step bearing trouble (the unit was of the vertical type). The entire unit vibrated considerably, especially with sudden load changes.

A certain amount of trouble was occasioned from time to time on account of the insulation on the field pieces breaking down and grounding the field circuit and short-circuiting the field turns as a result. Repairs had been made several times, but the trouble persisted in recurring. The reason for the insulation trouble in the field circuit was given as being due to the vibration resulting from the bent shaft.

However, it so happened that the writer visited the station containing this frequency-changer while it was down for repairs, some of the field poles having caused trouble again. An examination of the seat of trouble showed that the insulation showed none of the typical signs of abrasion or mechanical injury such as one would expect to find where the insulation trouble was due to the incessant shock or small knocks accompanying continual vibration. Instead, the insulation appeared to be somewhat discolored, the signs of moisture seemed to be present, although not in sufficient quantity to permit the statement to be made that the insulation was damp.

It now appeared that the previous diagnosis of vibration as being the cause of trouble might be wrong. Moisture was suggested as the cause. As no source of moisture could be found, oil was suggested, but the insulation had no appearance of being oil soaked. On holding some of the insulation close to the nose the writer discovered a slight odor of sulphuric acid, and that acid was present was later found to be correct by the use of litmus paper.

The cause of the failure of the insulation on the field of the synchronous motor was that sulphuric acid was able to collect on the insulation. The frequency-changer was a vertical machine. In the basement alongside the step bearing of the unit was a storage battery used for operating the switchboard, circuit breakers and emergency station lighting. This battery was housed, but the housing was not in good condition. The ventilating shaft had corroded to such an extent that instead of the acid fumes being carried off through the ventilating duct to the outside of the building, they had been sucked through the corroded holes in the shaft by the windage that occurred when the motor-generator was in operation.

The field of the motor, being the rotor and occupying the most exposed position for the fumes, was attacked most rapidly by the acid. It would doubtless have been only a matter of time before the insulation of the stator would have broken down also, although this would have taken longer, because of the heavier insulation and the more general application of insulating compound employed for 9000-volt windings than for 220-volt windings.

The battery room was repaired. A draft tube or ventilating duct of more generous proportions replaced the corroded and defective one, and all further trouble has apparently been prevented. It would seem that special care should be taken that storage battery rooms are located in places where the acid fumes can be readily carried off in a most direct manner, and that leakage of fumes and the presence of drafts that would tend to suck the fumes out of the battery room through cracks, leaks, etc., should be avoided. Where space does not permit choice of battery room location, suitable lagging can be employed to prevent the escape of acid fumes into the station.

LOCATING FAULTS IN UNDERGROUND CABLES.

Abstract of Article in Elektrotechnische Zeitschrift.

A method of fault location in underground cables that has been employed successfully in a large network in East Germany for the last two years permits one man locating trouble quickly and simply. By its means the location of the fault may be made as a check against calculations or to locate the exact position of the fault.

In one case a fault was found in a cable in which there was complete breakdown, and in another the case was that of a cable lying in 30 ft. of water. It was also used on other cables, and there was a notable success on two occasions on a direct-current cable which broke down twice at distances 150 ft. apart; in both cases the precise position of the fault was located. Many engineers still employ the plan of cutting the cable to find the defective part; others open some of the joints; all this is unnecessary.

When there is not a complete interruption in the cable, the method can be used in the following cases without interrupting the supply: (1) In polyphase systems without an earthed neutral if one phase is earthed; (2) in direct-current two-conductor systems, unless one of the conductors is uninsulated, and (3) with direct-current three-core cables, if the middle conductor is insulated and can be grounded if desired. Case (1) can be dealt with without any difficulty; in cases (2) and (3) the defective conductor will require to be earthed through a resistance for a short interval.

In the original article a diagram of connections is given. One pole of a direct-current generator is connected to the defective conductor, while the other can be connected to earth. If the circuit to earth is closed, then the current to earth passes through the armouring on both sides of the fault; a needle galvanometer is now connected in the circuit; it should have its sensitiveness properly adjusted, and should show deviations on both sides of the zero point. The direction of the throw and also its amount should be noted. If the positive pole is earthed, the negative pole of the instrument points towards the fault. When the position of the fault is entirely unknown, the observer proceeds by halving the defective length at each successive test. For instance, over a length of 1000 yards, it would probably be necessary to test at seven different points.

A special clamp consists essentially of a V-shaped grip which is passed beneath the cable. The grip is held at the end of a length of tube, through which a sharply-pointed rod can be fed forward by a screw device, which is clamped to the tube. As the pointed rod is fed forward through the grip, it penetrates the jute covering, and makes contact with the armouring of the cable. In this way a steady contact for the purpose of the test is obtained.

OBSERVATIONS AS TO INSULATOR FAILURE AND DETERIORATION.

Abstracts from Paper Before Pacific Coast Section, A. I. E. E.

As the result of the failure of insulators, much attention is now being given such matters as mechanical and electrical design, the investigation of ageing, the influence of mechanical and electrical stresses and climatic conditions upon different types of insulators and the same insulators under different sets of conditions. In a very able paper delivered before the A. I. E. E. in Los Angeles recently, L. M. Klauber discussed the theory of probabilities applied to failures of suspension insulators, pointing out the influence of factors of safety upon the probable reliability of a transmission line and its probable immunity from insulator troubles.

Mr. Klauber pointed out that although nearly every insulator failure is finally a flash-over there is little practical difficulty in differentiating between the two types of failure. The flash-over due to deteriorated line conditions shows a heavy foreign deposit on the insulator surface. In almost every case the bottom member of the string will be shattered; often the top member also, but rarely an intermediate member. Unbroken units will before cleaning give a zero reading with a megger and a very low flash-over with a high potential test. Subsequent to cleaning, however, unless badly burned by the power arc, they will give as high a megger and flash-over test as when new. Lines subject to difficulties of this kind cannot be tested with a megger in the field even on a clear, dry day, unless each unit is wiped off before test.

In the other type of failure occurs the fundamental condition that a number of units have failed by material depreciation (usually puncture) and the balance being unable to hold the line have subsequently flashed-over. The characteristic differentiating this class of failure from the former is the number of punctured units which occur at random throughout the string. Even if subsequently shattered by the power arc they may usually be readily distinguished from units shattered by the other type of failure.

In testing and renewing insulators on the line it is desirable that results be recorded in detail. The distribution of failures between strings, their location in different sections of the same line and the relative frequency of failure of units in corresponding positions in the string, all will be of interest in deducing the causes of failure. It is desirable to know whether bottom, top or intermediate units fail most frequently, and in what ratio; whether units in greater tension at dead-ends fail more frequently than those in suspension; whether units with bolts exposed to the direct rays of the sun fail more frequently than those on the same tower but with bolts toward the north and consequently protected from the sun by the porcelain shells. It is of interest to note whether failures follow hot spells, whether they are decreased by cleansing rains and other effects of the weather. If lines operating under similar conditions contain units differing in manufacture, it is of course important to determine separately the percentage of failures for each type. Also by noting the relative frequency of single and multiple failures, it is possible to determine whether failures follow the laws of probability for purely independent events, as above outlined, or whether successive unit failures are to a certain extent dependent events.

Contracting-Construction

Exit Sign and Emergency Lighting — Device for Signaling Stoppage of Motors—Changes in National Safety Code

RULES FOR WIRING EXIT SIGN AND EMERGENCY LIGHTING.

Revised Chicago Electrical Code Gives Complete List of Specifications for Wiring All Kinds of Buildings.

In connection with the rules governing the wiring of theaters, assembly halls, hotels and other buildings, the Department of Gas and Electricity of the city of Chicago has in the 1919 edition (just published) of its electrical code prepared a table specifying the kind of exit sign lights and emergency lighting systems required for different kinds of structures. It is probably the most complete specification for exit and emergency lighting that has ever appeared. Following is the table with explanation of the symbols:

Apartment buildings (three stories or more in height)		F
Asylums (more than ten persons and more than two stories high)	A-2	C
Assembly halls	A-1	E-1 and E-2
Banquet halls	A-1	E-1 and E-2
Billiard rooms and bowling alleys	A-1	E-1 and E-2
Churches	A-1	E-2
Clubhouses (less than 20 persons and more than four stories high)	A-2	B
Clubhouses (20 or more persons and more than two stories high)	A-1	C
Dance halls	A-1	E-1 and E-2
Department stores (more than two stories high)	A-2	B*
Dwellings	None	None
Expositions	A-2	E-1 and E-2
Factories (more than two stories high)	A-2	B
Garage (more than two stories high)	A-2	B**
Gymnasiums (if sleeping accommodations for 20 persons or more, and more than two stories high)	A-2	C
Gymnasiums (in buildings containing no assembly hall)	A-1	E-1 and E-2
Gymnasium (in buildings containing assembly halls)	None	None
Homes for aged or children (more than ten persons and more than two stories high)	A-2	C
Hospitals (more than ten persons and more than two stories high)	A-2	C
Hotels (20 or more persons and more than two stories high)	A-2	C
Infirmaries (more than ten persons and more than two stories high)	A-2	C
Jails (more than ten persons and more than two stories high)	A-2	C
Libraries (more than four stories high)	A-2	B
Lodge halls	A-1	E-1 and E-2
Lodging houses (20 or more persons and more than two stories high)	A-2	C
Moving picture theaters—(See Theaters)		
Office buildings (more than four stories high)	A-2	B
Parish halls	A-1	E-1 and E-2
Police stations (more than ten persons and more than two stories high)	A-2	B
Residences	None	None
Rooming houses (20 or more persons and more than two stories high)	A-2	C
Skating rinks		
Schools (more than 100 students)	A-2	C
School halls (in school building)	A-1	C
School halls (in separate building)	A-1	E-1 and E-2
Stables (more than two stories high)	A-2	B**
Stores (other than department stores, more than three stories high)	A-2	B
Theaters (regular theaters)	A-1	D
Theaters (not more than two sets of scenery and not more than 300 seats)	A-1	C
Theaters (not more than two sets of scenery and more than 300 seats)	A-1	D
Theaters (moving picture theaters with not more than 300 seats)	A-1	C
Theaters (moving picture theaters with more than 300 seats)	A-1	D
Warehouses	None	None

Note.—Any floor six inches below the surface level is considered as a basement.

(A-1) Emergency lighting system of gas or electricity in all halls, corridors, stairways or other means of exit, which shall be independent of all other lights. Separate meter and service switch and, on overhead services, separate service to outside of buildings. Lights to be controlled only in lobby. Lights shall be kept burning until audience has left building.

(A-2) Emergency lighting system of gas or electricity in all halls, corridors, stairways or other means of exit, which shall be independent of all other lights. Separate meters, and service switches, but service may be connected to mains inside of building. Lights must be controlled only at some point near the main entrance. Lights must be kept burning until the occupants have left the building.

Note.—Emergency lighting system must be electric where electricity is used for general illumination.

(B) Exit signs illuminated by gas or electric light.

(C) Exit signs illuminated by gas only. (Electric not permitted.)

(D) Exit signs illuminated by both gas and electricity. The electric lights must be connected to the emergency lighting system.

(E-1) Where auditorium is used for theatrical whether regularly or occasionally, and where the seating capacity is not more than 300, exit signs must be illuminated by gas; if more than 300, must be illuminated by both gas and electricity.

(E-2) Where not used for theatricals and where the seating capacity is not more than 400, exit signs must be illuminated by gas or electricity. Where the seating capacity is more than 400 exit signs must be illuminated by gas.

(F) Lights must be installed on each floor and in vestibule of public halls and must be so arranged as to thoroughly light the same. If the building is wired for electric light these lights should also be electric. They must be connected to separate circuits carried to cutout box and connected to owner's meter or to a separate meter. Lights must be kept burning from sunset to sunrise.

* Illuminated signs must be provided showing the number of the floor.

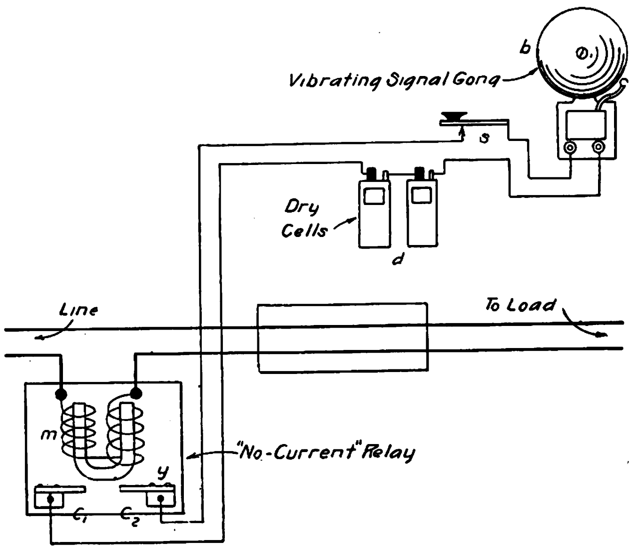
** Any building more than two stories high having a garage or stable on the first floor, exit signs must be illuminated by electricity; gas not permitted.

AUDIBLE SIGNAL TO INDICATE DISCONTINUANCE OF LOAD.

By Richard L. Dyke.

It is very often essential in industrial plants that certain motors or groups of motors be operated as continuously as possible. In such cases it is very desirable that the plant electrician or repair man be notified very quickly in the event of any trouble occurring that stops the motor. For this purpose the device shown in the accompanying sketch will prove very useful. By installing this device an audible signal will be sounded as soon as the current in the motor circuit drops off. It can also be used to indicate a shutdown on motors operating in places where nobody is working or watching.

In the sketch the signal is arranged so that a bell will ring when a group of motors in a distant building is stopped. Fig. 1 indicates the connections. A relay, M, was made and connected to the circuit which supplies the load. When the load is taking current through the line L, the magnet coils of M have current in them and pull up the U-shaped yoke Y. But when the load is discontinued, Y drops down and makes contact to cross C_1 and C_2. This closes the electric-bell circuit and causes B to ring. And it will continue to ring until switch S is opened. A large



Wiring Diagram for Audible Signal.

number of turns is not required on the magnet coils, M, as their function is merely to hold up the yoke Y. It is not, in most cases, necessary that the magnet coils be sufficiently strong to pull up Y, because it can be raised by hand. The wire used for the magnet coils, M, must be of sufficient size to carry the full-load current in the circuit.

PROPOSED CHANGES IN PART I, NATIONAL ELECTRICAL SAFETY CODE.

Revision Now Under Way Provides for Minor Changes in Safety Rules for Power Houses and Substations.

As previously announced, the National Electrical Safety Code is being revised by the Bureau of Standards, Washington, D. C., prior to publication of a new edition of this code. Part III, covering rules for installation of utilization equipment, has already been revised. A tentative revision of Part I—rules for the installation and maintenance of electrical supply stations and equipment—has been made, but has not been adopted; an opportunity is now offered to central-station engineers, contractors and others interested to submit constructive criticism of the revised rules prior to their adoption in the near future. A similar revision has been made of Section 9 of the Safety Code, including rules for methods of protective grounding of circuits, equipment and lightning arresters, and this is also open to such criticism. Copies of the tentatively revised Section 9 and Part I have been sent to all parties thought to be interested.

Most of the changes are not radical, but are intended to cover points which were previously omitted or which seemed to need clarification. Slight rearrangements to make a more logical grouping of the rules have also been made. The following are abstracts or the actual wordings of some of the more important new rules of Part 1; (matter in small type gives the actual wording of changes, while the larger type gives abstracts). It should be noted that these are not final, but only in tentative form.

Principle Proposed Changes in Part I.

Rule 104 (a)—Electrical apparatus and machinery rooms must be equipped for adequate artificial illumination available at all times.

106 (f) and (g)—Steel stairways and ladders must be suitably guarded.

108 (a)—Fire extinguishers shall not be installed in locations subject to high temperatures, unless specially designed for same.

108 (b)—Floors of galleries and rooms containing oil-filled switches and apparatus shall be drained and provided with oil gutters.

136. MOTORS—

(a) *Wiring Motors Below* 750—Motors operating at a voltage of 750 volts or less must be wired with the same precautions as required for industrial wiring carrying the same current.

(b) *Protection of Wiring Over* 750 *Volts*—All apparatus and wiring connected to circuits over 750 volts must be completely inclosed in substantial metal shields or casings and the conduit must enter and be properly secured to such casings or to suitable terminal boxes screwed or bolted to the casings. Shields, casing and conduit must be grounded as provided in Section 9.

The insulation of the several conductors for motors of over 750 volts where leaving the metal sheath of cables, must be thoroughly protected from moisture and mechanical injury. This may be accomplished by means of a pothead or some equivalent method. The conduit must be substantially bonded to the metal casings of all fittings and apparatus connected to the inside circuit. Except where exposed to moisture a metal sheath need not be provided over splices, but the ends of the sheaths must be belled out and sheaths must be bonded around splices by copper wire not smaller than No. 6 A. W. G. and suitable ground clamps.

(c) *Motors in Dusty Places*—Inclosed-type motors are recommended in dusty places, being preferable to wooden boxing.

(d) *Drip Pans*—Where practicable, motors permanently located on wooden floors must be provided with suitable drip pans.

144. *Apparatus with Oil*—Transformers, induction regulators and other electrical apparatus containing an appreciable amount of oil, when installed indoors shall be installed in fireproof inclosures, not having any doors or windows in such a position that burning oil could pass through them on to material or apparatus of a more or less inflammable nature. The inclosures themselves shall not contain any material or apparatus which could take fire from burning oil.

Where such apparatus is installed on a balcony or gallery above other apparatus a gutter or other means for draining off oil or preventing it from running down on to lower floors shall be provided.

Where such apparatus is installed outdoors, adjacent walls shall be of fireproof material and shall not have any doors or windows in such a position that burning oil could pass through them on to material or apparatus of a more or less inflammable nature. Material or apparatus outdoors which could take fire from burning oil shall not be placed within 25 ft. of the apparatus in question.

See Rule 108 (b) for requirement for oil gutters in connection with apparatus containing oil.

145. GROUND DETECTORS—

(a) *Where Required*—All circuits, except such as are permanently grounded as provided in Section 9, must be provided with reliable ground detectors. Detectors which indicate continuously and give an instant and permanent indication of a ground are preferable. Ground connection must be made as provided in Section 9.

(b) *Electrostatic Detectors*—Electrostatic ground-indicating devices shall be properly protected and be provided with a metallic shield if used on switchboards or near instruments.

150. (d) *Circuits Exposed to Higher Voltages*—If exposed through transformer windings, circuits below 750 volts shall be grounded unless everywhere in grounded conduit or other suitable duct or identified and guarded as required for conductors of the highest voltage to which they are exposed.

151. (d) *Lead Sheathing and Potheads*—Conductors between generators and outside lines shall be in plain sight and supported on approved noncombustible, nonabsorptive insulators or placed in approved metal conduit, tile or other fireproof ducts. Conductors installed in conduit or ducts where exposed to moisture shall be sheathed and the sheathing shall be grounded. Except for systems below 300 volts to ground the insulation of the several conductors where leaving the metal sheath of cables shall be thoroughly protected from moisture and mechanical injury by means of a pothead or some equivalent method.

(e) *Conductors Not in Conduit*—Conductors between generators and outside lines shall, where not in conduit, be kept so rigidly in place that they cannot come in contact. Where they pass through floors or fire walls they shall be carried through individual openings in fire-resisting insulating tubes or their equivalent and not through a common open space.

(f) *Protection Against Excessive Temperatures*—Wherever insulated conductors are exposed to excessive surrounding temperatures, a special protection shall be provided if the maximum temperature exceeds the maximum safe limiting temperatures adopted in the Standardization Rules of the American Institute of Electrical Engineers.

156—Wiring for illumination of the station or other utilization purposes should be installed as required for similar utilization equipment and conductors in Part III of the Safety Code.

157 (b)—During alterations or extensions to a station in service, equipment and apparatus exposed to weather, dirt, etc., shall be suitably shielded against same, and also made inaccessible to unauthorized persons or installed as per rules of Part III for equipment accessible to such persons.

161. LOCATION OF OIL SWITCHES. (See Rule 103 for hazardous locations.)—

(a) *Isolation*—Oil circuit-breakers and switches shall wherever practicable be isolated from other switches and electrical apparatus. On circuits of over 7500 volts they must be of remote-control type and be inclosed in separate fireproof cells or compartments.

(b) *Indoor Inclosures*—Oil switch or oil circuit-breakers when installed indoors shall be installed in fireproof inclosures, not having any doors or windows in such a position that burning oil could pass through them onto material or apparatus of a more or less inflammable nature. The inclosures themselves shall not contain any material or apparatus which could take fire from burning oil.

(c) *Drainage on Galleries*—Where oil switches or oil circuit-breakers are installed on a balcony or gallery above other apparatus, a gutter or other means for draining off oil or preventing it from running down onto lower floors shall be provided.

(d) *Outdoors*—Where oil switches or oil circuit-breakers are installed outdoors, adjacent walls shall be of fireproof material and shall not have any doors or windows in such a position that burning oil could pass through them onto material or apparatus of a more or less inflammable nature. Material or apparatus outdoors which could take fire from burning oil shall not be placed within 25 ft. of the switches or circuit-breakers.

164. (c) *Air-Break Disconnector*—An air-break switch or air-break disconnector shall be inserted in each conductor between electrical supply equipment or lines and sources of energy of over 5000 volts, if the equipment or lines may have to be worked on while the sources may be alive.

165. WHERE AUTOMATIC CUTOUTS ARE REQUIRED—

(a) Constant-potential generators, except alternating-current machines and their exciters, and transformers, or station auxiliaries shall be protected from excessive current by suitable automatic cutouts, except as noted below and in Rule 150.

For two-wire direct-current generators, single-pole protection will be considered as satisfying the above rule, provided the automatic cutout is so located or arranged as to be actuated by the entire generator current, and the action thereof will completely open the generator circuit.

(b) *Generators Not Electrically Driven*—For a generator not electrically driven supplying a two-wire grounded system, the automatic cutout shall be so placed as to disconnect the generator from all conductors of the circuit.

(c) *Generators Used with Balancer Sets.*—For two-wire direct-current generators used in conjunction with balancer sets to obtain a neutral for three-wire systems, an automatic cutout shall be installed, which in case of an excessive unbalancing of voltages will operate to disconnect the three-wire system.

(d) *Three-Wire Generators*—For three-wire direct-current compound or shunt-wound generators, an automatic cutout, other than a fuse shall be placed in each armature lead, and so connected as to receive the entire current from the armature. The automatic cutout shall consist of either: (1) a double-pole double-coil, over-load circuit-breaker, or (2) a four-pole circuit-breaker connected in the main and equalizer leads, and tripped by means of two overload devices, one in each armature lead.

These automatic cutouts shall be so interlocked that no one pole can be opened without simultaneously disconnecting both sides of the armature from the system.

(e) *Motors*—Motors shall be provided with cutouts and switches as required for motors in industrial installations by Part III.

170 (a) to (c)—Switchboards shall be so located as to reduce danger of communicating fire to adjacent combustible material. They shall not be built up to the ceiling, 3 ft. being left clear if possible. Spaces back of board must be kept clear and clean. If wired on the back, the board must be accessible on all sides.

180. LIGHTNING ARRESTERS—

(a) *Where Required*—Lightning arresters shall be attached to each wire of every overhead circuit connected with the station, except wires in cables with grounded lead sheath.

(b) *Indoors*—Lightning arresters, with auxiliaries, when installed inside of buildings shall be located well away from all other equipment, passageways and combustible parts of buildings. When of a type containing oil they shall be installed in fireproof inclosures not having any doors or windows in such a position that burning oil could pass through them onto material or apparatus of a more or less inflammable nature. The inclosures themselves shall not contain any apparatus or material which could take fire from burning oil.

(c) *On Galleries*—Where lightning arresters containing oil are installed on a balcony or gallery above other apparatus a gutter or other means for draining off oil or preventing it from running down onto lower floors shall be provided.

(d) *Outdoors*—Where lightning arresters containing oil are installed outdoors, adjacent walls shall be of fireproof material and shall not have any doors or windows in a position so that burning oil could pass through them onto material or apparatus of a more or less inflammable nature. Material or apparatus outdoors which could take fire from burning oil shall not be placed within 25 ft. of the arresters

184. (c) *Insulation of Attachments*—All choke coils or other attachments, inherent to the lightning-protective equipment, shall have an insulation from the ground or other conductors equal at least to the insulation demanded at other points of the circuit in the station.

ELECTRIFICATION OF RAILWAYS CONTEMPLATED IN FRANCE.

The French Ministry of Public Works is considering the question of adopting electric traction on French railways. A commission sent to this country to study railway electrification has recommended in a preliminary report the use of a 3000-volt direct-current system, such as that of the Chicago, Milwaukee & St. Paul railway.

BOOK REVIEWS

"Boiler Chemistry and Feed Water Supplies." By J. H. Paul. New York: Longmans, Green & Co. Cloth, 242 pages (8½ by 5½ ins.), with numerous illustrations. For sale by Electrical Review Publishing Co., for $4.50.

The properties of water used in boilers have always had an important bearing upon the safety and life of boilers; likewise upon their performance and efficiency. However, the chemistry of water has become of even more vital importance of recent years as higher steam pressures came to be employed, because of the higher temperatures involved and the greater opportunity offered to scale to become a hazard and to jeopardize efficiency. Boiler chemistry, by which is meant the chemistry that deals with the water entering the boiler, the deposits that collect in the mud drums and on the heating surfaces of the boiler, and the treatment of water before it enters the boiler that it may be made suitable, has not received the attention that it deserves. It will, therefore, be with gratification that engineers hail an intensely practical book upon this subject by J. H. Paul.

"Boiler Chemistry and Feed Water Supplies," as its name implies, deals with the properties of water supplied to boilers, what to guard against, and how to guard against these things; it tells of many and varied instances and experiences with boiler feed-water. The book is divided into seventeen chapters on the following subjects: Earth, Air and Water; Acids, Bases and Salts; Constituents of Natural Waters; Scales and Deposits; Softening; Soluble Salts; Iron; Carbonic Acid; Concentration of Waters Containing Carbonate of Soda; Action of Carbonic Acid on Iron; Corrosion; Condensed Waters; Superheater; Priming; External Deposits; Failure of Clean Tubes; Water Supplies; Appendix—carbonic acid in London waters; Index.

A book dealing with any phase of chemistry cannot be devoid of chemical terms and expressions. On the other hand, such terms and expressions need be only a means to an end, and they can be so explained and simplified that they expound and amplify a fact instead of masking it in the mind of the layman and those not specially conversant with chemistry. This is apparently exactly what the author of this book has done. He has employed chemical expressions as only a means to an end. The explanation, in simple and straightforward language, is the chief consideration; chemical technicalities are secondary and are used only as a means to an end. The result is that the book is very practical, hence should go a long way toward clearing up many difficulties and misapprehensions in the minds of those engineers who "do not know chemistry" and of those brought into close touch with conditions and who, while appreciating the dangers and objections of impure water, have little time or inclination to work things out for themselves. To such men this book on "Boiler Chemistry and Feed Water Supplies" should prove to be a very real boon.

As the author states, "chemistry has improved the physical character of industrial iron and steel and rendered possible the use of the high pressures now employed in steam boilers, and an acquaintance with the reactions which take place in a boiler under modern working conditions will enable steam users to preserve their boilers from those evils which are roughly summed up in the expression, "scale and corrosion" * * * "any chemical knowledge which will increase its (the boiler's) efficiency, preserve its life and save coal deserves thought and consideration."

The book handles a technical subject in a very practical manner. That space is devoted to economizers, to condenser tubes, mud drums and steam traps should make many engineers realize that chemistry and their work are related. The engineer possessing and reading this book will be a better engineer, and undoubtedly be worth more to himself and to his employer.

"Electrical Engineering Papers." By Benjamin G. Lamme. Pittsburgh: Westinghouse Electric & Manufacturing Co. Cloth, 773 pages (9 by 6 ins.), profusely illustrated. Price $2.50.

Benjamin G. Lamme, chief engineer, Westinghouse Electric & Manufacturing Co., has been connected with this company since 1889, during which time he has taken a prominent part in this company's work and has been largely responsible for the position this company holds in the engineering world today. As appreciation of Mr. Lamme's thirty years of continuous service, the Westinghouse Electric & Manufacturing Co. has recently published a book entitled "Electrical Engineering Papers," being a compilation of the most valuable papers on engineering subjects written by Mr. Lamme.

The book contains 773 pages, every one of which is of educational value. The papers have been gleaned from many different sources but all are typical of Lamme, the engineer, the mathematician, the student of humanity.

The book is not offered as a substitute for any textbook now in use, but, as the name implies, is a collection of engineering papers. Some of these are classic now—for instance, the one on "The Polyphase Motor," originally delivered in 1897 before the Niagara meeting of the National Electric Light Association. That this is still authoritative on the rotating field and induction motor principles is evident by the fact that the United States Navy copied it into their recent textbook for the young engineers of the Navy to study. Many other papers appeared originally in the Transactions of the American Institute of Electrical Engineers.

All the papers or articles are classics and are models of straightforward thinking and expression and analytical study. They can be read with equal advantage by he who seeks to learn the technicality of the subject or he who seeks to learn freedom of expression, consecutive thought and concise expression.

ELECTRIC FLASHER FORMS PART OF WINDOW DISPLAY.

An effective method of selling electric sign flashers is being used by the Electric Construction & Sales Co., Cleveland, Ohio. The company has a large electric sign of its own on the front of the building. This sign is operated by a flasher which forms a part of the window display. The flasher is placed in a neat glass case at the front of the window space.

The fact that the flasher is in actual operation serves to excite the curiosity of passersby, and it is no uncommon sight to see a dozen people standing in front of the window who alternately watch the flasher and the work that it is doing.

While the display may not be the cause of many direct sales, it is undoubtedly of great value because it sells the idea of electric signs and flashers.

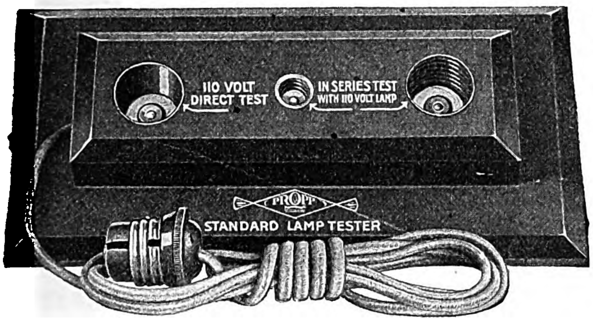
New Appliances

Portable Painting Outfit to Promote Economy in Paint and Painting—Handy Lamp Tester—Commutator Resurfacer

Propp Lamp Tester for Standard and Low-Voltage Lamps.

The dealer in lamps always likes to be sure that all lamps that go out of his establishment are intact, and the purchaser as a rule also appreciates, if he does not insist on, a test of each lamp as it is turned over to him. During the Christmas shopping rush there is always a big demand for Christmas-tree lighting outfits that in some dealers' stores almost overtaxes the capacity of the sales force. Consequently, every facility in selling is of special value at this time.

A special lamp-testing outfit has been developed for this purpose by the M. Propp Co., 108 Bowery, New York City. As illustrated herewith, it is of simple design, consisting of three lamp receptacles mounted on a board base and provided with cord and plug for conection with the 110-volt lighting circuit. The left receptacle is threadless for easy and quick direct testing of standard 110-volt lamps or of Christmas-tree series strings; in the latter case the plug of the set is merely inserted into the left receptacle. If the lamps do not all light, one or more of them are out of commission and each of the series lamps must be tested. This is done by putting them one by one into the middle receptacle, which is wired in series with the one at the right that is filled with a 110-volt lamp. In this way all lamp tests are very quickly and reliably made.



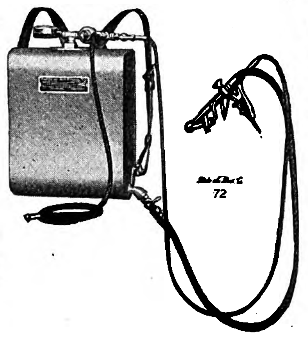
Device for Testing 110-Volt and Low-Voltage Lamps Quickly.

A Simple Commutator Resurfacer.

A very simple and inexpensive tool has been devised which is said to greatly reduce this continued expense and is daily proving its effectiveness in the plants of some of the largest industries. This appliance is known as the "Ideal" commutator resurfacer and consists merely of a manufactured block composed of special abrasive material and mounted on a metal backing provided with a handle.

When motors or generators show sparking at the brushes, the device is applied as a resurfacer while they are in service and under full load. By means of the handle it is held with a slight pressure against the revolving commutator or collector ring until the abrasive surface has cut down ridges and rough spots and entirely eliminated the sparking caused by the rough surface. Unless a commutator or ring is in extremely bad condition, a few minutes' work with this device will correct this trouble.

One of the features in the construction of the "Ideal" resurfacer is its uniform density. It being a manufactured article, the cutting surface is always uniform. The manufacturer, the Ideal Commutator Dresser Co., Chicago, has expressed its confidence in the device by a liberal ten-day free trial offer.

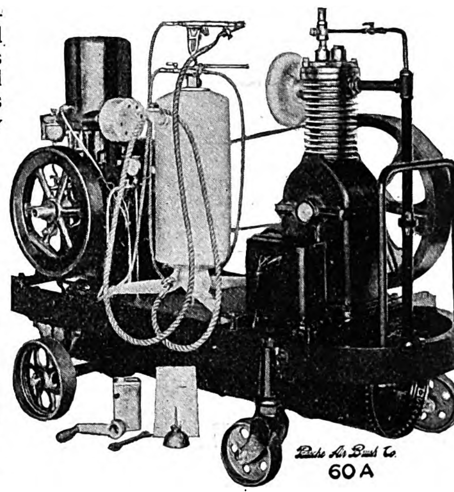


Paasche Napsack Painting Outfit.

Portable Painting Equipment Saves Time and Money.

With present high labor costs and the beginning of delayed building activity, special interest attaches to the Paasche air brush and portable painting equipment. The product of this company enables one man to do the painting ordinarily requiring the employment of four, six and even eight men using a hand brush; moreover, the work is done better and with less paint than when done by the old-fashioned method. Surfaces painted by the Paasche apparatus thus cost less to paint and require less frequent painting.

The Paasche outfit consists of an air brush, an air compressor, an air tank and engine or motor for driving the compressor (or hand pump as the case may be) and a length of flexible hose, and the various control mechanisms for manipulating the supply of paint, the pressure of air, etc. There are several different types of equipment, all embodying the same general principles, and depending upon whether one or two different colors of paint are used; the capacity of the unit, in gallons; and whether it is necessary that the entire outfit be moved or only part of it, which means according to the kind of work to be done. There is a type for every form of work and some of them are entirely enclosed against dirt and rain. In some of the types engine, compressor, air tank and paint drums are installed upon one portable truck. In others each of the fundamental units are mounted separately upon individual trucks. In yet other types the paint drum can be strung upon a man's back, like a knapsack, a convenient arrangement where the surfaces to be covered are difficult of approach, as smoke stacks and similar places; this outfit, complete with 6-ft. of hose, 3-gallon paint tank and fittings, weighs only 18 lbs. Still another outfit specially designed for painting smokestacks, tanks, and large surfaces elevated above ground, where scaffolding would be ordinarily required, is fitted with safety block and tackle and all necessary equipment for moving up and down safely. This is a very compact unit and consists of seat, 50-ft. of airline hose, tackle and tanks.



Paasche Portable Painting Outfit for Two Painters.

The Paasche painting equipments have been developed specially for painting efficiently such surfaces as walls, stucco houses, steel surfacees, brick buildings, structural work of all kinds, bridges, trucks, stacks, ships, etc. It can be used for finishing and general painting as well as for calcimining. It is being used by some of the largest steel manufacturers, including the Carnegie Steel Co., the Duquesne Steel Co., and others. Twelve Paasche equipments have recently been ordered by the Government for painting the forty large steel buildings that are now being erected at Savannah, Ill., for returned equipment.

Wherever and whatever is to be painted can be done quicker, better and cheaper when done the Paasche way than when done any other way, is the claim of the Paasche Air Brush Co., Chicago, who cite instances where men with only one arm have replaced several able-bodied men.

Lately Approved Appliances

Underwriters' Laboratories, established and maintained by the National Board of Fire Underwriters (for service—not profit), have examined, tested and listed these electrical appliances in accordance with the Laboratories' Code for Construction and Test of Electrical Appliances. Copies of complete lists of standard applances may be obtained from local inspection departments or from offices of the Laboratories in the principal cities.

Fixture for Use with Gas-Filled Lamps.—Duplex Lighting Works of General Electric Co., 6 West 48th street, New York, N. Y.
"Duplexalite." Catalog Nos. D-131, D-231, D-531, D-1031.
Listed May 16, 1919.

Fuses, Cartridge.—Atlantic Electric Goods Co., Inc., 1168 Broadway, New York, N. Y.
Cartridge enclosed fuses, 0-600 amperes, 250 volts.
Listed July 16, 1919.

Heaters, Curling-Iron. — American Electrical Heater Co., Woodward, Burroughs and Cass avenues, Detroit, Mich. Triangle Lektrik Sales Co., Detroit, Mich. (submittor).
"Triangle Lektrik," 100-125 volts, 85 watts, Catalog No. 601.
Listed May 15, 1919.

Heaters—Pressing Irons.—General Electric Co., Schenectady, N. Y.
Tailors' irons, 750-900 watts, 95-250 volts. Type Z-1053, 12-24 lb. sizes inclusive.
Listed Aug. 1, 1919.

Heating Appliances, Cooking and Liquid.—American Electrical Heater Co., Woodward, Burroughs and Cass avenues, Detroit, Mich.
"American Beauty." Electrically heated cooking appliances for voltages up to 250.
Glower stove, 500 watts, Catalog No. 33506.
Grill, 660 watts, Catalog No. 3375.
Hot plate, 8.9 amperes, Catalog No. 1100B.
Listed July 11, 1919.

Heating Appliances, Industrial and Laboratory.—General Electric Co., Schenectady, N. Y.
"G. E." Glue pots, 20-1100 watts, Types I-1, I-2, I-4, I-6, I-15 to I-18 incl.
Soldering irons, 75-275 watts, 95-250 volts, Types I-8 to I-12 incl.
Listed July 11, 1919.

Insulating Materials. — West Virginia Pulp & Paper Co., 200 Fifth avenue, New York, N. Y.
Fiber sheets having following properties: Absorptive to about same extent as ordinary fiber; readily combustible; moderate mechanical strength and readily worked with tools; not noticeably affected by temperature of 125° C.
While insulating material of this general type is not classed as either nonabsorptive or noncombustible and should, therefore, not in general be used as a substitute for materials so classed, this fiber is judged to be suitable for crossbars, washers, bushings and other small parts of electrical fittings where use of fiber has been recognized.
Manufacturers desiring to use this material should submit samples in commercial form for examination and test by Underwriters' Laboratories.
Listed July 12, 1919.

Internal-Combustion Engine Electric Plant.—Alamo Farm Light Co., 703 Tower building, Michigan boulevard and Madison street, Chicago, Ill.
Nonautomatic starting, internal-combustion engine (Standard Portable) for use with gasoline, and direct-connected electric generator, control apparatus and storage battery for small isolated stationary installations. Electric control automatically stops engine when batteries are fully charged. "Silent Alamo." Rating: Generator 1 kw., 32 volts. Gasoline capacity, 1¾ gal.
Listed Aug. 18, 1919.

Lamp Guards.—McGill Manufacturing Co., Valparaiso, Ind.
Portable steel guards with wooden handles with or without sockets. "Dreadnought," "National," "Crescent Reflecting," "Security," "Universal," "Mogul," "Tubular."
Wall lamp guards. Catalog No. 1436-40 incl., 1580-81 incl., 1583, 1585, 6000, 6005. "McGill."
Listed July 25, 1919.

Lamp Guards.—Racine Iron & Wire Works. Racine, Wis.
"Buck." Pendent or portable wire lamp guards. Catalog Nos. 1, 2.
Listed Aug. 21, 1919.

Outlet Bushings.—Adapti Manufacturing Co., 919-25 West street, Cleveland, Ohio.
Connector bushings of malleable iron or pressed steel, for connecting armored cable or flexible steel conduit to conduit boxes, Catalog Nos. 910, 931, 940, 941.
End outlet fittings for rigid conduit made for cast iron having porcelain covers with separate wire holes. Catalog Nos. 8900-02 incl., 8970-72 incl.
Listed Aug. 2, 1919.

Outlet Bushings.—James E. Gleason Co., 515 West Jackson boulevard, Chicago, Ill.
Connector bushings of pressed steel for connecting armored cable or flexible steel conduit to outlets.
Listed Aug. 8, 1919.

Outlet Bushings.—James C. Phelps, Springfield, Mass.
Brass and cast-iron fittings, "J. C. C." Caplets, Type AB.
For use only at an exposed end of conduit (but not under fixture canopies) and only where conduit wires pass out through fitting without splice, joint or tap within fitting.
Listed June 3, 1919.

Outlet Plates.—The B. & D. Electric Co., 183-185 Congress street, Boston, Mass.
Cast-iron outlet plates, Catalog No. 15.
Listed Aug. 5, 1919.

Outlet Plates.—The Pratt Chuck Co., Frankfort, N. Y.
Pressed-steel outlet plate ¾ in. for flexible tubing.
Listed July 19, 1919.

Outlet Plates.—The Toledo Metal Products Co., 956 Spitzer building, Toledo, Ohio.
"B.-G." Steel outlet plates, Catalog Nos. 904-R, 905-R.
Listed Aug. 9, 1919.

Panelboards.—Starrett Manufacturing Co., 523 South Green street, Chicago, Ill.
Consisting of double-pole toggle switch and plug-fuse cutout bases mounted in cutout box with auxiliary cover which encloses all live metal parts except flush receptacles for Edison plug fuses. Capacity not to exceed 30 amperes, 125 volts.
Listed July 31, 1919.

Raceway Fittings, Metal.—Appleton Electric Co., 218-30 North Jefferson street, Chicago, Ill.
Fittings for use with "Pagrip" metal raceways, Catalog Nos. 350, 355, 365, 370, 375, 380.
Listed June 27, 1919.

Receptacles for Attachment Plugs, and Plugs.—The Bryant Electric Co., Bridgeport, Conn.
"Bryant" or "Perkins." 12 amperes, 250 volts. For use in marine wiring when mounted in conduit boxes, receptacles, Catalog Nos. 583, 584; plugs 585-88 incl.
Listed July 2, 1919.

Receptacles for Attachment Plugs, and Plugs.—Central Electric Co., 320 South Wells street, Chicago, Ill.
Receptacles and plug attached to standard enclosed switch and so interlocked with switch mechanism that plug cannot be used to make or break circuit under load. "Ralco No. 42 Safety Receptacle." 60 amperes, 250 volts d. c. or 500 volts a. c., 3-pole.
"Ralco." 25 amperes, 220 volts. Catalog Nos. 1S.T. and 13S.T.
Listed Aug. 5, 1919.

Trade Activities

Ideal Electric Holds Sales Conference — New Roller-Smith Representatives—Electric Traveling Crane Exhibit

E. B. Badger & Sons Co., 63-75 Pitts street, Boston, Mass., announces the opening of a Chicago office, with Harry E. Wheeler as manager. Mr. Wheeler will be pleased to quote prospective customers on their requirements for air washers for turbo-generators, or spray ponds or cooling towers for cooling water for condensing plants.

Eureka Vacuum Cleaner Co., Detroit, Mich., is sending to dealers an attractive poster, 28 by 42 in. in size, an enlargement of the Eureka advertisement appearing in the October issues of *Ladies' Home Journal* and *Good Housekeeping,* and the Oct. 4 issue of the *Saturday Evening Post* and presents forceful arguments in favor of this labor-saving device. Another opportunity is thus afforded dealers of this cleaner to tie in with the extensive national advertising campaign now being conducted by the Eureka company. This campaign is one of the biggest things ever undertaken by the company and dealers can ill afford to pass by the opportunities presented by it to increase their sales for the Eureka vacuum cleaner.

Western Electric Co., 195 Broadway, New York City, has recently opened a new branch, consisting of a sales office and warehouse at 334 East Bay street, Jacksonville, Fla., in charge of A. H. Ashford. This new distributing house has been established for the purpose of enabling the company to give improved service to its customers in the extreme southeastern part of the United States. A complete line of electrical supplies and specialties will be carried at this house, this to include pole-line hardware, cross-arms and other pole-line construction material; all inside wiring material; portable sewing machines, vacuum cleaners, washing machines, heating apparatus and all other electrical household appliances.

Sprague Electric Works of General Electric Co., New York, N. Y., is sending out Bulletin No. 47942, introducing a new line of safety panel boards and cabinets, which are applicable wherever the live front type of panel board has heretofore been used. The branch circuit switches and main switches are distinctive features of these panel boards. They are simple in design, of strong construction, and positive in action, and are designed especially for safety panel board use and are claimed to outlast the type of switch generally used for this service. These panel boards meet the requirements of the National Board of Fire Underwriters. The bulletin contains considerable data on this new equipment and includes numerous illustrations.

Greaves-Etchells Furnace for Brazilian Plant.—Captain Teixeira, a member of the Brazilian Military Commission, who recently spent several months in this country investigating steel plants and electric furnaces particularly, has placed an order through Fenwick Freres & Co., New York City, for a Greaves-Etchells electric furnace, manufactured by the Electric Furnace Construction Co., Finance building, Philadelphia.

Electric Appliance Welcomes Home Soldier Employes.—On the evening of Sept. 26, the officers of the Electric Appliance Co., Chicago, tendered to its men returning from the service a reception and dance at the Masonic Temple. Various committees had charge of the affair, the Floor Committee taking upon itself to see that everyone became acquainted with the soldier employes. Several hundred couples danced into the early hours of Saturday morning, and all who were present pronounced the occasion a big success. The 40 soldier employes of the company who achieved distinction in many ways served in the Infantry, Medical Corps, Cavalry, Artillery, Ordnance, Quartermaster, and one in the Balloon Squadron. One of this number was gassed and another badly wounded, the latter still being in France.

The Bearings Co. of America, Lancaster, Pa., at a recent meeting of its board of directors decided to increase the facilities of the thrust bearing factory. A new building of the latest type of construction is to be erected in the immediate future, which will give approximately 10,000 sq. ft. additional space when the building is completed. This addition to the manufacturing facilities of the thrust bearing section of the company, with the new buildings which were completed last year for the increased production of its Universal joint plant in which is manufactured "Sterling" Universal joints for automobiles, trucks and tractors, is brought about by the material increase in the production of the automobile and allied industries. This will give the company four separate buildings, the first, for the first of complete thrust ball bearings; the second, for the manufacture of "Star" ball retainers of all types; third, for the manufacture of "Sterling" Universal joints, and fourth, for the manufacture of drop forgings. During the recent war, the company supplied large quantities of thrust bearings for use in Liberty airplanes, gun mount bearings for Navy Ordnance, thrust bearings for use in Class B motor truck steering gears, and for many other departments of war work that required ball thrust bearings.

The Roller-Smith Co., 233 Broadway, New York, N. Y., announce the appointment of the Alfred Collyer Co., 420 Power building, Montreal, Canada, as its agent for the entire Dominion of Canada and Newfoundland. The Collyer company will handle the Roller-Smith Co.'s products of instruments and circuit breakers. As the company has had an extensive experience in marketing electrical apparatus, it is particularly well fitted to handle the Roller-Smith Co.'s rather complex lines. The Alfred Collyer Co., which also represents the Wagner Electric Manufacturing Co., has a branch office at 183 George street, Toronto.

Allis-Chalmers Manufacturing Co., Milwaukee, Wis., is distributing Bulletin 1537, presenting details of Allis-Chalmers oil engines, Diesel type, and instructions for ordering repairs and spare parts. This publication, comprising 31 pages, is devoted entirely to line drawings and half tone illustrations of Allis-Chalmers oil engines and the various parts entering into their construction. Another bulletin prepared by the company is No. 16320 dealing with centrifugal pumps and centrifugal pumping units. Both the centrifugal pump and driving agent have certain fixed characteristics which cannot readily be altered by adjustment. For this reason both the manufacturer and purchaser of centrifugal pumping units should give careful consideration to these points, and in order that no important point be overlooked, it is recommended that the complete unit be purchased from one manufacturer who designs and builds both the pump and driving member. Some 40 pages of this booklet are devoted to detailed descriptions of centrifugal pumping units which the Allis-Chalmers company builds for practically any pumping requirement. The advantages of this apparatus are clearly set forth, the fundamental points of efficiency, accessibility, durability and ruggedness of construction having received careful consideration in the design of Allis-Chalmers centrifugal pumps. Illustrations of the various types of pumping units, views of typical installations, efficiency charts, etc., are also included. The experience of the Allis-Chalmers company in the design of centrifugal pumping units extends for a period of many years, and its ability to select and furnish a complete unit of its own manufacture is almost unique in this respect of combined responsibility.

Roller-Smith Co., 233 Broadway, New York City, announces the appointment of the General Machinery Co., 744-5 Brown-Marx building, Birmingham, Ala., as its agent in the states of Florida, Georgia, Alabama and Tennessee. The General Machinery Co. will handle the Roller-Smith Co.'s line of instruments, circuit-breakers and meters in this territory, and as it had an extensive experience in handling apparatus lines, it is particularly well fitted to handle the Roller-Smith Co.'s rather complex lines. The personnel of the General Machinery Co. consists of: B. A. Schroder, president, W. H. Price, sales engineer. The company has been located in Birmingham for about ten years and has a wide acquaintance with the trade. In addition to representing the Roller-Smith Co., it also represents the following manufacturers: Crocker-Wheeler Co., Goodman Manufacturing Co., Cutler-Hammer Manufacturing Co., Pittsburgh Transformer Co., and Esterline Co.

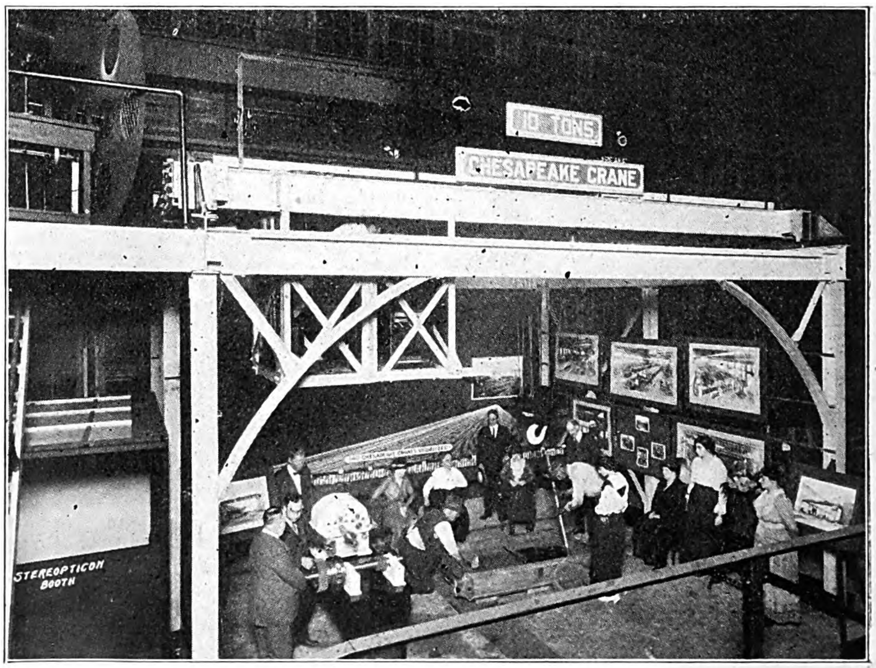
The Ideal Electric & Manufacturing Co., Mansfield, Ohio, held a sales conference at its Mansfield works during the week of Aug. 11. The following is a list of representatives who took part in the conference, S. Glen Vinson, secretary and general manager; L. S. Meeker, sales manager; T. Weiss of the Milwaukee office; C. A. Kuehn of the Cleveland office; James Kent of the Chicago office; R. F. Cooseka of the Minneapolis office and H. J. Brower of the New York office. Due to the business activities at the different agencies the district sales representatives from the following districts were unable to take part in the conference, J. M. Brugler of the Philadelphia office; A. L. Searles of the Grand Rapids office; and David Stead of the Denver office. In addition to the discussion of sales matters, the social side of the conference was a source of much pleasure to the "Ideal" men. Mr. Meeker took the various representatives through the plant explaining the details of the new types of motors under construction. From every point of view the conference afforded much benefit as well as pleasure and the Ideal Electric & Manufacturing Co. is already making plans for a more elaborate sales conference at some date in the future.

Cutler-Hammer Manufacturing Co., Milwaukee, Wis., has prepared a new four-page two-color 8½x11 folder, the title of which is C-H Drum Controllers. It gives prominence to the outstanding features of C-H drum controllers which have won an enviable position in the drum controller field. Three of the features are: accessibility, interchangeability of parts and interchangeability of methods of manipulation. Any C-H standard stock drum can be equipped with either rope, radial or straight line drive and these are interchangeable. The folder plays up other points, such as, the ease with which the contact fingers and the cylinders may be removed; the absence of wood in construction; the square metal shafts, and the straight non-stubbing fingers. Dimensions, ratings and other engineering data are given. Three types having common dimensions comprise five bulletin numbers, capable of controlling and motors from 1 to 100 hp. The folder had been prepared especially for the St. Louis convention of the Association of Iron and Steel Electrical Engineers, at which it was distributed last week, but it is also being forwarded on request by those interested in drum controllers.

Mercury Manufacturing Co., 4118 South Halsted street, Chicago, is sending out an illustrated circular entitled "Mule-Hide and The Trackless Train." Mercury tractors have been applied to practically every transportation problem and have been productive of wonderful results. A typical installation of the "Trackless Train" is that in the plant of the Lehon Co., manufacturer of Mule-Hide roofing for buildings and cars, and waterproof paper and insulating paper for refrigerator cars. In this circular is contained the testimony of Tom Lehon, vice-president and general manager of the company, bearing evidence of the accomplishments of the Mercury tractor. Mr. Lehon states that since the installation of the tractors, the cost of handling raw and finished products has been reduced 25% and no mechanical trouble has been experienced with the machine. In conclusion he recommends the tractor as an excellent investment no matter how difficult the haulage problem may be and recognizes the true worth of the "Trackless Train."

The Independent Pneumatic Tool Co., Chicago, is reported to be doing a business that compares very favorably with that of last year. When the war closed there was a heavy slump in pneumatic tool orders, as a great part of the output was being taken for use in war material industries. During the war the company's energies were devoted chiefly to the manufacture of pneumatic tools, but since then the electrical tool department of the business has been pushed with such success that its sales are expected to bring the total earnings up to a level with last year's net. Agencies are now being established for the company's electrical tools in Europe and in the orient and South America, and foreign orders are reported to be growing rapidly in volume. At the company's offices it was stated that the electrical tool business of the company is expected to equal that of the pneumatic tools in the not distant future. The company has paid 15% in dividends this year and on Oct. 1 paid more than 5%.

Electric Traveling Crane Exhibited for Foundrymen.—One of the most interesting exhibits held in connection with the annual meeting of the American Foundrymen's Association at Philadelphia, on Monday to Friday of this week, was a full sized 10-ton electric Chesapeake traveling crane in actual operation. An experienced woman crane operator demonstrated the use of this labor-saving machine to the foundrymen and other visitors. This exhibit was made by the Chesapeake Iron Works, Baltimore, Md., and served incidentally to call attention to the war record of this company in this line. Within 1½ years the company built, shipped and put into continuous service over 140 large electric traveling cranes, ranging from 20 to 110 ft. in span, and aggregating nearly 6000 ft. in span. Over 40 of these cranes were shipped to France for use in United States base ordnance plants and over 45 of them did day and night service in some of the largest ordnance plans in this country. Views of some of these war cranes were shown in the exhibit booth. The accompanying illustration shows the 10-ton exhibit crane receiving its dress rehearsal at the Baltimore works just before it was dismantled and shipped to the foundrymen's exposition at Philadelphia. This exhibit was produced at the request of F. S. Chavannes, president of the Chesapeake Iron Works, under the general direction of Frank L. Perry, the company's publicity manager, who will be remembered as the old Western Electrician, which was merged with Electrical Review in 1908.



A 10-Ton Chesapeake Electric Traveling Crane Being "Tuned Up" at the Works for Exhibition Before the American Foundrymen's Association.

Current News

Weekly Record of Construction Activities—Conventions

EASTERN STATES.

Fall River, Mass.—In connection with the construction of a new crude oil refinery to be located in the north end section of the city, by the New England Refining Co., estimated to cost $300,000, considerable new electrical and mechanical equipment will be required.

Greenfield, Mass.—Stanley Insulating Co. has had plans prepared for the erection of a new addition to its plant, to provide for increased operations. The structure will cost about $30,000.

New Bedford, Mass.—National Spun Silk Co. has awarded a contract to the J. G. White Engineering Corp., 43 Exchange place, New York, for the construction of a new one-story reinforced concrete power plant at its works, to cost about $100,000.

Springfield, Mass.—Westinghouse Electric & Manufacturing Co. is arranging plans for the erection of a large new addition to its plant at East Springfield.

Thorndike, Mass.—Leary & Walker, engineers, New Bedford, will soon award contract for the erection of a six-story, 75x163 ft., factory for the Thorndike Co., to cost about $175,000. A steam heating system and electric power will be installed.

Bridgeport, Conn.—Bryant Electric Co. has completed arrangements for the erection of a four-story addition to its plant on Hancock avenue, about 60x218 ft., to be used for increased capacity. The structure is estimated to cost $120,000.

Hartford, Conn.—Arrow Electric Co. has completed negotiations for the purchase of property adjoining its present plant, extending from Hawthorne street to the New Haven railroad, to be used for future expansion.

Stamford, Conn.—L. C. Terwilliger, Bridgeport, has completed arrangements for the purchase of the business of the Stamford Storage Battery Co., 22 Main street, Stamford. The new owner will continue operation of the business.

Buffalo, N. Y.—E. J. Wiggins Electrical Corp. has filed notice with the secretary of state of a change in its corporate name to the Allan Manufacturing & Welding Corp.

Dunkirk, N. Y.—Common Council is considering plans for the extension of the ornamental street lighting system from Fourth to Main streets.

New York, N. Y.—Display Stage Lighting Co., 314 West Forty-fourth street, has increased its capital from $10,000 to $50,000, for general business expansion. Notice of the increase has been filed with the secretary of state.

New York, N. Y.—Wilson-Maeulen Co., 781 East 142nd street, manufacturer of pyrometers and similar equipment, has awarded a contract to the Austin Co., 217 Broadway, for the construction of its proposed three-story plant to be located at St. Mary's street and Concord avenue, for increased capacity. Charles H. Wilson is president.

New York, N. Y.—Jandous Electric Equipment Co., 109 West Thirty-first street, has been awarded a contract for the electrical work in connection with the new public school building to be erected at Forest Hills, Long Island. The contract price was $13,456.

New York, N. Y.—Considerable new electrical and mechanical equipment will be required by the Aluminum Co. of America, 120 Broadway, in connection with the construction of its proposed three-story plant addition, about 125 by 300 ft., at Edgewater, N. J., contract for which was recently awarded to the Turner Construction Co., 244 Madison avenue.

Port Chester, N. Y.—P. R. Mallory, manufacturer of tungsten products, is having plans prepared for the construction of a new two-story and basement plant to provide for increased operations. The structure will be of reinforced concrete construction, about 40 by 112 ft., and is estimated to cost $60,000. Lockwood Greene & Co., 101 Park avenue, New York, are engineers.

Rochester, N. Y.—Plans have been filed by the Wheeler Green Electric Co., 29-33 St. Paul street, manufacturer of electric motors, etc., for the construction of a new addition to its plant, for increased capacity. The structure will be about 40 by 40 ft., and is estimated to cost $19,000.

Thorold, N. Y.—Plans are being arranged for the installation of a new street-lighting system throughout the municipality.

Elizabeth, N. J.—Considerable electrical and mechanical equipment will be required by the Warner Quinlan Asphalt Co., in connection with the construction of the proposed one-story filter plant, about 66 by 72 ft., to be located at Warner, N. J., estimated to cost $55,000.

Glassboro, N. J.—In connection with the construction of the proposed local normal school building by the State Board of Education, to be located in the vicinity of the railroad station, plans have been arranged for the erection of a power plant for general operation. The project is estimated to cost about $350,000. Calvin N. Kendall, State House, Trenton, is secretary of the board.

Hilton, N. J.—Following the acquisition of a tract of about four acres of land on Burnett avenue, Hilton, by H. Boker & Co., Inc., 101 Duane street, New York, manufacturer of steel and metal products, plans are being prepared for the construction of an initial group of buildings to form the first unit of a proposed plant by the company. Considerable electrical and mechanical equipment will also be required in connection with the new plant. Gilbert C. Higby, 207 Market street, Newark, N. J., is architect for the company.

Newark, N. J.—American Platinum Co., 231 New Jersey Railroad avenue, has had plans prepared for the construction of a new one-story brick boiler plant, about 25 by 42 ft.

Newark, N. J.—Public Service Electric Co. has filed plans for the erection of a new five-story brick and steel building and coal bunkers at its Point-No-Point electric station, about 48 by 92 ft., to facilitate operations. Estimated cost, $175,000.

Newark, N. J.—Eagle Electric Co. has filed notice of organization to operate at 158 Belmont avenue. Louis Maltz, 138 Prince street, and Morris Eklowstein, 230 West Kinney street, head the company.

Newark, N. J.—In connection with the establishment of the new plant of the Stanwood Rubber Co., located near the Newark-Elizabeth line, plans are being prepared for the erection of a new power plant, with capacity of about 1500 hp., to cost approximately $140,000. The site was formerly the property of the Diehl Manufacturing Co. and comprises a three-story reinforced concrete building with about 68,000 sq. ft. of manufacturing space. It is understood that the present power plant, a smaller structure, will be used for auxiliary operations at the works, while plans are also being prepared for a number of additions to the plant on adjoining property. It is proposed to have an initial output of about 500 cord tires a day, to be increased ultimately to 1000 tires and 2000 tubes per day. C. E. Barker is president.

Wilmington, Del.—Diamond Ice & Coal Co. is planning for the erection of a large addition to its plant, 11th street and Grant avenue, about 83 by 83 ft., estimated to cost about $50,000, and considerable electrical equipment will be required.

Bangor, Pa.—Plans are under consideration by the Bangor Central Quarry, operated by C. C. Wise and Peter Yetter, for immediate repairs in the boiler plant at the works, recently damaged by fire.

Carlisle, Pa.—C. H. Masland & Sons, Amber and Westmoreland streets, Philadelphia, Pa., have awarded a contract to the J. S. Rogers Co., Drexel building, Philadelphia, for the construction of a two-story power plant extension at its works on Carlisle Spring road, Carlisle. The structure with equipment is estimated to cost $150,000.

Catasauqua, Pa.—Town council has entered into a contract with the Lehigh Valley Light & Power Co., whereby the latter will furnish electric energy for street-lighting service to the municipality for a period of about ten years.

DuBois, Pa.—Northwest Mining & Exchange Co. is considering plans for the construction of an addition to its power plant. Seth H. Bloom is general manager.

Philadelphia, Pa.—Notaseme Hosiery Co., Mascher street, Germantown, will construct a power plant for works service in connection with its mill to be erected at Atlantic and I streets.

Philadelphia, Pa.—City has awarded a contract to the Dravo-Doyle Co., Commercial Trust building, for the installation of the proposed centrifugal pumping units at the Queen Lane pumping station. It is proposed to install four new units having a pumping capacity of 40,000,000 gal. every 24 hours. Estimated cost $404,600.

Philadelphia, Pa.—Penn Silk Hosiery Dye Works will build a new boiler plant and stack at its works.

Philadelphia, Pa.—In connection with the construction of a new five-story brick plant, about 80 by 250 ft., for the American Preserve Co., Third and Lehigh avenues, plans have been prepared for the erection of a new one-story brick boiler house, about 50 by 70 ft., to be used for general factory operation. Peuckert & Wunder, 310 Chestnut street, are architects for the company.

Pittsburgh, Pa.—Lutz & Schramm Co. has had plans prepared for the erection of a one-story boiler plant at 1412 River avenue.

Reading, Pa.—Metropolitan Edison Co. has been awarded a contract by the Textile Machine Co. for furnishing electric service for the complete operation of its plant.

Providence, R. I.—Electrical Products Manufacturing Co. has filed notice of organization to operate at 69 Sprague street for the manufacture of electrical goods. The company is an affiliated organization of the Commercial Radio Co. of America, Providence. H. A. McAvoy is secretary.

Baltimore, Md.—Maryland Color Printing Co. will install 600 hp. in motors.

Crownsville, Md.—Crownsville State Hospital has awarded a contract to the John Waters Building Co., 23 East Center street, for alterations and improvements in the power plant and heating system at the institution.

Monkton, Md.—In connection with the new plant of the Monkton Roller Mills, recently organized with a capital of $1,000,000, to comprise main manufacturing building, eight-story and basement, about 44 by 116 ft., with auxiliary structures, considerable electrical and mechanical equipment will be required. It is proposed to have a daily capacity of 2000 bbl. flour and 128,000 lb. mixed feed. Electric energy for operation will be furnished by the Consolidated Gas, Electric Light & Power Co., Baltimore. Otis E. McCoy is president, and Thomas B. Wolfe general manager.

DATES AHEAD.

National Association of Electrical Inspectors. Annual meeting, Springfield, Mass., Oct. 13 and 14. Secretary, W. L. Smith, Concord, Mass.

Illuminating Engineering Society. Annual convention, Chicago, Ill., Oct. 20-23. General secretary, Clarence L. Law, 29 West 39th street, New York City.

Illinois State Electric Association. Annual convention, Chicago, Oct. 22 and 23. Secretary-treasurer, R. V. Prather, Springfield, Ill.

Empire State Gas and Electric Association. Annual meeting, Buffalo, N. Y., Oct. 24. Secretary, Charles H. B. Chapin, 29 West 39th street, New York City.

American Society of Mechanical Engineers. Annual meeting, New York City, Dec. 2-5. Secretary, Calvin W. Rice, 29 West 39th street, New York City.

National Council of Lighting Fixture Manufacturers. Annual convention, Detroit, February, 1920. Secretary-treasurer, Charles H. Hofrichter, Cleveland, Ohio.

Norfolk, Va.—Norfolk Electric Manufacturing Co. plans to build a plant for the manufacture of induction motors of from 1 to 5 hp. Prices are desired on machine tools, ovens, bolts, etc. P. O. Sutton, 215 Cumberland street, is general manager.

Laurens, S. C.—Plans are under consideration by the city council for the issuance of bonds for $200,000, to cover the cost of extensions in the electric lighting and water systems, as well as other municipal work.

Plains, Ga.—Oct. 14 an election will be held to vote on the question of issuing $6500 in bonds to install an electric plant in connection with water plant. Address mayor.

NORTH CENTRAL STATES.

Akron, Ohio—Miller Rubber Co. is increasing its capital $800,000 to provide for factory expansion. This will bring its capital up to $9,832,700.

Genoa, Ohio—Nov. 4 the question of issuing $5,000 municipal light bonds will be submitted to vote. Address village clerk.

Mansfield, Ohio — Westinghouse Electric Products Co. will enlarge its plant by the erection of a six-story addition which will provide about 80.000 sq. ft. of floor space. The extension will be used for the manufacture of heating appliances, electric irons and similar products.

New Madison, Ohio—Madison Lighting Co. has increased capital from $3500 to $10,000.

Norwood, Ohio—Insurance adjusters inspected the ruins of the Norwood municipal electric light plant and water works and then requested the city officials to repair as far as possible the damage caused by fire. Address Harry J. Pierson, service director.

Oberlin, Ohio—A bond issue of $50,000 has been authorized for the construction of a municipal electric light plant.

Greencastle, Ind.—Standard Heating Sales Co. has changed its principal office from Terre Haute, Ind., to Greencastle, Ind.

Hammond, Ind.—American Steel Foundry Co. has purchased a tract of land in the Indiana Harbor factory district involving nearly $1,000,000. The tract comprises 100 acres, just south of the harbor ship canal and has a canal frontage of one-half mile. A program of expansion is being mapped out to begin as soon as the strike is over. This purchase quadruples the land holdings of the American Steel Foundry Co. and makes it one of the heaviest land owners in the Calumet factory district.

Indianapolis, Ind.—Haywood Tire & Equipment Co. will build a foundry to cost $75,000.

Indianapolis, Ind.—Cole Motor Car Co. will add two new buildings to its plant at Washington and Davidson streets. The expansion will involve an expenditure of $1,000,000. First building to be completed by Jan. 1, will be five stories, steel and brick construction, 180 by 228 ft. The second building, to be completed March 1, 1920, will be a duplicate of the first and will be 132 by 212 ft.

LaPorte, Ind.—Wanatah Electric Co. has changed its name to the Wanatah-LaCrosse Electric Co.

Muncie, Ind.—City council has authorized the erection of a new city building to cost $250,000.

Chicago, Ill.—American Car & Foundry Co. will build addition to its present plant on South Paulina street, south of Blue Island avenue, to cost, together with the rebuilding of the old plant, about $2,000,000. The present plant will eventually be torn down and a new one similar to the proposed addition will be built. The plant will have a capacity of 50 steel freight cars per day. It now turns out 30 daily. It will be one of the largest of the 16 freight car plants of the company.

Chicago, Ill.—Architect Z. E. Smith, 305 East 55th street, Chicago, has prepared plans and will let contracts for $200,000 shop and power house to be erected. Specifications include power station equipment, electrical equipment, boilers for steam heating.

Delavan, Ill.—Delavan, Green Valley and San Jose will be supplied with day and night current for light and power by the plant which is being rebuilt by F. B. Hullinger of San Jose, Ill. Mr. Hullinger has completed an addition, 40 by 60 ft., to his building and is installing two new boilers, 150 and 95 hp. respectively, and two new generators of 150 and 90 kv-a. respectively. A transmission line, 12 miles in length, will be built to connect Delavan and Green Valley with San Jose. The plant at Delavan will be closed. Green Valley has not been served with electric light and power before.

Elgin, Ill.—A bond issue of $200,000 is planned for a municipal lighting and electric power plant.

Elgin, Ill.—Elgin Sanitary Milk Co. will erect a $25,000 milk bottling plant. Address Oscar Ludwig, president.

Galesburg, Ill.—Farmers and Mechanics Bank will erect new bank and office building to cost $150,000.

Rankin, Ill.—Architects McCoy and Skaddin, Dale building, Rankin, have prepared plans for $30,000 water works and power house to be erected by city. The building will be one story in height, 30 by 86 ft. in dimensions. Address superintendent of water department.

Urbana, Ill.—University of Illinois will build new addition to power house to accommodate two 500-hp. boilers which are being added to the equipment.

Detroit, Mich.—Detroit Edison Co. will erect an $80,000 addition to its power plant. The specifications include generators, transformers, etc. Address Alex Dow, president, Whitman building, Detroit, Mich.

Detroit, Mich.—General Ice Delivery Co. is having plans prepared for the construction of a one-story 36 by 322 ft. ice storage plant on Warren avenue. An electric motor for power and an ice handling conveyor will be installed. Dalton R. Wells, 435 Woodward avenue, architect.

Escanaba, Mich.—If plans now under way materialize Escanaba is to have a great "white way." The plans now being worked out contemplate the erection of a large number of cluster lights on both sides of Ludington street from Oak street down to the post office block. Address Jacob Kratze.

Kalamazoo, Mich.—The city will hold an election Nov. 4 to vote on the issuance of $1,250,000 electric light bonds.

Reed City, Mich.—Osceola Light & Power Co. plans the installation of an auxiliary plant. It is reported that the company has placed orders for engines and boilers for the plant.

Ashland, Wis.—Northern National Bank will erect new bank building to cost, exclusively of interior work, $47,500.

Osseo, Wis.—The city council has under consideration the purchase of the local electric light plant and also the installation of a waterworks system.

Portage, Wis.—Contracts have been awarded for the Portage Madison, Janesville Interurban Railroad. After practically a standstill in construction for several years a contract has been awarded for completion of the line according to J. E. Jones, Portage, head of system.

Waupaca, Wis.—Waupaca county will receive bids for a hydroelectric power plant. Address E. H. Josslyn, Algoma block, Oshkosh, Wis.

Beverley, Kans.—Ordinance has passed granting a franchise to John S. Painter to furnish electricity to the city for a period of fifteen years. Waldo Hancock, city clerk.

Coldwater, Kans.—Election to vote $35,000 in bonds for the purchase of a new engine and to make other improvements to the water and power plant, carried.

Elk City, Kans.—C. R. Long, Elk City, has been granted a franchise to install a light plant that will give the city 24-hour service, starting with 50 street lights.

Garden Plain, Kans.—N. B. Rollins & Co., 209 Railroad Exchange building, Kansas City, Mo., engineers, have prepared plans for electric light plant to be erected by city. E. Behm, city clerk.

Hudson, Kans.—Engineers N. B. Rollins & Co., 209 Railway Exchange building, Kansas City, Mo., engineers, have prepared plans for a $15,000 electric transmission line to be built from Hudson to Stafford, Kans. Address Esther Arnold, city clerk, Hudson, Kans.

Junction City, Kans.—Riverside Power & Light Co. is making plans to extend its lines to White City and will form a circle of towns around this city. The company now furnishes power to more than forty towns in Kansas.

Richmond, Kans.—Plans are in progress for the construction of a transmission line from Ottawa, wiring the city of Richmond, purchasing meters, transformers, street lights and all other necessary equipment.

Seneca, Kans.—A new "white way" will be installed in the near future, which will extend four blocks.

Willis, Kans.—Engineers N. V. Rollins & Co., 209 Railway Exchange building, Kansas City, Mo., has prepared plans for a $9000 electric transmission line f rom Willis to Horton, Kans. Address E. Piner, city clerk, Willis, Kans.

Aurora, Mo.—Aurora contemplates purchasing one 15-hp. engine and 9-kw. dynamo for light plant.

Independence, Mo.—Election to vote $65,000 in bonds for the additions and extensions of municipal light and power plant, carried.

Marshall, Mo.—$46,000 in bonds have been voted for erection of electric light plant. Address mayor.

Richmond, Mo.—Plans are in progress for the installation of a "white way." Subscriptions are being solicited from business men.

Beatrice, Neb.—A new hotel to cost $500,000 will be erected by business men of the city.

Holmesville, Neb.—Plans are being prepared for erection of transmission line from Holmesville plant to supply current from lighting towns of Rockford, Filley, and Virginia. Address G. L. Humford, county auditor.

Kimball, Neb.—Election to vote $20,000 for electrical equipment carried.

Lexington, Neb.—The entire milling plant of the Platte Valley Milling Co. at Gothenburg, near here, burned, the loss being placed at $200,000, partly insured. The power plant, mill, elevator and office were destroyed.

Omaha, Neb.—City council has passed ordinance providing for the submission of $100,000 city jail bonds at the time of the regular election Nov. 4.

Plainview, Neb.—An election for a $24,000 bond issue for the installation of an electric light plant, carried.

Fargo, N. D.—$175,000 in bonds have been voted for erection of municipal light plant. John E. Hogan, commissioner.

Great Bend, N. D.—Business men and farmers have incorporated to build an electric light plant. The transmission line will extend from Hankinson to Wild Rice river. Work will be commenced soon. Address Joseph A. Renke, director.

Halton, N. D.—Bonds to the amount of $10,500 have been voted by the city for improvement to the electric light plant.

Madison, S. D.—The city commissioners have awarded to a Minneapolis concern the contract for erecting a power house, to replace that destroyed by fire some months ago.

SOUTH CENTRAL STATES.

Paducah, Ky.—An election will be held in November to vote on the question of issuing $100,000 municipal light bonds.

Clarksdale, Miss.—Johnson-Harlow Lumber Co. will improve its plant and install electric conveying equipment.

Jackson, Miss.—Jackson Light & Traction Co. will improve its electric generating plant. Address L. O. Gordon, manager.

Texarkana, Ark.—Southwestern Gas & Electric Co. is arranging plans for doubling the present capacity of its power plant. It is said that new generating equipment will be installed, the work being estimated to cost $75,000. W. L. Wood is general manager.

Wynn, Ark.—Plans are under consideration by the city for the construction of a new electric light plant, to be used for municipal service. The structure is estimated to cost $90,000.

Ponca City, Okla.—The city council has approved the proposed bond issue for $50,000 to cover the cost of extensions in the municipal electric light plant. W. H. McFadden is mayor.

Shattuck, Okla.—Plans are in progress for waterworks and electrical improvements to cost $75,000. Burns & McDonnell, Kansas City, Mo., engineers. O. W. Nichelson, city clerk. Bonds have been approved and will be sold in the near future.

Abilene, Tex.—American Public Service Corp. will erect plant here. The plans and specifications call for an expenditure of over half a million dollars and it will be one of the finest and best equipped electric ice and power plants in Texas. There will be large cold storage rooms in connection with the plant. High-power lines will be built from Abilene to Anson and other towns in this part of the state. The building will be fireproof throughout and the machinery all new and of the very latest design. A. Hardgrove, general manager.

Dalhart, Tex.—A modern lighting system is to be installed with the wiring under ground. Work will begin soon.

Marshall, Tex.—The installation of a "white way" is being considered.

Menard, Tex.—Menard Light & Power Co. is considering plans for improvements and alterations in its plant to facilitate operations. It is understood that new generating equipment will also be installed, the entire work being estimated to cost about $40,000.

WESTERN STATES.

Fort Sumner, N. M.—It is planned to install a large hydroelectric plant when the new dam is built, both for light and power purposes. The plant is estimated to cost between $35,000 and $40,000.

Nampa, Ida.—The Nampa Chamber of Commerce is considering the installation of a boulevard lighting system to replace the lights now in use.

Missoula, Mont.—The remodeling of the Missoula Light & Water Co.'s power dam in the Missoula river near Milltown, will cost about $85,000, according to H. L. Bickenbach, superintendent of the street railway here, who will have charge of the work.

St. George, Utah—Certificate of convenience and necessity was granted to the Dixie Power & Light Co. by the state public utilities commission authorizing the erection of a generating electric plant about 21 miles from St. George on the Santa Clara river. The company furnishes St. George and the surrounding territory with electricity and power now but desires to enlarge its plant in order to increase its capacity. Address T. L. Parker.

Seattle, Wash.—The city council has passed an ordinance appropriating $420,000 for expenditure in initiatory work on the city's Skaget river hydroelectric plant, 100 miles northeast of the city. The first work will consist of building a road, already located and surveyed, and the installation of a sawmill and power plant for construction purposes. The purpose is to engage a construction engineer to supervise the work of carrying out the plans to be furnished by the city engineer. It is proposed to pay the construction engineer an annual salary of $10,000 to $15,000.

Spokane, Wash.—F. E. Martin will erect a power house at the Edgecliff sanitarium at a cost of $21,110, contract having been awarded by the county commissioners.

Astoria, Ore.—Negotiations have been completed by the Pacific Power & Light Co. for the purchase of property located on Young's Bay, Astoria, comprising a total of about 15 acres, to be used as a site for the construction of a large new power, light and gas plant. In connection with the new plant, a distributing system will be constructed to furnish electric energy, etc., in the lower Columbia river district. The works are estimated to cost $75,000.

Bend, Ore.—The construction of a 1000-kw. steam plant is contemplated by the Bend Water, Light & Power Co. The new plant will double the present power outfit. Estimated cost, $100,000. J. H. Foley, Bend, manager.

Florence, Ore.—The Florence Electric plant owned by G. G. Bushman of Eugene was burned, causing a loss of $10,000. It will be rebuilt.

Grants Pass, Ore.—Plans are being arranged by the California-Oregon Power Co. for the construction of a new electric transmission line to extend from Medford to Roseburg.

Portland, Ore.—Northwestern Electric Co. has had plans prepared for extensions in its steam and electric mains, and active work has been inaugurated recently. The improvements are estimated to cost $100,000. G. C. Pierce is vice-president and general manager.

Chico, Cal.—Board of Trustees is understood to be arranging plans for the erection of a new local power plant and distributing system, to be used for municipal service.

Copperopolis, Cal.—Calaveras Copper Co. is understood to have completed plans for the erection of a new power plant and reservoir at its local plant, to be used for the furnishing of electric energy for general works operation.

Los Angeles, Cal.—Announcement has been made that plans are being prepared by the Goodyear Tire & Rubber Co., Akron, Ohio, for the erection of a large new plant on property recently acquired. The new factory will include a number of structures for various departments of operation, as well as the erection of an electric power station. Considerable electrical and mechanical equipment will be required in connection with the proposed project, which is estimated to cost in excess of $3,000-000.

Los Angeles, Cal.—In connection with the new packing plant to be constructed at Vernon by the California Provision Co., large quantities of electrical and mechanical equipment will be required. The works will comprise a number of structures, including boiler plant and refrigerating department. Estimated cost, $200,000.

Pasadena, Cal.—Warnerlite Co., Davenport, Iowa, manufacturer of electrical products for automobile service and kindred specialties, is planning for the construction of a large new local plant. The works will be erected on the unit system and it is understood that the initial structure is estimated to cost about $100,000.

Petaluma, Cal.—Petaluma - Santa Rosa electric railroad is planning to increase its present operations. Plans are being prepared for the extension of its electric system from Forrestville to extend to the Russian river at the Walls-Ford bridge.

Richmond, Cal.—Pacific Oil & Lead Co. has completed arrangements for the installation of 40-hp. additional in motors at its plant, to provide for increased operations. Electric energy will be furnished by the Western States Gas & Electric Co.

Richmond, Cal.—Plans are under consideration by the city council for the installation of a number of new electroliers for extensions in the street lighting system in the downtown district. It is understood that about 117 units will be installed.

Richvale, Cal.—Board of Supervisors has granted a franchise to J. W. Northedge providing for the operation of an electric light plant for the furnishing of electric service to Richvale. Power will be purchased from the Pacific Gas & Electric Co.

Whittier, Cal.—Southern California Edison Co. will build a new brick structure at Greenleaf and Penn streets, to facilitate operations. The building will be about 100 by 100 ft., and is estimated to cost $20,000.

PROPOSALS

Electric Light and Power Plant.—Bids are desired for the erection of a complete electric light, ice and power plant for the city of Wharton, Tex. Address C. M. Hughes, alderman ward No. 1, Wharton, Tex.

Power Plant Equipment.—Bids will be received at Youngstown, Ohio, until Oct. 13 for additions and alterations to electrical equipment of power plant in Mahoning county court house. Crippen & Funk, Ohio Hotel, engineers.

Lighting Fixtures.—Bids will be received Oct. 10 by the Board of Education of Independent School District, Virginia, Minn., for lighting fixtures for the vocational high school building, according to plans prepared by A. W. Kerr & Co., architects and engineers. Address C. R. Johnson, clerk.

Centrifugal Pumps.—Bids are desired by Clinton, S. C., for drilling one or two wells 10-in. or 12-in. in diameter at start, 8-in. or 10-in. finish, 500 to 700 ft. deep, and a centrifugal pump 750 to 1000-gal. capacity, to work against 550 lb. B. B. Mills, superintendent.

Hydroelectric Plant Equipment.—Until 10 a. m., Oct. 17, bids will be received by the Board of Public Works, Seattle, Wash., for furnishing hydroelectric machinery involved in the installation of an additional unit to the Cedar Falls hydroelectric station. C. B. Bagley, Room 234 County-City building, secretary.

Motor-Driven Pump.—Bids will be received by the board of trustees of the State Institute for Feeble-Minded of Western Pennsylvania at Polk, Pa., until Oct. 8 for furnishing a motor-driven low-service centrifugal pump and liquid chlorine machine with platform scales. Specifications may be obtained from Chester & Fleming, engineers, Union Bank building, Pittsburgh, upon deposit of $10. Marvin F. Scaife is secretary of the institution.

Personals

R. J. Gaskill Elected President International Municipal Electricians — J. J. Carrick Joins Paul W. Koch & Co.

CHARLES E. MERRILL, for the past ten years general purchasing agent for the Manhattan Electrical Supply Co., New York City, is now general manager of the Parr Electric Co., wholesale and export electrical supplies, New York City.

WILLIAM BURLEIGH has become chief engineer of the Machinery Sales & Electric Co., Detroit, in charge of designing, estimating and engineering of elevating and conveying equipment. For the past three years Mr. Burleigh has been connected with the Packard Motor Car Co., Detroit, in the capacity of assistant engineer.

JOHN J. CARRICK, who recently received his release from the Navy, has become identified with Paul W. Koch & Co., Chicago, in the capacity of sales engineer. After Mr. Carrick received his technical education he served three years in the electrical department of the Lincoln Park Board, Chicago, which period he spent in the construction of the power plant and underground cable system for park and boulevard lighting. Resigning this position he became connected with the Cutter Electrical & Manufacturing Co., Philadelphia, and for five years served as sales engineer in its Chicago office. At the outbreak of war Mr. Carrick entered the United States Navy with the Illinois Naval Militia, where he served for over two years, spending one year as electrical officer while with the Atlantic Fleet on the *U. S. S. Vermont.* He received the commission of lieutenant senior grade and was recently placed on the inactive list of the Navy.

F. M. WILKES has been appointed commercial agent and new business manager for the Arkansas Light & Power Co., Pine Bluff, Ark., succeeding W. F. Moody. Following his graduation from the Kentucky State University in 1908, Mr. Wilkes served in the power apparatus shops of the Western Electric Co., Hawthorne, Ill. After a year's service he became connected with the Public Service Co. of Northern Illinois as district superintendent in charge of inside and outside construction, continuing in this capacity for three years, when he was appointed consulting engineer associated with Henry C. Wood, Chicago, in 1913, in charge of power contract department, covering the operation of coal mines and the pumping plants in southern Kentucky. He later entered the service of the Missouri Public Utilities Co. as commercial manager with headquarters at Poplar Bluff, having charge of territory comprising the rice farming districts near Dudley and Fisk, Stoddard and Butler counties, Missouri, directing the electrically driven pumping stations for irrigation purposes. During the period of the war Mr. Wilkes served as a captain in the Signal Corps.

ROBERT J. GASKILL, who was elected president of the International Association of Municipal Electricians at its Chicago convention last week, is chief electrician of the city of Fort Wayne, Ind. Though a native of Pennsylvania, born in 1885, Mr. Gaskill was raised and received his early education in Indiana. His first electrical work was with the Bell Telephone Co. and the Western Union Telegraph Co., being employed in line construction work in northern Indiana and Ohio. In 1906 he entered the electrical department of the city of Fort Wayne, becoming chief

R. J. Gaskill.

electrician in the department of public safety the following year, which position he held until 1917, when he enlisted in the army and entered an officers' training camp. He was commissioned a lieutenant in the Artillery and later transferred to the Signal Corps and assigned to the 310th Field Signal Battalion, which went overseas in July, 1918, and served in the Toul sector in France and after the armistice with the Army of Occupation in Germany. He was discharged from the army in July, 1919, and returned to his former position with the city of Fort Wayne. Mr. Gaskill has always been greatly interested in the International Association of Municipal Electricians. He was vice-president for two years, a member of the executive committee for one year and was elected president at the Baltimore convention in 1916. His enlistment in 1917 prevented him from completing his term as president and as a tribute to his patriotism and ability the members again elected him president of the association.

H. C. HANCOCK, who has for several years represented the Trumbull Electric Manufacturing Co., Chicago branch, in the mid-western states, has severed his connection to accept the position of industrial engineer with the Great Lakes Electrical Co., Detroit, Mich., which is said to be the largest electrical supply jobber in the state of Michigan.

CLIFTON R. HAYES, who was elected president of the New England section of the National Electric Light Association at its annual convention last week, is manager of the Fitchburg Gas & Electric Light Co., Fitchburg, Mass., and is one of the best known central-station managers in the Northeast. He was born in Fitchburg, Mass., forty years ago and was graduated in electrical engineering from the Worcester Polytechnic Institute in 1901, and in 1909 received the degree of E. E. from that institution. Mr. Hayes has had a varied experience, including electrical engineering in both industrial and public utility organizations previous to becoming manager of the Fitchburg Gas & Electric Co. about eleven years ago. He was for two years assistant to the superintendent of motive power, Worcester Consolidated Street railway, and for five years electrical engineer for the Ludlow Manufacturing Associates. He is a past-president of the Fitchburg Y. M. C. A. and the Fitchburg Rotary Club, and last year was president of the Tenney Service Association, an organization of managers of public utilities, managed by Charles H. Tenney & Co., Boston.

Obituary.

C. H. HILL, chief electrical inspector of the Philadelphia Fire Underwriters' Association, middle department, and for many years associated with Washington Devereux on the staff of that organization, passed away on Sept. 23, and was buried from his late home in Palmyra, N. J., on Sept. 26.

CHARLES E. LORD, general patent attorney of the International Harvester Co., Chicago, died Sept. 25 from injuries sustained at the company's Deering harvester works when the automobile in which he was going through the plant was struck by a switch engine. Mr. Lord had been the head of the harvester patent department since 1912. He had previously been an examiner in the patent office at Washington, and later was in the service of the General Electric Co., Schenectady, N. Y., and still later with the Bullock Electric Co., Norwood, Ohio, and Allis-Chalmers Manufacturing Co., Milwaukee, Wis. He was a member of the American Society of Mechanical Engineers, Society of Automotive Engineers, Patent Lawyers' Association of Chicago, American Bar Association, American Institute of Electrical Engineers, and other organizations.

Financial News

Valuation at War-Time Prices Opposed.

A joint petition of the Southern Illinois Light & Power Co. and the Centralia Gas & Electric Co. for authority to purchase and sell electric and gas property of the Centralia company has been dismissed by the Illinois Public Utilities Commission. On the question of war-time prices, the decision says: "The commission cannot subscribe to a valuation which is based upon war-time prices in a case where substantially no investment has been made under war-time conditions. To do so would result in burdening a public already carrying a heavy load of war-time prices with increased costs of service received from plant and equipment which has experienced no added usefulness because of the war-time situation. Such a burden so placed could benefit only the interests selling the property, to the permanent disadvantage of the public which receives the service and the utility which would assume the responsibility of operating it upon a financially sound basis. We do not wish to be understood as condemning investment wisely and prudently made in the necessary development of utility property during war times. In many cases extensions and betterments have been made in the interests of the public good under these unusual and trying conditions. Capital so invested is entitled to consideration, but such does not appear to be the case to any marked extent in the present case."

Standard Gas Pays Dividend Debt.

All the back dividends on Standard Gas & Electric Co. preferred stock, amounting to 13%, were ordered paid by the directors, in common stock at par, and stock has been mailed to the preferred stockholders. A statement by President H. M. Byllesby accompanying the dividend announcement says that "in the first six months of 1919, without regard to any earnings accruing from its interest in the Shaffer Oil & Refining Co., your company has earned at the rate of over 7% per annum upon its common stock.

"In view of the now rapidly growing position of your company, it was deemed best to pay the accumulated dividends in this manner, rather than to deplete the company's cash resources at a time when it has large and increasingly profitable employment of its funds," the statement adds.

"From the earnings and general condition of your company and the rapidly expanding growth of its newly acquired oil and other interests there appears no reason why the earnings available for the common stock should not rapidly increase and place the value of the common stock of Standard Gas & Electric Co. substantially in excess of par."

Bell Telephone to Sell Notes.

To finance the continued growth of the Bell system, the American Telephone & Telegraph Co., it was announced recently, has arranged to sell $50,000,000 three-year 6% notes. It is expected that a public offering of the notes will be made shortly by a syndicate of bankers. An official of the company was quoted in New York as stating that action already taken by state commissions or consideration already given the present rate schedules of the company and its subsidiaries give assurance that nothing will be done by the rate regulation bodies to jeopardize the company's earnings, which are now, and for the last 13 years have been, sufficient for the payment of all charges and a dividend of 8% on the company's capital stock. The note issue has been underwritten by a syndicate headed by J. P. Morgan & Co.

The Allis-Chalmers Manufacturing Co., it is reported, for the nine months ending with September will have earned for the stock around $2,800,000 after all expenses and taxes. It is figured at this rate earnings on the common for the entire year would be about $8.50 a share after 10% on the preferred.

$4,989,000 Detroit Edison Bonds Offered.

The Harris Trust and Savings Bank (Chicago), Coffin & Burr, Spencer Trask & Co., First and Old Detroit National Bank, Detroit, and the Security Trust Co., Detroit, are offering $4,989,000 Detroit Edison Co. first and refunding mortgage 5% bonds. The bonds are due July 1, 1940, and are being offered at 89 and interest.

The company does the entire commercial electric lighting and industrial power business in Detroit and vicinity, serving a population estimated at over 1,000,000.

During the past seven years gross earnings have more than trebled, while net earnings are almost exactly two and three-quarters times the interest charges on all the mortgage bonds, including this issue. As officially reported for the year ended Aug. 31, 1919, gross earnings were $15,357,202 and net earnings $4,203,261.

Kentucky Utilities Bond Issue.

An offering of $3,500,000 first mortgage lien 6% gold bonds, series "A" of the Kentucky Utilities Co. is being made by Halsey, Stuart & Co., Chicago. The bonds are offered in denominations of $1000, $500 and $100 at 95.84 and interest, yielding 7%, and become due Sept. 29, 1924. They will be a direct obligation of the company and will be secured by a first mortgage upon all of the company's fixed property, rights and franchises now owned or which may hereafter be acquired with the proceeds of these bonds, and by a first lien upon the properties of the Electric Transmission Co. of Virginia through the pledge under the mortgage of all the first mortgage bonds and capital stock of that company now or hereafter outstanding.

The Kentucky Utilities Co., organized in 1912, owns and operates public utility properties. Not later than Oct. 1 the company will absorb the Tennessee Public Service Co., and will acquire all of the first mortgage bonds and capital stock (except qualifying directors' shares) of the Electric Transmission Co. of Virginia. These three companies have been operated practically as a unit for four years and are now serving, primarily with electric light and power, 38 communities with one or more public utility service, viz.: 38 with electric light and power, 8 with ice, 6 with water, 1 with gas, and 2 with street railway service. The company also owns all of the capital stock of the Kentucky Light & Power Co., which supplies light and power to five communities in western Kentucky.

Net earnings of the combined properties for the year ending Aug. 31, 1919, amounted to $448,862.07, or over twice the annual interest charges of $210,000 on all first mortgage lien bonds outstanding.

Progress Slight in Foreign Credit.

Bankers interested in plans for extending financial assistance to Europe, state that while the general situation is unchanged, some progress has been made in enlightening exporters, manufacturers and others on the necessity of their cooperation in extending credits to those countries in dire need.

Concerns who at first displayed little interest or enthusiasm in the bankers' plan now seem to be realizing the importance of bringing the suggestions to a head so that the matter of assisting Europe may be expedited.

War Finance Loans Repaid.

Advances of $220,885,523 have been repaid to the War Finance Corporation, according to announcement recently, leaving outstanding a balance of $105,797,989. The loans have been made to railroads, public utilities, industries and cattle growers. Although the corporation has authority to issue $1,000,000,000 in bonds for the financing of export trade it is not expected that any advances for this purpose will be made before the conclusion of peace.

Hurley Machine Plans Capital Increase.

Bonbright & Co., Inc., Chicago, and J. G. White & Co., New York City, are offering $1,500,000 three-year 7% gold notes of the Manila Electric Railroad & Lighting Corp. at 98½ and accrued interest. The notes are dated Sept. 1, 1919, and mature Sept. 1, 1922. The proceeds of this issue will be used for additions and improvements made necessary by the steady growth of the business. A sinking fund equal to 12½% per annum of the authorized amount of this issue must, during the life of these notes, be expended either for betterments and improvements to the property or used to retire notes by purchase in the market at not exceeding the redemption price or to redeem the same. These notes are a direct obligation of the company and are issued under a trust indenture by which the company covenants that while any of these notes are outstanding none of its subsidiaries shall create any new mortgage and that no new mortgage other than purchase money mortgages shall be created on any of the company's property without equally and ratably securing this issue. They are followed by $6,000,000 common stock which has paid dividends regularly since 1906 and since 1911 at the present rate of 6% or more per annum. The company during this period has also appropriated out of earnings $1,232,000 for replacements and renewals, and in addition has built up a surplus of $1,914,251, a total of $3,146,251. The corporation through its subsidiaries furnishes the entire electric light and power and railway service to the city of Manila and its environs in the Philippine Islands, having a total population of about 350,000. Average net earnings for the past ten years have been equal to over two and one-third times all interest charges including interest on these notes. For 1918 they were in excess of three and one-third times all interest charges. For 1918 65.5% net earnings were derived from the sale of electricity for light and power and 32.5% from the street railway service.

Railway & Light Reports Profits.

The reports for the year ended July 31, 1919, of the Railway & Light Securities Co. places the total profits at $256,095, profit from income $152,783, total income $178,760, and a surplus after dividends of $28,760.

The balance sheet as of July 31, 1919, shows cash on hand for redemption of collateral trust 5% bonds, $175,154; cash not including funds for redemption of collateral trust 5% bonds, $17,988; notes receivable, $165,348; surplus, $629,202, and total assets and liabilities, $3,657,241.

Western Power Placed on Six Per Cent Basis.

The Western Power Corp. has declared a dividend of 1½% on the preferred stock, placing the stock on a 6% annual basis, payable Oct. 15 to stock of record Sept. 30. Preferred dividends have been at the rate of 4% annually, with 2% a year being added to accrued dividends. There is now 12¾% in back dividends due on the stock.

Southern Traction of Illinois Sold.

Federal Judge English at Urbana, Ill., has approved the sale at public auction of the Southern Traction Co. of Illinois for $400,000. The purchaser, H. D. Mepham of New York, original promoter of the road, was instructed to pay the balance of the purchase price on or before Oct. 10.

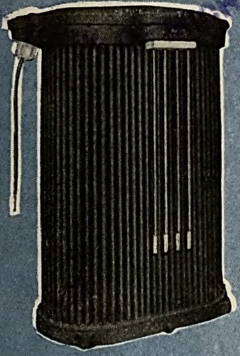
Willys Corporation Expansion.

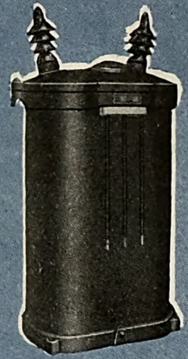
It has been announced that the new Willys Corp. will be in effect a combination to permit expansion of the Electric Auto-Lite Corp. of New York, the New Process Gear Corp. of New Jersey, and the Duesenberg Motors Corp. of New Jersey. The Willy Corp. will be capitalized

530

Electrical Review

ol. 75. No. 15. CHICAGO, OCTOBER 11, 1919 Three Dollars a Y





Electrical Review

WITH WHICH IS CONSOLIDATED WESTERN ELECTRICIAN AND ELECTROCRAFT

VOL. 75—No. 15. CHICAGO, SATURDAY, OCTOBER 11, 1919. PAGE 551.

Outdoor Substations in Connection with Coal-Mining Installations

General Requirements and Station Design — High-Tension Current Control — Salient Considerations

By H. W. YOUNG

President, Delta-Star Electric Co.

DEVELOPMENT of high-tension outdoor substations during the past few years has been due primarily to economic reasons. The demand for power in small communities could not be met with the conventional and comparatively expensive indoor types unless the rate for service was materially increased. That the various problems incident to development have been solved successfully, it is only necessary to point to the wide adoption of outdoor substations by utility companies. Passing at once to the question as to whether outdoor substations are applicable to the power requirements of coal mines, it

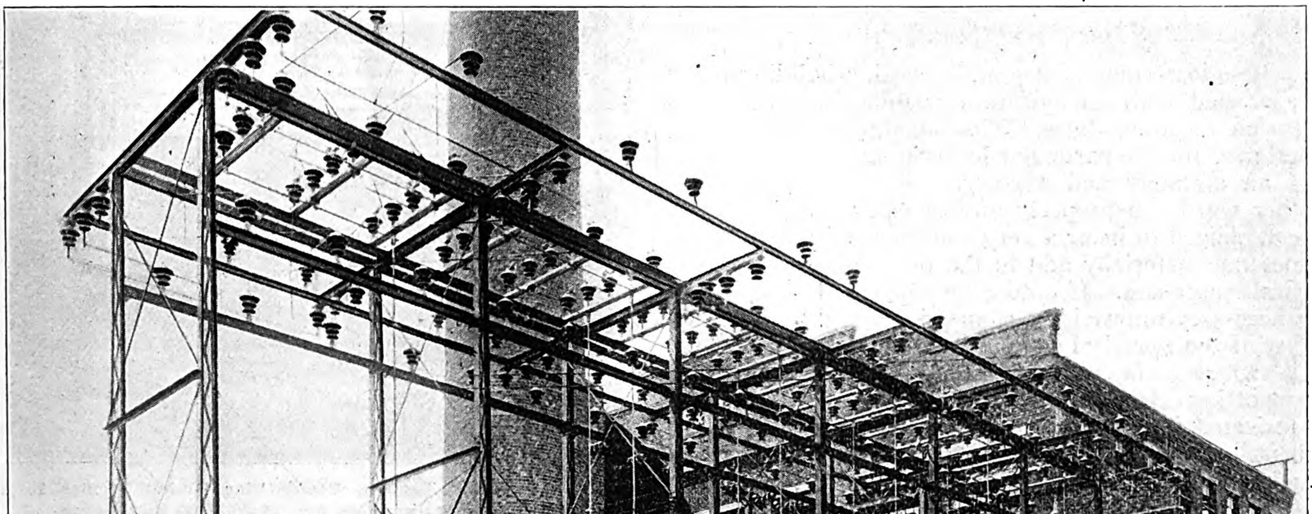


Fig. 1.—33,000-Volt Stepup Outdoor Substation Installation Outside a Power House Generating at 2300 Volts Stepping Up to 33,000. Twenty-one Coal Mines Are Supplied From Lines Leading From This Installation.

is well to consider first the elements entering into their construction.

Self-cooled outdoor transformers are no longer an experiment. The chief difference between an indoor and an outdoor transformer is in the type of bushings and cover. The outdoor type is commercially available in any desired capacity or voltage.

There are two distinct types of high-tension switches, the oil-break and the air-break forms. The oil-break switches are simply a development of the indoor types, the principal difference being in housings and terminals. They are thoroughly developed and in successful operation. Air-break switches are an accepted standard for transmission systems and are available in several forms. When provided with arcing horns or discharge horns, they can be used to open loaded circuits.

Lightning Arresters, Choke Coils, Fuses and Wiring Supports.

Outdoor types of electrolytic, oxide film and horn-gap arresters with or without limiting resistance are fully developed and have good service records. Outdoor choke coils are of the same general design as the indoor type with the exception of the insulating supports. The modern high-tension fuses can be used equally well indoors or outdoors, the only difference being that the outdoor mountings have petticoat instead of pillar-type insulators. High-tension wiring supports are standard commercial devices. Like the indoor types, they are made in many forms and assembled to meet the various wiring conditions.

Construction Requirements.

If indoor equipment is to be used, a building must be erected with wall or roof bushings for the high tension incoming lines. This building must first be designed for the particular location, hence the services of an architect and a contractor are required. In other words, to properly protect equipment, we have been obliged to incur a very considerable expense that does not materially add to the operation of the electrical equipment. If outdoor equipment is selected, it is necessary to provide a supporting structure for only part of the electrical equipment; the transformers and oil switches simply requiring a foundation slab. The supporting structure is composed of steel sections fabricated in a factory and shipped with the equipment, thus eliminating the expense of the architect and contractor, necessary with the indoor station.

The outdoor substation steel structures are of simple design and can be erected by common labor under the direction of a foreman connected with the electrical department of the mine. The steel-tower outdoor substation does not require much foundation preparation but can be erected on small concrete pillars on the side of a hill, on a piece of waste ground, or at points not suitable for other purposes.

General Design.

The general design of outdoor substations has been thoroughly standardized, the actual assembly of elements depending upon local conditions to be met. Where two sources of power, such as a double-circuit transmission line, are available, proper switching arrangements must be provided. A standard design for connecting transformers to either or both of two parallel and synchronous lines is shown in Fig. 3.

At the top of the tower are mounted two sets of three-pole, double-break-per-phase, air-break switches provided with separate interlocked operating mechanisms. Each switch has its own operating shaft and a handle so located that opening and closing the switch can be accomplished from ground level. In the high-tension side of the transformer wiring are located three single-pole combination choke coil and fuse units. On the opposite side of the tower are mounted three fused disconnecting switches connected to the separately mounted three-phase lightning arresters. From the one line diagram, the connections can be easily traced. The choke coils are so located that incoming high voltage surges or lightning disturbances are reflected to the arresters, where they will be discharged in the usual manner.

An important feature of this design is in the elimination of an expensive automatic oil circuit breaker on the high-tension side. That this saving can be made without jeopardizing the transformers is not generally understood by purchasers who often needlessly specify their use. It is essential that the expense be kept to the lowest possible value consistent with safety and good operation. As there is quite a difference in the cost of substations using automatic circuit breakers and air-break switches with fuses, the question immediately arises as to whether we can afford to use this lower cost equipment.

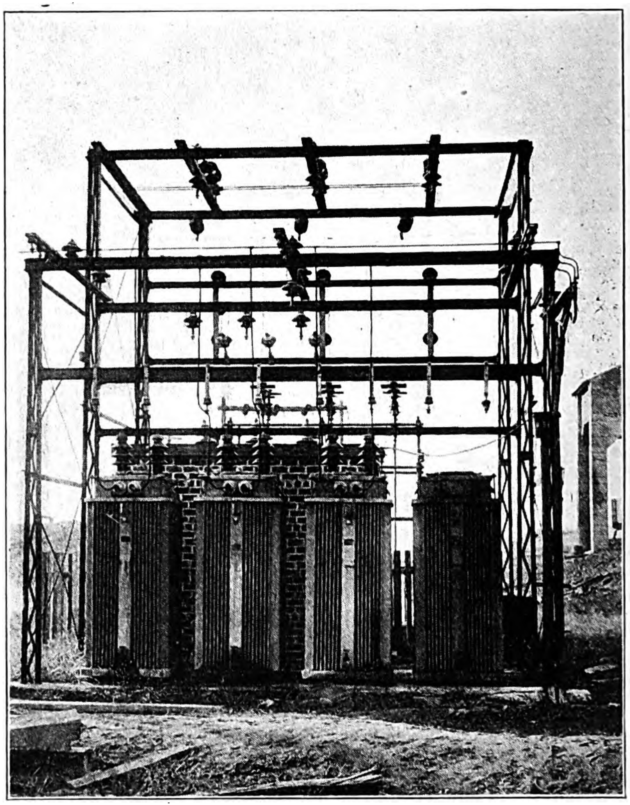


Fig. 2.—Substation Tapping Power Line Giving Service to a Coal Mine Containing 900-kw. 33,000/2300-Volt Three-Phase Transformer.

Damage Caused by Short Circuits.

It is conceded as a fact that the severity of damage done to transformers during short-circuit condition is in direct proportion to the amount of energy flowing into the circuit before the transformers are disconnected. Whether an automatic oil switch or fuse will clear the short circuit in the least time can be answered as follows: High-tension automatic oil switches of good design will open in approximately 0.16 sec. under short-circuit conditions. High-tension fuses of good design will clear short-circuits in approximately 0.013 sec. or from ten to twelve times as rapidly as the automatic oil switches.

High-tension fuses will, under short-circuit conditions, permit a current flow many times the full load rating. Assuming that the current flow with automatic oil switches will be no greater and by comparing the time elements of the fuses (0.013 sec.)

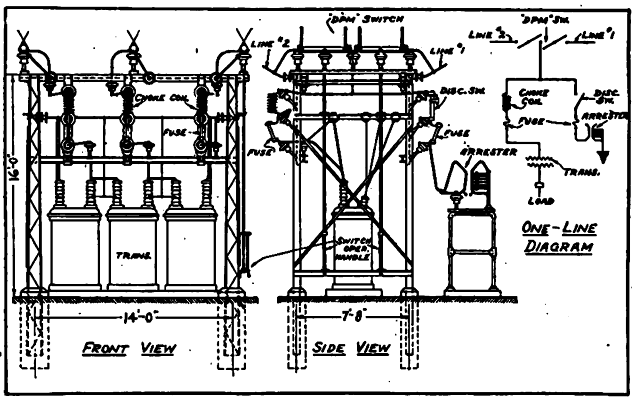


Fig. 3.—Steel Tower Substation with Transfer Type Switches for Connecting Transformers to Either or Both of Two Parallel and Synchronous Lines.

and the time element of the automatic oil switches (0.16 sec.), it follows that the slower operating switch will allow approximately twelve times more energy to flow into a short circuit than will flow with the faster operating high-tension fuse. In considering the above values, it should be borne in mind that the amount of reactance in the circuit including that of the transformers, will limit the actual flow with either device.

Over-fusing the Substation.

The exceptionally rapid action of fuses will therefore permit overfusing the transformers theoretically twelve times the normal current and still secure protection equal to that of an automatic oil switch. In actual practice overfusing from three to ten times normal is used depending upon local conditions. For power circuits subject to wide fluctuations, such as mining loads, high-tension circuit-opening devices should be so rated or adjusted that they will not operate except in case of actual trouble, such as transformer failure, and such cases are rare with modern transformer designs.

Such overload protection as is desired can be secured easily and cheaply by means of a low-tension automatic oil switch installed on the secondary side of the transformer bank. In substation practice, this combination of heavy high-tension fuses on the primary side, which will only open in case of transformer failure, and a properly adjusted oil circuit breaker on the secondary side of the transformer bank is an excellent protective system often taken advantage of.

The high-tension automatic oil switch has the advantage that it can be used for switching in addition to the overload feature. When fuses are used, it is necessary to install an air-break switch to disconnect the transformers from the line. In actual practice, however, it is often advisable and is considered good engineering practice to install disconnecting switches between the oil switch and the line. The reason for this is that the oil-switch contacts are necessarily concealed in the tanks and to be absolutely sure that a line is clear the disconnecting switches should be opened, thus giving the operator ocular evidence of disconnection.

Should the oil switch open frequently or under severe load conditions, it is advisable to inspect the contacts, oil levels, and condition of the mechanism. To enable inspection adjustments or repairs, it is often advisable to install auxiliary disconnecting switches so connected that the oil switches can be shunted and

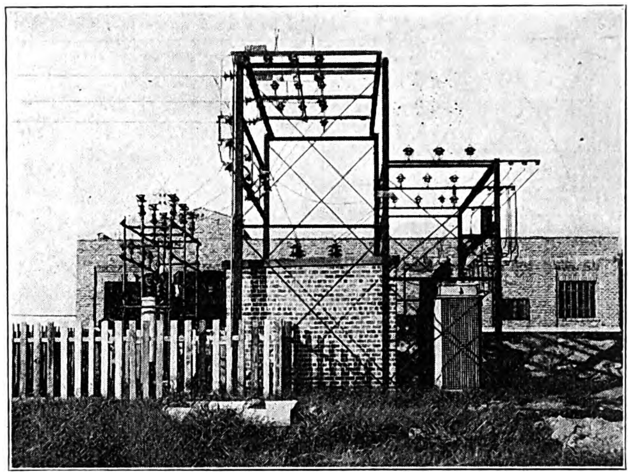


Fig. 4.—1200-kw. 33,000/2300-Volt Three-Phase Substation.

entirely disconnected from the circuit, power being temporarily delivered through the auxiliary switches.

Another point in favor of the oil switch is that after interruption it can, if in good condition, be immediately closed, thus reducing the time of service interruption. It will naturally require more time to open an air-break switch and replace fuses than it will to close the oil switch. The saving of a moment's time may in some instances warrant the additional expense of the oil switch. However, the average high-tension substation attendant, especially if not "hardened" by long experience, will after an interruption be inclined to go slow in closing the switch until he can actually view every possible part of the switch mechanism, assuring himself that it is in condition to resume service.

The fuse and air-break switch combination has, therefore, a certain advantage in that every part of the units, including contacts and condition of fuses, are in plain view of the attendant. The average man working on high-tension equipment has considerably more confidence if he can, without a shadow of a doubt, determine its condition at all times. The choice of equipment must finally rest with the purchaser but as a guide in determining in a general way the dividing line between the use of high-tension fuses and oil breakers, the following tabulation of substation capacities on which fuses can be advantageously used is given, when automatic oil breakers are installed on the low tension side.

Primary voltage.	Transformer capacity, kv-a.	Full load current per phase, amperes.	Rated capacity of fuses.
13,200	1000	43.7	200
22,000	1500	39.3	200
33,000	2000	35.0	175
44,000	2500	32.8	150
66,000	3000	26.2	100

When but a single source of power is used, the substation is simplified by omitting one of the three-pole air-break switches shown in Fig. 3. A typical design having but one source of power is shown in Fig. 6.

A recent coil mine installation made by Carl

Scholz, consulting engineer, for the Valier Coal Co., Chicago, and installed at Valier, Ill., shown in Fig. 6, is of interest in that it is a complete electrical installation using transmitted power furnished by the Central Illinois Public Service Co. which operates an extensive interconnected system. The incoming power

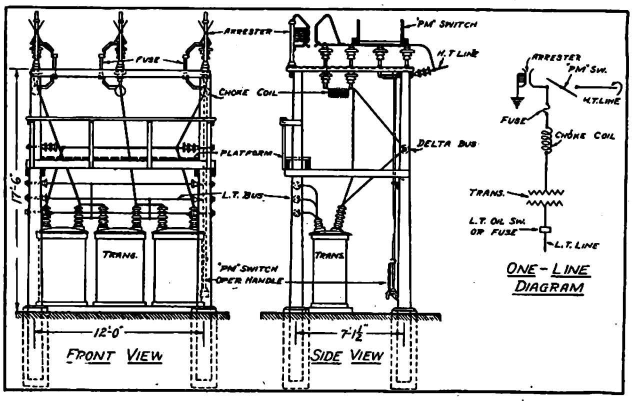


Fig. 5.—Typical Single Circuit Outdoor Substation with Large Capacity Transformers at Ground Level.

line is dead-ended to the steel tower, and by means of an overhead bus, taps are made to the arrester and load circuits. Three choke coils are so located that they offer a barrier to incoming lightning disturbances reflecting abnormal potentials to the arrester where they can be discharged. In the arrester circuit is a three-pole remote-control disconnecting switch operated by means of a handle at ground level. Below the choke coils is installed a three-pole disconnecting switch of the same type used in the lightning arrester circuit. Below this switch are three single-pole fuse mountings with fuses so rated that they will not blow except in case of transformer failure. The 33,000-volt primary metering equipment is located below the fuses, the current and potential transformers together with the watthour meter and demand indicator being a self-contained unit.

Just back of the main switching tower is located a second steel structure affording space for three 667-kv-a. 33,000/2300-volt, 60 cycle, single-phase transformers connected in closed delta. Above the transformers are the high-tension buses with their supports. The 2300-volt circuit is carried into the building by means of lead-covered cables and connected to a five-panel switchboard.

Panel 1 is equipped with a 2300-volt check meter and an automatic main oil circuit breaker. From this panel extends a 2300-volt bus located back of the other panels permitting connections to the various loads. Panel 2 controls the main underground feeder; panel 3 controls the 1350-hp. main hoist motor; panel 4 controls a 250-hp. air-shaft motor; and panel 5 controls the machine-shop and yard-lighting line. Each panel is equipped with automatic oil switches and the necessary instruments.

The underground cable from panel 2 terminates at a panel on which is mounted two automatic oil switches. The cable from one switch has a tap line to which is connected twenty underground substations, each station being equipped with three 25-kv-a. transformers and an oil switch. The feeder voltage of 2300 is transformed to 220 for use with alternating-current coal-cutting machines. On the same feeder cable is connected a 300-kw. 2300/220-volt motor-generator set supplying direct current for the main haulage trolley. This motor-generator set also supplies current to twelve stations for charging the storage battery locomotives. The other switch and cable supplies power to a 100-kw. 2300/220-volt motor-generator set for the main haulage direct-current trolley and also connects to twenty underground substations for supplying 220-volt alternating current to the coal-cutting machines.

The 75-kw. underground substations are at more or less temporary locations so that equipment can be moved as the work progresses, thus avoiding long secondary runs and giving full voltage to the motors. Control of the 1350 hp. hoist motor will be secured from the underground substation located near the base of the shaft. The operator, by means of switches and indicating devices, has positive control of and always knows the exact position of the hoist. During March, 25,000 tons of coal were mined at a power cost of approximately 6.5 cts. per ton, the load-factor on the station being 41.5%. During this month, power was also used for construction work in progress so that the total cost of power for coal mined was 8.1 cts. per ton. When the mine is in full operation and construction completed, the cost per ton will probably approximate 4 cts. or less.

66,000 Volt Substations.

The tendency toward higher transmission voltages has developed a need for 66,000-volt outdoor substations.

A feature of this type is in the use of three transformers in closed delta on one side of the station and a spare transformer at the opposite side. In case one transformer fails the spare can by means of disconnecting switches be immediately placed in service and in the correct electrical relation to the other transformers.

The high-tension side is controlled by means of a three-pole air-break switch operated from ground

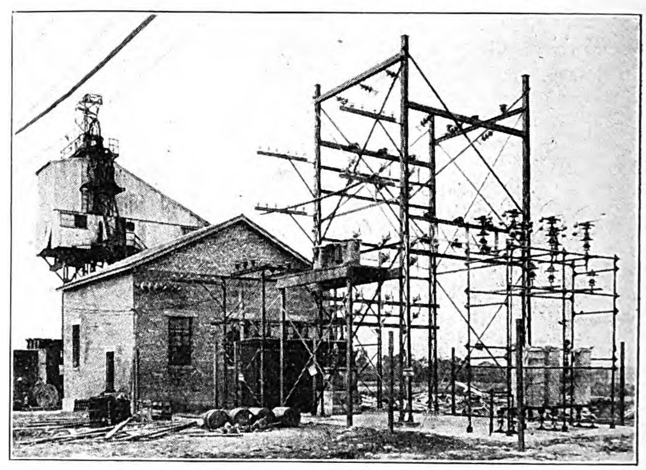


Fig. 6.—Scholz Substation at Valier, Ill. Supplied From Central Illinois Public Service Co.'s Lines.

level. On the switch bases are also mounted choke coils and fuses for the load circuit.

The lightning arresters are of the high speed sphere gap graded resistance type with auxiliary gaps shunted with limit fuses. In case of excessive flow of current to ground the limit fuses will operate in the usual manner. The arrester, however, is still connected to the line across the small auxiliary gap. This arrangement eliminates the possibility of entirely disconnecting the arresters after operation of the limit fuses.

Central-Station Rates in Theory and Practice

Fourteenth Article—Rate Systems and Reasons Therefor—Class Schedules Commonly Used—Minimum and Maximum Charges, Discounts and Related Features — Principal Types of Rates

By H. E. EISENMENGER

This is the fourteenth article of this series, which began in the issue of July 12. The first seven articles, constituting Part I, dealt with the cost of electric service. Part II consisted of six articles on the general policy governing selection of a rate system from the standpoint of profit contributed by the several classes of customers. Part III begins this week and will consist of six articles on rate systems. The remaining parts of this series will deal with rate analysis, accuracy of rates, utility regulation and other topics closely related to rates. These articles will continue weekly until the last issue of the volume, Dec. 27.

PART III—SYSTEMS OF CHARGING.

1. General Features.

A. Reasons for Making Different Rates for Different Classes of Consumers.

NOTE: The examples given in Part III for the various types of rates have been taken from the author's collection of rate schedules and from other sources of information. Pains have been taken to get reliable figures and the given figures are believed to be correct, although some of them may have become obsolete and others may be erroneous in other respects. The author assumes no responsibility for their absolute correctness. His object is to illustrate the type of rate to the reader more quickly and vividly by definite figures than is possible by mere abstract descriptions. It is of very little importance whether the figures are absolutely correct and up-to-date and whether they apply in this one or some other city. These articles discuss principles and are *not* intended as a book of reference for the actual rate schedules now used in the different cities.

103. It has been demonstrated in Parts I and II that not only the unit amount of the classified expenses (energy cost, demand cost and customer cost) varies between different classes of customers, but that also the percentage of the profit from different classes should vary between these classes. The rates—that means the prices—to different classes of consumers will therefore have to be different for these two reasons.[1]

Price is the cost plus profit. If the cost is figured according to the three items of energy cost, demand cost and customer cost, it seems logical that the price should be figured in the same way. But in the case of rates we have to deal with the general public and it is the opinion of most central-station managers that this method is too complicated for the public to understand, especially for the small consumer. The less the average consumer understands about the system of charging, the more prone he will be to assume that the whole rate schedule is nothing but a device made expressly to cheat him out of his money. In case of larger customers we may expect that the electric light company has to deal with somebody who has sufficient arithmetical training to understand a proper explanation of the rates, even if they embody the three-charge system.

The rates to different classes of customers will therefore vary not only in the amounts they charge, but also in the form. We will consequently have generally a number of different rate schedules, each one applying for a different class of service.

B. Classification of Consumers for Rate Purposes in Practice.

104. These classes of service are not standardized among the various central stations, but a selection from the following list is generally found in the rate schedules of most central stations:

1. *General Lighting* or sometimes *General Light and Power.*
2. *Residence Lighting.*
3. *Commercial Lighting,* which means lighting of business localities.
4. *Display Lighting* (signs, windows, decorative lighting).
5. *Street Lighting.*
6. *General Power.*
7. *Wholesale Power* (incidental lighting sometimes included).
8. *Retail Power.*
9. *Ice Making,* also called *Refrigerating Service.*
10. *Heating and Cooking.*
11. *Primary* or *High-Tension Service.* The current is delivered at the central station's primary voltage and transformed by the customer in his own transformers. This is practicable only for very large customers. This schedule may also be expressed by a deduction under the heading of transformer rentals, if the consumer does not use the company's stepdown transformers.[2]
12. *Off-Peak Service.* Under this schedule the customer agrees not to use his current during certain specified hours, generally the evening hours of the

[1] This refers to the unit charges (energy charge, demand charge and customer charge). If we reduce the customer's total payment to the kilowatt-hour consumed, as is frequently done, we get of course much wider fluctuations of the price (average price per kilowatt-hour) between different customers (see Section 13).

[2] Sioux City Gas & Electric Co.

winter months.[3] Sometimes the customer is allowed to use current under this schedule during the night hours only.[4]

13. *Auxiliary, Emergency* and *Breakdown Service.* For isolated plants in case of an increase of their demand over their capacity or in case of a breakdown of the isolated plant, in which case the installation is connected to the central-station service and its own generators through a double-throw switch.

14. *Battery Charging* for electric vehicles. Sometimes subdivided into "Wholesale" for public garages and "Retail" for private garages.

It is impossible to give a complete enumeration of all the varieties of schedules. Sometimes optional schedules appear under the same heading, so that the customer may choose which one of the two or more he considers preferable (see Section 106). The names of the schedules are, of course, not always the same as given above. Sometimes combinations of the above classes of schedules are found.[5]

105. A classification of the customers for rate purposes into these 14 classes, or into some of them, is carried out in every single large and medium-sized central station, and probably in every small one as well. Although these classes are by no means the only ones possible, other classes of rather isolated occurrence are found only in one or a few electric light companies.

C. Optional Rates.

106. Sometimes we find different types of rates, generally two in number, for the same class of customers in such a manner that the customer is allowed an option. One of the two rate schedules may, for instance, be of greater advantage to the customers with an energy consumption below a certain number of kilowatt-hours or with a demand below a certain amount or a combination of both. The other rate is then more favorable for the other customers (see first footnote of Section 108).

D. Minimum Charges and Guaranteed Minima.

107. Sometimes a rate schedule requires certain minimum guarantees from the customer, for instance a guarantee that his consumption during every month or every year will be large enough to bring his bill to a certain minimum amount either per month or per year.[6]

A minimum charge with the object of insuring a revenue of at least the "customer cost" from every customer is made in the vast majority of schedules which apply to residence lighting.[7] The minimum charge in that case ranges from 25 cents per month[8] to $1 net.[9]

The opinion of rate experts on the advisability of a minimum charge for residences seems to be strongly in favor of making such a charge, but it is not unanimous. A few of the large central stations in this country (among them New York, Chicago and Cleveland) prefer the gain in simplicity of the rate and the relatively slight risk that some of the customers now and then may pay less than a few dimes to the alternative risk of keeping prospective profitable customers away who are afraid to tie themselves down to a minimum.

These and similar questions in rate making are a matter of local conditions as well as of personal judgment and taste for which no hard and fast rules can be laid down. It is not easy to decide these questions and we have no means of saying, even afterwards, whether the decision was the best one or not. Rate making altogether is a matter of feeling and intuition as well as of exact research. Psychology, business instinct and experience have their place in the design of rates as well as engineering and mathematics. Many of the rate questions have to be decided temperamentally or artistically, if you please, rather than strictly scientifically.

108. An entirely different class from the minimum charges in residence schedules and other small-customer schedules is the minimum charge in schedules destined for large customers. The object here is to keep the small customers away from that schedule by requiring a rather large minimum payment per month or per year. In that case we have optional schedules, one with a high minimum charge and low unit rates per kilowatt-hour (or per kilowatt of demand or both) and the other schedule with a low minimum charge (or none at all) and a comparatively high unit rate per kilowatt-hour (or per kilowatt or both).[10]

Whereas the first kind of minimum charge is gen-

[3] In Allentown, Pa., for instance, current under the off-peak schedule is not available from 4 to 8 p. m. between Nov. 1 and Feb. 29. In St. Louis the peak hours assumed for the off-peak service are the following:

5:30 to 7:00 p. m. in October;
4:30 to 7:00 p. m. in November and December;
4:40 to 7:00 p. m. in January;
5:20 to 7:00 p. m. in February;
6:00 to 7:00 p. m. in March.

In Chicago an off-peak rate is available where the customer agrees during the peak period not to use more than 10% of the highest demand in the preceding year's peak period. The off-peak period in this case is counted between 4:00 and 8:30 p. m. from November to January and begins half an hour later in February.

Various methods are used to make the customer meet his obligations for the peak-loak period. A recording demand measuring instrument is installed as described in Insert XVI (for instance in Chicago) or a recording ammeter (Superior, Wis.). Where the off-peak schedule prohibits the customer from using any current at all during the peak period an automatic time switch in connection with a clock may be used (Spokane and St. Louis). Portland, Me., uses the expedient of stipulating that not more than 10% of the total power used annually shall be consumed between Nov. 1 and March 1 by consumers under the off-peak schedule. The "Ventilating Service" schedule at St. Louis, which is in effect an off-peak schedule, charges less for the service between April 15 and Oct. 15 than for the rest of the year. See also Section 111 about "Differential Rates."

[4] "Night Service" in St. Louis 10 p. m. to 7 a. m. and Spokane 7 to 7; "Night Power" in Hartford, Conn., 10 to 7, and Altoona, Pa., 11 to 6.

[5] Thus, for instance, in Topeka, Kans., under the "Battery-Charging Rate" customers must agree not to use current for that purpose between 4:30 and 8:30 p. m., so that the rate can be classed also as an off-peak rate. Another combination is, for instance, the "Primary Off-Peak Rate" in Detroit.

[6] This is not quite the same. For instance, a guarantee of $1200 per year is not entirely equivalent to one of $100 per month. The first guarantee would be fulfilled by a customer who is paying $150 during each one of the six winter months and $50 during each one of the six summer months, whereas under the second named plan that customer would be required to pay an additional $50 for every one of the summer months. The first plan requires a little more work on the part of the central station, since the bills of customers near the limit must be added up at the end of the year, whereas the other plan takes care of itself month by month. These considerations have led in a few cases to a stipulation of a monthly *and* a yearly minimum. The wholesale power schedule of Allentown, Pa., for instance, requires a minimum charge of 50 cents per horsepower connected and the twelve bills in a year must moreover amount to at least $15 per horsepower.

[7] This refers to central stations in cities of medium and large size. No information for statistical purposes is obtainable from the innumerable central stations in smaller towns, but we have no reason to assume that their rates should be essentially different from those in the larger cities.

[8] Duluth and New Orleans.

[9] The favorite amounts for the minimum charge in that case are 50 cents and $1; other values are of rare occurrence. In about a dozen cases we find yearly minimum charges in schedules which apply to residences. The most important of these cases are Baltimore, Boston, Brooklyn and Buffalo. In Pueblo, Colo., the residence lighting minimum charge is 3⅓ cents *per day*. St. Joseph, Mo., makes a higher minimum charge for residences in rural districts (75 instead of 50 cents), thus expressing the distance factor by the minimum charge. (A few central stations have entirely different rates for outlying districts.) Salem, Mass., increases the minimum charge from 50 cents to 75 cents for summer residences. The minimum charge of the Display Lighting schedule in Sacramento, Cal., varies with the season and is only about 57% in June of what it is in December. The General Lighting schedule of York, Pa., charges $1 minimum per month in winter and 50 cents in summer.

erally not more than $1 per month, the minimum charge or guarantee of the second type, that is, with the object of reserving a certain schedule for the large consumers, is naturally rather high and we find figures as high as $3000 per year (Primary Service, Indianapolis) or even $340 per month (Primary Large Lighting and Power, Chicago).

So far in this discussion the minimum charge has always been understood as a guarantee on the part of the customer to pay a certain amount in dollars and cents every month or year. This is the most frequent case. Not infrequently, however, we find a stipulation in a rate schedule requiring the customer to pay for a certain minimum number of kilowatt-hours or for a certain minimum of demand in kilowatts, watts, horsepower, or whatever the unit for the demand may be.

[10] For instance, in Toledo, Ohio, public garages can get battery-charging current at 5 cents per kw-hr. (net) with a minimum charge of $3 per month (this rate to be called Rate A hereinafter for short), but if they guarantee a minimum bill of $50 per month they get their current at 2 cents per kw-hr. (Rate B).

A graphical and analytical investigation of what this means may prove instructive. We step off as abscissae (horizontally) the energy consumption in kilowatt-hours (Fig. 4) and as ordinates (vertically) the amount of the bill in dollars per month. Beginning with Rate B we find that at 2 cents per kw-hr. the customer is to pay $20 for 1000 kw-hr. (point b_1), $40 for 2000 (point b_2), $60 for 3000, etc. The curve representing the bill as a function of the energy consumption will obviously be a straight line OB starting from the origin O. There is, however, a minimum of $50 for the bill. This minimum is denoted by the horizontal line NN'. The portion of the inclined line OB which is situated below horizontal NN' does not apply and NN' applies instead. Rate B is thus represented by the heavy dash-and-dot duct from N over P to B. On the other hand, we have the optional rate A of 5 cents per kw-hr. with a $3 minimum. We get the straight line OA and here again a minimum charge applies. This is now $3 and is represented by the horizontal line MM'. Rate A is represented by the heavy outlined duct from M over K to A. As the customer has the desire to get the lowest bill possible he will pick out that one of the two rates which shows the lower bill for his particular energy consumption; in other words, the rate represented by the duct which is lower for that respective energy consumption. The bill of the customers who choose their schedule wisely is then given by the ordinates of the shaded area. Small customers will be better off on Rate A, large ones under Rate B.

Where is the limit between those two sizes of customers, in other words, up to what energy consumption is it more advantageous for a customers to use Rate A? This limit is evidently given by the point L where the line duct ("curve") of Rate A intersects that of Rate B. The intersection means that the bill is the same for the respective energy consumption, whether the customer is being charged under Rate A or Rate B. This intersection is given by point L in Fig. 4 and the energy consumption belonging to that point will give the limiting value. We can

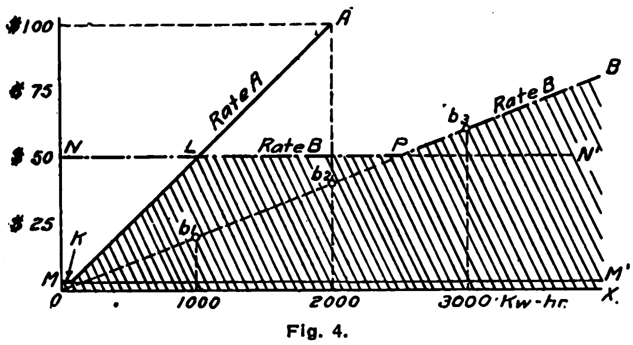


Fig. 4.

either find that value in kilowatt-hours by measuring it in the drawing with the kilowatt-hour scale or we can figure it in the following way:

The ordinate of L is $50 because L lies on the minimum-charge line NN'. On the other hand, the unknown amount of energy multiplied by 5 cents per kw-hr. must give $50. It is easy to figure out that 1000 kw-hr. are necessary to make up a charge of $50 at the rate of 5 cents per kw-hr. All customers with less than 1000 kw-hr. energy consumption should choose Rate A, the others Rate B.

The graph Fig. 4 also shows that all customers using Rate B between the points L and P are charged the identical amount of $50. Point P can easily be found as corresponding to

$$\frac{\$50}{2 \text{ cents per kw-hr.}} = \frac{5000 \text{ cents}}{2 \text{ cents per kw-hr.}} = 2500 \text{ kw-hr.}$$

Therefore, all customers using between 1000 and 2500 kw-hr. per month and choosing the schedule which is of best advantage for them will have to pay uniformly $50 no matter how large their energy consumption was within these limits.

We find further that the minimum charge of $3 (Rate A) affects the 5-cent-per-kw-hr. rate for such customers only as have a kilowatt-hour consumption of less than 300/5 = 60 kw-hr. per month (point K).

This is not quite the same as guaranteeing a minimum bill (except in case of the simplest rates), as will be shown later (Section 168), but the object is the same.

E. Maximum Unit Charges.

109. In some cases we find a clause in the rate schedules to the effect that where the average charge per kilowatt-hour figures out higher than a certain specified maximum the bill shall not be higher than what corresponds to that maximum average amount in cents per kilowatt-hour, regardless of what the schedule says elsewhere. This is in a certain measure the reverse of the minimum charge discussed in the preceding sections. Here, as well as with the minimum charges (see first footnote to Section 107) this restriction may apply either to the individual monthly bill or to the sum of the 12 monthly bills rendered during the year. For examples and further discussion of this principle of the maximum unit charge (which is not frequently applied) see Section 124, first and third footnotes.

F. Prompt-Payment Discounts and Delayed-Payment Penalties.

110. A prompt-payment discount, to induce the customers towards early settlement of their bills can be found in about three of every four rate schedules of the more important central-station companies in this country. The time within which this discount is allowed is 10 days in the great majority of cases, and the percentage taken off is usually either 10% or 5%. Sometimes the discount is expressed in terms of cents per kilowatt-hour, generally 1 cent or 0.5 cent per kw-hr. In a few cases the discount is limited, for instance the discount is given only on the first 200 kw-hr.[11] In some cases the gross unit charge is an odd figure which becomes a round figure after the deduction of the discount.[12]

Of course, most of the customers avail themselves of the prompt-payment discount and this makes the rate look higher on paper than what is actually being paid. If, for instance, we have a 10-cent-per-kw-hr. rate with a prompt-payment discount of 1 cent per kw-hr., the rate which almost everybody is actually paying will be 9 cents per kw-hr. and yet almost everybody will say: "We have a 10-cent rate." The company will get the blame for a higher rate than it actually charges. For this reason a few companies have reversed the statement by introducing a delayed-payment penalty. This would mean in the example quoted above: 9 cents per kw-hr. with a delayed payment penalty of 1 cent per kw-hr. It amounts to the same, only it sounds better and the impression given is more correct.[13] In one case[14] an aditional stipulation is made that the minimum amount of the delayed-payment penalty is 25 cents. The idea of this is evidently that as soon as a customer gets on the delinquent list he causes the company a certain amount of clerical work and other expenses, no matter how large or how small the amount of his bill is. We see here again the principle of the minimum charge.

[11] Lighting and Power schedule, Indianapolis, Ind.

[12] For instance, the cooking rate in Toledo, Ohio, is a straight-line meter rate of 5.56 cents per kw-hr. with 10% discount if the bill is paid within 10 days, thus making the net rate practically 5 cents per kw-hr.

[13] Delayed-payment penalties can be found in the rates of Philadelphia, Cincinnati, Washington, D. C., and a few other cities. In New Orleans, where two electric light companies are operating, one of the two charges a 7-cent rate with a 10-day delayed penalty of 1 cent for general lighting, whereas the other one charges an 8-cent rate with a 10-day prompt-payment discount of 1 cent.

[14] Topeka, Kans.

II. The Various Types of Rates.

A. Introduction.

111. The various types of rates base the amount of the bill of a certain consumer on his energy consumption or on his maximum demand or on both.

There are a very few exceptions to this rule, but under certain unconstrained assumptions we can bring even these under the above rule.

In the first place we find some isolated cases of rates which make the amount payable dependent also on the amount which the customer has been willing to guarantee in advance as a minimum payment per month.[1]

Evidently there will exist a certain guarantee for every customer which makes his bill smaller than any other guarantee would. If he guarantees less than that amount he will have to pay an unnecessarily high unit price and if he guarantees more his guarantee is higher than what he actually consumes. It is clear that, provided the consumer chooses his guarantee wisely, he will find his bill dependent only on the energy consumption and the demand, in other words, under that assumption there will be only one amount of the bill possible for every conceivable combination of kilowatt-hours consumption and kilowatts demand.

Another exception to the above rule, that the price charged to the customer under a certain schedule depends only on the amount of the kilowatts used and kilowatt-hours consumed by him, is the so-called time-differential rate which, however, though extensively in use in European countries, is hardly used in this country. Almost the only instance the author could find of this rate in this country is the "Time-Differential Service" rate in Detroit for auxiliary and emergency service for private plants. Ten cents per kw-hr. are charged for all energy consumed between 1:00 p. m. and 6:30 p. m. and 4 cents per kw-hr. at all other hours. This really is nothing but a combination with an off-peak schedule (cf. Section 104, footnote). If we consider the high-rate hours and the low-rate hours separately, we have again reduced the amount payable to the original elements of kilowatts and kilowatt-hours in each one of the two daily periods.

If, therefore, in this manner all rates can be assumed to be based upon the two elements of kilowatt-hour consumption and kilowatt demand only, we can distinguish the following three classes of rates:

(1) Rates based on the energy consumption only.
(2) Rates based on the maximum demand only.
(3) Rates based on both energy consumption and maximum demand.[2]

B. Rates Based on the Energy Consumption Only.

1. *The Straight Meter Rate.*

112. The straight meter rate is one of the simplest and one of the oldest systems of charging, but by no means one of the most satisfactory ones, at least not for general use. The customer's bill is proportional to the number of kilowatt-hours used, as measured by a watt-hour meter.[3] Frequently the straight meter rate is combined with a minimum charge[4] or sometimes with a customer charge.[5] The advantages of the straight meter rate are its simplicity and the readiness with which it is understood by the public.

113. A variety of the straight meter rate is the *prepayment-meter rate* for very small customers. A prepayment meter is a watt-hour meter constructed in combination with a vending machine ("penny-in-the-slot" machine). The customer inserts a coin of certain specified value, for instance a quarter, into the slot of the prepayment meter and then is furnished with current until he has consumed the amount of energy for which he has paid by that sum. After that time his circuit is automatically opened by the mechanism of the prepayment meter and his lights go out, usually after a warning of some kind has been given to him.

Opinions on the merits of the prepayment meter, as on so many other rate questions, are divided. The idea of paying in small amounts in preference to paying comparatively larger sums at the end of the month certainly appeals to some classes of the poorer population and is based on sound psychology. Meter readings are unnecessary and bad debts are avoided. On the other hand, the meter is more expensive and complicated than an ordinary watt-hour meter and gives more occasion for complaints. The extinguishing of the lamps at inopportune times is a great annoyance, especially if there is no coin of the required denomination at hand.[6]

(To be continued.)

ENGINEER TO BE SUGGESTED FOR INTERSTATE COMMERCE COMMISSION.

The American Association of Engineers, through its president, Dr. F. H. Newell, University of Illinois, is petitioning President Wilson to select as his next appointee to membership in the Interstate Commerce Commission, some qualified representative of the engineering profession. It is pointed out that the commission, in its railway valuation work, is the employer of a large number of the most skilled engineers in the United States, and that it would be only a fitting recognition of the engineers to appoint one of their number to a position on the commission itself.

---

[1] An example is the Retail Lighting and Power schedule of Pittsburgh, which charges the following average prices per kw-hr.:

Cents per kw-hr.	If maximum demand is	And guarantee is
10	1	$ 1.00
9	1	3.00
8	1	5.00
6.5	1	10.00
5.5	1	15.00
5	1	20.00
4.25	1	25.00
3.75	2	36.00
3.25	3	52.00
2.75	5	79.00
2.25	8	107.00

Add $1.00 to guarantee for each additional kw. of demand.

Another example is the Toledo Battery-Charging rate, which is quoted and discussed in footnote 10 of Section 108.

[2] We might add to this for the sake of completeness a fourth class, that is, rates which are independent of either energy consumption and maximum demand. This class has, however, only academic and slight historic interest. Every customer of the class, for instance every residence customer, would have to pay under that rate the same amount, no matter how large his installation and the size of the lamps in his sockets and no matter how long he is burning them. The rate is reduced to the customer charge and all other costs, but the customer cost, are averaged into the customer charge, the assumption being that the difference in cost between residence customers is not very large and that we can simply charge the average cost for every customer plus a percentage of profit. Such rates have been in use in a very few cases during the earliest days of central-station history. If the author's information is correct, one instance was in Monticello, N. Y. This type of rate has been abandoned long ago. (See later Part V—"Accuracy of Rates").

[3] An example of a straight meter rate is the Residence Lighting rate of the Bronx Gas & Electric Co., of New York, where the customer is simply charged 12 cents per kilowatt-hour.

[4] For instance, in the General Lighting and Power schedule of Boston, which charges 8.5 cents for every kilowatt-hour consumed, but with a minimum charge of $9 per year, payable monthly.

[5] Battery-Charging schedule of Springfield, Ohio, which makes a customer charge of $1.50 and an energy charge of 3 cents per kw-hr.

[6] About another rate especially adopted for the smallest customers, the limited flat demand rate, see Sections 128-130.

Tests to Determine Deterioration of Small Dry Cells with Age

Explanation of Terms—Outline of Test Methods—Results Obtained — Abstract of Paper Before American Electrochemical Society

By A. J. HELFRECHT

IT IS well known that small dry cells undergo a steady depreciation in capacity from the time they are made, and a knowledge of the rate at which such depreciation takes place has become of great technical importance due the extensive use to which dry cells are being put, and because of the new and exacting demands which are being placed upon this type of cell in its application to wireless telegraphy and telephony.

The term "shelf deterioration" is employed to designate the decrease in capacity which a dry cell undergoes when not in use. This factor has been touched upon in various papers presented to this society, and it is the purpose of this paper to present further data on this subject dealing specifically with the smaller sizes of cells.

The actual determination of the capacity of a dry cell involves its discharge and, therefore, its destruction; hence, to determine the rate of deterioration over a period of time by this method, tests must be made upon a sufficiently large number of cells of identical construction to give the required information. To avoid the complication and expense involved by such method, there is need of a deterioration test which can be made on a single cell without its destruction by the testing method. But no such test has been evolved which gives more than a crude approximation. It is a common but a decidedly misleading practice of numerous battery makers to guarantee their product not to deteriorate more than a specified percentage over a given period of time as judged by the decrease in voltage. The absurdity of this method is shown by the fact that the open circuit voltage of a cell has little relationship to its watt-hour capacity. A cell may decrease 50% in actual capacity, while its open circuit voltage may decrease not more than 10%. A more rational, but still unsatisfactory method which has had some use is to judge the deterioration of a cell by measuring its "flash" or its instantaneous short-circuit current at various intervals. It is known that as a cell deteriorates with age its internal resistance increases and consequently its flash decreases.

The main purpose of this paper is to present results showing how closely this method of judging cell deterioration approaches the method involving the actual measurement of capacity through discharging the cells.

Cells of four different sizes representing the range of the flash light cells on the market were employed in this test. Part of these were purchased on the open market of a standard well-known make, and to eliminate the factor of uncertainty as to the time which elapsed from the date of manufacture to the date of purchase, many other cells of these same sizes were made up in our laboratories by trained workmen, using standard materials, such as are used in the regular marketed product, special care being taken to avoid variations in construction between the different cells.

In the absence of uniform testing methods adopted by manufacturers, in the investigation covered by this paper the "flash" tests were made by short-circuiting each cell through a low-resistance Weston ammeter for as short a period as would indicate the steady maximum deflection of the needle. This test was repeated periodically over a year's time to indicate the deterioration. Since the initial flash differs greatly between individual cells of one make, the decrease of flash as time passes is expressed not in terms of decrease in amperes but in percentage of the initial flash when the cells are first put on test. This method places the readings as between different batteries on a more common basis.

Capacity tests were made by a method described in detail in "Characteristics of Small Dry Cells," by C. F. Burgess,* and designated here as the "4 ohm" test, in which each cell is connected to a 4-ohm coil and discharged 8 hours per day until the closed circuit voltage drops to 0.5 volt.

The corresponding test recommended by the Bureau of Standards consists in the use of a 2.75-ohm coil and discharging to a similar end point of 0.5 volt.

The "4 ohm" test used for the investigation set forth in this paper was adopted prior to the publica-

*Trans. Am. Electrochem. Soc. (1916), 30, 257.

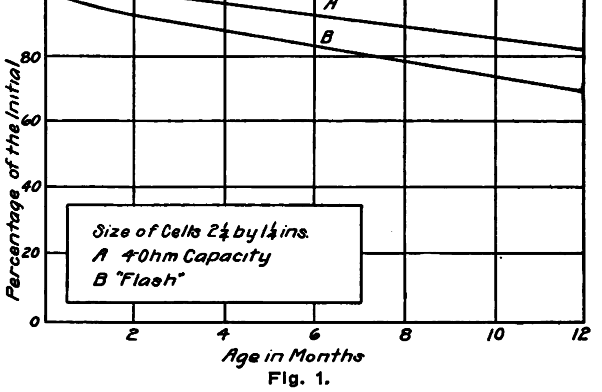


Fig. 1.

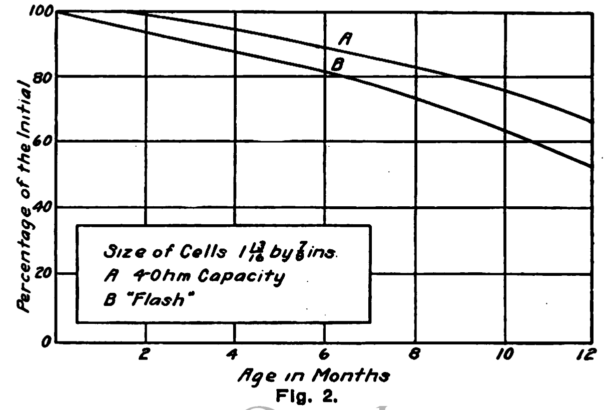


Fig. 2.

tion of the bulletin of the Bureau of Standards and to draw a comparison between these two tests a special lot of cells was made up and tested by the two methods.

Results.

In comparing the "4 ohm" test for capacity with the "2.75 ohm" test and expressed in time of service

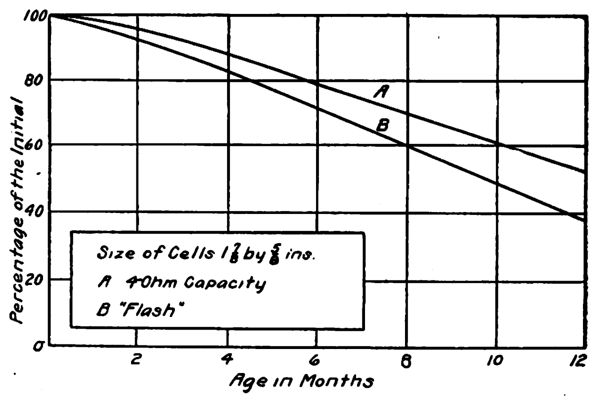


Fig. 3.

until the cells reached the 0.5 volts end point, the average of numerous measurements showed that the time of service on the latter test is 60% of that of the former with a range between 55% and 65%. In the accompanying curves, Fig. 1 shows the depreciation of the most largely used size of flashlight cell, such as is employed in tubular handlamps, 1½ ins. diameter and 2¼ ins. high. Graph *A* shows the percentage decrease in capacity during a period of one year as determined by the "4 ohm" test. There is no appreciable depreciation in capacity during the first two months, and during the remaining 10 months the depreciation of about 17% follows approximately a straight line. The corresponding graph *B*, derived by the "flash" test indicates an almost linear depreciation from the beginning of the test. The notable deduction from this curve sheet, as well as from the others which follow, is that the depreciation indicated by the "flash" test is decidedly greater than that measured by the actual capacity.

Curves Nos. 2, 3 and 4 represent in a similar way tests on smaller sizes of cells and indicate clearly the variations in performance as the cells decrease in size.

The curves as a whole show that the actual depreciation as measured by the capacity tests is less than the apparent depreciation determined by the flash tests and this departure becomes especially marked in the smallest size of cell. This difference is due to the fact that the "flash" test is influenced mainly by the internal resistance of the cell which slowly increases with age. Since this internal resistance is but small as compared with the resistance through which the cells deliver current when working normally or when placed on capacity test, the increased internal resistance does not necessarily influence to a large degree the ability of the cell to deliver current as measured in ampere hours. This must not be taken as an argument against the use of the "flash" test to indicate depreciation since the great simplicity and convenience of this test amply justifies its use. Where it is used, however, it should be borne in mind that it indicates a more rapid falling off in capacity than is actually the case, and the injustice which may thereby be done to the cell is especially great in the smallest sizes.

It is of interest to note that in Figs. 1, 2 and 3 the graphs *A* and *B* are divergent at their lower ends, while for the smallest size of cell (Fig. 4), the two lines converge. This is explainable by the fact that as the flash becomes zero the capacity must also approach zero, and in Figs. 1, 2 and 3 this convergence would be noted if the tests were carried further.

Previous discussions held before this have shown that any test on a dry cell will show the condition of a dry cell only at the time it is tested, without indicating what the condition of the cell will be at the same future date. While this is undoubtedly true, it is nevertheless true that shop and laboratory tests accompanying uniform methods of manufacture may furnish the means of foretelling with reasonable accuracy the future performance of a dry cell.

While the "4-ohm" test as used in this report cannot be considered as a standard method in view of the recommendations of the Bureau of Standards for a "2.75-ohm" test, nevertheless the curves here presented may be taken as representing fairly well the true relationship between the "flash" and the "capacity" tests. This statement is based upon a "2.75-ohm" test being made on a number of cells of various sizes and ages as a check against the "4-ohm" test.

It must also be borne in mind that either 2.75 ohms or 4 ohms per cell represents a much more rapid discharge than the small dry cells are frequently called upon to deliver in service. For example, in radio work, in which the cell shown in Fig. 3 is extensively employed, the actual current requirements are very low. A resistance of 333 ohms per cell has been adopted for testing batteries for such service. Extensive investigation has been made by one laboratory on batteries designed for this type of service, 15 cells being assembled in a battery delivering an initial voltage of 22.5 volts. In testing these batteries an end point of 17 volts is taken through a resistance of 5000 ohms. The results derived from such tests give curves of the same general shape as shown in curve No. 3. It may be noted, however, that on very slow discharges, the decrease in capacity is shown to be less during the early part of the life of the cell than is shown where the more rapid discharge method is employed.

While it is difficult to express numerically the depreciation which might be expected from dry cells as

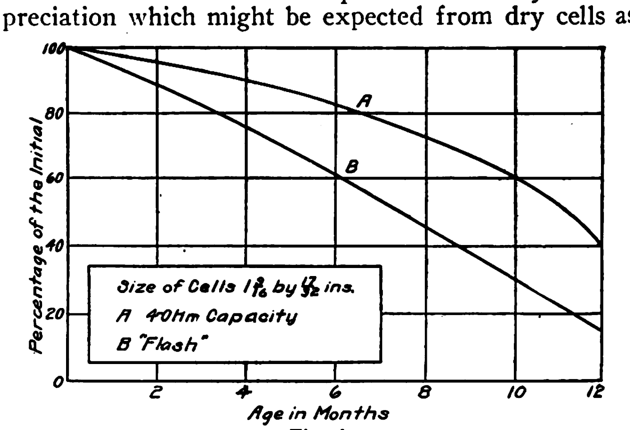


Fig. 4.

found on the market, nevertheless an approximation may be arrived at. From the data on which this paper is based, the following table has been compiled to indicate the reasonable depreciation of the four important sizes of small cells.

Size of Cells. Inches.	Centimeters.	Depreciation per Month, % First 2 Mo.	Last 10 Mo.
2¼ by 1¼	5.7 by 3.2	0.0	2.1
1 13/16 by ⅞	4.6 by 2.2	0.25	4.0
1⅞ by ⅝	4.8 by 1.6	2.0	5.5
1 9/16 by 17/32	4.0 by 1.4	2.0	6.5

Street Lighting and Traffic Accidents

Analysis of Year's Traffic Accidents in Cleveland as to Time of Day and Season Shows Large Percentage Due to Lack of Light — Value of Good Street Lighting Shown

By WARD HARRISON

Illuminating Engineer, National Lamp Works of General Electric Co.

An exhaustive survey has been published* showing that improper or inadequate lighting is at least a contributing cause of 24% of our industrial accidents. There are, however, no definite data available which show how many of the traffic accidents on city streets are due to this cause. The following survey of 3549 traffic accidents, shown on

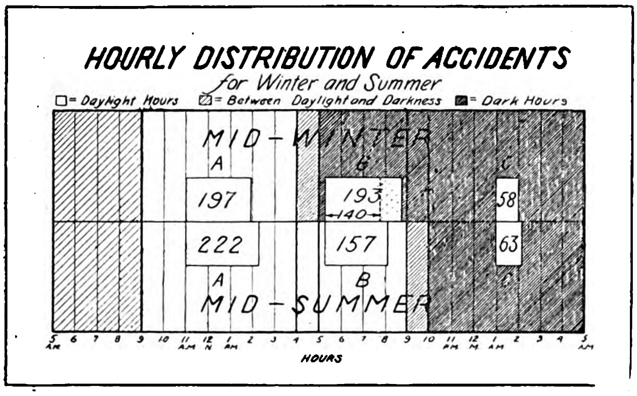


Fig. 1.—Graphic Study of Street Traffic Accidents in Cleveland as Compared to Hours of Daylight and Darkness in Summer and Winter.

the records of the Police Department of the city of Cleveland, for a period of one year will therefore be of some interest.

The purpose of this survey was to determine, if possible, how many of the 1059 accidents which occurred after dark would have been avoided had daylight or its equivalent been available. The simplest way of making such an estimate would be to compare the accidents which occur between, say, 5 and 9 p. m. in mid-summer when daylight is available with the number for the corresponding hours in mid-winter when it is dark. The records actually show that there were 157 accidents between these hours in June and July, while for December and January the total was 193, or about 22% more.

There are, however, several other variables beside the question of daylight and darkness which one must take into consideration when comparing accidents in winter with those in summer. For example, there are as a rule very many less vehicles on the streets in mid-winter, hence less liability of accident; on the other hand, this factor is counterbalanced to some extent by the effect of slippery pavements. It is necessary therefore to separate out these other variables before we can decide upon just how many of the 193 accidents on mid-winter evenings should be attributed to lack of light. Obviously, we can find the relative effect of all these other factors, except lighting, by comparing the number of accidents which occur during the middle of the day in winter months with those in the summer months or, for that matter, those that occur in the middle of the night at both seasons of the year. On this point the records show for December and January 12½% less accidents between 9 a. m. and 4 p. m. than occurred during the same hours for June and July, and they also show 8½% less accidents for the winter months during the hours that were dark at both seasons, viz., from 10 p. m. to 5 a. m. We are justified therefore in stating that, except for the question of light, there would really have been fewer accidents between 5 and 9 p. m. in the winter months than for the corresponding summer months. To be exact, instead of 193 accidents in the winter for every 157 accidents in the summer, we would have found 140 accidents in the winter had it not been for the lack of daylight. In other words, there were 53 accidents which can be attributed directly to lack of light. If we apply the same proportion, viz., the ratio between 53 and 193 to the total number of accidents occurring after dark in Cleveland during the whole year, we find that 292 of them are to be attributed to lack of light, and of these at least 14 must be classed as fatal accidents.

It of course seems out of the question today to provide street lighting which is as effective in pre-

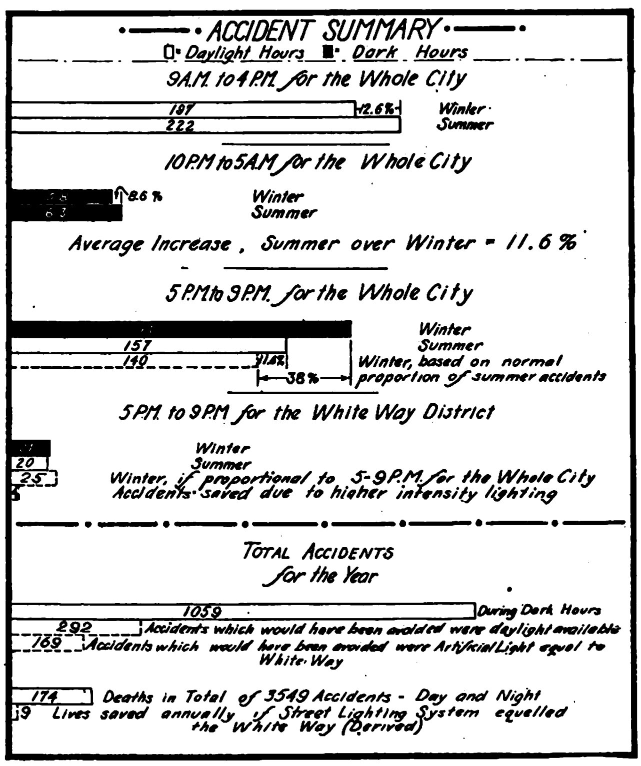


Fig. 2.—Comparison of Street Traffic Accidents at Corresponding Hours in Summer and Winter, Showing Influence of Darkness.

*"Illumination and One Year's Accidents," by R. E. Simpson, Travelers' Insurance Co. Transactions, Illuminating Engineering Society, Vol. X, No. 9 (1915).

venting accidents as daylight itself. It is nevertheless interesting to contrast the difference in accidents in the White Way district of the city with the number occurring in other portions. In this case, however, the total number of accidents involved is so small that the figures can only be taken as indicative. In the White Way district there were 20 accidents in summer between 5 and 9 p. m., and 21 in winter; whereas, the proportion for the city as a whole for these hours would indicate 25 accidents in the winter to every 20 occurring in the summer. We are safe in saying, therefore, that the higher intensity lighting in the White Way district has a marked tendency to reduce accidents.

The charts included, Figs. 1 and 2, summarize graphically the information given above.

HYDROELECTRIC POWER DEVELOPMENT IN BRITISH EMPIRE.

Further Report by British Water-Power Committee on Status and Plans for Development in Colonies, Etc.

We give below a summary of the present position of hydroelectric power development work in different parts of the British Empire and some European countries, as brought out in the second report issued by the Water Power Committee of the Conjoint Board of Scientific Societies.

The British Government has appointed a committee to investigate the water-power resources of Great Britain and Ireland. In India two eminent engineers have been appointed by the Indian Government to investigate the more promising sites. In Ceylon the water-power question is being considered by a committee appointed by the Ceylon Government. In British Guiana the discovery of large deposits of bauxite has suggested a possible and immediate use for the enormous water powers which the colony possesses. In Canada the government and community are fully awake to the necessity of such developments. In Australia a preliminary investigation ordered by the government of New South Wales has been commenced, and in Tasmania developments are progressing as fast as conditions permit. A great desire to promote hydroelectric schemes is manifesting itself in New Zealand, and the government is actively interesting itself in the investigation of promising schemes and in the East African Protectorate, government sanction has been obtained for the appointment of a special water engineer to organize a hydrometric survey of the protectorate.

The majority of the European states are showing intense interest in the matter, largely in consequence of the great demand for power for the manufacture of munitions, combined with the general world shortage of coal. In the countries at war, the normal development has been accelerated in a very large degree. Thus in France since the end of 1915, some 850,000 hp. has been actually put into commission or is in process of active development, and by the end of 1921 the country will have at least 1,600,000 hp. under control, as compared with 750,000 hp. before the war. In Italy concessions totaling over 250,000 hp. are already under way, and it is estimated that schemes totaling 2,000,000 hp. will be in operation in a few years. In Norway, Sweden and Switzerland large developments have been in train, while in Iceland a hydroelectric scheme contemplating the development of over 1,000,000 hp. from the River Fjorsaavasdraget is planned by an Icelandic company. In Spain various large projects are under consideration, including one on the Douro which is estimated to be capable of giving some 350,000 hp. In Bavaria a large project has been initiated to be financed in part by the state, in part by the various towns interested, and in part by existing stations; the total cost of the scheme is about 78,000,000 marks. In Wurtemburg, Saxony, and Prussia the state is to participate in the development and administration of electricity works. In Austria some 433 falls, with an aggregate average yield of 1,500,000 kw., have been surveyed; of these 17 have been secured outright, while seven additional concessions are pending. The aggregate of these 24 schemes totals 135,000 kw. Other large hydroelectric schemes have been planned and include an installation of some 25,000 kw. on the Talebor river, and one of some 120,000 kw. on the Wallsee.

Some information is given briefly respecting the use of hydroelectric power for railway electrification in the United States and a good deal of attention is naturally devoted to developments in Canada. In France much of the line of the Compagnie du Midi in the region of the Pyrenees has already been electrified by the aid of water power, and in many countries the electrification of trunk lines is under consideration.

In regard to British Guiana the principal available water powers lie on the Essiquibo river, with its tributary the Potaro, the Mazuruni river, and the Cuyuin river. On the Potaro river, the Kaieteur gorge has a total drop of over 1000 ft. The Kaieteur fall itself has a vertical drop of over 740 ft., the width of the head of the fall being about 400 ft. when the river is full. In times of exceptional drought, however, the width shrinks to 50 or 60 ft. No actual measurements have as yet been made by the government of the colony, but it is evident that the potential water power of British Guiana is extremely large. Thus the Kaieteur alone at the fall and gorge, assuming a mean depth of 10 ft. over the fall, offers possibilities of 2.5 million hp. The power developable in periods of drought, assuming a width of 60 ft. and a mean depth of 5 ft., would be about 125,000 hp. As very extensive deposits of bauxite have been proved in British Guiana, the country would appear to be exceptionally well situated for becoming an important producer of aluminum for the empire.

Turning to Australia, it is shown that the chief electrical engineer of New South Wales estimates that 300,000 hp. is continuously available from 18 schemes already investigated or partially investigated. The chief powers are on the Snowy river, 137,400 hp., the Clarence, 100,000 hp., and the Tumut, Shoalhaven and Nymboida, each about 10,000 hp.

In Victoria the large scheme for utilizing the available water powers between the Kiewa and Snowy rivers is still under consideration. It is estimated that the scheme will give more than 100,000 hp. at an estimated total outlay on a pre-war basis of $4,390,000.

The Tasmanian Government hydroelectric department is continuing its policy of surveying, as opportunity permits, the more promising sites. At present the principal purchasers of power from the hydroelectric department are the Hobart Corporation for tramways and general municipal requirements, the Electrolytic Zinc Co., and the Hydroelectric Power & Metallurgical Co., Ltd., which has installed works for the manufacture of calcium carbide. The present capacity of these works is 5000 tons per annum, but it is proposed to increase this. It is estimated that the electrolytic zinc plant may eventually absorb up to 26,000 hp. There appears to be every prospect of a ready demand for all the hydraulic power which can be developed by the department.

In Papua, or British New Guinea, taking all the rivers of any size, with their tributaries, in the central, northeastern, Kumusi, and Mambare divisions, it is estimated that the available horsepower would be somewhere in the vicinity of 6,000,000; and if the huge river systems in the gulf, delta and western divisions were included, 10,000,000 hp. would be well under the mark.

In addition, it is estimated that the occupied territory of German New Guinea affords possibilities of between 7,000,000 and 10,000,000 hp.

A great desire to promote hydroelectric schemes is manifesting itself in New Zealand. The success which has attended the hydroelectric works at Coleridge is apparently having considerable influence in favor of constructing other power schemes throughout the dominion. A scheme for the development of three important sites in the North Island has been prepared. From these it is proposed to develop 130,000 hp., requiring a plant capacity, in the main power stations, of 160,000 hp. The scheme is intended to render power available for every householder in the island and for any industry; also for main-line electrification, light railways and for coal and other mines. The sources mentioned are capable of supplying much more power than it is proposed to develop under the present scheme. Various new industries depending on the supply of electrical energy are either started or are proposed, and it seems clear that the government will be drawn into extensive hydroelectric development for the whole of the dominion.

In Rhodesia a gauging of the Zambesi at a point five miles above the Victoria Falls shows that the volume of water was 11,750 cu. ft. per second. It is estimated that the available fall is 315 ft., which would correspond to an output of about 350,000 hp.

In East Africa three projects, each of about 2000 hp., are being negotiated within 50 miles of Nairobi, and numerous smaller projects are being developed. In 1918 government sanction was accorded to the appointment of a special water engineer to organize and carry out, so far as funds may allow, a hydrographic survey of the protectorate.

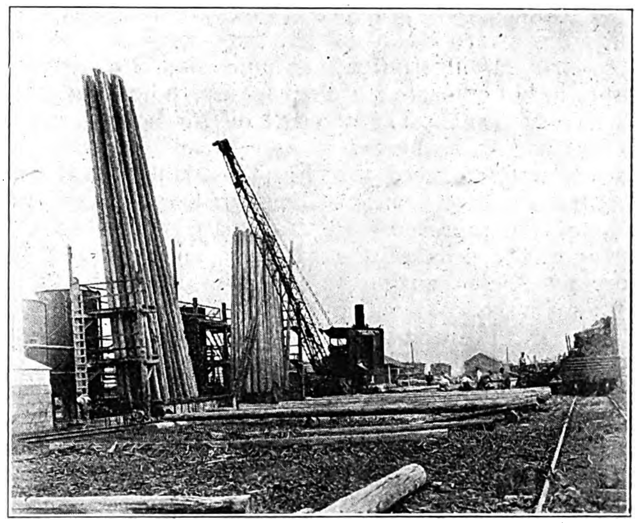
CONSERVATION ESSENTIAL IN CONSUMPTION OF WOODEN POLES.

Effective Preservative Treatment More Than Doubles Pole Life—Results in Conserving Supply and Reducing Maintenance Costs—Co-operative Treating Plant.

A preservative treatment for cedar and other classes of wooden poles used in carrying telephone, telegraph and electric power lines is fully recognized as essential in the conservation of our forest resources and of special importance in reducing maintenance charges in connection with such lines. The standing timber suitable for poles, existing in the northern, northwestern and southern states, is by no means limitless. In fact, it is estimated by competent authorities that the requirements for replacements and normal expansion will result in a practical exhaustion of such resources within 60 years, unless effective methods of conservation are extensively applied.

The erection of telephone and electric lines was very active in the central states and other sections 10 to 15 years ago, and on many of those lines practically very little consideration was given to any preservative treatment of the poles. As a result, the present demands for replacements due to decay are very heavy. Those replacements amount to hundreds of thousands of poles annually.

While the practice of treating the butts of poles is greatly increasing, it is estimated that at least 65 or 70% of the poles being required are erected without preservative treatment. The number of poles purchased in the United States in 1915 reached over 4,000,000, classified as follows: Western red cedar and northern white cedar, 2,314,980; southern white cedar, 89,244; chestnut, 651,643; cyprus, 67,644; pine, 546,233. Data supplied by the Forest Service show



Plant of Western Cedar Pole Preservers, Sand Point, Idaho, Showing Locomotive Crane in Service and Two Loads of Poles Receiving "B" Treatment.

that 95% of all poles are destroyed by decay, 4% by insects, and 1% by mechanical abrasion.

An estimate of the average life of poles of the several classes is as follows:

	Untreated, years.	Treated, "B" method, years.
Western red and northern white cedar	16	30
Chestnut	12	16
Cyprus	6	15
Pine	6½	20*
Southern white cedar (juniper)	8	18

*Pressure method.

This estimate is regarded as conservative, especially with regard to poles of the western red and northern white cedars, for which a longer average life is claimed.

The three standard methods of wood preservative treatment constitute the pressure process, in which the entire pole or log is treated; the open-tank method, usually adopted for treating the butts of poles; and the brush method, usually applied in the field and in the treatment of a comparatively small number of poles. These processes involve the use of both creosote and carbolineum as preservatives, and only the butt treatment is usually adopted for cedar poles required in transmission lines.

The three open-tank methods adopted by the Western Red Cedar Association are outlined in specifications prepared by that organization, designated as "A," "AA" and "B."

Treatment "A" requires a four-months' period of seasoning and the removal of fibrous inner bark preparatory to treatment. The poles are then placed vertically in an upright tank in which the butts are submerged in carbolineum, produced from pure coal tar, for a period of 15 minutes. The preservative is heated to a temperature of 215° F., at least once during every four hours' treatment, and it is required that it shall not fall below 180° nor exceed 230°.

Treatment "A" provides for the same preparation and methods of butt treatment as are required in "A," but requires the use of creosote instead of carbolineum. In this case, it is specified that the creosote shall be a coal-tar distillate and which must become completely liquid at 38° F. As in the use of carbolineum, the creosote is required to be used at 215° F.

Treatment "B" provides for placing the poles with butts downward in an upright tank, as shown in the accompanying illustration, for immersion first for four hours in hot creosote and then for two hours in a bath of cold creosote. The creosote oil for hot treatment is specified to be heated to 212° F. and for the cold bath at not to exceed 112° F. This double treatment secures deep penetration—about 50 to 75% penetration of the sapwood. In this treatment the hot oil expands the cells of the sapwood and the cold oil contracts them, causing an expansion and contraction of air in the cells which results in drawing the oil deeply into the wood.

It is considered impossible in the treatment of cedar-pole butts to secure a penetration deeper than the sapwood, as the oil penetration is resisted by a fibrous growth between the sapwood and the heartwood, and a penetration deeper than the sapwood is not necessary because decay at the ground line always starts at the outside and works inward. But the penetration of the sapwood must be to a depth sufficient to overcome volatilization of the preservative oil.

Many pole users have been content with the cheaper installations of untreated poles, with the resultant shorter life and the inevitable higher maintenance costs of the line.

Another wasteful practice has been to install poles of somewhat larger diameter than actual service requires, to allow for a certain amount of deterioration by decay before replacements become necessary. Thus, if a pole of 28-in. circumference is all that is required to support the line safely, a pole of 36-in. circumference is selected to allow for a 1¾-in. depth of decay, and still leave a pole of a size to sustain the load. The adoption of a pole of the smaller size and giving it an effective butt treatment, would be far more economical in the long run and much less wasteful of timber resources. That is, the longer life obtained by choosing a pole unnecessarily large could have been secured by selecting a pole of just sufficient size and giving it a preservative treatment.

The height of butt treatment is determined by the length of poles and the height of the ground line. Thus, a 20-ft. pole, sunk to a depth of 3½ ft., would require a 5-ft. height of treatment; a 30-ft. pole, set at a depth of 6 ft., would require a 7½-ft. height of treatment.

The illustration given herewith shows the treatment plant of the Western Cedar Pole Preservers, at Sand Point, Idaho. The stockholders in this concern are the members of the Western Red Cedar Association, of Spokane, Wash., and its operations are confined to the treatment of poles for those members. In this plant equipment is provided for pole-butt treatment by the "A," "AA" and "B" processes described above, of which the double treatment by hot and cold creosote is required in most cases. The plant has a capacity for treating four carloads of poles per day by the "B" method and is operating at about that capacity. The equipment comprises two 20,000-gal. steel working tanks, circular in form, for hot and cold creosote, rectangular treatment tanks and a round sump tank of concrete, and a 50,000-gal. storage tank for creosote and the necessary steam-boiler plant. In the illustration a locomotive crane is shown in service handling the poles.

RECENT IMPROVEMENTS IN AND FACTORS INFLUENCING INDUSTRIAL CONTROL EQUIPMENT.

Abstract of Paper Presented Before Association of Iron and Steel Electrical Engineers.

By H. D. James.

Westinghouse Electric & Manufacturing Co.

It is not probable that radical changes will be made in the general design of magnetic contactors, as experience has shown that the clapper type of magnet is more reliable than the coil and plunger type, and it is desirable to have all of the essential parts removable from the front of the board. An effort is being made to reduce the number of parts and to use as few different sizes as possible.

A careful study of the design of magnetic contactors and other control apparatus, together with our accumulated experience, enables improvements to be made which reduce the wear and maintenance and decrease the liability to freezing or failure of operation. A consideration of any contactor shows that the essential part of the device is the contact and arc rupturing means. Whether the contact is closed by hand, by magnet, or by an air cylinder, the important part of the problem is the ability of the contactor to handle the current and to stand up under repeated operation. The rolling contact is the most reliable type now in use, but an analysis of various designs indicates a considerable variation in the performance of this contact.

In the rolling contact the movable contact member is usually attached to the armature of the magnet and mounted on an auxiliary pivoted member which will be designated as the contact support. The pivot of this contact support approaches the stationary contact through the arc of a circle and the movable contact is tilted forward so that its tip comes in contact with the stationary contact tip. A further movement of the magnet armature causes the movable contact to roll against the stationary contact until the heels or bottom parts of the contacts are in engagement. The relation between the pin, around which the contact support rotates, and the position of the contacts is an important part of the design. The action of the contacts against each other cannot be a true rolling action, as the contact support hinge pin rotates through a circle and therefore its center moves up and down, due to this rotating action. The least amount of roll is obtained when the moving contact center is located so that it moves at an equal distance on either side of the line drawn from the heel of the contact to the armature hinge pin. Even with the above arrangement of centers there is always sufficient sliding action to keep the contacts clean. Any excessive sliding action causes additional mechanical wear on the contacts and in this way reduces their life.

An excessive sliding action is a disadvantage from another point of view. If the surfaces of the contacts become rough, they have a tendency to lock together and prevent the sliding action. While this locking together is not absolutely positive, it has been found sufficient in cases where the sliding action is excessive to prevent the armature of the magnet from sealing. This can be readily understood by considering two gear wheels in mesh with each other and an effort to move one gear relative to the other at the same time that they are rotating.

When a magnetic contactor is closed the contacts strike together with considerable force and there is a slight rebound. This is true of any two elastic bodies coming together; the motion is arrested and a slight rebound takes place. When the contact rebounds it draws a small arc which softens the surface of the contacts at the point where they touched. If these contacts are permitted to come together at the same point after the rebound, there will be a decided tendency to weld or freeze, due to the softened metal parts coming into contact. This re-establishment of contact at the same point is prevented by the closing movement of the magnet armature. During the period of rebound, the armature has travelled closer to the magnet core and the center carrying the contact support is in a new position, so that contact is re-established at another place.

The closer the contact support hinge is to the heel of the contact, the quicker the rolling action, and therefore the less liability to freeze. With a long slow roll, the opportunity to weld or freeze seems to be very materially increased. It is possible to obtain a welding of these contacts by energizing the closing magnet and then immediately de-energizing the magnet in such a way that the contacts will just touch and then drop away. With a slow-acting magnet and a long roll contact, it is easier to obtain this condition than where the center of contact support is close to the contact. This condition is the only one under which a well-designed contact will weld on normal overload current.

The closer the center of contact support is to the contact, the greater the lever action exerted by the closing means and therefore the greater ease with which a welded contact may be broken apart. This is of particular value in connection with manually actuated contactors, as these are more likely to be welded, due to improper operation. If the contact is closed by a cam, the operator can exert a very powerful force to break open any ordinary weld.

Importance of Magnetic Blowout.

The life of the contacts and arc box depends upon the efficiency of the magnetic blowout. The function of this blowout will be better understood by a brief description of the action which takes place in the arc box. The arc may be considered as consisting of a stream of positively and negatively charged gaseous particles or ions that travel rapidly from one contact to the other under the influence of the electrostatic field, which is established between the contacts by the line voltage. This stream of rapidly moving ions constitutes the arc current between the contacts; since it is a flexible conductor it can easily be stretched out lengthwise or readily deflected. If a transverse magnetic field is applied to this conductor, the reaction between the conductor and the field will be similar to the action which takes place in a motor where a conductor carrying current is placed in a magnetic field. The conductor moves in the same direction as it would in a motor. This movement increases its length, which cools the arc gases and increases the resistance to the flow of current. The increased length makes it more and more difficult for the voltage across the arc to maintain the flow or ions, until the arc becomes unstable and is finally ruptured. The length of the arc depends upon the amount of current flowing when the arc is established, upon the voltage between the contacts and upon the stored energy in the circuit. The length of this arc may readily be influenced by the design of the arc box and blow-out field.

In addition to the ions, which makes up the flexible conductor, some stray ions accumulate in the arc box. If the distance between the contacts is small, the voltage between the contacts may cause these stray ions to reestablish the arc by forming a new flexible conductor. Oscillograph records show that the arc is sometimes re-established two or three times before it is finally interrupted. The re-establishment of the arc depends upon the design of the arc box and the separation of the contacts. The higher the voltage, the greater the separation required. If two contactors are used in series, there is much less liability of the arc re-establishing itself. The two breaks in series also assist in rupturing the arc, as they require the maintenance in series of two flexible conductors made up of ions, they also distribute the heating effect between two or more arc boxes so that it is much easier to cool the arc.

To rupture an arc, it is necessary (1) To lengthen this arc, so as to increase the resistance, and therefore decrease current, and at the same time, to cool the arc. (2) The contacts should be separated far enough to prevent a re-establishment of the arc or two or more breaks should be used in series for this same purpose.

The cooling of the arc vapor and lengthening of the arc path is usually accomplished with a magnetic blow-out. This lengthening and cooling may be materially assisted by interposing barriers or arc splitters in the path of the arc. In this manner, the ions, which maintain this arc stream, are not only cooled and discharged by contact with the sides of the arc box and the surrounding air, but are also cooled by coming in contact with these arc splitters. The length of the arc is also materially increased while it is still under the influence of the blowout field, by stretching it across these arc splitters. The projection or throw of the arc beyond the edge of the arc box is therefore decreased and much more energy can be broken in the same size of arc box. If the arc extends a considerable distance beyond the edge of the arc shield, it ceases to be under the influence of the magnetic field and may continue to hang on for an appreciable length of time. The burning on the contacts and arc box for any given current depends directly upon the length of time the arc is maintained. The further the arc must travel in order to be ruptured, the greater the time for burning. By using these arc splitters, the arc is extinguished more quickly and therefore the amount of burning is decreased.

The material of which the arc shield is made bears an important relation to the duration of the arc. A good many asbestos compounds, now in the market, contain a binder, which is fused by the arc and forms a conducting skin on the side of the arc box. It is therefore very desirable to construct arc boxes of material which does not form a conducting skin. The more refractory the material, the greater the life of the arc box.

Editorial Comment

Street Lighting and Accidents

STREET lighting has long been recognized as having three main functions. It helps one who has to venture out on the streets after dark to find his way and locate his destination, to go without molestation by those maliciously inclined, and to avoid collisions, falls and other accidents. With the steady growth of automobile traffic in recent years there has been a tendency to increase of street traffic accidents, both by day and night. The far from satisfactory condition of the average automobile headlight has contributed to the latter increase, but it is generally realized that improved street lighting would materially decrease the number of traffic accidents at night. To focus attention upon the subject it was desirable to have definite data available on the effect of darkness upon street accidents and to what extent these might be reduced by modern street lighting.

Data on this matter have now been gathered as the result of an analysis of street traffic accidents in Cleveland, made by Mr. Ward Harrison of that city and reported in an article in this issue. He shows conclusively that there is a big increase in accidents during corresponding hours of summer and winter when daylight and darkness prevailed. In the well lighted part of the city this difference was very small, thus showing the accident-prevention value of modern street lighting. It would be desirable to confirm these findings by definite figures extended over a numzer of years, if possible, and including other cities.

While no one has seriously questioned the safety value of street lighting, data like these are of great intrinsic value when it comes to advocating proposed lighting betterments before city councils and other municipal authorities. Just as with industrial lighting, if one can show concrete benefits in lives saved or accident damages avoided, the arguments make much more impression than abstract statements and generalities.

Some Considerations in the Electrification of Coal Mines

WITH the agitation for higher rates of remuneration and shorter working hours—the bituminous coal miners are demanding a 60% increase in wages and a 5-day week of 6 hours each—to which must be added the fact that a very large number of foreign-born miners are going back to their native countries, coal-mine operators face today the very serious problem of combating increasing costs on the one hand and curtailed production on the other. There is but one solution to this problem, and that is to utilize to the full mechanical methods of mining and apply them most efficiently.

This means, of course, in nine cases out of ten, electrification. And electrification, efficiently carried out for most economical investment, the greatest reliability and minimum operating charges, means the purchase of central-station power, the employment of electricity as the working agent in almost every phase of getting the coal from the ground to the railroad car, and scientific secondary or underground distribution throughout the mine so that line losses and local trouble are minimized and shutdowns localized.

In going over to central-station service, installation costs must be kept to a minimum because there is sometimes small margin between central station and isolated plant costs, not capitalizing the other advantages of purchased service. However, the high value of coal, the value at which it might be marketed if not burned for power purposes, is making the margin wider and wider. In other instances, the lower the cost of supplying service, the greater the profit in the utility. In all cases, therefore, it is to the advantage of someone, frequently of everyone, that the cost of delivering "service" be a minimum. Elsewhere in this issue appears an article by Mr. H. W. Young on the "Outdoor Substations in Connection with Coal-Mining Installations," a solution to keeping the cost of delivery service down. There is little to be said further in this connection, for most of us know what Mr. Young has done toward making the outdoor substation what it is today. These columns have advocated the outdoor substation for so long and for so many applications that our readers must have learned our doctrine of "do not house what does not need housing."

An outdoor substation, *per se,* may with a little modification of detail but retaining the same salient features be used with equal success and effectiveness indoors—throughout the mine. In both instances reliability, economy of cost and flexibility are the predominating conditions to be met, to which portability must be added for the movable type. The place where service should be delivered is at the mine head. The place for the substation in the mine, or substations, as the case may be, is at the center of gravity of the load. As the center of gravity of the load changes the location of the portable or movable substation should change also, speaking generally. By so doing, the investment in conductors is kept down, energy losses are reduced and voltage regulation is maintained so that equipment and men are not handicapped. Only those that have worked in electrified coal mines appreciate the manner in which low pressure and poor voltage regulation are answerable for burnt-out motors, flashovers of direct-current apparatus and lost time in general.

The electrification of coal mines during the next ten years is prone to play an important part in combating the high cost and scarcity of labor and the demand for less work and more pay. Coal-mine electrification, unlike many other forms of electrification, calls for frequent adjustments to take care of changed locations of active workings, increase in depth of shaft and similar causes. The substation at the mine head may be expected to remain quite permanent except insofar as increased capacity and extensions may be required from time to time to care for the increased energy consumption taken by the mine. The initial choice of a flexible type of outdoor substation is therefore a fact to be borne in mind.

So, too, the distributing network in the mine will require periodic modification to meet new needs, and to this extent the portable substation is a factor in economical operation, in keeping down the kilowatt-hours per ton of coal mined, the investment in conductors and energy loss chargeable to distribution and voltage regulation.

Coal will play a vital part in our national life for many a day—perhaps forever, so far as we know now. Electrification of the coal mines is not only a matter of lowering the costs of mining and therefore in affecting the cost of coal to the consumer and to industry. Electrification means that coal can be better conserved, since coal can be mined less wastefully and less need be left behind in abandoned workings.

Records for Electrical Departments

IT IS obvious that the value of records depends on how much use is made of them and what results they bring. There are, no doubt, as many errors of omission as commission in this respect in factories, industrial plants, repair shops and the like. Neglecting to keep adequate records is as bad policy as to become involved in complicated record systems which may take more time to maintain than does actual production itself. Where to start and where to leave off is a matter of experience, observation and precaution.

Good practice in keeping records for electric repair shops and for industrial plants and other institutions having an electrical repair and maintenance department is indicated in an article by Mr. R. B. Gerhardt in this issue. While Mr. Gerhardt's suggestions are confined to the electrical departments of steel mills, it can be assumed that the points brought out regarding records of costs, production, inspection and tests will be well taken by any one in charge of an electrical department or repair shop.

The activities of such establishments being so varied, there can never be a great degree of standardization in the keeping of records. "Moderation in all things" seems to apply to records, and should be the rule to follow.

British Water-Power Utilization Progressing While American Waits

ONE of the many matters which the British prime minister is pledged to bring before Parliament when the legislators resume their sittings late in October is hydroelectric power development. Early in the year we particularized certain proposals which were advanced by the Water Power Resources Committee relating to nine potential schemes for Scotland which, if carried out, would upon the then average practice of coal-fired stations represent the equivalent of 1,850,000 tons of coal per annum. At that time it was urged that if some of the aforesaid schemes were to be quickly taken in hand so as to give useful employment to labor in 1919, speedy legislative action ought to be proceeded with giving the Board of Trade power to acquire the necessary rights and instruct engineers to complete their surveys, prepare plans and estimates. Doubtless it was owing to the heavy demands upon Parliament that the matter was delayed. The committee wanted the legislative part of the business to be put through quickly so that actual construction work could be begun in the summer now already past. If the bill now promised for the late months of the year is approved, that may happen next year instead of this, but the schemes or part of them, are now definitely accepted as part of the government intentions respecting the industrial development of the United Kingdom and, failing accidents, the way appears clear for something practical to proceed.

Interest in the matter is not limited to the United Kingdom for a second section has now been issued of the report of the Water Power Committee of the Conjoint Board of Scientific Societies on hydroelectric proposals and achievements throughout the whole British Empire. We publish some extracts from this important document elsewhere in this issue. It enters in detail into the greatness of the work and the opportunities and again lays emphasis on the need which has been recognized by careful British electrical observers for some time past of providing more adequate training facilities in British universities and technical institutes for young engineers wishing to take up this branch of the profession.

In the days of cheap coal hydroelectric work was not extensive in the United Kingdom. The colliery workers' wage and other demands, also coal transportation and other costs, have, by doubling the cost of the former commodity, altered the situation in favor of water power. This fact, coupled with the awakening of all parts of the British colonies to the folly of permitting prodigious waste of running water, has placed hydroelectric questions in the forefront of the engineering reconstruction problems of the entire empire, and indeed of practically the whole world. While our British cousins are actively planning, and actually carrying out water-power development, we are in the meantime still waiting on Congress to take some definite action on the matter.

Current Events

Electrical Christmas Campaign — Inductive Interference Survey—S. E. D. Activities—Northwest Association Meets

PRELIMINARY PLANS ANNOUNCED FOR "ALL-ELECTRICAL CHRISTMAS."

Society for Electrical Development Makes Survey of Electrical Trade Conditions and Prepares Plans for Holiday Selling.

Announcement has just been made that the Society for Electrical Development is completing plans to make this an "All-Electrical Christmas." In line with the plans carried out in 1915 for "Electrical Prosperity Week" and in 1916 for "America's Electrical Week," representatives of the society have completed a survey covering 16 states and the province of Ontario, Canada, during which electrical conditions in every branch of the industry were studied at close range.

In most cities the contractors, dealers, jobbers and manufacturers reported the greatest volume in their history. Manufacturers and distributors of electrical specialties are far behind on orders and dealers in these devices are finding ready sale. As one retailer expressed it: "For the first time in the history of electrical appliance selling in this city people are coming into the store to buy large and expensive specialties, which heretofore we had to go out and sell with the hardest kind of selling."

Based upon this information, the society has prepared complete and comprehensive sales and advertising material for holiday selling. This material will comprise posters, colored leaflets, envelope enclosures, cards for counters, cars and windows, form letters and various other advertising matter. It is planned to distribute this co-operative help to the trade at large, as in former campaigns. The society will supply details of the campaign and material upon request. Its headquarters are located at 29 West Thirty-ninth street, New York City.

RAILWAY AND UTILITY COMMISSIONERS TO CONVENE.

Meeting at Indianapolis Oct. 4 Will Be Concerned with Discussion of Transportation and Utility Problems of Readjustment.

The National Association of Railway and Utilities Commissioners will meet in Indianapolis, Ind., Oct. 14. John W. McCardle of the Indiana Public Service Commission will deliver the address of welcome. Governor Goodrich of Indiana, Mayor Jewett of Indianapolis, Clyde B. Aitchison, chairman of the Interstate Commerce Commission, and Max Thelan, director of service for the federal administration, will be among the leading speakers. Three hundred commissioners are expected to attend.

All sessions will be held in the Claypool Hotel and will continue five days. The meeting will largely be devoted to a consideration of reports of special and standing committees, which will cover all phases of railroad and utility regulation. Among the important subjects are public ownership and operation, safety of operation, service of railroads, service of utility companies, railroad rates, utility rates, demurrage, express companies, grade crossings, statistics and accounts, capitalization and state and federal legislation. It is expected that the various plans for the return of the railroads to private ownership, as well as the Plumb plan for nationalization of the systems, will be discussed.

The officers of the association are: President, Charles E. Elmquist, Minnesota; first vice-president, Charles M. Condler, Georgia; second vice-president, Joseph B. Eastman, Massachusetts; secretary, James B Walker, New York; assistant secretary, L. S. Boyd, Washington, D. C. The association comprises all of the railroad and public utility commissions in the United States, as well as those in Hawaii and the Philippine Islands. There are now 53 different commissions belonging to the association, representing every state in the Union with the exception of Delaware, which is the only state having no regulatory commission.

ELECTRICAL EXPORTS FOR JULY FAR BELOW RECORD.

Serious Slump From the Record Figures of June, but Substantial Increase Over July of Last Year.

Figures for the July electrical exports just made public through the monthly summary of the foreign commerce of the United States issued by the Bureau of Foreign and Domestic Commerce, Washington, D. C., show a very decided drop from the phenomenal total of last June, when there was reported an aggregate of $10,990,717. However, as compared with July of 1918 there was an increase of over 11%.

The detailed figures for last July and those for the corresponding month of last year are given in the following table:

Articles.	July, 1919.	July, 1918.
Batteries	$ 379,021	$ 240,640
Carbons	70,991	100,098
Dynamos or generators	475,271	283,407
Fans	142,103	105,823
Heating and cooking apparatus	156,745	64,822
Insulated wire and cables	659,893	477,448
Interior wiring supplies, including fixtures	160,099	135,221
Lamps—		
Arc	835	521
Carbon-filament	4,076	6,775
Metal-filament	240,719	309,919
Magnetos, spark plugs, etc.	203,809	151,821
Meters and measuring instruments	125,589	236,019
Motors	546,794	943,006
Rheostats and controllers	26,854	18,730
Switches and accessories	403,748	186,086
Telegraph apparatus, including wireless	44,892	30,710
Telephones	274,387	296,970
Transformers	285,496	287,459
All other	1,794,783	1,518,470
Total	$5,996,105	$5,393,949

These figures do not include electric locomotives, which are separately listed in the government reports.

INDUCTIVE INTERFERENCE COMMITTEE MEETS IN CHICAGO

Data to Be Collected by National Electric Light Association Sub-committees.

The first meeting of the newly formed Inductive Interference Committee of the National Electric Light Association was held in Chicago on Sept. 22 and 23. It is the purpose of the committee to study the inductive interference situation and its relation to practices of the power industry.

The discussions, with the deep interest which they evidenced, brought out clearly the increasing seriousness of this situation, due primarily to the rapid multiplying of the circuits of all parties concerned, to the ever-increasing susceptibility of telephone circuits attendant upon new advances in the telephone art, and to the lack of understanding of generally satisfactory methods of controlling the disturbing effects.

Plans were developed for organizing and inaugurating the committee's work in pursuance of which two sub-committees were appointed, one for the purpose of collecting general data pertinent to the subject and the other for studying the problems being encountered.

The efforts of the former sub-committee, of which S. G. Rhodes is chairman, will include the gathering and analyzing of all available data of actual cases of inductive interference, with descriptions in detail of the causes, nature and extent of disturbance, measures of relief applied, allocation of expense involved and other conditions. Any company that has experienced troubles of this character can lend effective support to the committee by contributing its information, mailed to W. C. Anderson, technical secretary, National Electric Light Association, 29 West 39th street, New York City.

The latter sub-committee, of which H. B. Gear is chairman, will work toward building up a centralized agency for assisting power and lighting companies to arrive at sound and proper solutions of their inductive interference problems, and for effecting a closer co-operation in matters of this nature.

The chairman of the Inductive Interference Committee is A. E. Silver, Electric Bond & Share Co., 71 Broadway, New York City.

ELECTRICAL MEN GIVE LUNCHEON TO EDWARD N. HURLEY.

Testimonial of Appreciation Presented by the Society for Electrical Development.

At a luncheon given on Sept. 19 at the Engineers' Club of New York in his honor by prominent men of the electrical fraternity, representing the Society for Electrical Development, Edward N. Hurley was presented an engrossed parchment testimonial expressing appreciation of his work while head of the United States Shipping Board.

The presentation was made by J. M. Wakeman, general manager of the society, who said, in part:

"When the United States entered the war it was already well recognized that ships were the all important weapon needed to keep the world safe from the hordes of barbarians who threatened it. Among the most notable achievements of this great country was the rapid construction of those vitally important ships.

"Representing the officers, directors and members of the Society for Electrical Development, I take the greatest pleasure in presenting you with this engrossed copy of the resolution passed by the directors and bearing their signatures, testifying their appreciation of the valuable and truly wonderful services you, as chairman of the United States Shipping Board and chief executive of the Emergency Fleet Corporation, rendered not only to this country, but to the entire world. Your work, Mr. Hurley, will be given a prominent place in history and we rejoice in the feeling that you are one of the oldest members and staunchest friends of the Society for Electrical Development. We feel honored that we are permitted to thus record our appreciation of your great achievements."

In acknowledging the presentation, Mr. Hurley said among other things: "I resigned my job with the Shipping Board to get back to the electrical business and I have spent some six weeks investigating what has been going on since I left it to take up governmental work. I am astounded at what has been done. In Washington, during the war, I was present when the question of doing something for the street railways of this country came up. I was asked to aid in the problem of bringing about some sort of an adjustment. Because I have always been interested in the success of the electrical industry, I complied.

"No industry has tried to help people more than the electrical, and that includes the street railways of this country, and no other industry can be of so much benefit to the people of this country. We are before the people more than any other industry and the country cannot afford to ignore the situation existing in the street railways, when they have difficulty in paying their fixed charges. They and everybody connected with the industry are doing one thing—trying to give service. And it is discouraging to feel that the public doesn't understand. They must be brought to understand, and that is one function of the Society for Electrical Development. It is to make people understand, to aid in helping all men of the electrical industry to get together, to hold hands and to stay together. Gentlemen, we must all hold hands, with each other and with the public, or I am frank to say some very important industries will be crucified.

"I think the whole electrical industry can well take to heart this message: Hold up your head and BE OF SERVICE. That is the thing the electrical industry exists for—to BE OF SERVICE."

The parchment is signed by the following directors of the Society for Electrical Development:

Henry L. Doherty, president, Cities Service Co.

James H. McGraw, president, McGraw-Hill Co.

Joseph E. Montague, vice-president, Niagara Electric Service Corp.

E. W. Rockafellow, Western Electric Co.

Fred B. Adam, president, Frank Adam Electric Co.

James R. Strong, president, Tucker Electric Construction Co.

L. P. Sawyer, National Lamp Works of General Electric Co.

Fred Bissell, president, F. Bissell Co.

Walter D. Steele, vice-president, Benjamin Electric Manufacturing Co.

Earnest McCleary, president, McCleary-Harmon Co.

Charles W. Price, chairman of board, Electrical Review.

J. Smieton, Jr., secretary and treasurer, Society For Electrical Development.

J. M. Wakeman, general manager, Society for Electrical Development.

CANADIAN GENERAL ELECTRIC JOINS SOCIETY FOR ELECTRICAL DEVELOPMENT.

Company Receiving Suggestions for Large Display Rooms and Greater Co-operation with Contractor-Dealers—Other Canadian Firms Joining.

The Canadian General Electric Co., with headquarters in Toronto, Ont., has become a member of the Society for Electrical Development, as have several other Toronto electrical firms, chiefly contractors and dealers. It is planned to extend the work of the society throughout the Dominion of Canada on an increased scale. The Honorable Frederic Nicholls, who for over 30 years has been prominent in Canadian electrical industrial activities, is president and general manager of the Canadian General Electric Co. A. S. Edgar, supply sales manager, together with Mr. Horton and Mr. Mallett, from the main office, have been spending considerable time in the New York offices of the society planning the co-operative work.

The Canadian General Electric Co. is building a new structure to house what will be the finest and most complete electrical showrooms in Canada. Many unique features will be incorporated in this department, which will be operated largely for the convenience of the contractors and dealers of Toronto and the surrounding cities. There will be rest rooms, consultation rooms, with stenographers in attendance, rooms for demonstrations of electrical appliances and specialties and provision made for carrying on a vast educational work within the trade.

CALL FOR ANNUAL CONVENTION OF JOVIAN ORDER ISSUED.

Meeting to Be Held in Chicago on Nov. 5 and 6 to Decide on Reconstruction or Disbanding of the Order.

The seventeenth annual convention of the Jovian Order will be held in Chicago, Nov. 5 and 6, at the Hotel Sherman, following a meeting of Jupiter's cabinet called for Nov. 4. The Jovian Order, like other similar bodies, because of retrenchment made necessary during the World War and changed conditions within the electrical industry, suffered during the past several years a material decrease in membership and income.

This impairment of finances and man power has reached a point so serious that some exceedingly resultful measures of reconstruction must be placed in effect or the order abandoned. This condition was defined in a resolution adopted by Jupiter's cabinet at a meeting held by that body on June 6, to the effect that this annual convention be petitioned by the cabinet to either disband the order or provide assured sources of revenue sufficient to cover a definite budget that will permit the order to realize the great potential good that rests within it.

The Jovian Order has been in existence 20 years. The fundamental principles upon which it was founded and for which it asked the support of the electrical industry were sound at the time of its inception, they are sound today, and will remain sound. The order has accomplished much within the industry.

It is believed by a considerable number of officers and members that the Jovian Order is far from a state of hopelessness; that it can be saved; that it can be guided and rejuvenated to high estate, to become an instrumentality of tremendous usefulness to our great industry, and to each of the mites and mighty that make that industry. Hence all interested in the revival of the organization and who treasure pleasant memories of its days of power and good are urged to attend the convention next month.

MEMBERSHIP CAMPAIGN OF WESTERN SOCIETY OF ENGINEERS.

Intensive Drive Is to More Than Double Membership in Six Days—Chicago and Neighboring Engineers Showing Interest.

Mention was made in these columns of an intensive membership campaign to be conducted by the Western Society of Engineers, Chicago. The time originally set was the week of Oct. 6-11, but preparations on a larger scale made it advisable to defer it to Oct. 11-17. A special campaign rally dinner was given on Oct. 9 at the Morrison Hotel to all interested in the drive, which is expected to bring in at least 2000 new members in six days. Fourteen teams are actively at work. On the evening of Oct. 10 a smoker was given to all participants, including prospective members. Six rally luncheons are to be held each noon on the active days of the drive. Engineers in and near Chicago are showing much interest in the campaign and recognizing the advantages of affiliation with this organization of engineers of all branches of the profession, which recently celebrated its 50th anniversary.

Detailed information can be obtained at the society's headquarters, 1735 Monadnock Block, Chicago.

INCREASED USE OF ELECTRIC VEHICLES IN ITALY.

Large Corporation Being Formed to Manufacture and Operate Electrics—Eagerness to Co-operate With Americans.

The shortage of gasoline during the war has brought about considerable use of electric vehicles in Milan, more particularly for heavy trucking. Although with normal conditions gasoline will not continue at its present price of a dollar a gallon, it will always be high in Italy and that of electricity low. The cities of the Po Valley are all level and the roads in the country are very good.

One electric garage in Milan operates electric busses for all of the hotels and also a regular express-truck service between Milan and Bergamo. It is organizing a 3,000,000 lire corporation to manufacture and operate electric vehicles. It is connected with the Soc. Generale Italiana Accumulatori Electtrici, which will make the batteries. This latter concern was a branch of the Tudor group, but has now been taken over entirely by Italians.

The company would like to form a combination with some American concern manufacturing electric trucks. It is possible that considerable business might be done in parts of trucks such as controllers, steel wheels, etc., and even entire trucks minus the batteries if the price was right. The address of this concern can be obtained from the Bureau of Foreign and Domestic Commerce, Washington, D. C., or its numerous branch and co-operative offices in the leading cities of the country, by making reference to file No. 40723.

Northwest Electric Power Men Hold Important Convention

Central-Station Delegates from Four States and Many Visitors Meet at Seattle — Papers and Discussions Deal with Vital Problems — J. B. Fisken Elected President of Association

By W. A. SCOTT

THE electric public utility companies of Washington, Oregon, Idaho and Montana were well represented at the twelfth annual convention of the Northwest Electric Light and Power Association held at Seattle on Sept. 24 to 27, inclusive. This organization is a geographic section of the National Electric Light Association. Close to 150 delegates and guests were registered; included among the latter were 15 representatives of power companies and other electrical concerns of California. The convention was notable for its unanimity of action on important matters, for the ready grasp of problems before it, and for the ability manifested in papers and discussion.

All the sessions were presided over by H. J. Gille, of the Puget Sound Traction, Light & Power Co., president of the association. At the opening of the convention, Mayor C. B. Fitzgerald of Seattle gave a brief address of welcome. This was followed by President Gille's address, in which he first gave a review of the important part played during the war by those trained in the public-utility industries.

President Gille's Address.

Entering then into the affairs of the public utilities, Mr. Gille covered all phases of the subject, showing the problems and duties to be met. The following extracts cover some of the salient features of his address:

"The public, which had been taught that the combination of capital necessary to successfully and economically develop the large public utilities of this country was somewhat of a menace, was suddenly awakened to the fact that it was only by reason of the existence of such development that the tremendous construction necessary to successfully prosecute a great war was possible. Shipyards sprang up almost over night. Large machine shops and other war industries demanding large blocks of power came into existence, and yet this extraordinary demand for electric energy was everywhere promptly met. Nor is there a single record of any electric light and power company seeking in the slightest measure to take advantage of the country's abnormal needs to secure an abnormal profit. With the prices of every other commodity advancing by successive strides, the prices of electric energy remained practically stationary, despite the large increased cost in production and labor.

"Along with the other questions that have profited by the experiences of the past two or three years is that of standardization and equipment. Lamps and appliances have been brought up to a spirit level of quality that would have taken years to bring about had not necessity compelled. And at the same time much that has been worthless and unnecessary in the way of appliances and equipment has been scrapped and such machinery as was employed in the manufacture of our own necessities has turned out goods with the hall mark of quality, benefiting the electrical industry.

"One of the peace-time problems confronting us today is the development of business to employ the energy released from the needs of war production, and the development of the great industrial opportunities on the Pacific Coast, and particularly in the Pacific Northwest. Industrial research for developing industries employing electricity as a motive power should be vigorously prosecuted. I realize that few individual companies, except the large ones, can afford to engage competent investigators for this purpose, and it might be wise for the association to undertake this work along broad lines for the benefit of all member companies. Chambers of commerce, commercial clubs, associations of manufacturers, jobbers and dealers should co-operate with the central-station companies in working out such a plan and in encouraging new industries.

"In the Bureau of Labor statistics of the United States are records of wholesale prices of 240 commodities, grouped under nine heads. The average index number in 1913 was 100; in April, 1919, it was 203. In other words, the wholesale prices of 240 commodities have more than doubled since the date of the first record. For some reason the price of electricity for light and power is not included in this list of commodities, probably because it is included under the class of service. If, however, an index number showing the movement of light and power rates were available, and could be compared with the commodity-price movement, a very striking difference would be observed, as even in the few cases where rates have been increased it was only a fraction of the commodity-rate increase.

"If 100 represented the normal in 1913, the average light and power index number today for all member companies would probably not be more than 115. Our customers who produced these commodities which have increased tremendously in price have benefited by increased profits. In the meantime our own net earnings have not been increased. This statement is made in the face of greatly increased gross earnings, due to increased business, but the business extensions have compelled large additions to our plants and at very high construction costs.

"The furnishing of power for the operation of railroads is a problem that confronts all of the power companies on the Pacific Coast, as well as the inter-mountain companies. In a period of less than 15 years the manufacturers of electrical equipment have perfected motors for heavy duty, as well as for high speed, capable of handling the heaviest trains over railroad lines having the most difficult grades. The Chicago, Milwaukee & St. Paul railway has over 400 miles of electrified lines in operation in Montana, the power for which is being furnished by the Montana Power Co.; and the Milwaukee management will place in operation over 200 miles of electrified lines across the Cascade Mountains, in the western division, in the state of Washington, between Othello and Puget Sound, within a short time. The power for the western division will be supplied by the Washington Water Power Co., on its eastern end, and the Puget Sound Traction, Light & Power Co. on the western end. The success of the operation of the Rocky Mountain division in Montana is well known. At a recent hearing before the Interstate Commerce Commission in Portland, evidence was presented showing the economy of electrical operation. The testimony was based upon the authority of comparative records of steam and electrical power, and went into the question in detail, a summing up of which would tend to show that the proportions were 408 to 524 in favor of electricity. The figures were adduced upon a 1000-ton-mile basis.

"The success of railroad electrification is assured, and there is no small reason for doubt that in a short time many of the railroads in the United States will be operated with electric power. The character of the power load for operating a railroad is somewhat intermittent and can be furnished cheaper by a power company on account of a diversified load for light and power, than by a separate power plant. It is, therefore, of the greatest importance that we co-operate with the railroad officials in the working out of economical and reliable power supply.

"In the matter of co-operation between central-station companies, manufacturers, jobbers and dealers, we cheerfully acknowledge the success of the plan developed by our neighbor, the Pacific Coast Section, and I am convinced that a similar plan should be worked out in the Pacific Northwest. Much good has been accomplished in this direction through the efforts of W. L. Goodwin and S. A. Chase, and I would recommend that a committee of this association be appointed to work with the manufacturers and jobbers as well as with the contractors and dealers to bring about practical co-operation.

"Our industry, even outside of its engineering and technical branches, is highly specialized, and our greatest need is for men qualified and properly trained in its various branches. While it is theoretically true that merit and ambition must eventually rise to the top, it is also true that opportunity plays a large part in a man's development. The electrical industry has had a marvelous development by reason of the ability and breadth of vision of the men who have been connected with it. The accomplishments of these men were not accidental, and their opportunities were not a matter of chance, but resulted from their ambition to do one certain thing, in one certain branch of the industry, coupled with the ability of their superiors to seek out and recognize their qualifications. Along that line it is the duty of every manager, and head of department to ascertain what the particular ambition of every subordinate is; to then determine if he is qualified along that particular branch, and if so give him the opportunity of developing himself. It is only by these means that men with particular ability can be found, and when found properly trained to take the places of those who are now doing the work, and carry on."

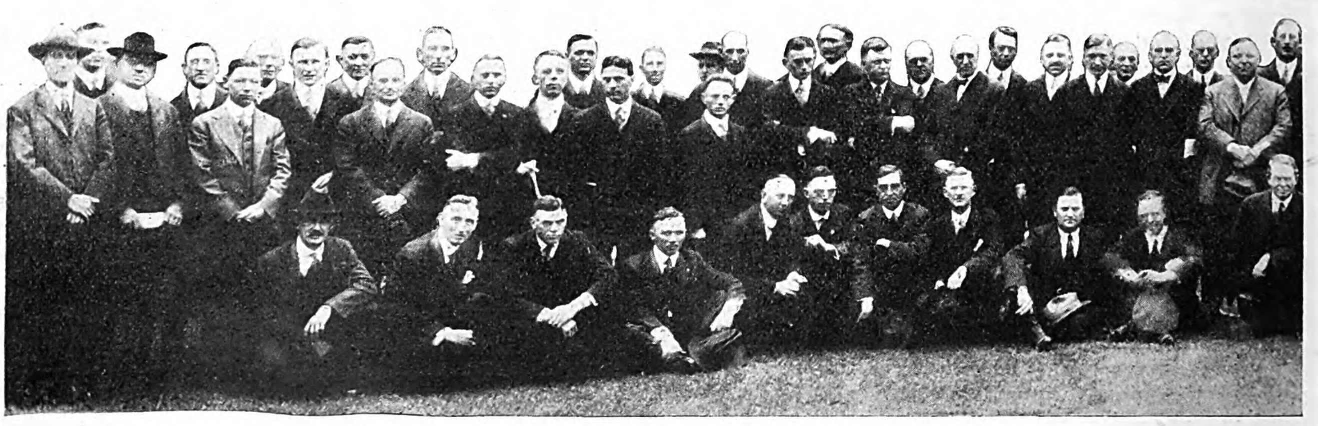
R. H. Ballard, of Los Angeles, president of the N. E. L. A., being unable to attend, sent a letter to the convention, which was read by the secretary. In this Mr. Ballard delegated A. Emory Wishon, of the San Joaquin Light & Power Co., Fresno, Calif., to represent him. His letter entered briefly into many important matters, giving emphasis to the necessity for greater water-power development; and urged co-operation among all branches of the industry, and the adoption of some method of participation by employes. The matter of good relations with the public and municipal ownership were discussed. Mr. Ballard thought the geographic section was the place in which all differences might be ironed out.

The report of W. E. Herring, secretary-treasurer of the association, was read; it showed a cash balance in the treasury of $5200.

O. B. Coldwell, of the Portland Railway, Light & Power Co., chairman of the Executive Committee, submitted a revision which his committee had made of the constitution for the association, which was subsequently adopted in lieu of the original provisions. It creates a stronger Public Policy Committee in each state, and under its provisions sufficient funds may be supplied for carrying out the plans of such committees.

On the recommendation of the Executive Committee, W. J. Grambs, of the Puget Sound Traction, Light & Power Co., was made an honorary member of the association.

E. Hofer of the *Manufacturer and Industrial News,* Salem, Ore., appeared before the convention, and, in a brief address, discussed matters pertaining



Group of Delegates and Guests from Washington, Oregon, California, Idaho, Utah and Montana in

to the rehabilitation of the public utilities, by securing the co-operation of the public. Concerning labor problems, he advocated voluntary mediation within each industry.

Report of Hydroelectric Committee.

G. E. Quinan, chief engineer of Puget Sound Traction, Light & Power Co., Seattle, chairman of the Hydroelectric and Technical Committee, read the committee's report. This valuable report dealt with revision of the National Electrical Safety Code, standards for transformers, rating of oil switches, turbogenerator fires, inductive interference with telephone lines and other related topics.

The reading of this report was followed by extended discussion, entered into by O. B. Coldwell and L. T. Merwin, of Portland; F. D. Nims, John Harisberger, and others, of Seattle. The convention tendered to Mr. Quinan a vote of thanks for his research and service in preparing the report.

Accounting Methods.

Proper methods of accounting, adaptable to city and suburban electrical business, were treated in a paper presented and read by J. S. Simpson, of the Washington Water Power Co., Spokane. His initial statement was that the object of a set of books was to have it show at any time the actual financial condition of a corporation or firm, and also to meet the requirements in rendering federal and state government reports applicable to public utilities.

In the discussion that followed, the subject of billing customers and making collections received much attention. The plan of maintaining district offices in a city for the convenience of customers and to secure closer personal contact with them received the endorsement of a number of delegates. Under such a plan it was considered important that district managers have complete information at all times as to each customer's account. The method of keeping down billing costs by listing charges for services and goods on one bill had been adopted by some companies. It developed that in some lines of business it is essential that bills be rendered weekly; that the cost of billing and collecting was running too high; that the various companies should compare methods and costs and get away from methods which are cumbersome and expensive. In discussing meter reading, the fact was brought out that continuous meter reading had been found advantageous; and that the plan of allowing the customer in outlying districts to do the meter reading had proved satisfactory. This phase of the discussion was entered into by H. J. Gille, F. D. Nims, L. R. Grant, G. E. Quinan, R. W. Clark, of Seattle; H. L. Walther, Medford, Ore.; O. B. Coldwell, J. D. Scott, of Portland; W. M. Hamilton, Salem; Geo. D. Brown, Wenatchee; L. R. Lewis, Spokane; and E. E. Walker, Vancouver, B. C.

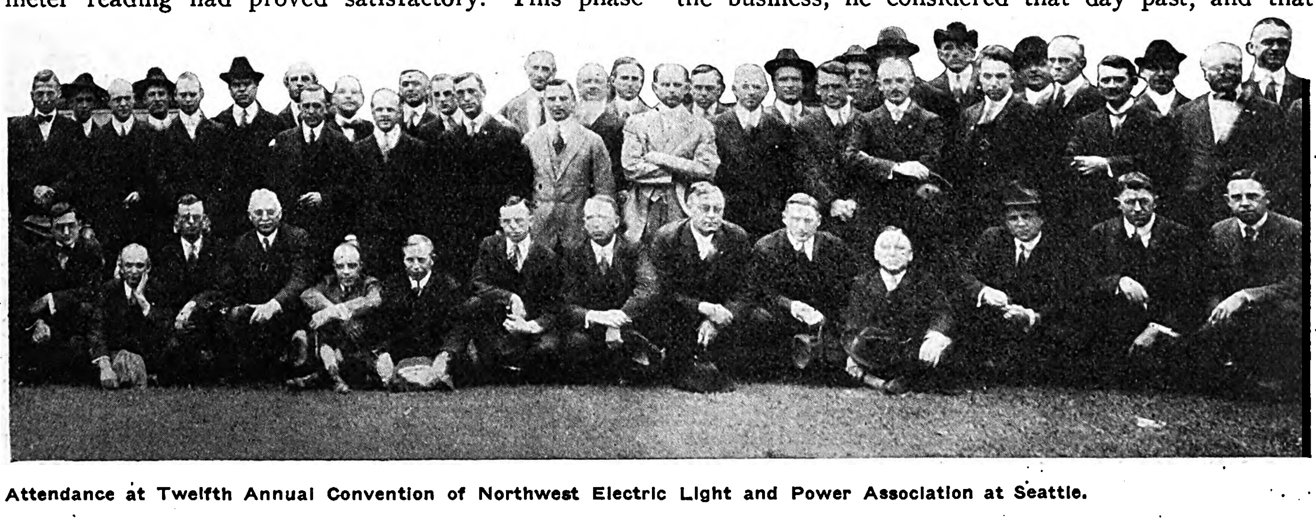
In answer to the question of H. H. Schoolfield, Portland, as to the computing of interest on construction and heavy maintenance, Mr. Simpson, author of the paper on accounting, stated that interest on construction should begin as soon as the money is raised, and cease when the plant was turned over to the operating department; and that no interest should be allowed on maintenance. The subject of depreciation was then discussed. In practice it was declared much of this can be standardized.

The evening of Sept. 24 was given to a lecture on "Electricity Today," by Wm. H. Easton, of the Westinghouse Electric & Manufacturing Co. The lecture attracted a large audience, which included a good many persons outside of the electrical industry. After giving an outline of the rapid development of electrical applications within the last 20 years, Dr. Easton predicted that in the future the adaptation of electrical energy to industries and utilities would be 20 times as great as at present. Numerous lantern slides were used in exhibiting the many applications of electricity in the industries and in domestic and farm life.

Electrical Merchandising.

The second day's sessions were devoted to round-table conferences on electrical merchandising, electric ranges and water heaters. They attracted a full attendance and brought out animated discussion and undivided attention. The round-table discussion in the forenoon, on Improving Electrical Merchandising, was conducted under the chairmanship of L. A. Lewis, Washington Water Power Co., Spokane. Mr. Lewis presented a paper dealing with the relations between manufacturers, central stations, jobbers, contractors and dealers, clearly showing the need of a policy of co-operation. He then called for 5 and 10-minute discussions, in which many took part.

E. E. Walker, British Columbia Electric Co., Vancouver, B. C., took up the attitude of central-station companies toward the merchandising branch, as to whether the tendency was to conduct the merchandising feature as a separate unit, or to run it as an adjunct to power and light production. While in former days, as a means of creating a demand for electrical appliances, it was necessary to mix the two phases of the business, he considered that day past, and that



Attendance at Twelfth Annual Convention of Northwest Electric Light and Power Association at Seattle.

now the merchandising of appliances should be on a profit-producing basis. He realized, however, that in some smaller centers it is still difficult to separate the two classes of the business. He predicted that in most cases central stations will continue in the merchandising business, but that their co-operation with the regular dealers will be such as to be advantageous to the latter, thus resulting in increasing the number of distributors.

John V. Strange, of the Pacific Power & Light Co., read an interesting paper on "Relations with Dealers and Contractors," taking up the subjects of prices, merchandise handled by central stations, and selling campaigns. In most of the larger cities he thought the appliance trade may be well and sufficiently served by local dealers; but in localities in which the central station is a factor in merchandising its competition should be such as to allow the contractor-dealer to live and prosper. He gave the manufacturer credit for accomplishing much in educating the public to the extent of creating a demand for appliances. Pioneering days are over and central stations will serve themselves by encouraging the local dealer.

D. E. Harris, sales manager of Pacific States Electric Co., San Francisco, spoke of the co-ordination of electrical interests in California, and showed how the local contractor-dealer in towns and the smaller cities is able to succeed when he receives the co-operation of central stations and jobbers.

W. S. Berry, sales manager Western Electric Co., San Francisco, referred to the work accomplished in California by an advisory committee of nine members, representing all branches of the industry, and expressed the hope that a similar plan may be adopted in the Northwest. He gave a brief account of the work of the field men working under the direction of that committee.

Robert Sibley, editor of *Journal of Electricity*, San Francisco, in further explanation of the California plan, said it was a method of co-ordinating the interests and services of the four branches of the electrical industry by means of the advisory committee's field men, and the help of the jobbers' salesmen.

Lewis A. McArthur, Pacific Power & Light Co., Portland, in speaking of merchandise accounting, outlined methods of cost keeping, including overhead and profits. The stock, he insisted, should be kept in salable condition and should be regarded the same as cash; and in the possible turnover of two and three times a year he considered the gross profit should not be less than 21%, and an additional 5% should be added if the goods are sold on installments extending over six months. In the sale of appliances to employes, he said the practice had been to make a price of cost plus 10%.

D. E. Harris and others discussed the subject of discounting the customers' paper, and in connection with this the Morris Bank plan was referred to. W. A. Marsden, of Electrical Appliance Co., Seattle, had found it possible to sell washing machines and other appliances in competition with central station and department stores.

Geo. A. Boring, Portland manager for Pacific States Electric Co., spoke of the good services of jobbers' salesmen in advising dealers in sales methods and displaying goods.

A. C. McMicken, sales manager Portland Railway, Light & Power Co., advised against the practice of carrying heavy stocks, but suggested the buying from jobbers in monthly requirements and let the latter absorb the carload discounts. Buying in heavy quantity, he considered, was not justifiable. Let the jobber do it.

Lewis A. McArthur said it was inadvisable for dealers to handle more than one make of each appliance, and W. O. C. Sawyer, of Yakima, supported the same contention. He said that, for instance, after the experience of carrying 4 or 5 kinds of vacuum cleaners, the store of the Pacific Power & Light Co. at Yakima got down to only one kind. The salesman's loyalty is thus not divided by efforts to sell several kinds.

H. C. Schade, of Portland Railway, Light & Power Co., read a brief paper on the experience of selling appliances through employes other than salesmen. It was considered a good method of extending sales and also a means of interesting many employes in the success of the company and in becoming users of appliances themselves. C. M. Brewer, of Mountain States Power Co., Albany, Ore., spoke of his success in selling electric ranges through special salesmen and other employes, and the sale of other appliances by co-operating with dealers. Under this head, A. C. McMicken told of paying bonuses to regular salesmen in the electrical appliance store, and said the plan had resulted in increasing sales materially. The effect had been better than that of a direct increase in salary.

S. M. Kennedy, Southern California Edison Co., Los Angeles, by invitation of President Gille, delivered an interesting address. After speaking of the dual responsibility of central stations—to stockholders and to the public—he turned to the subject of the selling of merchandise by central-station companies. He cut to the core of the question when he stated that the central station's chief interest in the merchandising branch rested in the matter of developing and building up the energy load. Securing and maintaining a satisfactory load for the generating plants in southern California had been accomplished by a system of genuine co-operation among all concerned. As the dealers become strong and effective in caring for the appliance trade, the central stations there gradually relinquish that branch of the business. His company, he said, keeps appliances on sale, but is not an aggressive competitor.

Sale of appliances through employes, other than regular salesmen, was explained and discussed by L. R. Grant, of Puget Sound Traction, Light & Power Co., Seattle, and the discussion was continued by others.

The National Convention of the N. E. L. A. in Southern California Next Year.

The afternoon session of Sept. 25 was crowded with matters of great interest. The first hour was given over to the California visitors. They were invited to speak on the 1920 convention plans for the N. E. L. A., on their California Electrical Development League, and other subjects. The first speaker was A. Emory Wishon, of the San Joaquin Light & Power Co., Fresno, who represented President R. H. Ballard of the N. E. L. A. He spoke of the co-operation of the leading electrical men of California to promote the success of the 1920 convention of the N. E. L. A., and he asked the co-operation of the Northwest. The great idea, by means of that convention, is to bring the East to the West, to bring them into closer contact. The national body was essential, but interest in the geographic sections should also be maintained.

Robert Sibley, referring to the problems of readjustment before the country, said the electrical industry would be a potent factor in working them out. He said the use of electrical energy per capita west of the Rocky Mountains was four times as great as that east of those mountains. The co-operative movement was harmonizing all interests and the ideals of the West were being carried to the nation.

S. M. Kennedy spoke of Mr. Ballard of the N. E. L. A. as a constructive president, and he predicted the convention of the national body, in southern California next May, would be one of the greatest in the history of the association. He asked assurances that the members of the Northwest association would be there in force. On motion of H. L. Walther, of Medford, Ore., the convention went on record in favor of attending the national convention as a body, and O. B. Coldwell, of Portland, was appointed committee to arrange for doing so.

Electric Ranges and Water Heaters.

The round-table conference on this subject was under the guidance of A. C. McMicken, of Portland. The matter was treated under separate heads, including advertising and merchandising. John V. Strange, of Pacific Power & Light Co., read a paper on "Advertising Service," which had been prepared by Mr. Gilham, advertising manager for Utah Power & Light Co., Salt Lake City. A paper on "Merchandising the Electric Range," by J. F. Durge, of Utah Power & Light Co., was read by R. W. Clark, of Seattle. Both papers brought forth interesting discussion. A few of the points made clear were that the first essential is to sell the idea; that service is the basis of success in selling ranges so they will stay sold; the confidence of all employes is an asset, and this can be built up by having them use ranges and understand them; much of the success of electric ranges is due to the wise policy and methods of manufacturers; we should get away from the idea that electric cooking is a seasonal proposition, as it is one of all-year utility; demonstrations in stores and influence of cooking schools are of special benefit; every range should be set up, inspected and tested before it is delivered to the customer.

F. N. Cooley, of Western Electric Co., Seattle, read a paper on "Electric Bake Ovens," by E. E. Rowley. It was shown how this class of ovens for restaurants and hotels and for commercial bakeries had greatly developed. Their great advantages were in perfect distribution of heat, their safety, economy, speed in baking and sanitary features. It was stated that there are 38 electric bake ovens on the lines of Utah Power & Light Co.

D. F. Henderson, of Washington Water Power Co., Spokane, said that company had 1131 electric ranges on its lines, and he gave some account of the new line construction necessary to handle this service, saying the revenue from this source justified the expenditure. He gave some interesting figures on the costs of electric range maintenance. It was explained that ranges were now being sold only in connection with the sale of water heaters.

H. J. Gille called into question the actual profit of electric range sales in small towns and in the country; and R. W. Clark, Seattle, said the prices of ranges had increased, the cost of wiring had also advanced, and he intimated that possibly development of the electric range business had in some cases been at the expense of the central station.

J. C. Henkle, of Portland Railway, Light & Power Co., submitted a valuable paper on "Range Maintenance Methods and Costs," as shown in the operation of that company's service department. He was followed by L. R. Grant, of the Puget Sound Traction, Light & Power Co., Seattle, on rates for ranges, water heaters and similar service.

The features of the last day were the presentation of two important papers and the discussion they brought out. The first was by W. H. McGrath, of Puget Sound Traction, Light & Power Co., Seattle, on "Value of Public Utility War Experiences and Their Effect on the Future." In Mr. McGrath's absence his paper was read by R. W. Clark. The paper referred to the various experiences of the electrical utilities and especially commented on the inflexibility of the present system of rate regulation. Mr. McGrath advocated a national campaign of education to bring the public to realize the economic fundamentals of the public utility business and appreciate the need of more speed in rate adjustments or more flexible rate schedules in order to meet emergency conditions more promptly.

David L. Huntington, president Washington Water Power Co., in discussing Mr. McGrath's paper, considered the position and conclusions of the latter axiomatic and not open to argument. He then took up such matters as taxation, replacements, construction, flexible rates and methods of educating and informing the general public on the problems faced by public utility companies. These he treated in a most lucid manner. S. M. Kennedy advocated the use of newspapers in disseminating information to patrons and the public. A. E. Wishon presented the advisability of interesting local people in becoming stockholders in the concern. The West, he said, could not advance ahead of its hydroelectric development.

The second paper was on "Industrial Heating," by C. A. Winder, of the General Electric Co. Mr. Winder's paper was read by O. L. Coward. The author covered a wide range of subjects dealing with the electric furnace, heat treating, enameling, core baking, welding, fruit and vegetable drying, bake ovens and vulcanizing.

In the discussion, the commercial point of view was given by B. S. Manuel, of Westinghouse Electric & Manufacturing Co.; H. J. Gille spoke on rates for heating loads; G. E. Quinan took up its application to steel furnaces and discussed the matter of load-factor; A. C. McMicken, speaking of rates for such loads, said continuity of service and adaptability were of far greater moment. He spoke of the installation in Portland of the first electric brass furnaces in the Northwest in which a 300-kw. load will be required. Among others who discussed different phases of electric heating were D. L. Huntington, J. King, R. W. Clark, A. A. Miller and F. D. Nims.

The nominating committee presented a list of nominees for officers of the association for the ensuing year. These were unanimously elected by the convention, as follows:

President, J. B. Fisken, chief engineer of Washington Water Power Co., Spokane.

Vice-presidents: F. D. Nims, of North Coast Utilities, Seattle, for Washington; G. L. Myers, of Pacific Power & Light Co., Portland, for Oregon; F. M. Kerr, general manager of Montana Power Co., Butte, for Montana; W. D. Putnam, of Idaho Power Co., Boise, for Idaho.

The convention closed with a banquet at the Army and Navy Club on the evening of Sept. 26, attended by about 150 members and guests.

Commercial Practice

Electric Heating in Typewriter Factory — Progressive Municipality's Electric Range Campaign—Rate Referendum

ELECTRIC HEAT IN THE TYPEWRITER INDUSTRY.

Paper Presented Before American Electrochemical Society's Meeting in Chicago Describes Plant of Royal Typewriter Co.

By A. M. Clark.

Industrial Heating Dept., General Electric Co.

The Royal Typewriter Co., of Hartford, Conn., is one of two companies manufacturing typewriters who bake the finish on typewriter parts in electrically heated ovens in preference to other methods now in use, such as in gas or oil heated ovens.

The installation consists of a battery of six ovens. Four of these ovens are 7 ft. 5 in. high, 7 ft. 1 in. deep, and 6 ft. 2 in. wide, while the other two are slightly smaller. Each oven has a connected load of 27 kw. The heating units which rest on the floor take up very little space and run at a relatively low temperature. This low temperature, combined with the ventilation which is provided, practically eliminates the danger from explosions and fires. The ovens run almost without attention, as automatic control and a time clock insure the desired temperature and the throwing off of the current at a predetermined time.

Oven No. 1 is used for baking japan on the spacer bar of typewriters. These spacer bars are made of soft wood, and are given five coats of a rubber japan, which gives a hard-rubber-like surface which cannot be easily dented. It was found advisable to use a temperature of 250° F. for 3 hours for the first four bakes. The last bake is run at a temperature of 275° F. for the same period of time.

The other five ovens are used for baking japan on the frames, ribbon spools, base plates, top dust plates, back dust plates, front plates, and paper tables. The finish on these parts requires a more complicated system of baking and finishing. In the first of these ovens the parts to be baked, having first been dipped in a metal japan are baked for five hours at 350° F., after which they are rubbed down by hand and again put through the same process in the second oven. Before being placed in the third oven they are sprayed with a black-baking japan and baked for five hours at 400° F. After this bake the parts are all sanded and rubbed clean and the same operation is repeated using the fourth oven. They are then rubbed down by hand with a hard piece of felt and powdered pumice, giving them a very smooth dull finish, sprayed with the same black-baking rubbing japan and baked for five hours at 400° F., when they are ready for the final assembly of the typewriter.

These ovens have been in operation for more than four years and have proven very satisfactory.

The following tables show the comparative capacity and cost of operation of two of the ovens, one equipped with gas and the other with electric heating equipment. The second table shows the comparative cost of gas and electricity per day, per month, and per year, and a saving per year of more than 20%, or $360.36 for each oven.

Summary of Fuel Costs per Bake in Japan Ovens.

	Electricity.	Gas.
Capacity	300 frames	180 frames
Capacity	3,288 lb.	2,055 lb.
Fuel used per bake	123 kw-hrs.	1,100 cu. ft.
Rate	$0.015 less 40%	$0.85—12% = $0.75
Cost per bake.	$1.10	$0.825
Cost per frame	$0.00366	$0.00458
Cost per pound	$0.000334	$0.000401
Fuel Cost—Full Time.		
Cost per day..	$ 4.62	$ 5.78
Cost per month	120.12	150.15
Cost per year..	1441.44	1801.80
Saving per year	360.36	

or 20% of present costs, without allowance for savings in defective bakes.

From the above it is evident that the Royal Typewriter Co. under the conditions existing in Hartford, Conn., is able to effect a considerable saving in dollars and cents by using electrically heated ovens. A superior finish without any increase in the cost of labor is also an item which makes the electrically heated ovens desirable.

In addition to the above, the Royal Typewriter Co. has found that electric heat proved advantageous in other ways as well. With gas-heated ovens their experience showed that owing to burning, underbaking, dust and variations in the heat, a certain percentage of bakes was lost. It was also found that with electric heat they get a superior and uniform finish, which is durable and does not easily chip off.

There are a number of companies manufacturing typewriters who are undoubtedly contemplating the installation of electrically heated ovens to bake the finish on typewriter parts. As this method is economical and insures a very good and uniform finish, it should not be long before the typewriter industry is using electrically heated ovens exclusively.

PROGRESSIVE MUNICIPAL ELECTRICAL PLANT MAKES GOOD HEADWAY WITH ELECTRIC COOKING.

Beloit Light and Water Department, City of Beloit, Kans., Finds Publicity and Propaganda Get Results.

By F. A. Darst,

Superintendent, Beloit Light and Water Department, Beloit, Kansas.

The Light and Water Department of the City of Beloit, Kans., has been carrying on a "Cook with Electricity" campaign during the past summer with results that are very gratifying. As the system is quite small, as are also the number of customers, relatively speaking, it may be of interest to tell what has been the effect of this electric cooking campaign upon the station output; and the manner in which this form of load is supplied.

Beloit is a town of 3750 population, and operates a municipal electric light and water plant, the total generating capacity of the electric light plant being 270 kw. The city does not sell electrical appliances or supplies but leaves this business to the merchants. This department does, however, help to interest prospective consumers in the use of electricity for various purposes, and as soon as a customer or prospective customer is found, the dealers are apprised of the fact at once. One of the dealers handles Hughes ranges, another one handles Westinghouse ranges and a third dealer handles General Electric ranges.

Last spring when a range campaign was commenced the Beloit Light and Water Department had 36 electric ranges connected to its transmission lines and today it has 73 electric ranges in service. I believe, when we began our campaign, every one of the 36 electric range consumers were absolutely satisfied with electric cooking and we used them as living advertisements, referring to them very frequently when talking to prospective range patrons. Next year we will double our present number of electric ranges in use without any trouble, as we find the demand is still very good. One of our dealers sold three ranges in one week and another one of the dealers sold two, and I have been informed that they have several more prospects for ranges this season.

Our range rates are as follows: Twelve cents per kw-hr. for the first three kw-hrs. consumed, per room per month, and 4 cts. per kw-hr. for the remainder. Minimum rate, $1.50 per month.

With this rate the municipality is able to obtain a very large appliance load which it would not otherwise be able to obtain.

The output of the municipal plant for the months of May, June and July was 146,174 kw-hrs., divided as follows:

Sold to consumers,

Lights	46,314	54.3%
Power	16,847	19.8%
Ranges and lights	22,140	25.9%
Total sold	85,301	100. %

	kw-hrs.
Total sold consumers	85,301
Used pumping water	19,763
Used street lighting	10,031
Used at plant	6,203
Unaccounted for	24,876
	146,174

From these figures it will be noted that the range business has added materially to the current sold. The output increased during these months from a total of 46,267 kw-hrs. generated during the month of May to 58,125 kw-hrs. generated in August, which is a gain of 20.4%.

It has been the experience of the municipality that the diversity-factor of the range load is such that in practically every instance where the transformers were previously large enough to carry the lighting load that they will also carry our added range load. No trouble has been experienced in carrying four ranges on one 5-kv-a. transformer and there are as many as eight ranges on one 10-kv-a. transformer.

The Beloit Light and Water Department has used the reverse side of the light and water receipts for advertising electric cooking and also the local daily paper.

Service connections for range consumers are made with No. 8 weatherproof wire and 25-ampere three-wire meters are used on this class of services, connecting lights and range on the same meter. At first separate services were used and separate meters for light and range services but the one meter method has proven much more satisfactory.

The municipality's electric ranges are competing with coal which sells at $9.50 to $11.00 per ton, and it is due to the high fuel cost that we are unable to give a better than a 4-cent rate on this class of service.

ELECTRIC CONSUMERS ASKED IF RATE INCREASE IS JUSTIFIED.

Central-Station Company Gives Customers Opportunity to Express Their Opinion as to Rates to Public Utility Commissioners.

The Commonwealth Electric Co., Summit, N. J., has adopted rather novel means to win the support of its consumers in connection with a proposed rate increase of 1 cent per kw-hr. for light and power, and ½ cent per kw-hr. for cooking service. The company recently made application to the Board of Public Utility Commissioners for permission to make this advance in its rate schedule and immediately following mailed a circular letter to its customers enclosing a blank form to be returned signed with an expression of views. This letter read in part as follows:

> If you do not feel that the company is reasonably entitled to make this increase (10%) in the rates you should tear off this slip, sign it with your name and address and mail it to the company at once. It is the desire of the company that every one of its consumers should have an opportunity to express their views to the Public Utility Commissioners, who, as you know, are the judges and jury in such matters, and this company will present to the commission all slips which are returned properly signed.

In explanation of this action the company sets forth that it believes that its patrons desire it to maintain a first-class quality of electric service and that they are willing to pay for such service whatever may be a just and reasonable charge. The company has endeavored to maintain adequate service during the war, irrespective of the cost, and believes that the service has been of the best quality and thoroughly satisfactory to customers.

COMMERCIAL ACTIVITIES OF BOSTON EDISON ELECTRIC ILLUMINATING CO.

Commencing September 2, the Edison Electric Illuminating Co. of Boston started to finance its own lease sales on such electric appliances as washing machines, vacuum cleaners, dish washers, etc. During the war, when financial conditions were "tight," and public utilities had to retrench in outlay of men, materials and money and when the Government asked that expenditures be curtailed to an absolute minimum, the company arranged that their customers make purchases of current-consuming devices through payments made through the Morris Plan Co. when buying on installments.

The company, in going back to its pre-war method of selling the higher priced devices, states it is very glad to once again come into the closer contact that always occurs when direct payments are made by their customers. The company in financing sales is charging 8% on deferred payments.

Operating Practice

Transmission Structures of Steel and Wood—Cooling Coils—Portable Blower for Cooling Underground Cables

COMPOSITE TRANSMISSION STRUCTURES OF STEEL AND WOOD.

Abstracts from O-B Bulletin Tell War Practice of Alabama Power Co. to Reduce Line Costs and Increase Life of Supports.

By F. C. Weiss.
Superintendent, Line Construction, Alabama Power Co.

During the period of extreme high prices of transmission line materials the construction of priamry lines was limited to those serving essential war industries. Where conditions gave an opportunity for utilizing such construction so that it could be operrated in post-war times for commercial purposes, the installations were designed along lines of a more permanent character.

In 1918 the Alabama Power Co. was confronted with just such a problem on a 27-mile transmission line from its Bessemer substation to Gorgas, Ala. A 110-kv. connection for these two points was necessary. The high cost of right-of-way necessitated the construction of a double-circuit structure. This developed the problem into a matter of high price of steel and the necessary approval of the War Industries Board.

A composite structure of wood and steel was found to be the most economical under the conditions outlined above. Accordingly, test towers were constructed and various loads applied; finally the towers were tested for destruction.

The tests developed the weak points in exact accordance with the engineers' figures. The design of the wood-steel joint was perfected and steel work adapted to more economical erection costs, and the Alabama Power Co. then proceeded with the construction of this new type of tower which showed an over-all saving of more than 10% on the entire line over standard steel towers figured on a basis of market prices of July, 1918.

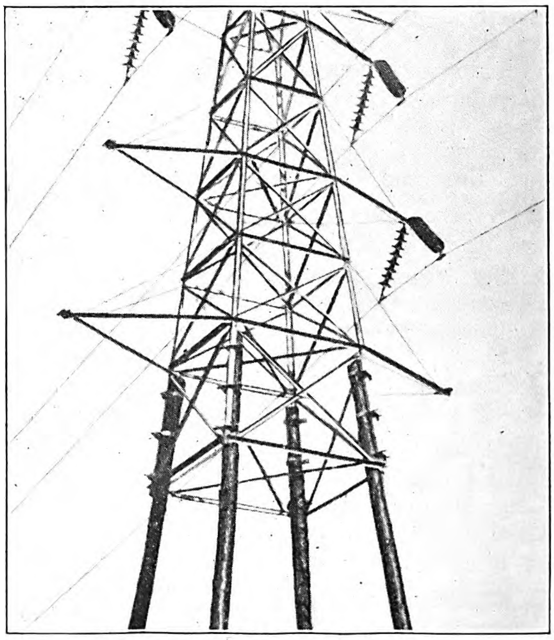
Two types of towers were used, one with four legs and one with two legs. The basis of the line was a two-legged structure with four-legged structure at points of special stress and at intervals of not more than one mile. The result is a line of semi-flexible type with more than ordinary stiffness.

The two-legged structure consisted of two creosoted long leaf yellow pine poles supporting 1750 lb. of galvanized steel super-structure. The four-legged towers consist of four creosoted long leaf yellow pine poles supporting 2750 lb. of galvanized steel superstructure. The normal spacing at the base is 15 ft. using 50-ft. poles with 8-in. tops. The steel superstructure is 32 ft. in height, clamped by steel bands to five feet of timber, making a mechanically strong and also a neat appearing wood-steel joint. Wood filler blocks perfected the fit from pole to channel section on two-legged structure and to angle section on four-legged structures.

The structures are designed to carry two galvanized steel 3/8-in. ground wires and two No. 2/0 copper three-phase circuits, insulated by 7 units Sanitary O-B suspension disks. The standard span is 700 ft. with maximum span of 2100 ft. The country traversed by the line is very hilly and to take care of side hill construction as well as special crossing clearances some 60-ft. poles are used in conjunction with the standard 50-ft. poles. A grounding wire is used on each pole and pole steps provided for workmen.

The poles were set as it is customary in pole construction. The depth of pole hole is 7½ ft. in normal instances and back-filling was done with dry mixture of cement with earth as found. This back-fill gives reasonable protection against side strain.

The steel structures are designed so that the lower 8 ft., including the wood-steel joint make a separate section. This section is used as a template, in squaring and aligning the structures after the poles are placed and properly back-filled. The additional steel work is handled by means of a small gin-pole mounted



Composite Wood and Steel Tower.

on the tempate section. This class of construction is very difficult to handle without especially trained workmen.

An analysis of costs indicated that the labor charges on this line were the same as for the standard 5000-lb. steel double-circuit tower line. The cost of excavating was less, the cost of hauling more, and erection or assembly less.

The relative cost can be better understood by a transmission engineer by stating that the character of the country necessitated the assembly of the structure "in the air." Also, 40% of the excavation was in rock.

The service that can be expected from this type of construction in first analysis is limited to the life of the wood-steel joints. This can be safely set as 10 years with reasonable attention from operators. Further, as wood section fails it can be replaced by wood or steel without excessive construction costs or interruptions to service.

STOPPAGE AND LEAKS IN TRANSFORMER COOLING COILS.

From Paper on "Symposium of Operating Difficulties," Before Pacific Coast Section, A. I. E. E.

By Julian Adams,

Assistant Electrical Supt., Pacific Electric Railway Co.

In the substations of the Pacific Electric Railway system the transformers vary in size from 100-kv-a. to 1000-kv-a. and a large percentage of them are water cooled. With these substations scattered over a wide area, all sorts of water conditions are encountered. In localities where a large amount of solid matter is held in solution considerable trouble has been experienced with the transformer water coils becoming clogged with the solids deposited by the water on the interior of the coils. The presence of the deposit is indicated by a gradual decrease in the amount of water which will flow through the coils and as the amount of water is decreased the temperature is raised and the deposit of the solid matter becomes more rapid.

Our experience in cleaning these coils has indicated that the best method is to pump in a dilute solution of muriatic acid through them. For this purpose we make use of a 1½-in. all brass centrifugal pump. We start by pumping water through the coils and slowly add muriatic acid until a maximum strength of about 2 pints of acid to 10 gallons of water is used. It is often necessary to pump the acid through for several days before the coils are clean. If acid of the final strength mentioned is used to start with it is likely to result in stopping up the coils completely, and when this occurs it is sometimes impossible to clear the coils even with the use of high pressure. We had one case of this kind, and when the coils were cut open they were found to be solidly plugged with very dense iron oxide. In this case the water came from a deep well pump and examination showed that the pump casing in the well had been eaten away by electrolysis and the iron transferred to the interior of the transformer coils in the form of iron oxide. This of course was an unusual case.

Some of the older transformer coils were made of very thin brass tubing and after some years of service these coils gave a great deal of trouble due to leaks produced by local galvanic action set up through impure water by the dissimilar metals composing the brass. In a few cases leaks developed in these coils which allowed sufficient water to get into the transformer, before it was detected, to short the transformer windings. In more recent years copper has replaced brass for transformer coils and heavier tubing used, making more durable coils. While iron coils seem to be meeting with some favor, they are open to the objection that iron has much lower heat conductivity than copper, thus requiring greater coil area and weight for equal cooling effect, also a greater labor cost.

It is of course apparent that much of the trouble that developed with transformer water coils, both as to their becoming clogged and as to their leaking, could be avoided by the use of an effective purifying system for the water, but where a large number of substations are involved, as well as a large number of different kinds of water, the cost of an effective purifying system of water is considerable.

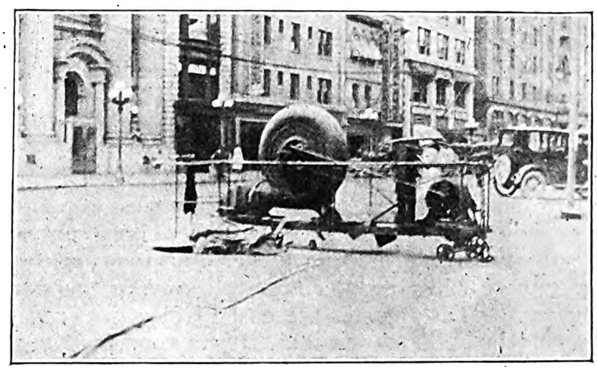
In the case of new installations the simplest and cheapest means of avoiding trouble with transformer water coils is not to use them. In sizes up to 1000-kv-a. self-cooled transformers now cost little if any more than water cooled transformers and when the cost of installing and maintaining a cooling water circulating system in connection with water cooled transformers is considered, together with the other costs incident thereto, it is my opinion that the use of water-cooled transformers is undesirable even in sizes much larger than 1000-kv-a.

PORTABLE BLOWER FOR COOLING OF OVER-HEATED DUCT SECTIONS.

Practice of Detroit Edison Co. for Overcoming "Hot Spots" in Underground Cables.

When a periodical temperature survey of an underground distributing system brings to light a particularly hot duct section of, say, 150° F. or more, some means must be adopted to dissipate the heat if trouble is to be avoided. This is accomplished in Detroit according to G. B. McCabe, in the *N. E. L. A. Bulletin* by the use of locally applied forced ventilation from a portable blower. The outfit consists of a blower of the upper right-hand horizontal-discharge type equipped with a 28-in. fan and directly connected to a 7.5-hp., 220-volt direct-current motor. The entire equipment is mounted on a steel truck.

When a particular hot duct run is discovered the blower outfit is hauled to the vicinity and mounted over the manhole at one end of the run. The discharge pipe from the blower is inserted in a circular sheet-iron plate of the same diameter as that of the manhole cover. The iron plate and the discharge pipe are then cemented in place with asbestos cement in order to make an air-tight joint. At the other end of the hot run a ventilating cover is placed which covers the manhole.



Portable Blower Outfit Employed by Dayton Power & Light Co. Answers Same Purpose as That of Detroit Edison Co.

This cover consists of a number of 1-in. by 0.5-in. iron bars placed 0.75 in. apart and bound together by a circular band. Direct-current service at 250 volts is furnished to the blower motor from some nearby pole or wall box. The current of air is forced through the underground ducts until the temperature of the duct section affected has been reduced to the desired degree.

Contracting-Construction

Suggestions for Obtaining and Keeping Records of an Electrical Department—Effect of Lightning on Circuit Unexplained

RECORDS FOR AN ELECTRICAL REPAIR AND MAINTENANCE DEPARTMENT.

Methods for Gathering Records Advocated in Paper Presented Before Association of Iron and Steel Electrical Engineers.

By R. B. Gerhardt.

Inasmuch as the direct benefits derived from an accurate method of securing and keeping records and data in an electrical department are hard to capitalize, such systems should be elaborated with great caution else the benefits will not be commensurate with the expense involved. In a well organized and well regulated department the records of most value are:

(1) Cost records.
(2) Force reports.
(3) Foremen's and motor inspector's reports.
(4) Station and power distribution reports.
(5) Electrical repair shop production reports.
(6) Storehouse and material reports.
(7) Employes' records and accident reports.
(8) Generator, motor and transformer data.

Cost Records.

The electrical department may be considered a business in itself, and, as in any other business, the most vital records to the successful conductance of same are the cost records. In most plants it is the usual practice for the accounting department to take care of all cost accounting entering into the cost of electrical energy to be billed to the various operating departments and also of cost of electrical repairs to these various departments. There have been innumerable treatises published on power-house cost accounting, and we will not enter here into any further study of same, but, as regards the cost of electrical repairs, it would be well to consider satisfactory methods of arriving at a cost price. The electric repair shop can usually be operated as any other standard shop account and all work going through same should bear a definite order number and proper accounting done to give the cost on this order when the work is completed. However, in the smaller plants this would involve considerable expense, and it is often the practice to distribute the cost of the electric repair shop operations on a basis of the labor distribution in this shop, this labor being accounted for daily according to the number of hours worked on repairs for any of the plant departments.

The shop costs will consist of labor, material and overhead. The overhead is approximate at best, but should be determined monthly as a percentage on the labor by dividing the cost of all items, such as foreman, clerk, telephone, light, heat, power, etc., by the total cost of all producing labor. This figure can be determined readily by the accounting department.

Every shop, no matter how small, should have a job ticket system. This would consist of a number of serially numbered tags, either in duplicate, or single tags with corresponding numbers in a record book. This tag can be an ordinary small shipping tag and should take a form similar to that shown in Fig. 1. If difficulty is encountered in some places in establishing the material charge, such odds and ends as tape, solder, etc., which nearly every worker carries on his bench, can be carried in the overhead without destroying the value of the record. This card should be turned into the shop office after the work has been accepted as complete. It should then be routed to the person maintaining the apparatus record, who will take off the total repair charge on the record card for this particular piece of apparatus. This gives a fair value to the job, enables the shop production to be recorded and gives the superintendent immediate data on the maintenance cost of the apparatus.

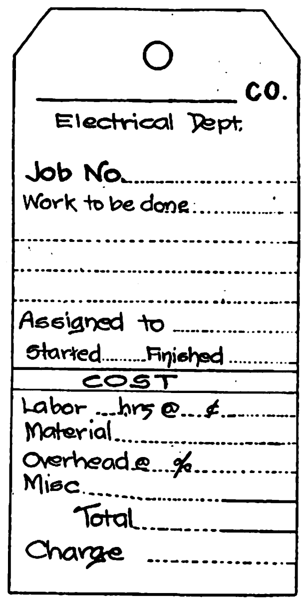


Fig. 1.

It is often desirable to secure an accurate cost figure on a particular armature or motor or controller to be repaired, and in such cases a good practice is to have the accounting department assign a special charge, such as a repair and renewal order, for this job, in which case when the work is completed they can furnish an itemized cost of same.

Force Reports.

An accurate daily report of the electrical department force distribution is essential to the proper handling of the department, and usually a copy of this report is requested by the management, principally as a guide to determine whether the department is being handled efficiently or not. The force report should be divided up according to departments in the plant, showing under each department the number of foremen, assistants, motor inspectors, electricians, repairmen, helpers and any others. To obtain the force report an efficient and inexpensive method usually employed is to have each foreman or motor inspector

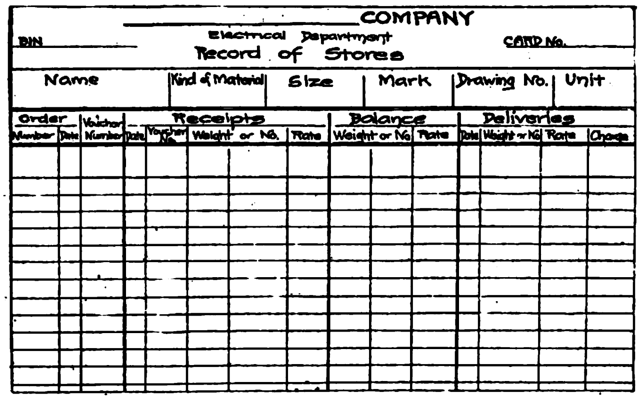


Fig. 2.

in charge of a shift in each department make out a time distribution sheet for his men, to be collected by the department timekeeper on his daily round of the plant, said timekeeper compiling the figures for the final report when he returns to the office each morning.

Foremen's and Motor Inspectors' Reports.

Along with the force report made out each shift by the foremen and motor inspectors should go a condensed written report of the important work taken care of during the shift, this report to indicate any delays due to electrical failures, results of inspections, explanation of remedies for delays and principal work done other than this. Such reports, together with cost records and force reports, give complete data on the electrical repairs in any department.

From the practice of having foremen and motor inspectors turn in daily reports there sometimes results a tendency on the part of these men to elaborate too much in these reports and give too much detail, or the reverse, be too brief and not give sufficient information. One fundamental point, however, should always be insisted upon, i. e., a statement of the plant delays chargeable to the electrical department, with an explanation of these delays and remedies for same, the foremen's or motor inspectors' signature to be written below this statement. When this is insisted upon and the man given to understand by the department superintendent his full responsibilities for an accurate check between this report and the plant delay sheet, the desired end is usually accomplished, viz., that proper co-operation is secured in keeping down such delays.

Station and Power Distribution Reports.

It is becoming more and more the practice in industrial plants to secure, as far as possible, an accurate distribution of electrical energy to the various departments, and, therefore, the electrical department station records are invaluable for this purpose. A station report is usually a printed form giving space to record all energy distribution data, according to the outgoing feeders. When such a station has an operator in continual attendance it is a wise policy to have all distribution meters read hourly, as this keeps the operator's attention more closely applied to his work and prevents his falling asleep at night.

In many of the departments in which energy-metering instruments are lacking it becomes necessary, in order to secure proper distribution of power, to make tests under normal conditions of load for the purpose of securing a basis for making a charge for this energy, and at the end of each month the energy consumption is figured out on the basis of such tests. Likewise at the end of the month the final power distribution report is made up in the department office, which gives an accurate statement of the energy furnished to all accounts properly chargeable, and this statement is the accounting department's basis of distributing the cost of producing this energy.

Electric Repair Shop Production Reports.

Under cost records we have considered electric repair shop production costs, but there is still further information from the shop which is essential to the good management of same, and this is production data. In other words, how many armatures of a certain type are rewound in a given period; the average number of man-hours for rewinding these armatures; an accurate record of the armature serial numbers; a short condensed statement of the work involved in the repairs, and similar information for motors, controllers, transformers, etc.

On these records a great deal or a very small amount of effort may be expended. One very good method of keeping data on armature repairs is to have each armature winder make out in duplicate, one copy to be kept by himself, and the original turned in to the office, a record which will serve more as a diary, and which gives the information referred to above. It is very desirable and satisfactory for the department superintendent to know when an armature goes out on a breakdown job and fails without apparent reason, and by referring to the armature winder's daily diary the responsibility for poor workmanship in the case of such failure is easily determined.

Storehouse and Material Reports.

There is probably more miscellaneous material carried in the storehouse for the use of the electrical

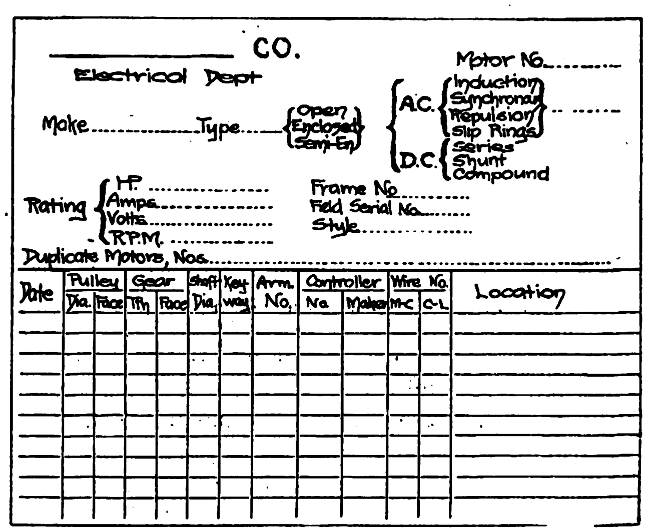


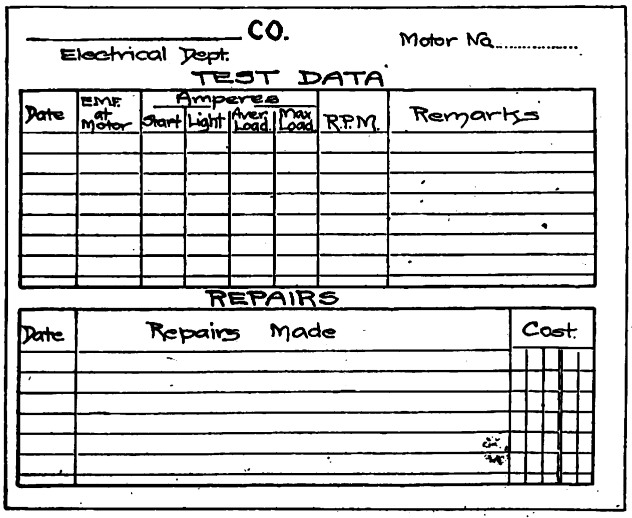
Fig. 3.

department than any other department in an industrial plant, and an accurate and reliable storehouse record on this material is absolutely essential. Any material used in the department is first obtained by placing a requisition to cover an order for the purchase of same. For keeping a proper record of this material a card index scheme is usually used. Each item of material is carried on a card as shown in Fig. 2, and properly indexed, each card bearing a number. This card should contain the following information: Requisition and order numbers for each receipt of this material, date of receipt in warehouse, voucher number, unit cost, weight and kind of material. The card should also contain a column for balance and deliveries. By working this scheme in connection with a bin system in the storehouse, the material records can easily be kept and a satisfactory check made at any time with very little expense. It is usually the custom to set a minimum amount or number of each piece of material to be carried in stock, and whenever the storekeeper sends to the bin to take out material it can be easily noted whether the minimum amount still remains, and if not a note made and requisition placed for additional amounts in order to replenish the stock.

Employes' Records and Accident Reports.

A record of department employes showing the date of employment, check number, work or job to which assigned, any further changes of assignment, rate, change of rate, and termination is very essential to the proper management thereof. This record, however, should be kept confidential and where it is not available for everyone's use.

Department accident reports are so closely connected with employes' records that it has been found desirable to keep these two forms of records together. A copy, however, of the accident reports is also maintained for the use of the department safety committee in its work. Each plant usually has its special form


______ CO. Motor No. ....
Electrical Dept.

TEST DATA

Date	E.M.F. at Motor	Amperes Start	Light	Aver. Load	Max. Load	R.P.M.	Remarks

REPAIRS

Date	Repairs Made	Cost

Fig. 4. Back Side of Form Shown in Fig. 3.

of accident report so it is not necessary to discuss the form this should take.

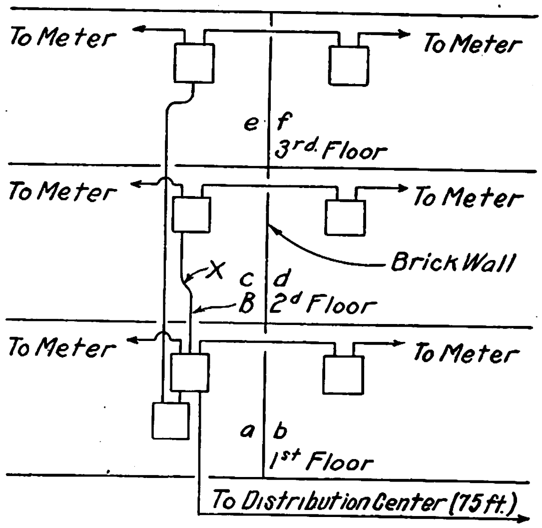
General Motor and Transformer Data.

This data is most easily compiled and maintained on a card index where an individual card is made out for each of these units, and thereon is given all data pertaining to each, which covers serial number, nameplate data, principal dimensions, including, in the case of generators and motors, size of shaft, keyway, pulley or gearing data, all particulars regarding windings, brush size, etc. A sample motor card is shown in Figs. 3 and 4. The motor data cards should be indexed according to departments and a cross index kept showing the motors by size and type, and in this way a complete record of the total number of motors of each size and type is readily available.

PECULIAR EFFECT OF LIGHTNING ON A DISTRIBUTION CIRCUIT.

By W. F. Perry.

During a violent thunderstorm recently the lighting circuits in several of the suites of a Boston apartment house were put out of commission. The building contained 36 suites and was of brick and concrete construction. The wiring was installed in conduit and was so arranged that the suites were fed in groups of six from a two-wire main. There were two of these suites on each floor. In a small closet in



Wiring Diagram Showing Location of Circuits and Fault.

each suite were placed the service cutouts and the meter. There were no other cutouts, the number of outlets being small, the service cutouts protected the wiring system as well as the meter. The feeder which supplied current to these suites was No. 12 rubber-covered duplex wire. The service supplying the building was of the three-wire type and entered the building underground.

While the storm was in progress the fuses which protected the feeder blew out, as did the service fuses in the two lower suites. A trouble man from the central-station company was called and replaced the blown fuses, but he could get no current in the four upper suites. An electrician was called and he spent several days in search of the trouble without finding the cause. Later, the writer was called upon to solve the problem.

Several hours were spent in getting "the lay of the land" and in working out various tests upon the defective lighting circuits. A sketch was made, showing how the runs of conduit were made and how the several lines of wire were connected at the junction boxes. The accompanying illustration gives an idea how the conduit was run between boxes.

The trouble was found in the riser *B* at the point marked *X*. About ¾ in. of the outer braid of the No. 12 duplex was blown off and a piece ⅜ in. long of one side of the circuit, including wire, rubber and braid, was missing, the remaining ends looking as if the piece had been cut out with a knife. There was nothing to indicate the presence of fire, as the rubber and braid were not charred.

[Editor's Note.—The peculiar effect of lightning in this case seems unexplainable. If some of our readers have had similar experiences their comments would be welcomed.]

QUESTIONS AND ANSWERS

All readers are invited to submit questions and answers to this department. Anonymous communications will not be considered. Questions should relate to electrical matters of any kind. Answers contributed by readers should be submitted preferably within eight days of the date of publication of the question and should be limited, if possible, to 300 words. Payment will be made for all answers published.

Questions.

No. 467.—Operating Cost of Electric Household Refrigerators.—I would like to know from some reliable source what is the operating cost of the electrically operated refrigerators that are being recommended for household use. What is the experience as to their dependability?—R. H. T., New York, N. Y.

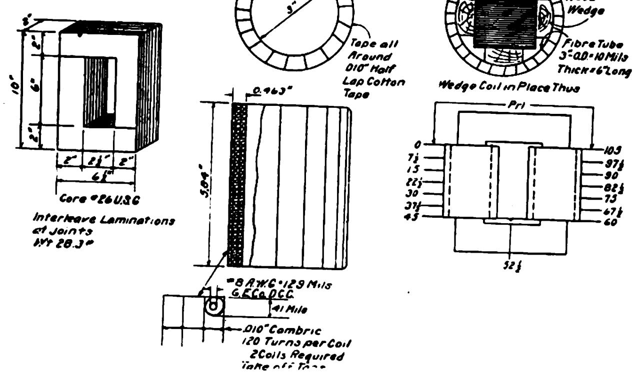
No. 473.—Changing Motor Frequency.—I would like information regarding changing of a ⅛-hp. Holtzer-Cabot single-phase motor of 1130 r. p. m. and 12 poles now operating on 133 cycles to make it possible to operate on 60 cycles at a speed of 1200 to 1300 r. p. m.—M. B., Dekalb, Ill.

No. 474.—Inferior Wire for Fixtures.—In my experience I have often run across fixtures wired with old Code wire and with No. 20 and even No. 22 low-voltage wire. I understand that considerable quantities of these wires are being used. What can be done by a contractor who wants to live up to Rule 30*c* of the National Electrical Code to meet the competition of those who ignore this rule?—B. T. F., Morgan Park, Ill.

Answers.

No. 464.—Transformer Design.—I am trying to build a transformer with 110-volt primary and 14 steps on the secondary varying by 7½ volts up to 105 volts, thus, 7½, 15, 22½, 30, etc. Each step must be capable of carrying 10 amperes. What size and amount of wire is necessary on the primary and secondary windings?—W. A. S., Augusta, Kans.

Answer A.—The attached sketches illustrate an autotransformer capable of doing what W. A. S. wishes without being as expensive as a transformer with isolated primary and secondary would be. This transformer will operate on 100 to 120 volts, 60-cycle alternating current. As many taps as desired may be brought out. The case may be 6 by 10 ins. by 12 ins. high. A cover must be provided. Place the terminal



No. 464.—Design of Autotransformer with Numerous Taps.

board on top. For method of clamping laminations, see "Gray's Electrical Machine Design" or similar work.—H. E. W., Chicago, Ill.

Answer B.—Owing to the fact that no data are given concerning the operating characteristics of the transformer in question it is difficult to supply figures which will exactly suit the builder's purpose. The following data may be of some value:

Core area, square inches	9
Number of turns on primary	412
Size of primary conductor, B. & S.	14
Number of turns per layer—primary (approximate)	69
Number of layers—primary	6
Volts per turn	0.26
Length of primary conductor, ft.	370
Number of turns on secondary	395
Size of secondary conductor, B. & S.	14
Number of turns per layer—secondary	69
Number of layers—secondary	6
Length of secondary conductor, ft.	362

Secondary taps brought out as follows:

7.5 v.	= 28 turns	45 v.	= 168 turns	82.5 v.	= 308 turns
15	= 56 turns	52.5	= 196 turns	90	= 336 turns
22.5	= 84 turns	60	= 224 turns	97.5	= 364 turns
30	= 112 turns	67.5	= 252 turns	105	= 392 turns
37.5	= 140 turns	75	= 280 turns		

—W. F. P., Atlantic, Mass.

No. 471.—Ringlemann Charts for Determining Smoke Density.—The use of Ringlemann charts is frequently mentioned in connection with the determination of the density of smoke emitted from smokestacks. I would much appreciate an explanation of what the Ringlemann chart actually is and how the density of smoke may be determined from its use.—M. A. P., Spokane, Wash.

Answer A.—Ringlemann charts, named after their originator, are used for determining readily the density of smoke. The density of smoke is at best somewhat elusive and hardly permits of a definite basis for comparison. However, there are a number of "standards" employed, one of the best known and simplest of which is by the use of the Ringlemann charts. These charts are quite generally accepted as the standard today.

There are six Ringlemann charts, numbered respectively from No. 0 to No. 5. Chart No. 0 is white and is rated as being 100% white or zero black. No. 1 chart is rated as 80% white or 20% black; No. 2 as 60% white or 40% black; No. 3 as 40% white and 60% black; No. 4 as 20% white or 80% black, and chart No. 5 as 0% white and therefore 100% black. The Ringlemann charts or cards are made by ruling lines at regular intervals; the higher the number of the card the thicker and closer are the lines, consequently the card looks more or less gray at a distance.

In using the Ringlemann charts, they should be placed vertically at such a distance from the person that is to determine the smoke density that any of the charts appear to be of a uniform shade of coloring. That is to say, the checks must not be visible, but instead the cards should appear of different shades from the absolute black to the slightly dark, according to the card placed in position. The person observing the smoke should stand not less than 100 ft. nor more than one-quarter of a mile away from the stack. The observer's position should be such that the direction of his observation is at right angles to the direction of travel of the smoke. He should avoid looking in the direction of bright sunshine, and the background against which the smoke is to be studied should be free from trees, buildings and similar objects that tend to harmonize with the smoke.

Compare the smoke emitted from the stack with the Ringlemann charts, and determine which of the cards corresponds to the color of the smoke. The period for deciding the chart corresponding to the smoke is usually taken as 15 seconds. The color of the smoke may change frequently, and the observer should write down on paper at every 15-second interval the chart number corresponding to the color of the smoke.

How long a stack should be watched, depends upon how much time can be devoted to the matter, to what extent the stack is given to emitting smoke, and whether the effluent from the stack changes very radically in color from time to time. For example, a hand-fired plant may emit dense clouds of smoke periodically corresponding to the act of throwing coal on the fire, whereas a plant using mechanical stokers will give a very much more uniform density of smoke, because in the one case firing is erratic and in the other case continuous. Half an hour should probably suffice under most conditions.

A few definitions of terms, and a simple example in the use of the Ringlemann charts will suffice to make their use understood.

(1) A stack-minute corresponds to watching the stack under scrutiny for one minute.

(2) In any set of observations the stack-minutes are obtained by multiplying the number of stacks observed by the number of minutes during which the observations are performed.

(3) A smoke unit is understood to be that value during which one minute of No. 1 smoke or its equivalent occurs. For example, one minute of No. 2 smoke (which means a smoke density corresponding to chart No. 2) is equivalent to two smoke units. Likewise, two minutes during which the smoke has a density corresponding to No. 3 chart would give a smoke unit of six, or six smoke units. Three minutes of No. 4 chart would correspond to 12 smoke units.

The percentage of smoke density is percentage of light that is prevented from passing over the stack because of the smoke. The smoke density is calculated as follows:

$$\text{Percentage smoke density} = \frac{\text{Smoke units} \times 0.20 \times 100}{\text{Stack-minutes.}}$$

$$\text{This when simplified gives} \frac{\text{Smoke units} \times 20}{\text{Stack-minutes.}}$$

Understanding what the Ringlemann charts are, what they represent and how a smoke unit is determined, an example in the use of these charts for an actual smoke inspection should clear up any misunderstandings and place the matter upon a proper basis for future application.

During one hour a stack was watched and its smoke compared with Ringlemann charts with the following results recorded:

Smoke density according to Ringlemann chart.	Duration of smoking minutes.
No. 4	2
No. 5	1½
No. 3	3⅓
No. 2	10
No. 1	9
Clear	34

Smoke units are the product of chart number and duration corresponding to this number. Hence,

$$4 \times 2 = 8$$
$$5 \times 1\tfrac{1}{2} = 7\tfrac{1}{2}$$
$$3 \times 3\tfrac{1}{2} = 10\tfrac{1}{2}$$
$$2 \times 10 = 20$$
$$1 \times 9 = 9$$

55 total smoke units.

Therefore, according to formula previously given,

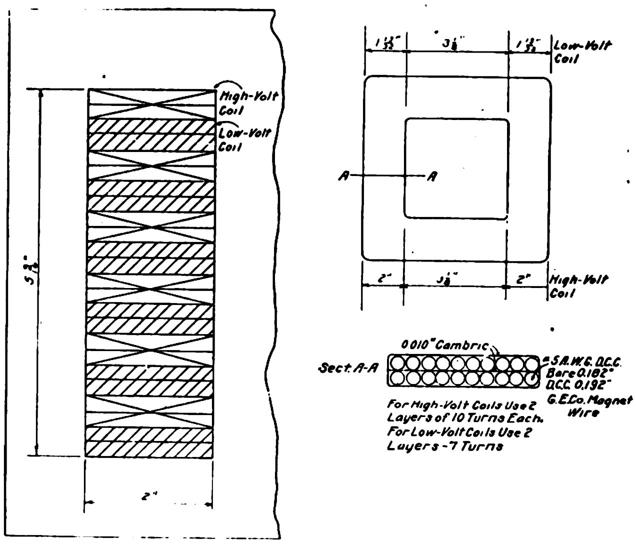
$$\text{Percentage smoke density} = \frac{55 \times 20}{60} = 18\% \text{ (approx.).}$$

In observing smoke densities, it is a good thing to use cross-section paper in a notebook. Each entry is made as shown above and each step toward the result should be kept when observations are made for civic purposes. When observations are being made merely for personal reasons, it is well for the firemen to keep a close and accurate log of boiler-room operations, as in this way much may be learned in the way of smoke abatement.—W. H. D. M., Chicago, Ill.

[Another answer to this question has been submittded by another reader. It will appear in an early issue.]

No. 472.—Rewinding a Transformer.—I have the complete core and case of a 2½-kw., type H, 60-cycle G. E. transformer which I would like to rewind for the ratio of 88-176-volt primary and 115-230-volt secondary of about 2 kw. capacity. The inner core is 3 by 3 ins., extending over the outside of the coil in four equal sections of 2½ by 1¼ ins. cross-section, leaving a winding space around the core of 2 by 5¾ ins. The original voltage ratio was 1200-2400 primary and 120-240 secondary. The use of this transformer is to be for intermittent service only of about 2 to 3 hours' duration, for demonstration of fractional-horsepower alternating-current motors. Please advise what size of wire and number of turns to use on primary and secondary windings. Would it have to be oil-cooled like the original? Would a 3-hp. direct-current motor, old style G. E., wound with two No. 14 B. & S. wires in parallel, wave-connected, running as converter on 115-volt direct-current line, be sufficient for this purpose or would it be necessary to decrease the capacity of the transformer to suit the converter? The present alternating-current voltage obtainable at the converter averages 88 volts, 60 cycles, single phase.—V. S., Portland, Ore.

The sketch herewith shows one of the many possible methods for solving the problem. The view at the left shows the layout of the coils and the view to



No. 472.—Rewinding of a Transformer.

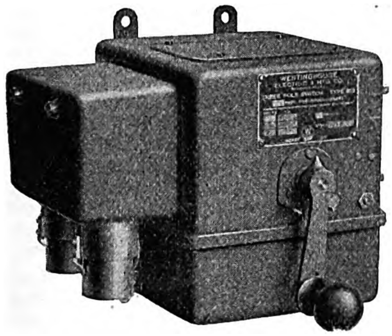
the right the dimension of the coils and method for their insulation. These coils can best be wound on a form and then slipped out. The quantity of material can be easily taken off by calculation from the sketch. With this arrangement a single size of wire is used and no oil is needed to load up the transformer for 2-kv-a. intermittent use. Sufficient data are not given for an intelligent answer to the second question, but I believe the converter can be made to carry a 2-kv-a. load under the conditions stated. I would suggest keeping a thermometer on the machine for the trial run.—H. E. W., Chicago, Ill.

New Appliances

Safety Inclosed Starting Switch—Hubbell Devices—Series-Parallel Controller—Light Plant—New Turbine Governor

Westinghouse Safety Inclosed Motor-Starting Switch.

Safety for the operator, safety for the motor and equipment, and safety for itself are the three features embodied in a new type of starting switch for small induction motors that is being put

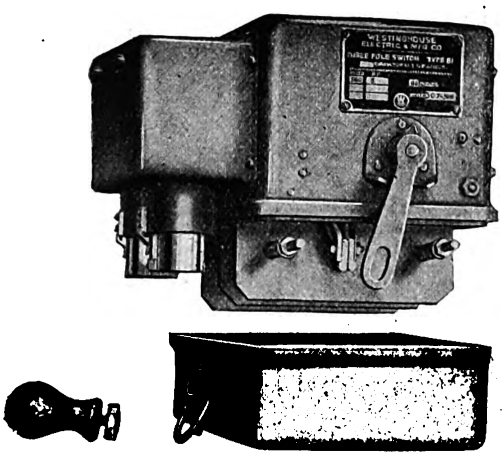


Type 815 10-hp. Quick-Make-and-Break Starting Switch.

on the market by the Westinghouse Electric & Manufacturing Co., East Pittsburgh, Pa. The switch is said to be absolutely accidentproof and well nigh foolproof as well.

The action of the switch is automatic and involves use of strong springs attached to the contact parts and controlled by a trigger. This trigger is released by overload, failure of power or by hand. When the switch passes the neutral point, the spring snaps it the rest of the way.

Safety to the operator from injury due to contact with live parts is assured by the entirely inclosed, dust-and-dirt-proof case. It is impossible to touch the live parts by accident for this reason. Safety to the operator and equipment from restarting after the machine has shut down is assured thus. When power leaves the equipment a low-voltage protective relay releases the trigger and throws the switch. Upon the return of power it is necessary for the operator to move the handle first to the reset position and then to the running position before the motor can again be started.



Type 815 Quick-Make-and-Break Starting Switch with Tank and Arc Barrier Removed to Show Position of Contacts.

Any undue overload causes the overload relay to release a trigger which opens the switch the same as on failure of voltage. Overload throws off the switch just the same as power and the switch must be reset before the motor can again be started. This overload relay prevents burnout of the motor. Motor burnouts may arise from two causes—an overloaded machine or the opening of one wire, due to the blowing of a fuse or other cause and subjecting the remaining phases to an extra burden. The overload relay may be set to open the switch at any desired point, such as 100-110-150% of full load. Fuse protection is not sufficient to guard motors against burnout. A fuse that, without blowing, will carry the starting current, which is several times the operating current, will also carry without blowing sufficient overload to burn out the motor. The overload relay is provided with oil dashpots which afford a time-element protection, permitting the carrying of small peak loads and the starting current without interruption of service. However, they will allow the operation of the overload relay if the overload is heavy or is sustained long enough to threaten the motor. This insures the motor against burnout and at the same time permits maximum production.

Replacing burned-out fuses with copper wire when new fuses are not available results in a burned-out motor the next time an overload occurs. This danger is eliminated because the new switch uses no fuses and automatically resets itself when the overload is removed. Besides this, the danger of shocks and burns in replacing fuses is eliminated.

When the handle of the switch, moving toward the "on" position, passes the neutral point, the spring whips the contacts together. The same action takes place with the opening of the switch. This rapid opening and closing of the contacts practically eliminates the injurious effects of arcing and preserves the life of the switch.

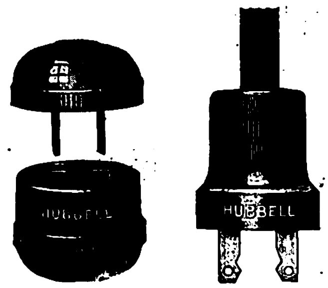
Asbestos barriers between the sets of adjacent contacts have permitted the omission of switch oil with all its accompanying fire hazards and other objectionable features. But when explosive gases are present and the danger of explosion is greater than the fire hazard, the contacts may be immersed in oil. Emergency-stop push buttons may be connected in the low-voltage relay circuit and located at any convenient point near the machine.

This switch has been approved by the National Board of Fire Underwriters. Two sizes are made, each for use on two and three-phase motors, on voltages up to 600. Type No. 815 starts motors of 10 hp. or less while Type No. 816 starts motors up to and including 25 hp.

New Hubbell Cord Connector and Cap.

Harvey Hubbell, Inc., Bridgeport, Conn., has recently added two new devices to its extensive line of electrical specialties, namely, the No. 6180 cord connector and No. 6337 elongated cap. The former measures only $1\frac{5}{8}$ ins. over all and is of exceptionally neat design. Although so small it is sturdy enough for use with any appliance where a cord connector of 660-watt, 250-volt capacity is desired.

The elongated cap is made of composition throughout. While similar in appearance to this firm's No. 6336 cap,



Compact Cord Connector and Composition Elongated Cap.

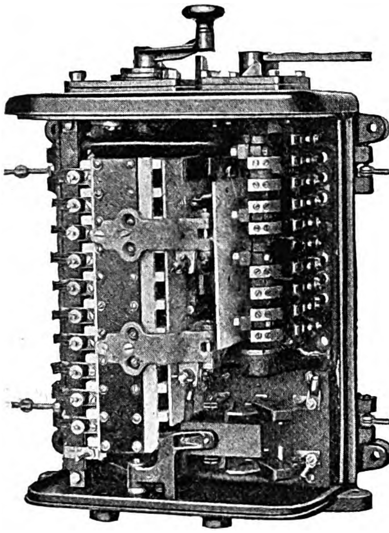
this new one has a half-inch cord hole for No. 14 and 16 reinforced cord.

Drum Controller for Series-Parallel Operation of Locomotive Motors.

A drum type controller for series-parallel control of two series motors is one of the new products of the Cutler-Hammer Manufacturing Co., of Milwaukee, Wis. This controller, which is provided with both a main cylinder and a reverse cylinder, is for use on storage-battery locomotives or on trolley locomotives using 250 volts or less.

The motors are accelerated by the main cylinder, which has seven points of control. A star wheel provides an interrupted motion to the lever, so the operator readily feels the speed points. The fourth point is the full series or low-speed running point and the seventh the full parallel or high-speed running point. All intermediate points are resistance points. The Wheatstone bridge method is used for transition from motors in series to motors in parallel between the fourth and fifth points of control, and as the circuit is not opened, continuous torque is obtained during the transition. Arc barriers are provided between each contact finger, and strong magnetic blowouts prevent excessive arcing.

The reverse cylinder is positively interlocked with the main cylinder so it cannot be operated when the latter is in any but the "off" position. The fingers of the reverse cylinder are therefore not used for making or breaking



New Two-Motor Storage Battery Locomotive Controller—Cover Removed to Show the Two-Cylinders.

the current; hence the contact parts will last indefinitely and magnetic blowouts are unnecessary.

Two cutout switches allow either motor to be by-passed, if it becomes damaged in any way, and the locomotive operated by the other motor until repairs are made. When one cutout switch is thrown to by-pass its corresponding motor, mechanical interlocks prevent closing the other cutout switch or operating the main cylinder beyond its full series position, thus eliminating the possibility of a short-circuit.

A dust-tight and weatherproof construction is obtained by fitting the sheet-metal cover under a ledge in the top and providing a rubber gasket between the edges of the cover and the cast-iron frame.

This new controller has the following features of construction common to other C-H drum controllers: Cast-iron sections of cylinder clamped on square insulated shaft, using no keys or taper pins, thus making removal easy; cylinders readily removed from case by merely taking off top plates; steel contact fingers of main cylinder mounted on square insulated metal shaft, which can be removed by taking out two cap screws; all fingers provided with drop-forged copper tips of the nonstubbing type.

The contact fingers and segments may be adjusted or renewed without removing the cylinders from the drum case. Those on the reverse cylinder are exposed by merely loosening two thumb nuts and throwing back the blowout plate and arc barriers.

Most mine-duty apparatus is employed where the service conditions are severe and delays in operation costly, consequently this new controller has its parts very liberally proportioned to prevent wear and breakage, and those parts which do wear are made accessible and easily renewable.

Buda-Ross Steam-Turbine Electric Light Plants for Construction Projects, Etc.

There are many cases of construction projects where the contractor has a steam boiler for supplying hoisting engines, pumps, compressor sets, etc., and where light is also needed. A steam-driven lighting plant could be of special service in such cases. In many cases small isolated sawmills, oil-well-drilling outfits, cotton gins, steam shovels, small steamboats, etc., could use a similar outfit.

The Buda Co., Chicago, Ill., began manufacturing small steam turbogenerators for locomotive headlight service about six years ago. The use of the small steam turbogenerator has grown in many industries and the demand for this kind of a lighting plant has grown to such an extent that the manufacturers have made some recent improvements in it, enlarged the facilities for production, and will market it generally through dealers as one of the main line of Buda products.

This practically new plant is known as the Buda-Ross electric light plant. It is an unusually small one for a steam turbogenerator plant, the smaller size having a capacity of ½ kw. and the larger size 1 kw., making it adaptable for lighting small plants and portable outfits.

The steam turbine and the electric generator are built compactly into one direct-connected unit. The field coils of the generator have a compound winding which keeps the voltage uniform on any lamp load ranging from zero to the full capacity of the plant. This makes the operation of the lighting plant entirely automatic, requiring no other attention than turning on the steam when the lights are needed and turning off the steam when lights are no longer needed. The generator is of the bipolar type and wound either for 32 volts or 110 volts direct current as desired.

As with the headlight plants, the turbine for the new plant is of the mulistage, radial-flow, impulse type. Its speed is kept uniform, regardless of fluctuations in steam pressure within the range of 85 to 200 lbs., and regardless of the electrical load within the range of from zero to full capacity, by a centrifugal, throttling type of governor which admits only enough steam at the primary nozzle to run the turbine at the speed required.

Westinghouse Marine Turbine Governors Keep Speed of Vessel Uniform.

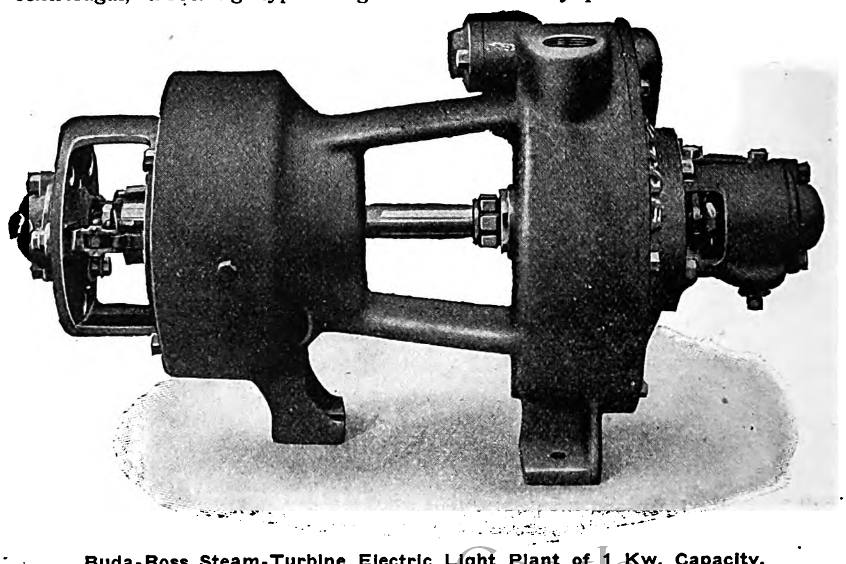
To guard against racing the majority of marine-turbine builders install on their machines an automatic tripping device, which is set to shut off all steam to the turbine when the speed reaches a limiting point of, say, 10% or 15% above normal. This stops the turbine entirely and in order to start up again the trip must be reset and the steam valve opened.

All marine turbines made by the Westinghouse Electric & Manufacturing Co. are fitted with governors which under no circumstances will shut the turbines down completely, but which will regulate the flow of steam to the nozzles in such a manner that the speed is kept practically constant under all conditions of fair and rolling seas.

The arrangement consists of a vertical spindle mounted on the forward end of the turbine, driven by a worm wheel from the main shaft at a speed of about one-quarter of that of the main shaft. At the top of this spindle is mounted a fly-ball governor of the familiar type, the motion of which is transmitted through a system of levers to a small steam relay piston valve, which in turn regulates the flow of steam to the operating cylinder of the main governor valve.

As the speed of the turbine increases above normal, the governor weights are thrown farther away from their center of rotation by centrifugal force and the steam relay valve is moved a corresponding amount. This opens up the steam ports which exhaust the steam from the bottom of the governor valve-operating cylinder, producing an unbalanced condition, and the governor valve starts to close, slowing down the turbine. But as soon as the speed is reduced to normal the governor weights return to their former position, moving back the relay and reopening the governor valve.

While no attempt is made to obtain extremely close regulation, such as is needed on electric generator drives, it has been found that the marine governors are very positive in their action.



Buda-Ross Steam-Turbine Electric Light Plant of 1 Kw. Capacity.

Trade Activities

Organization of Booth Electric Furnace Company—Domestic Engineering Taken Over by General Motors—Catalogs

Westinghouse Electric & Manufacturing Co., East Pittsburgh, Pa., is sending out a new price list on electric ranges and bayonet immersion type liquid heaters, effective Sept. 10.

Remmert Manufacturing Co., St. Louis, Mo., of which William Remmert is the organizer, was recently awarded a basic patent on its Locomotive washer. Mr. Remmert is a well known designer and an expert in washing machine construction, and his experience covers practically every make of washer. About three years ago he conceived the idea of a machine which would eliminate the mechanical appliances and rubbing devices which come in contact with the clothes while they are being washed. This he claims is accomplished in the Locomotive washer in which the clothes receptacle contains no moving parts, the possibility of tearing clothes thus being eliminated. To provide the necessary water agitation the entire receptacle or tub is moved horizontally over a runway by means of reducing gears and an eccentric. In this way the water is forced through the fabric, cleansing it thoroughly and quickly. The machine is very compact and substantially built with all moving parts inclosed.

Domestic Engineering Co., Dayton, Ohio, manufacturer of the Delco light and power plant for use on farms, and in isolated public buildings, will be taken over by the General Motors Co. It is reported that the acquisition of the Domestic company involves millions of dollars, and through the deal Dayton will benefit immensely as expansion plans will be prosecuted on a gigantic scale. Though the Domestic company was incorporated only three years ago with a capital of $800,000, the development of its business was so rapid that the capitalization was increased to $1,500,000. During the three years of its existence the company has manufactured 100,000 lighting plants, and the product has been shipped to Australia, England, France, South America, China, Japan and other foreign countries. An enlargement of the foreign trade will be one of the earliest developments under the new consolidation plans. The Domestic Engineering Co. now employs a force of 2000 persons in office and factory and 3500 salesmen whose territory embraces all sections of the United States and the world. It has been reported also that accessories manufactured by the company assure a volume of business reaching $3,000,000 annually. The plant now occupies 340,000 sq. ft. of space and new buildings are under course of construction.

Eureka Vacuum Cleaner Co., Detroit, Mich., is distributing a new folder to the trade, containing various sales helps for the dealer of the Eureka vacuum cleaner. There is a particularly fruitful field for this labor-saving device, and dealers should avail themselves of the opportunities afforded to promote the sale of this product by linking their sales efforts with the national advertising campaign which is being conducted by the company. The folder contains full-page reproductions of forceful advertisements appearing in the *Saturday Evening Post, Good Housekeeping, Ladies' Home Journal* and other mediums. In addition, it includes a series of newspaper advertisements, providing space for the name and address of the dealer. These have been prepared especially for the dealer for use in local papers, and electrotypes of the "ads" are furnished by the company. As a part of its sales and promotion and advertising campaign, a great variety of attractive window cards, hangers, folders and booklets are also offered by the Eureka company.

Important Change in Booth-Hall Management. — Announcement is made of the organization in Chicago of a new corporation under the laws of the state of Illinois known as the Booth Electric Furnace Co., with paid up capital of $1,000,000. Of this amount one-half is preferred stock, and one-half common. The new company has acquired all the patents, assets, and good-will of the Booth-Hall Co., well known as a manufacturer of electric steel and brass melting furnaces, and has taken over the business formerly carried on by that company. It will greatly enlarge the scope of operations, and develop the electric furnace business along standard manufacturing lines rather than on a special engineering contracting basis. The Booth rotating furnace which has been in successful operation during the last six months, and which is especially designed for the melting of non-ferrous metals, has been thoroughly developed and standardized, and the company is prepared to deliver this type of furnace in four sizes, viz., 250-lb., 500-lb., 1000-lb., and 2000-lb. equipments. The well-known 2-phase, 2-electrode Booth-Hall furnace for the melting of iron and steel will also be made in five sizes, namely, ¾-ton, 1½-ton, 3-ton, 6-ton, and 12-ton. An improved type of furnace, oval in shape, has been designed, and prompt shipment can be made of any one of these five sizes.

The new company will have exceptional manufacturing facilities for turning out furnaces in quantities. Not only have all parts been standardized, but each furnace will be assembled complete before shipment, and thoroughly tested out to absolutely insure mechanical and operating perfection. Associated in the management of the company will be a number of the best known engineering and operating executives in the public service field. L. E. Myers, of Chicago, president of the L. E. Myers Co., has been elected president of the new corporation; C. H. Booth, formerly president of the Booth-Hall Co., vice-president; W. K. Booth, formerly chief engineer of Booth-Hall Co., secretary; and L. J. Clark, of the L. E. Myers Co., treasurer. In addition to the president, vice-president and secretary, the board of directors will include Martin J. Insull, vice-president of the Middle West Utilities Co., and E. W. Lloyd, of the Commonwealth Edison Co., both of Chicago. The new company is prepared to carry on an aggressive campaign for business, and will open sales offices in different parts of the country to properly handle its business. An adequate engineering staff will be maintained to co-operate with customers in connection with their electrometallurgical problems, especially those relating to the melting of metals.

Edison Electric Appliance Co., 5660 West Taylor street, Chicago, is distributing a new catalog of lamp socket appliances and heavy duty equipment. It comprises some 25 pages and contains brief and comprehensive descriptions at Hotpoint appliances accompanied by illustrations. In this publication is introduced a new line of beautiful silverware which is doubtless one of the highest developments of the art of electric hollow-ware. This ware is the celebrated 1847 Rogers Brothers, Adam Period design, and is so constructed that lifetime service is insured.

The new coffee percolators of this line, as well as other coffee percolators manufactured by the company, are equipped with a safety switch, which is a feature worthy of consideration. Increases in voltage and the fact that electric percolators were allowed to "go dry" while current was still on, resulted in burnouts of heating and damage to percolators. To solve this difficulty the engineering department of the Edison Electric Appliance Co. has brought forth a safety switch, which may be put into service again after an accidental overheating has caused the circuit to be opened, and is claimed to prevent burnouts and damage to appliance. It operates equally well on either direct or alternating current and is placed in the bottom of the percolator, being covered with the base plate.

Current News

Weekly Record of Construction Activities—Conventions

EASTERN STATES.

Westminster, Vt.—Abenaquet Machine Works will erect a one-story shop, 150x500 ft., to cost $200,000.

Cambridge, Mass.—New England Telephone Co., 50 Oliver street, Boston, has commenced the construction of a new two-story addition to its local telephone building. The structure will be about 35x35 ft., and is estimated to cost $70,000.

Cambridge, Mass. — Cambridge Electric Light Co., Western avenue, has awarded a contract to Walsh Brothers, 150 Hampshire street, for the construction of its proposed transformer building on Western avenue. The structure is estimated to cost $10,000. French & Hubbard, 88 Pearl street, Boston, are engineers for the company.

Lynn, Mass.—Davis Lynn Storage Battery Co., Commercial street, has recently broken ground for the construction of a new one-story addition to its plant, about 50x200 ft. The structure is estimated to cost $35,000. Edward D. Dearborn, 24 Elm street, Lynn, is the building contractor.

Worcester, Mass.—Worcester Brass & Electro Plating Co. has purchased the factory of Oliver M. Dean & Sons, 316 Shrewsbury street, for $27,000 and will move there.

Providence, R. I.—H. H. Electric Storage Battery Co. has filed notice of organization to operate at 506 Broad street. Edward Hacking, 954 Lonsdale avenue, Central Falls, heads the company.

Woonsocket, R. I.—Arthur Dauray, Jr., 186 Harrison avenue, has filed notice of the organization of the Electric Maintenance & Engineering Works, to operate a general electrical contracting and repair establishment at 143-45 Railroad street.

Albany, N. Y.—Hunt, Helm & Ferris are having plans prepared for a factory and storage building.

Auburn, N. Y.—Auburn Button Works, 48 Canoga street, has filed plans for the construction of a new one-story boiler plant and engine house at its works. Contract for the structure, which is estimated to cost about $10,000, has been awarded to William Ludke, 33 Hockeborne ave., the building will be about 56x71 ft.

Canandaigua, N. Y.—Plans are under consideration by the Department of Public Works for the installation of a new electric street lighting system throughout the municipality. Power for operation is furnished by the Rochester Railway & Light Co. The system would include new concrete lighting standards placed about 100 ft. apart.

Greenwich, N. Y.—Consolidated Electric Co., Greenwich, Washington county, has filed notice with the secretary of state of an increase in its capitalization from $150,000 to $210,000, to provide for general expansion.

Lockport, N. Y.—The lamps and gas committee in its report to the aldermen recommended that the three-year proposal of the Lockport Light & Heat Power Co. to light the streets of the city at the rate of $57.50 per lamp per year be accepted and suggested that the council take up the matter of a municipal lighting plant for the city.

Oneida, N. Y.—Fire recently damaged a portion of the local power plant of the Morrisville Electric Light & Power Co., with loss estimated at about $5000. It is understood that immediate repairs will be made.

Rochester, N. Y.—Common Council has recently passed an ordinance providing for the installation of additional electric lighting units on Oxford and Dartmouth streets, to facilitate the present service.

Troy, N. Y.—Common Council has approved an appropriation of $145,000, to provide for the installation of a new and modern police-fire alarm signalling system throughout the municipality. Of this sum, $125,000 will be utilized for the installation of the system, while the remaining $20,000 is to provide for the erection of a new central station at Seventh and State streets.

Port Henry, N. Y.—In the near future the Port Henry Light & Power Co. will erect a new power plant and dam, two miles west from this village at a cost of $250,000.

Belleville, N. J.—In connection with the construction of the proposed local plant of the Overland Tire Co., 15 River street, for the manufacture of rubber tires, estimated to cost $90,000, considerable electrical and mechanical equipment will be required for operation.

Cape May, N. J.—United States government has had plans prepared for the installation of a new central heating plant with equipment at the local Government station. Commander J. D. Robnet, Senior Member, Board of Survey, Appraisal and Sale, Navy Yard, Philadelphia, Pa., is in charge of the work.

Irvington, N. J.—Final contracts have been awarded by the Atlantic Chemical Co. for the construction of the proposed group of factory buildings at 1190 Grove street. The plans include the construction of a large boiler plant department, to be used for general works operation. Hughes & Horton, Essex building, Newark, are architects for the company in charge of construction.

Newark, N. J.—Radel Leather Manufacturing Co., Wilson avenue, has awarded a contract to the Reynolds Construction Co., 308 South Ninth street, for the erection of a new boiler plant at its works. The structure will cost about $6000.

Newark, N. J.—A four-story plant, 60 x 80 ft. will be erected by the General Electric Co. at a cost of $66,000.

Newark, N. J.—In connection with the construction of the new plant of the New Jersey Pull Clean Towel Co., to be located in Halleck street, plans have been prepared for the erection of a boiler plant for factory operation.

Newark, N. J.—American Platinum Works, 231 New Jersey Railroad ave., has completed foundation work for the construction of the proposed factory and boiler plant to be located at Oliver and New Jersey Railroad avenues. The new works will provide for increased operations. Frederick Kilgus, 13 South Sixth street, Newark, is the building contractor.

Paterson, N. J.—Large quantities of electrical and mechanical equipment will be utilized in connection with the construction of the new municipal garbage incinerating plant, plans for which are now under consideration by the Board of Public Works.

Phillipsburg, N. J.—In connection with the construction of the new local sewage disposal plant by the city estimated to cost $137,980, contract for which has just been awarded, considerable new electrical and mechanical equipment will be required.

Pompton, N. J.—New York Telephone Co. has commenced the removal of its pole line to its new lines on the Newark-Pompton turnpike, now in course of construction by the state highway department.

Trenton, N. J.—The new power plant now in course of construction at the plant of the Trenton Malleable Iron Co., New York avenue, is rapidly nearing completion, and it is expected that operations will be inaugurated at an early date. S. W. Mather & Sons, Trenton, are the building contractors. The structure is estimated to cost $20,800.

Trenton, N. J.—Application has been filed with the Board of Public Utility Commissioners by the Bell telephone interests for approval of the increased telephone rates fixed by Postmaster General Burleson while the telephone lines were under federal control. The company is planning to increase the rates of the Delaware & Atlantic Telegraph & Telephone Co. by approximately 25% after Dec. 1.

Frankford, Del.—Prominent local business interests are taking active steps for the organization of a new company to engage in the generation and distribution of electric energy. It is proposed to construct a new local power plant, as well as install a new electric street-lighting system.

Millsboro, Del.—Plans are under consideration for the installation of a new electric street-lighting system.

Allentown, Pa.—International Motors Co. will erect an addition to its plant, two stories, 300 x 600 ft. Estimated cost $1,000,000.

Allentown, Pa.—City council has passed an ordinance creating a division of electric lighting in the water department, as well as adopted a resolution directing the preparation of the necessary legislation whereby the water department will be enabled to raise the sum of $62,000, to be used for the construction of an electric light and power plant for municipal service.

Carlisle, Pa.—General construction for erecting a $150,000 power plant for C. H. Nasland & Sons, America and N. Moreland street, Philadelphia, has been let to J. S. Rogers, Co. Drexel building, Philadelphia, Pa. Complete electric installation to be made of dynamos, transformers, switchboard, etc.

Columbia, Pa.—Borough council has recently awarded a contract to the Edison Electric Co., Lancaster, for furnishing electric service for the operation of the municipal electric street lighting system for a period of five years.

Greensburg, Pa.—Penn Aluminum Co., Pittsburgh, will erect a plant here.

Philadelphia, Pa.—Electric Storage Battery Co., Nineteenth and Allegheny streets, has broken ground for the construction of the proposed one-story building, to be located at 19th and Willard streets. The structure will be about 32x97 ft., and is estimated to cost $14,000. William Steele & Sons Co., 1600 Arch street, is the contractor.

Pitman, Pa.—The sum of $75,000 will be expended for improving the municipal light plant.

Baltimore, Md.—Chesapeake & Potomac Telephone Co. has announced the opening of a new telephone central office, located in the building at 5 Light street, to be known as "Calvert" exchange. The cost of the installation of the new switchboard, with accessory equipment, is placed in excess of $150,000.

Baltimore, Md.—In connection with the construction of the proposed packing plant of the William Schluderberg & Son Co., to be erected at Baltimore and Fifth streets, 339x414 ft., estimated to cost approximately $300,000, considerable new electrical and mechanical equipment will be required.

Cumberland, Md.—Application has been filed with the Public Service Commission by the Potomac Edison Co., for permission to take over and consolidate the electric and gas utilities of this city, including the street railway system and the Edison plant which furnishes light, heat and power with the company's plant at Grafton, W. Va. Included in the proposed consolidation is the plant of the Hartland Co., Hartland, W. Va., and the operations of the natural gas companies which supply this territory from the Central West Virginia field.

DATES AHEAD.

National Association of Electrical Inspectors. Annual meeting, Springfield, Mass., Oct. 13 and 14. Secretary, W. L. Smith, Concord, Mass.

Illuminating Engineering Society. Annual convention, Chicago, Ill., Oct. 20-23. General secretary, Clarence L. Law, 29 West 39th street, New York City.

Illinois State Electric Association. Annual convention, Chicago, Oct. 22 and 23. Secretary-treasurer, R. V. Prather, Springfield, Ill.

Empire State Gas and Electric Association. Annual meeting, Buffalo, N. Y., Oct. 24. Secretary, Charles H. B. Chapin, 29 West 39th street, New York City.

Jovian Order. Annual convention, Chicago, Nov. 5 and 6. Headquarters, Hotel Sherman. Acting Mercury, Eli C. Bennett, St. Louis, Mo.

American Society of Mechanical Engineers. Annual meeting, New York City, Dec. 2-5. Secretary, Calvin W. Rice, 29 West 39th street, New York City.

Electric Power Club. Meeting, Hot Springs, Va., Dec. 11, 12 and 13. Headquarters, Homestead Hotel. Secretary, C. H. Roth, 1410 West Adams street, Chicago.

National Council of Lighting Fixture Manufacturers. Annual convention, Detroit, Mich., February, 1920. Secretary-treasurer, Charles H. Hofrichter, Cleveland, Ohio.

Danville, Va.—W. V. Young and Thomas S. Jones, Chatham, Va., are understood to have completed negotiations for the purchase of the plant of the Chatham Light & Power Co. for a consideration of about $17,000. It is said that the new owners are planning for operations on an increased scale.

Norfolk, Va.—A plant will be erected by the Norfolk Electric Manufacturing Co. P. O. Sutton, 215 Cumberland street, is general manager.

Laurens, S. C.—$200,000 bonds have been voted for extending the lighting and water systems. Address mayor.

Jacksonville, Fla.—W. L. Griffs and associates will establish an electric light plant at Atlantic Beach to furnish lights to cottagers.

Millville, Fla.—W. L. Wilson, Panama City, and associates, are planning for the construction of a new local electric plant with a five-mile transmission system extending to Panama City, the entire work being estimated to cost about $100,000. Thomas L. Johnston, Panama City, is engineer for the project.

Mount Dora, Fla.—Issuance of $27,000 municipal electric light and water bonds was voted. O. W. Sadler, mayor.

St. Petersburg, Fla.—The Ford Service Station is in the market for five 7½ and 10 hp. electric motors.

Pelham, Ga.—The council has contracted for power with the Gwyer-Alabama Power Co., the corporation which recently bought the Albany Power & Manufacturing Co., and is now building a much larger plant across the Flint river whereby that company will furnish electric power for Pelham's business houses, homes, streets and industries.

NORTH CENTRAL STATES.

Cleveland, Ohio—Architect R. Thompson, 6110 Euclid avenue, has prepared plans and will let contract for $50,000 concentrator station. Specifications include electrical machinery, electric power generating machinery, etc., to be erected by Cleveland Railroad Co., 700 Leader News building.

North Canton, Ohio—Hoover Suction Sweeper Co. is having plans prepared for an addition to its plant. The structure will be four stories, 80 x 170 ft., and will cost $125,000.

Port Clinton, Ohio—Ohio State Rubber Co. will erect a 100 x 300 ft. power plant. The specifications include electric power plant equipment and machine shop equipment, $15,000 to be expended. N. A. Bruess, president. Architect M. C. Millock, Sandusky, Ohio, has prepared plans.

Evansville, Ind.—Bucyrus Steam Shovel Co. will double its working capacity and will also build a hospital for the workmen, the total cost of the improvements to be $500,000. The company employes 400 workmen and is arranging to employ night shifts.

Fort Wayne, Ind.—Fort Wayne Engineering & Manufacturing Co. has increased its capital stock $200,000, the total capitalization now being $500,000 instead of $300,000. H. C. Paul is the president of the company.

Terre Haute, Ind.—The machine shop of the American Car & Foundry Co. burned with loss estimated at $100,000. Rebuilding will be begun as soon as the insurance is adjusted.

Terre Haute, Ind.—Bowen Motors Railway Corp. has completed plans for the erection of a plant to produce its gasoline propelled passenger car for use on steam roads for short runs.

Valparaiso, Ind.—McGill Manufacturing Co., manufacturer of electrical supplies, has under consideration the erection of a three-story plant, 65 x 260 ft., to cost $150,000.

Chicago, Ill.—Gulbransen-Dickinson Co. will shortly erect a six-story and basement addition to its present factory. The building will be of reinforced concrete and brick, with a frontage of 250 ft. and will embody the latest ideas in modern factory arrangement and equipment.

Chicago, Ill.—H. Channon Co., manufacturer of machinery supplies, will erect a seven-story building at North Market and West Randolph streets, to cost $450,000.

Chicago, Ill.—Gloria Light Co. will build a four-story factory building on property, 84x125 ft., in Sangamon street, which will cost about $75,000.

Deer Creek, Ill.—Deer Creek Power & Light Co. will construct and operate an electric light plant.

Fairbury, Ill.—A committee has been appointed to secure funds for ornamental lighting for streets. W.

A. Roth, president of commissioners.

Freeport, Ill.—H. W. Horst Co., Rock Island, Ill., is building a five-story and basement building for the Furst McNess Co., manufacturing chemists.

Galesburg, Ill.—Rowe Manufacturing Co. will build new reinforced steel and brick factory building. Company will also install a bolt factory for making all the bolts used in its manufacturing. The company will also extend the saw tooth building and when completed it will be 114 by 400 ft. Other improvements include the extension of the loading track. Six acres of land haye been acquired for the extension of the plant.

Minier, Ill.—A new electric light company will incorporate for the purpose of installing an electric light plant and bringing current from the traction system. Address G. E. Peine.

Springfield, Ill.—At the November election the question of issuing $400,000 in bonds in aid of the municipal plant will be submitted to vote.

St. Charles, Ill.—The council has passed an ordinance authorizing an issue of bonds for improving electric light plant. The work will be done at once. Address city clerk.

Vandalia, Ill.—Consulting Engineers Fuller & Beard, 721 Olive street, St. Louis, have prepared estimates for improvements to light and water systems. $140,000 will be expended. Address city clerk.

Waukegan, Ill.—Allied Masonic orders will erect a $100,000 Masonic Temple.

Chilton, Wis.—Aluminum Specialty Co. has awarded contracts for a factory and power house, two story, 60 by 200 ft., to cost $40,000.

Fond du Lac., Wis.—Northern Casket Co. will build a new power plant for its factory at Fond du Lac. E. E. Dillon, Madison, Wis., has been retained as consulting engineer and is drawing the plans and specifications for the plant.

Stoughton, Wis.—M. A. Kimball has a contract and will erect a power plant for the city. Power equipment will be purchased. L. C. Currier, clerk.

Kalamazoo, Mich. — Engineers Woodmansee & Davidson have prepared estimates for improving electric light plant. The question of issuing $1,200,000 bonds will be submitted to vote at the November election. A. Sonderenk, city clerk.

Three Rivers, Mich.—Nillingham & Cobt, Press building, Kalamazoo, Mich., have prepared plans for a 5-story, 380 x 175 ft., power plant and paper mill to be erected by Eddy Paper Co. Specifications include paper machinery, equipped with generators, transformers, etc. Address C. E. Nelson, manager, Three Rivers, Mich.

Dubuque, Iowa—A physical appraisement of the property of the Dubuque Electric Co. will be made by the Stiver Auditing Co., Des Moines, Iowa. This work is in addition to an audit of the books of the company. The entire task of appraisement and auditing is being done in order to arrive at a correct idea of what increased rates should be allowed the company. The company will pay one-half of this expense and the city one-half.

Elkhart, Kans.—Excavation has been begun for a settling basin, and for the foundation of a new power house for the city water and electric light plant. The city recently voted $60,000 bonds for the extension of the plant.

Kansas City, Kans.—$150,000 electric light bonds will be offered for sale. The bonds will be issued for improvements at the electric light plant, which will practically double its capacity. Of the $500,000 voted, $250,000 already have been sold.

Kansas City, Mo.—Kansas City Bolt & Nut Co. will expend in excess of $1,000,000 for additions to its plant, increasing its monthly capacity to 65,000 tons by next March. Five open-hearth steel furnaces, each of 50-ton capacity, 22-in. rolling mill, with traveling tilting tables and overhead cranes and electric power will be installed.

St. Louis, Mo.—Wagner Electric Manufacturing Co., 6400 Plymouth avenue, is arranging for the construction of a new five-story addition to its plant, about 160x400 ft., to provide for increased capacity.

SOUTH CENTRAL STATES.

Benton, Ky.—City council is understood to be arranging plans for the immediate installation of a new electric light plant, to be used for municipal service.

Greenfield, Tenn.—The city has voted $70,000 bonds for water and electric light plants. Address Clyde Ezzell, mayor.

Knoxville, Tenn.—Tennessee Mills will expend from $75,000 to $100,000 for building a two-story, 70x30-ft. addition to its plant and install new underwear knitting machinery.

Lebanon, Tenn.—Tennessee Power Co., Nashville, will erect a transmission line from Lebanon to Murfreesboro.

Irondale, Ala.—City has approved a bond issue of $5000 to cover the cost of the construction of a new transmission line to Birmingham. J. W. Richards is mayor; F. O. Floyd is engineer.

Lexington, Miss.—Issuance of $20,000 of municipal bonds for electric light purposes was voted. W. J. Jordan, city clerk.

Natchitoches, La.—City commissioners are having plans prepared by Xavier A. Kramer, consulting engineer, Magnolia, Miss., for alterations and improvements in the municipal light and water plant. It is proposed to install new alternators, engine and pumping equipment, and arrange for the construction of a new power station building. F. W. Johnson is mayor.

Horatio, Ark.—The city contemplates the installation of electric light and water plants. Address the mayor.

Ponca City, Okla.—$50,000 in bonds have been voted for electric light extension. Address W. H. McFadden, mayor.

Kyle, Tex.—Kyle Power & Light Co., recently incorporated, is arranging plans for the construction of a power plant for local service. C. F. Heidenreich is manager.

Waco, Tex.—Central Texas Electric Railway Co., recently incorporated with a capital of $500,000, is arranging plans for the construction of an electric railway system from Waco to Temple for passenger and freight service. It is said that the plans will include the ultimate construction of an extension to Austin, and thence to San Antonio. The board of directors is as follows: J. L. Davidson, O. A. Rifle, and S. M. Clark, all of Waco; P. A. Clark, Rosenthal, Tex.; Henry Meisner, G. E. McSelver, and H. L. Dailey, Temple, Tex.

Sadler, Tex.—H. L. Kinney, Grayson county, advises that a chamber of commerce has been organized and a franchise granted to a Denison firm for the immediate erection of an electric light plant at Sadler.

Wichita Falls, Tex.—In order to provide electric power and lights for a wide scope of territory in northwest Texas the Wichita Falls Electric Co. will greatly enlarge its central power station here and extend its transmission line to a number of cities and towns. It is stated that the proposed improvements will cost about $1,000,000. The company is already furnishing electric power for oil well pumping plants in the Burkburnett district and for other industries of this city and adjacent section.

WESTERN STATES.

Missoula, Mont.—Missoula Light & Water Co. will expend about $85,000 in remodeling its power dam in the Missoula river near Milltown. H. L. Bickenbach will have charge of the work.

Nampa, Idaho—The installation of a boulevard lighting system to replace the lights in use is being considered by the Nampa Chamber of Commerce.

Ogden, Utah—Application has been made by the Uintah Power & Light Co. for a preliminary permit for the construction of an electric generating station on the Uintah river, to furnish 4000 hp. The plant would be situated on the Uintah river in the Ashley forest and distribute power to all of the towns in the Uintah basin. If the permanent permit is granted the right of occupation for 50 years is granted.

Roseburg, Ore.—Roseburg will have a municipal lighting and power plant, according to plans of the city council. Mayor Hamilton with Claude Frear, city engineer, located a fine power site on the North Umpqua river, east of the mouth of Rock creek, 25 miles east of the city.

Rio Vista, Cal.—Plans are being completed for the construction of a 22,000-volt power line from Hood to Franklin by the Great Western Power Co., this work to cost about $20,000. Most of the power will be used for pumping water, which is needed for the big agricultural development in the Franklin district.

CANADA.

Hamilton, Ont.—International Plow Works has under consideration the erection of a manufacturing plant. B. H. Prack, Lumsden building, Toronto, engineer.

New Toronto, Ont.—Goodyear Tire & Rubber Co. of Canada, Ltd., will erect a $200,000 addition to its factory. Plumbing, heating and electrical contracts will be let.

Coquitlam, B. C.—Gregary Tire & Rubber Co., Vancouver, plans the erection of a factory to cost $175,000. Gardiner & Mercer, 827 Birke building, Vancouver, architects.

PROPOSALS

Light and Water Plant.—Bids will be received Oct. 13 for the construction of a water and light plant at Ansonia, Ohio. G. L. McKibben, of Van Wert, has prepared plans. Address city clerk.

Water-Tube Boiler.—Bids will be opened in the Treasury Department, supervising architect's office, at 3 p. m., Oct. 28 for an additional 200-hp. water-tube boiler at the Bureau of Engraving and Printing, Washington, D. C., in accordance with drawings and specifications, copies of which may be had at the above office, in the discretion of the supervising architect. James A. Wetmore, acting supervising architect.

Pneumatic-Tube System.—Bids will be opened at 3 p. m., Oct. 27, in the office of the supervising architect, Treasury Department, Washington, D. C., for a pneumatic-tube system in United States assay office at New York, N. Y. Drawings and specifications may be obtained from the supervising chief engineer, Room 731, United States Customhouse, New York, N. Y., or at the above office, in the discretion of the supervising architect. James A. Wetmore, acting supervising architect.

Electric Work.—Bids will be opened in the office of the supervising architect, Treasury Department, Washington, D. C., at 3 p. m., Nov. 28, for furnishing materials for the construction of the United States post office at Gilmer, Tex., including materials for concrete, reinforced concrete, stone, granite, brick, structural terra cotta, structural steel, miscellaneous iron and steel work, composition roofing, slate roofing, sheet-metal work, plastering, interior marble, sanitary slate, lumber, millwork, painting, glazing, hardware, plumbing, heating, electric work, etc., in accordance with drawings, specifications and bills of quantities attached thereto. Copies may be obtained after Oct. 23 from the custodian of the site at Gilmer, Tex., or at the above office, in the discretion of the supervising architect. James A. Wetmore, acting supervising architect.

Electric Conduit.—Bids will be opened in the office of the supervising architect, Treasury Department, Washington, D. C., at 3 p. m., Nov. 10 for furnishing the labor required in the construction complete (including heating, plumbing, electric conduits, and wiring) with material that will be furnished by the Government, for kitchen and mess hall, officer's quarters, attendants' quarters and garage and approaches, for the United State marine hospital at San Francisco, Cal. Drawings and specifications may be obtained from the superintendent of construction, room 403, post office and courthouse, San Francisco, Cal., or at the above office, in the discretion of the supervising architect. James A. Wetmore, acting supervising architect.

Hydroelectric Machinery.—Board of Public Works, Seattle, Wash., is asking for sealed bids up to 10 a. m., Oct. 17, for hydroelectric machinery required for an additional unit at the city's Cedar Falls hydroelectric station. The requirements are for a 10,000-kw. generator, alternating current, revolving field, 3 phase, 60 cycles, 6600 volts. Generator is to be direct-connected to water wheel, and to withstand for one hour runaway speed of water wheel, without injury to machine. Water wheel may be of impulse or reaction type, with horizontal or vertical shaft, and may have more than one runner. It is to be driven from a 78-in. penstock, 7500 ft long. Capacity of wheel shall be not less than 16,000 hp., with a speed not to exceed 515 r. p. m.; other requirements include a 200-kw. exciter unit, consisting of a direct-current generator, direct-connected to a water wheel, the latter to be driven from a steel penstock, supplied with water from the main penstock through a connecting tap. All necessary accessories are to be included in bids submitted.

FOREIGN TRADE

[Addresses of firms referred to in these trade opportunities may be obtained by writing to the Bureau of Foreign and Domestic Commerce, Washington, D. C., or its branch and local co-operative offices. Request for each opportunity should be on a separate sheet and the file number given.]

Engines (30,761).—An American exporting company desires to purchase suitable engines and boilers of a type necessary for running a rice-milling plant. Its requirements are a small, compact steam-power plant consisting of horizontal tubular (preferably portable) fire-box boiler with engine mounted on same and connected to boiler, in two sizes, 30 and 50 hp. References.

Motors, Dynamos, Wire, Electrical Appliances (30,646).—A Spanish merchant established in the United States, having representatives in Spain, is about to visit that country and desires to secure agencies for the sale of tools, hardware, lathes, electrolytic copper wire, iron plates, motors, dynamos, electrical appliances, paints, chemicals, drugs, and crome-tanned upper leathers. References.

Electric Lamps (30,729). — An agency is desired by a man in Italy for the sale of electric lamps, hardware, oilcloths, linoleum, toys and drawing instruments. Quotations should be given c. i. f. Italian port. Correspondence should be in Italian or French. References.

Engines (30,736).—A manufacturing firm in France desires to secure exclusive agencies for France and her colonies of agricultural implements, including tractors and internal combustion engines. Correspondence may be in English.

INCORPORATIONS

Queens, N. Y.—McPhilben Lighting Fixture Co. Capital, $43,000. To manufacture electric and gas fixtures, etc. Incorporators: H. Schneider, M. Malk, and B. Schaefer, Queens.

New York, N. Y.—New York Power, Steam & Engineering Co. Active capital, $52,500. To engage in a general electrical and mechanical engineering capacity, etc. Incorporators: S. E. Trumbull, T. W. Barnes, and A. V. Clements, Albany.

Schroon Lake, N. Y.—Schroon Lake Lighting Corp. Capital, $30,000. To operate a local electric light plant. Incorporators: B. F. Stetson, M. C. Stanton, and R. B. Dudley, Elizabethtown.

Phoenix, N. Y.—Northern Cayuga Light & Power Corp. Capital, $50,000. To operate an electric light and power plant and distributing system in the Phoenix district. Incorporators: Frank Longley, C. E. Dudley, and James D. Bloomfield, Meridian, N. Y.

Wilmington, Del.—Glascox Electric Co. Capital, $10,000. To operate a local electrical engineering establishment. Incorporators: George G. Steigler, W. F. O'Keefe, and J. H. Dowdell.

Beckley, W. Va.—Beckley Machine & Electric Co. Capital, $25,000. To manufacture machinery, electrical specialties, etc. Incorporators: A. J. Truman, W. E. Griffiths, J. T. Evans, J. L. Smith, and J. S. Lilly, Beckley.

Paducah, Ky.—Suburban Electric Supply Co. Capital, $30,000. To manufacture electrical supplies. C. B. Smiley is the principal incorporator.

Gilbert, Iowa—Gilbert Electric Co. has filed articles of incorporation at the office of county recorder to be $15,000 divided into shares of $100 each, to be paid up in full. Address John Hill, president. The object of the incorporation is to erect, operate and maintain poles, wires and other equipment for the purpose of transmitting electrical energy for light, heat, power and other legitimate purposes, to sell and distribute such electrical current in and adjacent to the town of Gilbert.

Minier, Ill.—Minier Electric Light & Power Co. has been incorporated with capital of $15,000. Address George Peine.

Pine Village, Ind.—Pine Village Light & Power Co. has been incorporated with capital of $10,000 to supply light and power for the village of Pine Village. Address Melvin Akers, Pine Village, Ind.

Personals

Major Jackson Cited—P. S. Klees Becomes Vice-President of Pierce Fuse—Warner Jones Joins Dayton Fan & Motor

FRANK O'RYAN has been appointed district manager of the Allis-Chalmers Manufacturing Co. at Denver, Colo.

C. S. ANDERSON, formerly superintendent of the Clark Electric Power Co., Tooele, Utah, is now superintendent of the Butler district of the Western Pennsylvania Power Co.

MALACHI G. BRENNAN, advertising manager of the Sanford Riley Stoker Co., Ltd., Worcester, Mass., has been transferred to the sales department of the Chicago office of the company. He will be succeeded by Otis C. Sheldon.

LEWIS A. BELDING, who for the past two years has been assistant professor of mechanical engineering at Stevens Institute of Technology, Hoboken, N. J., is now associated with the Thomas A. Edison interests at Orange, N. J., in the power service division, as service engineer.

MAJ. JOHN B. JACKSON, an engineer with the Commonwealth Edison Co., Chicago, is the recipient of a citation signed by General John J. Pershing dated April 19, 1919, "for exceptionally meritorious and conspicuous service." Major Jackson was in the Corps of Engineers and was assigned to the office of Chief of Engineers, A. E. F. In the Division of Construction and Forestry he had direct administrative charge of electrical projects in France; that is, in all territory except the immediate fighting zone.

R. L. FRISBY, testing engineer of the Commonwealth Edison Co., Chicago, has resigned to become chief electrician for the Kansas City Light & Power Co. Mr. Frisby has been connected with the Commonwealth Edison Co. for about 16 years, during which time he has been connected with operation. For many years he has had charge of testing at the Fisk, Quarry and Northwest stations of the company. It has been through his efforts that numerous operating economies and safety methods have been adopted at these power houses of the company. In addition to testing and maintenance at the Fisk street generating station, Mr. Frisby has carried on a considerable amount of research work at the company's laboratories in connection with balance relays for generator protection, the use of noncombustible generator coils, the use of exploring coils versus thermocouples for determining "hot spots" and similar work relating to large turbogenerator stations. In Kansas City he will have charge of operating and maintenance of the entire system, where it is expected that his extensive experience with Chicago's large system will prove, alike, of service to himself and the Kansas City Light & Power Co.

WARNER JONES, formerly special representative of the National Carbon Co., Inc., and whose duties have called him to all parts of the country, is now sales manager of the Dayton Fan & Motor Co., Dayton, Ohio. He will have charge of the sales and advertising departments of the company and will be responsible for the advertising and sales of the Dayton fans and small motors. Mr. Jones has had 20 years' experience in selling various kinds of electrical merchandise, and the experience and acquaintanceship that he brings with him will undoubtedly be of great value to the Dayton Fan & Motor Co. He has many new ideas on the merchandising of electrical equipment that will doubtless be of great interest to electrical supply jobbers and dealers throughout the country as well as manufacturers of electrical apparatus who use small motors.

PETER S. KLEES has tendered his resignation as manager of the Franklin Incandescent Lamp Works of Westinghouse Lamp Co., New York City, to become associated with the Pierce Fuse Corp., Buffalo, as vice-president and sales manager. Mr. Klees has been prominent in the lamp industry for many years, having joined the organization of the American Incandescent Lamp Co. in 1899. In 1905 he went to Hartford as a member of the sales department of the Franklin Electric Manufacturing Co., later becoming sales manager and then also vice-president. He continued in this capacity until the sale of this company in 1918 to the Westinghouse Lamp Co., at which time he became manager of the Franklin Works and removed to New York City. Mr. Klees has a very wide acquaintance among electrical men throughout the country, who will be glad to hear that his new interest in the fuse field will still keep him in the industry.

COL. EDWARD A. DEEDS, president of the Domestic Engineering Co., Dayton, Ohio, was the principal speaker and guest at a dinner given in his honor by the Indiana section of the Society of Automotive Engineers at the Claypool Hotel in Indianapolis, Ind., Oct. 10. At the age of 26 Colonel Deeds joined the staff of the Thresher Electric Co. as assistant draftsman, becoming chief engineer and superintendent within a year. Shortly afterwards he went to the National Cash Register Co., where, as maintenance engineer, he built the power house and electrified the plant. Leaving that position he went to Niagara Falls where he built and put into operation the shredded wheat plant. On the completion of this work he returned to the National Cash Register Co. as vice-president in charge of engineering, remaining there until 1914. In April, 1917, he was called to Washington as a civilian member of the munitions standards board. Later he became a member of the aircraft production board and was placed in charge of the production division of the board's activities. In August, 1917, he was commissioned a colonel.

COL. T. H. DILLON of the Engineers Corps of the United States Army, has resigned from the army and his appointment to a professorship of Electrical Engineering at the Massachusetts Institute of Technology is announced, thereby adding his name to the already notable electrical engineering staff of that institution. Colonel Dillon graduated from the military academy at West Point in 1904, and was appointed to the Engineers Corps of the army. After some military duties he was assigned to the Engineer School of Application of the United States Army, from which he graduated in 1907. Since then he has had a wide, varied and notable engineering experience. He was in Cuba during the American occupation as assistant to the director of public works. He was occupied in the Philippines on the military survey of the Island of Luzon, part of the time being in charge of the work. Later he was located at Portland, Ore., in charge of the construction of the Dalles-Celilo canal around the Dalles of the Columbia river, and the roads in the Crater Lake National Park. He then was assigned to Panama and made electrical engineer of the Panama Canal and superintendent of the Gatun Locks. Here he was also in charge of engineering in the locks division and the hydrographic division. He had the unique experience of locking the first great ships through the Gatun Locks.

In 1918 he went to France as colonel in command of the 37th Engineers, which was the notable electrical and mechanical regiment whose reputation is widely known. In France he was deputy chief engineer of the First Army of the American Expeditionary Forces during the St. Mihiel, the Aisne-Marne and Argonne-Meuse campaigns, in charge of the mechanical and electrical work, water supply, general construction, army shops and engineers' supplies for the army throughout these notable campaigns. After the armistice, Colonel Dillon was made deputy to General McKinstry, who was the chief of the board of damages in allied countries, and as such he had charge of the plans for making the estimates for the American peace commissioners of personal and property damages suffered by the allies on account of the aggressions of the enemies in the war. Colonel Dillon brings a large fund of scientific training and engineering experience to his duties at the Massachusetts Institute of Technology, where he will make a specialty of instruction in the problems of electric railroads, including tramways and electrification of steam railroads and in the problems of power transmission.

For the Readjustment Period—What?

LIV.

Financing Foreign Trade

Commercial interests of the United States will be asked to unite and determine on a definite plan of action regarding trade with other countries at a conference of business men of the country, to be held in New York Oct. 16 and 17.

The conference, which will be held under the auspices of the American Manufacturers' Export Association, will discuss the export situation and also, it is expected, will devote considerable time to considering the lengths to which manufacturers are prepared to go in utilizing facilities for financing foreign trade provided by the Edge bill.

Among those interested in calling the conference are James A. Farrell of the United States Steel Corp., W. W. Nichols of Allis-Chalmers Mfg. Co., A. C. Bedford of the Standard Oil Co., E. M. Herr of the Westinghouse Electric Export Co., W. C. Durant of the General Motors Co., W. L. Saunders of the Ingersoll-Rand Co., F. A. Seiberling of the Goodyear Tire & Rubber Co., William H. Ingersoll of Robert H. Ingersoll & Brother, and Robert A. Shaw of the National Aniline & Chemical Co., Inc.

The widespread interest being taken in this effort to crystallize the views of business on foreign trade problems is regarded as a sign that American manufacturers and shippers, who have only recently entered the export field, are determined to make this international trade a permanent part of their business.

Factories which increased production during the war to meet abnormal demands are continuing to maintain their enlarged output because of orders from overseas. Not a few of the manufacturers who are operating on this basis declare that any great decline in the volume of the nation's foreign business is certain to bring depression and unemployment in its wake.

The accompanying reproduction of an announcement in the daily press calls attention to a matter of importance to manufacturers of electrical equipment. I hope it will have the consideration which it deserves.

C. A. TUPPER *President*
INTERNATIONAL TRADE PRESS, INC., CHICAGO

Financial News

$10,000,000 Power Deal Authorized.

Hydroelectric development in California was given a decided impetus by the Railroad Commission recently when it approved the purchase of the properties of the Northern California Power Co. by the Pacific Gas & Electric Co. Approval of this transaction by the Railroad Commission, in addition to making possible a merger of power properties that will prove of great benefit to the state, will prevent threatened litigation that promised to block for years needed hydroelectric development. Its immediate effect will be to make possible the development of the Pit river project, a gigantic power scheme, held in abeyance by the Pacific Gas & Electric Co. because of threatened trouble with the Northern California Co. over water rights.

The order by the Commission makes possible a transaction involving an amount approximating $10,000,000, the approval covering the purchase by the Pacific Gas & Electric Co. of 10,000 shares of the Northern California Power Co. stock at $34 a share and the assumption by the gas company of the power company's obligations totaling $6,213,526.74. The Pacific Gas & Electric Co. is willing to pay for the stock forthwith and has agreed to pay for the properties on or before Dec. 1, 1948, the sum of $3,400,000, in addition to assuming the Northern company's obligations.

Northern California Power Co. generates and distributes electric energy in portions of the counties of Shasta, Trinity, Tehama, Colusa, Glenn and Butte. It sells water in Redding and Willows, and manufactures and distributes gas in Redding, Red Bluff and Willows. The company's engineer estimates that to reproduce the properties at present day prices would cost $13,300,000. Its listed assets total $18,471,668.36.

As further evidence that the transaction is for the best interests of the Northern company's stockholders, the commission points out that from 1913 to 1918 the company paid no dividends but levied assessments totaling $1,400,000. Up to May 31, 1919, it was in arrears $225,029.80 in sinking fund payments, owned notes amounting to $249,250 and would have to meet, in February, 1920, maturing debentures aggregating $370,000. Taking into consideration the Pit river project, and the required expenditure of $6,000,000 for the first unit of this development, the commission says:

"An expenditure of from $6,500,000 to $7,000,000 must be made to keep Northern California Power Co. a solvent up-to-date public utility corporation and able to discharge its obligation to the public. There is no doubt that an entirely new financial program would have to be devised by the company to install even the first unit of the Pit river development."

Rochester Railway Issues Stock.

Rochester Railway & Light Co. has completed arrangements for the issuance of 6% cumulative preferred stock for $500,000, a portion of the proceeds to be used to increase the present service facilities of the company. The company has recently commenced the changing of the system used at the present time from direct to alternating current, it being held that the latter system is preferable for long distance transmission, with greater efficiency at a lower cost of production.

Hurley Machine Votes Capital Change

Stockholders of the Hurley Machine Co. at a special meeting held last week voted to change the capitalization of the company from 15,000 common shares of $100 par value to 200,000 shares of no par value. No change was made in the preferred stock issue, which is 5000 shares of $100 par value.

It also was voted to increase the directorate from five to nine members, the new directors elected being Edward F. Carey, president of the Haskell-Barker Car Co.; Joseph E. Otis, vice-president of the Central Trust Co. of Illinois; Silas Strawn of Winston, Strawn & Shaw, and Edward N. Hurley, Jr., president of the Hurley Supply Co.

The directors have also directed that the present outstanding 11,650 common shares be called for cancellation and exchange for the new common stock on the basis of seven shares of new stock for one share of old common. The exchange will be made with stockholders of record Oct. 15, who also will be offered the right to subscribe to 10,000 shares of new stock at $35 a share. The proceeds from the sale of stock will be used for plant extensions.

Brazilian Traction Note Issue.

An issue of $7,500,000 Brazilian Traction, Light & Power Co. three-year 6% secured gold notes is being offered at 92½ and interest to net about 7% by the Continental and Commercial Trust and Savings Bank and William A. Read & Co., Chicago. The notes are dated Nov. 1, 1919, and mature Nov. 1, 1922. The total authorized issue is $10,000,000. The company agreed to pay the United States normal income tax up to 2% if exemption is not claimed by the noteholder.

Public Service Notes Offer.

Halsey, Stuart & Co. are offering $2,500,000 Public Service Co. of Northern Illinois three-year 6% collateral notes, series C. due Sept. 1, 1922, at 98 and interest, yielding 6¾%. A part of the proceeds of this issue will be used to pay off the $1,500,000 two-year 6% notes of the company. The balance of the proceeds will reimburse the company for expenditures made, or to be made, for improvements and extensions. The notes were all sold within an hour after the books were opened. The syndicate underwriting was very largely oversubscribed.

Dividends.

Carolina Power & Light Co. has declared a quarterly dividend of 1½%, payable Nov. 1 to stockholders of record Cct. 15.

A quarterly dividend of 1¾% on preferred stock has been declared by the Fort Worth Power & Light Co., payable Nov. 1 to stockholders of record Oct. 21.

Babcock & Wilcox Co. has declared a quarterly dividend of 2%, payable Jan. 1 to stock of record Dec. 20.

Southern New England Telephone Co. has declared a quarterly dividend of 1¾%, payable Oct. 15 to stock of record Sept. 30.

A cash dividend of 75 cts. per share on preferred stock has been declared by the Puget Sound Traction, Light & Power Co., payable Oct. 15 to stock of record Oct. 2.

A dividend of 1¾% has been declared by the Public Service Co. of Northern Illinois, also a dividend of 1½% on preferred stock, both payable Nov. 1 to stock of record Oct. 15.

Chicago Pneumatic Tool Co. has declared a quarterly dividend of 1½%, payable Oct. 25 to stock of record Oct. 15.

Illinois Northern Utilities Co. has declared a dividend of $1.50 a share on preferred stock, payable Nov. 1 to stock of record Oct. 20.

Sullivan Machinery Co. has declared a quarterly dividend of 1½% with the usual extra dividend of 1%, both payable Oct. 15 to stockholders of record Oct. 1.

A quarterly dividend of 2% has been declared by the Kaministiquia Power Co., payable Nov. 15 to stock of record Oct. 3.

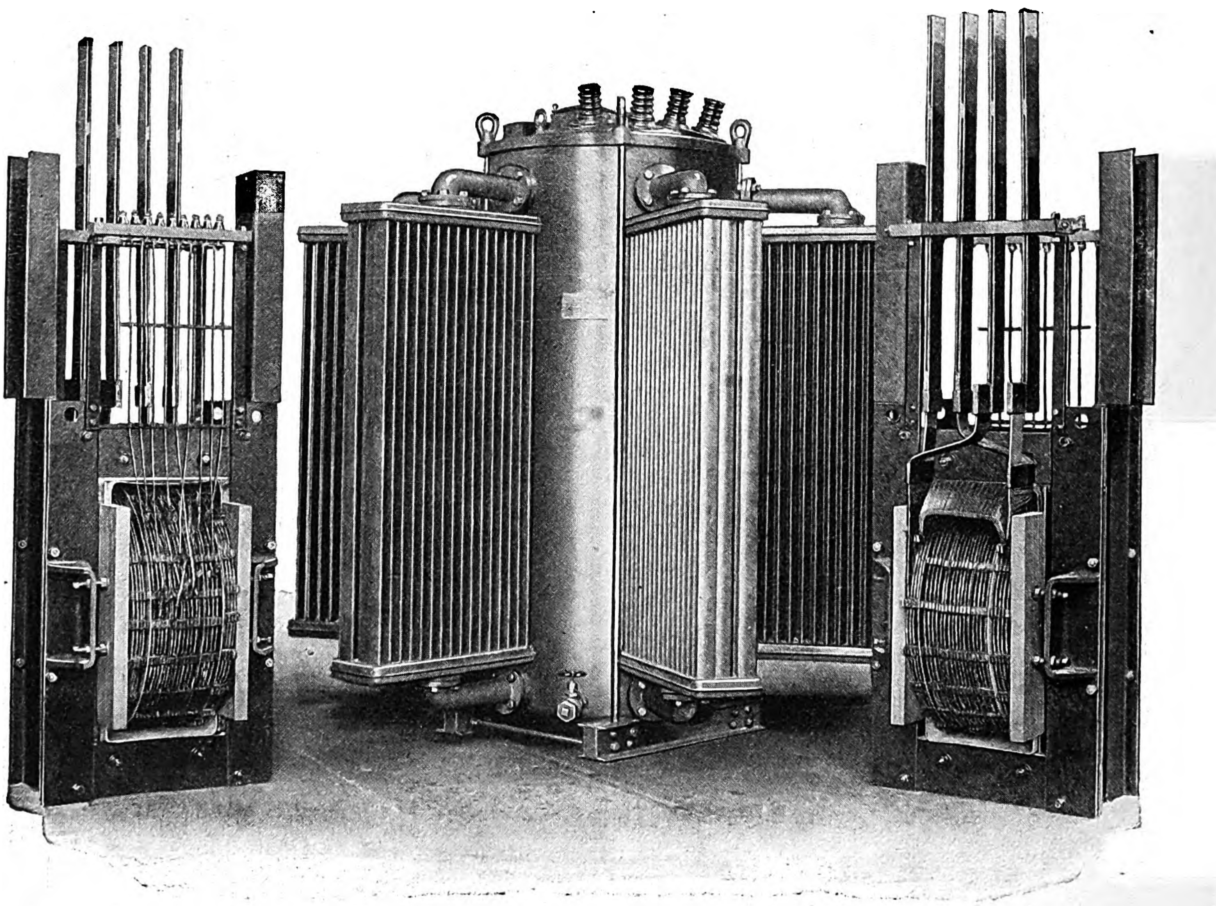
WEEKLY COMPARISON OF CLOSING-BID PRICES OF SECURITIES OF LEADING ELECTRICAL COMPANIES.

Quotations furnished by F. M. Zeiler & Co., Rookery Bldg., Chicago.

Public Utilities.	Div. rate. Per cent.	Bid Sept. 30.	Bid Oct. 7.
Adirondack Electric Power of Glens Falls, common	6	14	14
Adirondack Electric Power of Glens Falls, preferred	6	77	78
American Gas & Electric of New York, common	10+extra	118	127
American Gas & Electric of New York, preferred	6	40	40½
American Light & Traction of New York, common	..	215	220
American Light & Traction of New York, preferred	6	94	94
American Power & Light of New York, common	4	..	..
American Power & Light of New York, preferred	6	..	..
American Public Utilities of Grand Rapids	..	5	..
American Public Utilities of Grand Rapids, preferred	7	25	25
American Telephone & Telegraph of New York	..	99½	99½
American Water Works & Elec. of New York, common	..	5	4
American Water Works & Elec. of New York, particip.	7	10	20
American Water Works & Elec. of New York, first preferred	..	59	55½
Appalachian Power, common	..	4	4
Appalachian Power, preferred	7	21	25
Cities Service of New York, common	+extra	483	471
Cities Service of New York, preferred	6	77	76½
Commonwealth Edison of Chicago	8	107	108
Comm. Power, Railway & Light of Jackson, common	..	20	21½
Comm. Power, Railway & Light of Jackson, preferred	6	49	49
Federal Light & Traction of New York, common	..	7	10
Federal Light & Traction of New York, preferred	..	47	58
Illinois Northern Utilities of Dixon	6	75	75
Middle West Utilities of Chicago, common	..	30	29
Middle West Utilities of Chicago, preferred	..	50	50
Northern States Power of Chicago, common	..	65	65
Northern States Power of Chicago, preferred	ex.div.7	90	90
Pacific Gas & Electric of San Francisco, common	..	68	66
Pacific Gas & Electric of San Francisco, preferred	6	88	89⅝
Public Service of Northern Illinois, Chicago, common	7	85	85
Public Service of Northern Illinois, Chicago, preferred	6	87	91
Republic Railway & Light of Youngstown, common	4	11	9
Republic Railway & Light of Youngstown, preferred	6	47	45
Standard Gas & Electric of Chicago, common	..	31	31
Standard Gas & Electric of Chicago, preferred	8	41	40
Tennessee Railway, Light & Power of Chattanooga, common	..	5	4
Tennessee Railway, Light & Power of Chattanooga, preferred	6	13	10
United Light & Railways of Grand Rapids, common	4	43	44
United Light & Railways of Grand Rapids, preferred	6	70	70
Western Power of San Francisco, common	..	24	23
Western Union Telegraph of New York	extra	83	83
Industries.			
Electric Storage of Philadelphia, common	4	98	119½
General Electric of Schenectady	8	164	165
Westinghouse Electric & Mfg. of Pittsburgh, common	7	54¾	54¾

Electrical Review

. 75. No. 16. CHICAGO, OCTOBER 18, 1919 Three Dollars a Year



Electrical Review

WITH WHICH IS CONSOLIDATED WESTERN ELECTRICIAN AND ELECTROCRAFT

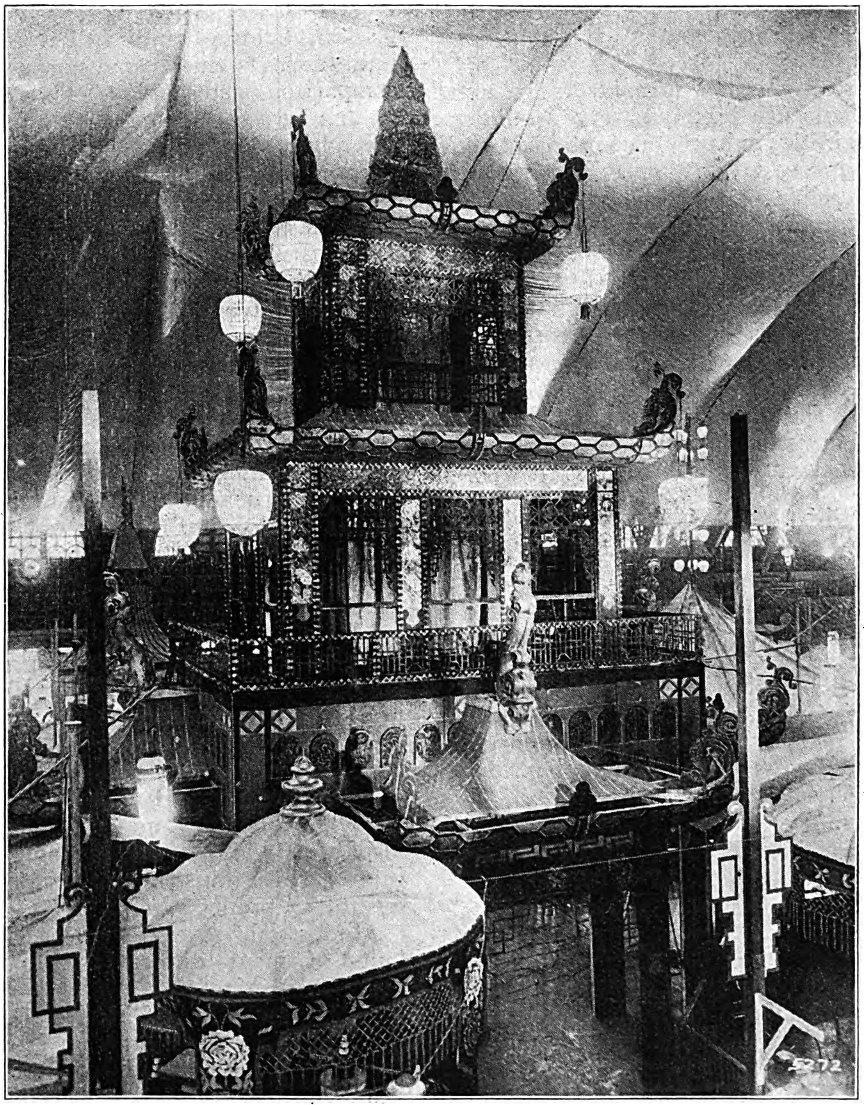
VOL. 75—No. 16. CHICAGO, SATURDAY, OCTOBER 18, 1919. PAGE 639.

Chicago Electrical Show Proves a Noteworthy Success

Elaborate Decorative and Lighting Effects Are Features of Show—All Branches of Industry Make Representative Exhibit of Electrical Products

AFTER being without an electrical show for eight years Chicago came back into its own again with a show that eclipses by far all its former attempts at making a display of electrical products.

The most striking features of the show, which opened at the Coliseum Oct. 11 and which will continue until Oct. 25, are the lighting and decorative effects. They are conceded to be the most elaborate that have ever been used in connection with any electrical show. The whole scheme of decoration is typically Chinese in effect and centers about a pagoda, 60 feet high, which graces the exhibition. This pagoda is ornamented with 18,000 "Novagem" jewels which were originally a part of the famous "Tower of Jewels" at the Panama-Pacific Exposition at San Francisco, Calif., in 1915. The pagoda is brilliantly illuminated with searchlights and forms a beautiful centerpiece around which the exposition booths are grouped. The decorative effects of the latter are secured by means of smaller Chinese pagodas, bamboo-thatched roofs, lanterns, sunshades, paintings and the like. Gold and dull red are the predominating colors in the scheme of decorations.



Chinese Pagoda Which Forms Centerpiece at Chicago Electrical Show.

The lighting effects are secured by means of searchlights and floodlights together with numberless Chinese lanterns, the latter serving to subdue the high intensity of the units and in combination with the dull colorings make the exhibition very pleasing to the eye. The lighting effects and decorative scheme were designed by W. D'A. Ryan, director of the Illuminating Engineering Laboratory of the General Electric Co., who also designed those at the Panama-Pacific Exposition.

The immensity and completeness of the exhibition can perhaps be better realized when it is stated that the Coliseum, in reality

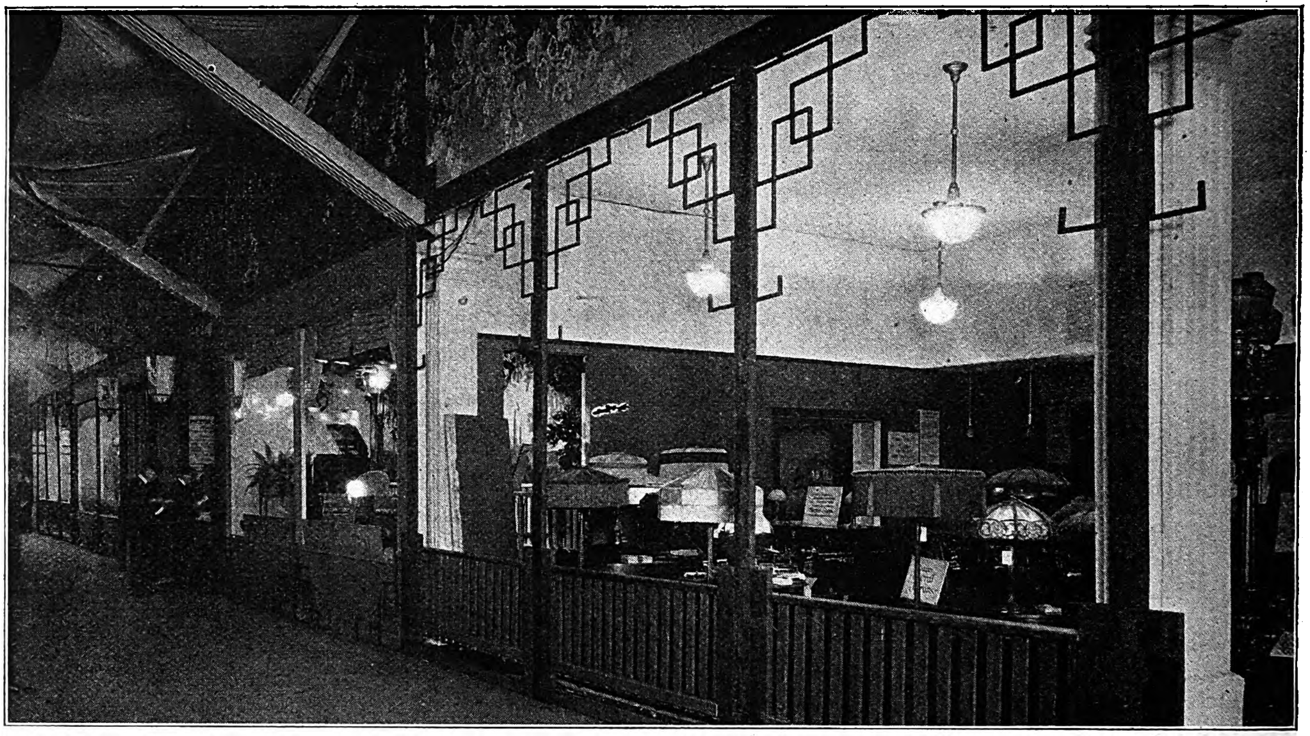


Exhibit of Residential Lighting Units and Show Window Lighting at Chicago Electrical Show.

a very large exposition building, appears rather small to the casual observer.

Over 100 electrical manufacturers are represented at the show, and their varied exhibits serve to indicate the progress made in the industry since the last show was held in Chicago eight years ago. This progress is particularly noticeable when one stops to consider that at that time Mazda C lamps, multiplex telegraphy and wireless telephony were unknown, and such devices as enclosed switches, electric furnaces and heating apparatus, industrial reflectors, electrotherapeutic apparatus and electric cooking utensils were in the early stages of development.

To do full justice to all the exhibits is not possible with limited space. The following notes are the result of disinterested observation of what seemed to be the most striking developments exhibited.

Wireless Telephony and Multiplex Telegraphy.

The most recent development of the electrical art to be exhibited at the show is that of wireless telephony. The U. S. Signal Corps has installed a station and conversations are carried on with a station in one of the downtown office buildings. Phonograph music is transmitted by wireless telephony from the latter station to the Coliseum and there amplified so those in attendance at the show may hear. Conversation is also transmitted to stations at Ludington, Mich., and Milwaukee, Wis.

Multiplex telegraphy, by means of which four messages may be sent in each direction over a single wire at the same time, is shown by two interconnected machines exhibited by the Western Electric Co.

Lighting Equipment.

The many exhibits of manufacturers of lighting equipment augment the lighting effects of the show proper. Prominent among these is an exhibit showing a comparison between modern and antiquated method of industrial lighting. Two shops identical as to machinery, benches, etc., have been equipped, one with modern lighting units and the other with old-style units, such as cluster and unshaded drop lights. The comparison is so striking, as one walks from one room to another, that it effectively convinces any one of the advantages of good industrial lighting. In connection with this display, which is made by Commonwealth Edison Co., is a clever scheme for showing the illuminating value of a dozen or so different makes of industrial lighting units. Large plats showing the light distribution curves for all of the units are placed directly under the corresponding units themselves. When one of the latter is in operation, one can tell not only from the unit in question but from its distribution curve what the characteristics of the particular reflector or lighting unit are. Good show-window lighting is illustrated by an actual window display alternately illuminated with old-style equipment and with modern reflectors; also the use of daylight Mazda lamps for bringing out color values is illustrated by a display alternately illuminated by Mazda "C" units and by daylight Mazda lamps.

The evolution of the modern lamp is shown in an exhibit of the National Lamp Works of General Electric Co., types of lamps from prehistoric times up to the new "White Mazda" being displayed. In connection with this exhibit moving pictures showed the steps in the manufacture of "White Mazda" lamps and souvenirs made of "White Mazda" glass are manufactured and given away.

Westinghouse Lamp Co. showed the method of inspection and packing of lamps and by means of colored slides illustrated other steps in the manufacture of its products.

Industrial, store, office and residential lighting units of many different designs are exhibited by various manufacturers.

A large number of householders are attending the show and they find attraction in the many exhibits of electrical washing and ironing machines, vacuum cleaners, ranges and other electrical heating and cooking utensils. Among the electric baking ovens being

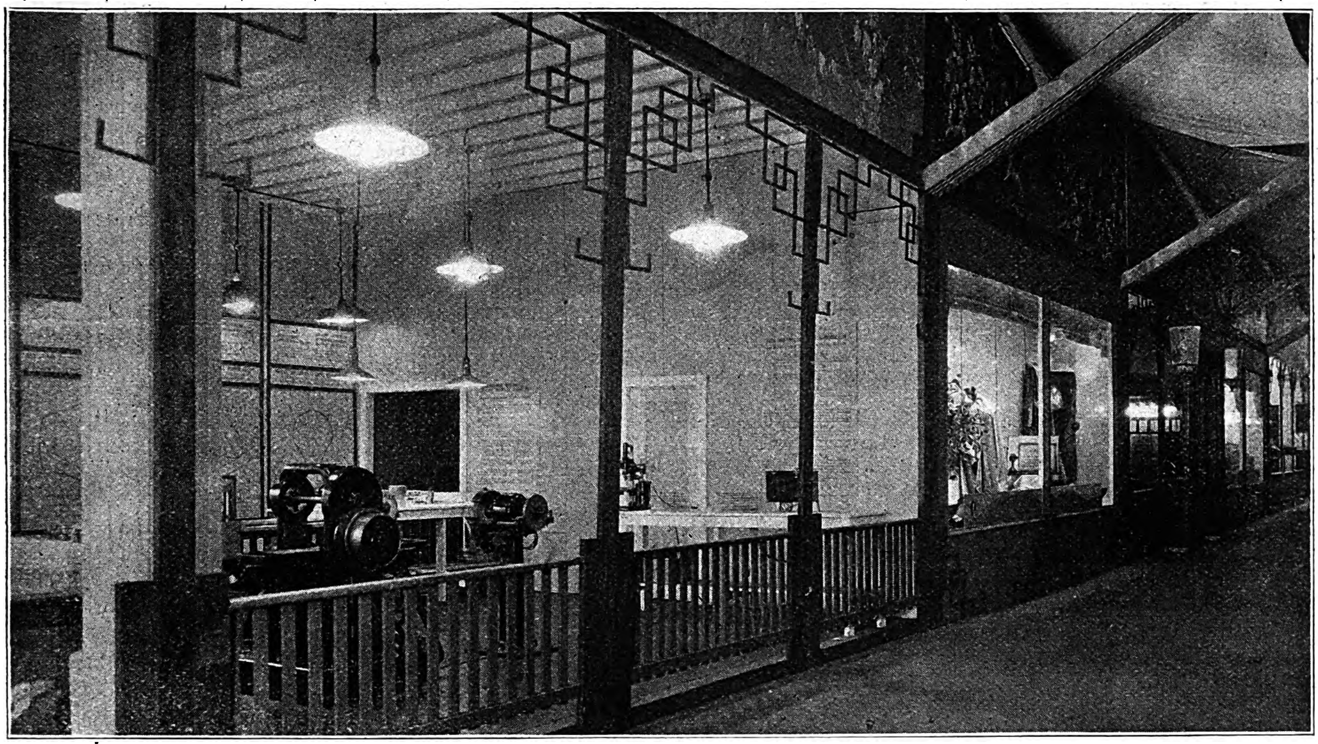


Exhibit of Modern Industrial Lighting Units and Show Window Lighting at Chicago Electrical Show.

shown is an automatically operated oven made by the Westinghouse Electric & Manufacturing Co. A combination kitchen sink and electric dishwasher is exhibited by the Dunn Manufacturing Co., and the Edison Electric Appliance Co. is showing its new automatic electric range.

A constant-current welding machine with 200 amperes capacity forms part of the General Electric Co. exhibit, which also includes industrial heating devices, an acid-resisting insulated motor, wiring devices, etc.

Electric furnaces and samples of their products are exhibited by the Booth-Hall Co. and the Detroit Electric Furnace Co. One type of furnace is built upon the rocker principle while the other is of the revolving type.

The part that asbestos plays in the electrical industry is shown by the H. W. Johns-Manville Co. exhibit, which also includes enclosed switches, fuses, cutout bases, etc.

An exhibit by the Chicago Telephone Co. contains equipment to illustrate the procedure and operation of completing a telephone call. Sections of "A" and "B" boards are used to demonstrate the method of putting through a call in the exchanges.

The electrical contractors of Chicago are represented at the show with an exhibit conducted by the Electrical Contractors' Association of Chicago. Pictures of various installations form the background of the booth, and two electrically lighted miniature houses make an interesting exhibit that draws many prospective house-wiring customers.

Attendance at the show was stimulated by the Commonwealth Edison Co., which gave coupons with its electric light bills, entitling the holders to half-rate admission. The first week the attendance was larger than was expected and demonstrators are kept busy afternoon and evening showing the many time and labor-saving electrical devices at the show.

List of Exhibitors and Their Exhibits

Altofer Bros. Co., Peoria, Ill.—Electric washing machines.

Ackerman-Johnson Co., Chicago—Screw expansion bolts.

C. F. Adams Co., Chicago—Electric washing machines.

Apex Appliance Co., Chicago—Electric washing machines.

American Ironing Machine Co., Chicago—Electric ironing machines.

American Steel & Wire Co., Chicago—Steel and wire.

Americolite Co., New York, N. Y.—Electric lighting fixtures.

American Enameled Magnet Wire Co., Muskegon, Mich.—Magnet wire.

Anderson Electric Specialty Co., Chicago—Portable automobile headlights and specialties.

Amalgamated Machinery Corporation, Chicago—Automatic heaters.

M. B. Austin & Co., Chicago—Electrical jobbing specialties.

Art Metal Manufacturing Co., Chicago—Industrial and residential lighting fixtures.

Bake-Rite Corp., Chicago—Electric baking ovens.

Benjamin Electric Manufacturing Co., Chicago—Industrial reflectors and wiring specialties.

Bennage Co.—Electric glue pots, soldering irons, etc.

Bleadon-Dunn Co., Chicago—Electric therapeutic apparatus.

Blue Bird Appliance Co., St. Louis, Mo.—Electric washing machines.

Booth-Hall Co., Chicago—Electric furnaces.

Frank S. Betz Co., Hammond, Ind.—Electric therapeutic devices.

Central Electric Co., Chicago—Industrial reflectors, electrical supplies and auto accessories.

Central Station Institute, Chicago—Students' electrical courses.

Chicago Reedware Manufacturing Co., Chicago—Electric lamps.

Chicago Telephone Co., Chicago—General exhibit showing operation of telephone service.

Chicago Washing Machine Co., Chicago—Electric washing machines.

Clements Manufacturing Co., Chicago—"Cadillac" electric vacuum cleaners.

Commonwealth Edison Co., Chicago—General exhibit of central-station service; industrial, store, office and residential lighting, household appliances, etc.

Coyne Trade and Engineering Schools—Electrical engineering schools.

Commercial Lighting Co., Chicago—Electric lighting fixtures.

Contra-Pole Electric Co., Brooklyn, N. Y.—Electrotherapeutic apparatus.

Crane Co., Chicago—Electric power-plant supplies.

Crouse-Hinds Co., Syracuse, N. Y.—Electric switches and safety devices.

Cutler-Hammer Manufacturing Co., Milwaukee, Wis.—Electric switches, lifting magnets, wiring and heating devices.

George Cutter Co., South Bend, Ind.—Industrial and street-lighting specialties, switches and panelboards.

Frank B. Cook Co., Chicago—Electric soldering irons and specialties.

A. J. Deer Manufacturing Co.—Electric grinders and choppers.

Detroit Electric Furnace Co., Detroit, Mich.—Electric furnaces.

Delta-Star Electric Co., Chicago—High-tension electric distribution specialties.

De Mooy Electric Co.—Electrotherapeutic apparatus.

Dunn Manufacturing Co., Chicago—Electric dishwashing machines.

Duparquet-Huot & Moneusse Co., Chicago—Electric ranges and hotel equipment.

Eden Appliance Co., Chicago—Electric laundry machines and vacuum cleaners.

Edison Electric Appliance Co., Chicago—Electric heating appliances.

Edison Storage Battery Co., Orange, N. J.—Storage batteries and accessories.

Electric Appliance Co., Chicago—Electric jobbing supplies.

Electrical Record, New York, N. Y.—Electrical publications.

Electrical Journal, Pittsburgh, Pa.—Electrical publications.

Electrical Review, Chicago—Electrical publications.

Endless-graph Manufacturing Co., Chicago—Combination electric lamp and phonograph.

Eureka Vacuum Cleaner Co., Detroit, Mich.—Electric vacuum cleaners.

Estate Stove Co., Hamilton, Ohio—Electric ranges.

Electric Club of Chicago—General exhibit.

Electro-Magnetic Tool Co., Chicago—Electric hammers and drills.

Electric Storage Battery Co., Philadelphia, Pa.—Storage batteries and accessories.

Electro Steam Radiator Co., Chicago—Electric steam radiators.

Edison Lamp Works of General Electric Co., Harrison, N. J.—Mazda lamps.

Electric Service Construction Co., Chicago—Jobbers and contractors.

Electric Vacuum Cleaner Co., Cleveland, Ohio—Electric vacuum cleaners.

Electrical Contractors Association, Chicago—General exhibit of installations.

Electrical Testing Laboratories, New York, N. Y.—Exhibit of tested materials.

Elwell-Parker Electric Co., Cleveland, Ohio—Electric industrial trucks.

French Battery & Carbon Co., Madison, Wis.—Dry battery specialties, flashlights, etc.

Federal Sign System (Electric), Chicago—Electric signs, washing machines, vacuum cleaners, fuses, etc.

General Electric Co., Schenectady, N. Y.—Industrial heating devices, motors, street-lighting equipment, wiring devices, etc.

Grether Fire Equipment Co., Dayton, Ohio—Reflectors and flood-lighting equipment.

Habirshaw Electric Cable Co., New York—Electric wires and cables.

Hamilton-Beach Manufacturing Co., Racine, Wis.—Sewing machine motors, vibrators, vacuum cleaners, etc.

Handel Co., Chicago—Electric Lamps.

Hoover Suction Sweeper Co., North Canton, Ohio—Electric suction sweepers.

Hurley Machine Co., Chicago—Electric washing machines, ironing machines and vacuum cleaners.

Hot-Flo Faucet Corp., New York, N. Y.—Electric water-heating devices.

Hotwat Distributing Co., Chicago—Electric water-heating devices.

Ilg Electric Ventilating Co., Chicago—Electric ventilators.

Illinois Electric Co., Chicago—Electric jobbing supplies.

Inland Electric Co., Chicago—Electric jobbing supplies.

Judd Laundry Machinery Co., Chicago—Electric washing and ironing machines.

H. W. Johns-Manville Co., New York—Fuses, asbestos products, fire extinguishers, molded insulation, fibre conduit, etc.

Kellrohe Co., Chicago—Electric ironing machines.

Keeps-Fresh Electric Bakeries, Chicago—Electric ovens.

K. W. Battery Co., Chicago—Electrical storage batteries.

King Manufacturing Co., St. Joseph, Mo.—Electric street-lighting equipment.

Landers, Frary & Clark, New Britain, Conn.—Heating and cooking appliances.

Lindstrom, Smith Co., Chicago—Electric vibrators, heating devices, etc.

Lu-mi-nus Sign Letters Co., Chicago—Electric signs.

Manhattan Electric Supply Co., Chicago—Electric jobbing supplies.

Manufacturers Distributing Co., St. Louis.—Electric washing machines.

Majestic Electric Development Co., Philadelphia—Electric heating devices.

McClellan Refrigerating Co., Chicago—Electric refrigerating machinery.

Meyer, W. F.—Electric tools.

McGraw-Hill Co., New York—Electrical publications.

Edward Miller & Co., Meriden, Conn.—Electric lamps.

National Lamp Works of General Electric Co., Cleveland, Ohio—Incandescent lamps.

National X-Ray Reflector Co., Chicago—Reflectors, floodlights, etc.

New Home Sewing Machines Co.—Electric sewing machines.

Irwin Manufacturing Co.—Electric washing machines for metal parts.

Henry Newgard Co., Chicago—Electric contractor.

1900 Washer Co., Binghamton, N. Y.—Electric washing machines.

Oneida Truck Co.—Electric trucks.

Pathe Freres Phonograph Co.—Electric phonographs.

Pittsburgh Reflector & Illuminating Co., Pittsburgh, Pa.—Industrial lighting specialties.

Pneuvac Co., Worcester, Mass.—Electric vacuum cleaners.

Public Service Co. of Northern Illinois—Central-station service.

Regina Co., New York—Electric vacuum cleaners.

Reynolds Electric Co., Chicago—Electric sign flashers.

Roth Bros., Chicago—Electric motors.

Rutenber Electric Co., Marion, Ind.—Electric ranges and heating devices.

Remmert Co., Belleville, Ill.—Electric washing machines.

Shelton Electric Co., Philadelphia—Electric vibrators and specialties.

Simplex Electric Heating Co., Cambridge, Mass.—Electric heating and cooking devices.

Signal Corps, U. S. Army—Electric wireless signalling.

Standard Stamping Co., Huntington, W. Va.—Electric washing machines.

Surf Manufacturing Co., Milwaukee, Wis.—Electric washing machines.

Thomson Electric Welding Co., Lynn, Mass.—Electric welding machinery.

Thordarson Electric Manufacturing Co., Chicago—Electric X-ray apparatus, transformers, etc.

Torrington Co., Torrington, Conn.—Electric vacuum cleaners.

United Electric Co., Canton, Ohio—Electric vacuum cleaners.

Universal Electric Washer Co.—Electric washing machines.

Universal Products Co.—Farm-lighting plant.

J. W. Vaughn—Electric meat cutters.

Walker Vehicle Co., Chicago—Electric trucks.

Weeks Manufacturing Co.—Electric sterilizers.

Western Electric Co., Chicago—Electric cooking, heating and cleaning devices, sewing machines, etc.; printing telegraph, wireless telephone.

Wadsworth Electric Manufacturing Co., Covington, Ky.—Switches and wiring devices.

Westinghouse Electric & Manufacturing Co., East Pittsburgh, Pa.—Electric heaters, motors, household appliances, etc.

Yankee System of Baking, Chicago—Electric ovens.

Central-Station Rates in Theory and Practice

Fifteenth Article—Defects of the Straight Meter Rate—Why Large Consumers Deserve Lower Rates — Various Forms of Step Meter Rates — Detailed Study of the Step Meter Rate

By H. E. EISENMENGER

This is the fifteenth article of this series, which began in the issue of July 12. The first seven articles, forming Part I, treated of the cost of electric service. Part II included six articles on the policy to be followed in selecting a rate system. Part III begun last week will consist of six articles on the various rate systems in use. Parts IV to VI will discuss rate analysis, accuracy of rates and rate regulation by commissions. The articles will continue weekly until the close of this volume, Dec. 27.

PART III—SYSTEMS OF CHARGING—Continued.

II. The Various Types of Rates—(Continued).

B. Rates Based on Energy Consumption Only.

2. *Application of Lower Average Kilowatt-Hour Charges to Larger Energy Consumers.*

a. Reasons for the Desirability of a Graduation of the Kilowatt-Hour Charges.

SECTION 114. The defect of the straight meter rate—apart from the defects which it shares with all other rates based on the energy consumption only—is that it makes the large consumer pay the same unit price as the small one. The adequate prices per kilowatt-hour under a pure meter rate are far from being the same for all consumers. They become steadily lower as the energy consumption of the customer becomes larger and larger. There are a number of reasons for this which will be explained in the following.[1]

115. Wherever business transactions are made, it is an established principle that the wholesale buyer gets lower prices than the small consumer. Very few exceptions can be found from this sound business principle. As far as the electricity supply business is concerned, it is clear (from what has been said in Part I about the cost of electric service) that large consumers cause smaller unit cost and inasmuch as the cost is at least one of the factors that make up the price, we are justified in expecting to find lower unit prices for larger consumers in the electricity supply business.

The "customer cost" which is the same for all customers, as we have seen, makes the average cost per kilowatt-hour higher if a small consumer is being served than if the consumer is a large one. These differences in cost can be very considerable. Let us assume, for instance, that the customer cost to the central station be 60 cents per customer per month and that all the rest of the total cost to the central station (demand cost and energy cost together) be 3 cents per kilowatt-hour.[2] These values are in no way extremes and they can be said to be near average conditions. (The figures of the different central stations vary within wide limits.)

Now with these assumptions we can figure out the following table for the total average cost of customers with various energy consumptions:

Monthly Energy Consumption in kw-hr.	Average Cost to the Central Station in cents per kw-hr.
5	$\frac{60 + (3 \times 5)}{5} = 15$ cents per kw-hr.
10	$\frac{60 + (3 \times 10)}{10} = 9$ cents per kw-hr.
20	$\frac{60 + (3 \times 20)}{20} = 6$ cents per kw-hr.
100	$\frac{60 + (3 \times 100)}{100} = 3.6$ cents per kw-hr
1000	$\frac{60 + (3 \times 1000)}{1000} = 3.06$ cents per kw-hr.
10000	$\frac{60 + (3 \times 10000)}{10000} = 3.006$ cents per kw-hr.

We see from this that the average cost per kilowatt-hour falls, first rapidly, with increasing energy consumption, and then more slowly, until for very large energy consumptions it becomes practically constant and converges towards the limit of 3 cents per kilowatt-hour.

Another reason why the average cost of the kilowatt-hour becomes lower as the energy consumption of the consumer increases is that the large consumer generally has a better load-factor, or a better diversity-factor, or both. A consumer, for instance, who is using only 10 to 20 kw-hr. per month is generally a residential customer or a small store owner, and this

[1] Graphical methods convey the best and most accurate conception of these several reasons and their effects. Drawings have been termed "the engineer's language" and it has been the author's experience that many commercial men get shy when it comes to representation of facts by curves. According to the leading principle of these articles to make their contents accessible as far as this can be done, to those who do not take kindly to mathematics and graphical representation, an attempt will be made in the following to explain purely by words the question why and how the unit price varies with the amount of the energy consumed, but the same question is treated graphically and much more thoroughly in Insert X. Readers who entertain no objections against curves are strongly advised to substitute Insert X for Sections 115-117. Later in the articles graphical and elementary mathematical methods will be found indispensable.

[2] From what has been explained before (Part I) it is not quite logical to divide the demand cost by the number of kilowatt-hours. The result of the operation is an average value which applies only under the given load-factor conditions. But as long as we deal with rates which do not take any cognizance of the maximum demand of the customer, we must of necessity be satisfied with this rough average, inaccurate as it may be. This is a disadvantage intrinsic to all rates which are based on the energy consumption only.

type of user is, as a rule, a short-hour user. If the kilowatt-hour consumption is a little larger, that is if it approaches the first 50 or 100 kw-hr. per month, we will in some cases still have a residential customer or a store owner, but a larger one. People living in larger residences are more liable to use current-consuming appliances other than lamps, such as flatirons, toasters, heating and cooking apparatus, and the like. Now these appliances generally have a much greater capacity than the ordinary lamp; a flatiron, for instance, is using 300 to 500 watts, or roughly as much as ten lamps. These appliances are largely used during the daylight hours and consequently they bring about an improvement of the customer's load-factor and with that of the central station's load-factor. Medium-sized stores are liable to use all-day lights in the back part of the establishment, also ceiling fans, desk fans, etc., which has a tendency to improve the customer's load-factor. If we now proceed to customers using several hundreds or thousands of kilowatt-hours per month, this increase in energy consumption is due generally not only to an increase in the size of the installation but also to the increase in the number of hours of daily use. If we go into a hotel, or a restaurant, or a large store, a theater, an office building, etc., we will always find a number of lamps burning in daytime, not a few of them may be even burning 24 hours a day; for instance, in the lobby and other portions of a hotel. Such large establishments will frequently also have some motors connected to the lines, for elevators, ventilators, refrigerators, and the like. All this means that large lighting consumers will have a better effect on the central-station load-factor than small ones. The same applies to power consumers, only for different reasons. A little workshop with not more than one or two machines consuming electric power will at some times during the day run at full load and at others at no load. The variation between the maximum and the minimum load will be 100%. If we have 100 motor-driven machines there will be a certain diversity between their power demands, just as we have seen a diversity between the power demands of different consumers. Every single one of the hundred machines may vary between full load and no load, but the more machines we have, the larger is the probability that at the time when one machine is running at full load another will have very little or no load so that the peaks and valleys of the various machine's load compensate each other and the load curve of the total establishment will be flattened out and become the smoother the larger the number of the power-consuming machines is; that is, in general the larger the energy consumption of the consumer is.

116. The above refers to the cost. If we were to add the same percentage for profit in every case (cost-of-service principle, see Part II) obviously the same relations would subsist between the prices charged to various customers as have been found between the cost of these customers. The value-of-service principle requires, however (see Part II), different percentages of profit for different customers and we shall now investigate in what manner the relations between prices for various sizes of customers will differ from the relations between costs of the same customers.

It has been shown in the discussion of the value-of-service principle (Sections 97-99) that the percentage of profit from the largest and from the smallest customers should be smaller than that from the medium-sized ones. This furnishes another reason why the consumers with a large energy consumption should receive lower unit prices per kilowatt-hour. But at the same time the value-of-service principle seems to point towards giving lower prices to the small consumers also and this in opposition to what we have found so far about what the cost of the small customer is. The tendency of the value-of-service principle to lower the price per kilowatt-hour to the smallest consumers doubtless exists, but in case of the straight meter rate it is more than offset by the influence of the fixed customer cost which has just been explained. We see, for instance, in the table of Section 115 that the change of the average cost per kilowatt-hour which is due to the influence of the customer cost is much more marked in the region of the smallest consumers than in that of the medium and large consumers. It vanishes the more the larger the consumers become. If we assume, for the sake of an example, the typical small consumer to be one of 20 kw-hr. and the typical medium-sized consumer to be one of 200 kw-hr. monthly consumption, the average cost per kilowatt-hour of the small customer would be 6 cents per kw-hr. and that of the medium one 3.3 cents per kw-hr. The cost to the central station of the typical small consumer is then nearly twice as high, if referred to the kilowatt-hour, as that of the medium-sized one and even if we add a very much lower percentage of profit for the small consumer in obedience to the value-of-service principle, the price charged to him per kilowatt-hour will still be higher than for the medium-sized consumer.

117. Summarizing, we can say: Where the customers are classified by their kilowatt-hour consumption only, the unit kilowatt-hour prices should decrease with the size of the consumer for the following three reasons:

1. The fixed customer cost is distributed over a larger number of kilowatt-hours.
2. The load-factor is liable to be better for large energy consumers than for small ones.
3. The percentage of profit is to be reduced for both the largest and the smallest consumers according to the value-of-service principle. This works towards further lowering of the prices of very large consumers. As regards the smallest consumers this effect is more than offset by item 1.

Several attempts have been made to follow this principle in the meter rates, that is to correct the straight meter rate in such a manner that the larger energy consumer gets lower average prices per kilowatt-hour. These methods consist either of a restriction of a given straight meter rate to certain classes or sizes of customers or of a modification of the meter rate which results in the so-called *sliding-scale rate* or of the addition of an explicit customer charge. The term "sliding-scale rate" means meter rates which specify decreasing charges per kilowatt-hour as the energy consumption of the customer increases.

These methods will be discussed hereinafter.

b. The Methods for Applying Lower Average Kilowatt-hour Prices for Larger Energy Consumers.

1. Limited Application of the Straight Meter Rate.

118. Those central stations as are using a straight meter rate at all restrict it to certain classes of consumers, at least certainly all the large and medium-sized central stations. Some central stations have restricted the straight meter rate to small customers only, chiefly residential customers or "general lighting" customers. Others have several straight meter rate schedules, those with higher charges applying to such classes as are liable to consist of small energy users only, such as residence lighting, whereas the lower charges apply to such uses where the amount of energy consumed is greater or the load-factor is better, or both.[3]

2. The Step Meter Rate.

119. Another one of these methods is given by the step meter rate. The range of kilowatt-hours, beginning from zero, is divided into a certain number of "steps" and the unit price charged per kilowatt-hour depends upon the "step" which the customer's energy consumption has reached in that respective month. The higher the step which has been reached, the lower is the charge made per kilowatt-hour. In contradistinction to the "block rate" to be discussed hereafter, all kilowatt-hours consumed by a certain customer in a certain month are charged at the same price.[4]

A step meter rate can also be expressed in the form of a straight meter rate with "quantity discounts," that is, discounts which increase as the quantity consumed increases.[5]. The quantity discounts need not be given according to the number of kilowatt-hours. They can also depend on the amount of the bill.[6] In case of pure meter rates this is only another form of stating the same thing, but we will later see some of the rates where it does make a difference whether we apply the quantity discounts according to the number of kilowatt-hours or to the amount of the bill (see Section 168).

120. The plain step meter rate has a serious drawback and that is the possibility of a reduction of the bill by an increase of the consumption.[7] The man who is careful about his bill and understands the rate may under certain circumstances reduce his bill by wisely wasting energy shortly before the meter reader comes around. He can thus not only make the company furnish gratuitously the wasted energy, but he can reduce the company's revenue from him besides.[8]

This sudden reduction in the income of the company from the consumer is smaller and less important if the difference of the prices per kilowatt-hour between neighboring steps is smaller. If, therefore, we wish to design a schedule with a given unit price in the first step (maximum price) and another given unit price in the last step (minimum price) it follows that the difference between these two prices should be split up and divided between a large number of intermediate steps if the effect of the above-mentioned undesirable feature shall be kept in narrow limits. We find for this reason that step rates in practice frequently have a large number of steps.[9]

Another method for getting around the drawback mentioned is to make a statement in the step-rate schedule to the effect that the total charge is never to be greater than what would be due (at the next lower rate, that is at the next higher step) for a greater consumption.[10]

This may also change the form in which the step rate is expressed, inasmuch as the upper end of a step must no longer coincide with the beginning of the next higher step (or remain within 1 kw-hr. below it). The whole range of energy consumption within which the charge is constant is then exempted from the steps, or counted as separate steps.[11]

121. A step meter rate with this stipulation can to a certain degree also be expressed as a system of optional straight meter rates, each one involving a

[3] For example, Reading, Pa., charges 10 cents per kw-hr. for residence lighting and 3 cents per kw-hr. for cooking and heating. This is also based on the "value of service" principle (see Part II.) The Toledo rate discussed before (Section 99) that is, a straight meter rate varying with the guaranteed minimum in such a manner that the higher the guarantee the lower the kilowatt-hour charge, belongs also in this class.

[4] The example of the General Lighting schedule at Allentown, Pa., will illustrate this rate. Under this schedule the charge per kilowatt-hour is as follows:
10 cents, if the customer's monthly energy consumption is 100 kw-hr. or less.
9 cents, if the customer's monthly energy consumption is between 101 and 200 kw-hr.
8 cents, if the customer's monthly energy consumption is between 201 and 400 kw-hr.
7 cents, if the customer's monthly energy consumption is between 401 and 800 kw-hr.
6 cents, if the customer's monthly energy consumption is 801 kw-hr. and over.

[5] For instance, the Retail Power rate in Birmingham, Ala., is a straight-line meter rate of 7 cents per kw-hr. with the following quantity discounts applying on the total bill:
10% if the energy consumption is 450 kw-hr. or less.
15% if the energy consumption is more than 450 kw-hr.
This means that the rate is 6.3 cents per kw-hr. if 450 kw-hr. or less are consumed and 5.95 cents per kw-hr. if more than 450 kw-hr. are consumed.

In the General Lighting rate of Mobile, Ala., which is a step meter rate, the prompt-payment discount is stepped off according to the energy consumption. The gross rates are:
10 cents per kw-hr. up to 50 kw-hr.
9 cents per kw-hr. from 51 to 150 kw-hr.
8 cents per kw-hr. from 151 to 300 kw-hr.
7 cents per kw-hr. from 301 to 500 kw-hr.
6.5 cents per kw-hr. over 500 kw-hr.
The prompt-payment discount is 3 cents per kw-hr. if the consumption is 1 to 50 kw-hr. and 2 cents per kw-hr. if the consumption is over 50 kw-hr.

The net amount per kilowatt-hour for the first step is therefore $10 - 3 = 7$ cents, and for the second step $9 - 2 = 7$ cents. The prompt-payment discount is therefore in this case graded in such a way as to entirely wipe out the difference between the first and the second step.

[6] General Lighting rate of Jacksonville, Fla. The following discounts are given on a straight meter rate of 7 cents per kw-hr.:

10% if the monthly bill is at least \$50, 15% if the monthly bill is at least \$100, 20% if the monthly bill is at least \$150; 25% if the monthly bill is at least \$200; 40% if the monthly bill is at least \$300.

This is, of course, the same as if we were to say: The rate is a step rate charging (net)
7 cents per kw-hr. for 1 to 5000/7 or 1 to 714 kw-hr.
6.3 cents per kw-hr. for 715 to 10 000/7 or 715 to 1428 kw-hr.
5.95 cents per kw-hr. for 1429 to 15,000/7 or 1429 to 2142 kw-hr.
etc.

[7] A customer, for instance with a consumption of 200 kw-hr., in the above Allentown schedule, will have to pay $200 \times 9 = 1800$ cents or \$18. If now he increases his energy consumption by one kilowatt-hour, that is to 201 kw-hr., he will have to pay $201 \times 8 = 1608$ cents or \$16.08.

[8] This is clearly shown in a graphic representation of the step rate. We again step off the energy consumption horizontally in kw-hr. as abscissae and plot the amount of the corresponding monthly bills vertically as ordinates (Fig. 5). The line representing the 10-cent-per-kw-hr. rate (for the above Allentown schedule, footnote 4, Section 119) is found by joining the origin O with a point given, for instance, by the abscissa 500 kw-hr. and the corresponding ordinate $500 \times 10 = 5000$ cents or \$50 (point A_{10}). This inclined straight line represents a straight

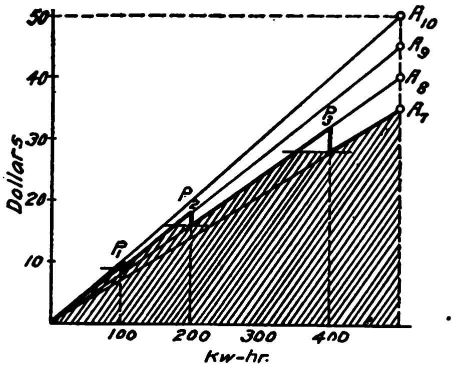


Fig. 5.—Step Meter Rate.

10-cent-per-kw-hr. rate and applies as far as the 10-cent rate applies, that is from 0 to 100 kw-hrs. From there on (point P_1) the 9-cent rate applies, which is represented by another straight line drawn from the origin under a correspondingly smaller angle to point A_9 (500 kw-hr., \$45). The figure shows clearly the resulting peak at P_1 which indicates how the bill suddenly drops as soon as we exceed the 100-kw-hr. mark; 100 kw-hr. are billed at \$10 and 101 kw-hr. at \$9.09. The same condition is repeated with the transcending of every one of the other steps (points P_2, P_3, etc., heavy outline).

[9] The Optional Power rate schedule of Newark, N. J., has as many as 42 steps. The Retail Power rate of Wilmington, Del., has 24 steps, and many schedules have a dozen steps or so.

[10] The Retail Power schedule of Albany, N. Y., is an example of a step meter rate with this stipulation.

The effect of this stipulation represented graphically is the cutting off of the sawtooth-like peaks of the charge curve by horizontal lines. (Compare the shaded area in Fig. 5.)

minimum guarantee of its own in such a way that the rates with the higher kw-hr. charges require lower guarantees and vice versa. (Compare the example in footnote 10 of Section 108.) This represents a step meter rate of the described variety, *provided* the customer chooses that one of the optional rates which results in the lowest total payment for his energy consumption. The customer may therefore have to pay more than under the equivalent step meter rate, but he can never be charged less.[12]

If a step rate contains the stipulation that the charges are never to be higher for a smaller energy consumption than for a larger one—no matter in which one of the above forms the stipulation is made—the customer can no longer decrease his bill by judiciously increasing his energy consumption. But he can increase his consumption in a considerable range without being charged for the increase. The drawback of the rate is mitigated, but not removed.

For some remarks on the theory of the step rate see also Insert XI.

---

[11] For instance, the General Lighting schedule of Lynn, Mass., charges:
10 cents per kw-hr. (net) for 1 to 228 kw-hr.
8 cents per kw-hr. (net) for 285 to 1800 kw-hr.
6 cents per kw-hr. (net) for 2400 and over.
No bill is made out larger than what would be obtained for a greater consumption at a lower rate.
It will be seen that 228 kw-hr. at 10 cents per kw-hr. cost the same as 285 kw-hr. at 8 cents per kw-hr., etc.
The step meter part of the General Lighting and Power schedule of Washington, D. C., is worded after the following fashion:
6 cents per kw-hr. for the first 3200 kw-hr.
$192 for 3200 to 3500 kw-hr.
5.5 cents per kw-hr. from 3500 to 4545 kw-hr.
$250 for 4545 to 5000 kw-hr.
5 cents per kw-hr. from 5000 to 7500 kw-hr.
$375 for 7500 to 8333 kw-hr.
etc. ....
This is obviously only another way of expressing the above stipulation.

[12] The Off-Peak Emergency Lighting and Power schedule of Des Moines, Iowa, for instance, provides the following optional rates:
3.1 cents per kw-hr. with guarantee 4,500 kw-hr. (that is $139.50)
2.9 cents per kw-hr. with guarantee 6,000 kw-hr. (that is $174.00)
2.7 cents per kw-hr. with guarantee 8,000 kw-hr. (that is $216.00)
2.4 cents per kw-hr. with guarantee 10,500 kw-hr. (that is $252.00)
2.2 cents per kw-hr. with guarantee 14,000 kw-hr. (that is $308.00)
2.0 cents per kw-hr. with guarantee 18,000 kw-hr. (that is $360.00)
etc.
This is evidently the same as the following step meter rate with a minimum charge of $139.50 (as above):
3.1 cents per kw-hr. for less than 6000 kw-hr.
2.9 cents per kw-hr. for 6000 to 8000 kw-hr.
2.7 cents per kw-hr. for 8000 to 10,500 kw-hr.
etc.
with the provision that no charge shall be higher for a lower number of kilowatt-hours than for a higher one. (See Fig 6.)

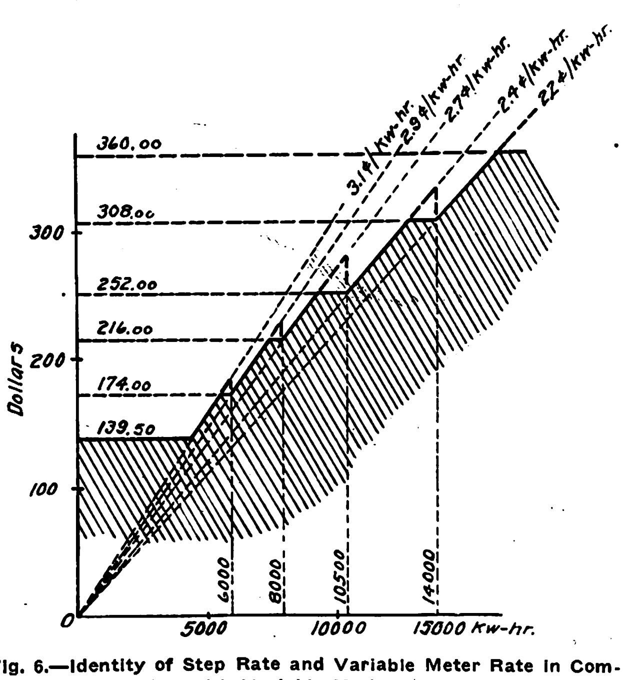


Fig. 6.—Identity of Step Rate and Variable Meter Rate in Combination with Variable Minimum Charge.

Insert X—Appendix to Section 114.

Reasons for the Desirability of Graduation of the Energy Charges With Pure Meter Rates.

(Graphic Interpretation.)

The problem of how and why the energy charge of a pure meter rate should vary with the energy consumption is much more readily interpreted by the curve which shows the total charges (customer's bill) as a function of the energy consumption than by the customary curve of the average charges per kilowatt-hour and the former curve gives a much better and more direct insight into the problem than the latter. It is easy to reduce the curve of the total charges to the curve of the average charges per kw-hr. (see Insert XIV) should this be desired, but it is not at all necessary. The total bill is really the primary function of the energy consumption and the average charge per kw-hr. is a secondary function, being

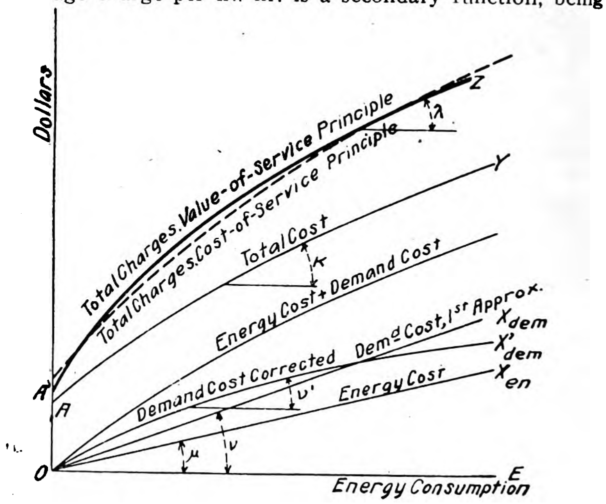


Fig. A (Insert X).

the total bill divided by the energy consumption. (The only exception to this is the straight meter rate where both functions may be considered to be of equal importance.)

As regards the shape of the curve of total charges, we have to remember that the total charge, i. e. the bill, is composed of cost plus profit.

The cost, as has been shown in Part I, is composed of the energy cost, the demand cost, and the customer cost.

The energy cost is proportional to the energy consumption and the curve representing this part of the cost with relation to the consumption is therefore a straight line OX_{en} (Fig. A) rising from the origin O of co-ordinates.[1]

As we are dealing at present with such rates only as do not contain any demand charge, we will have to base the entire cost of calculation on the kw-hr. as unit, that is, we will have to average the demand cost in some manner between the kilowatt-hours consumed. Assuming as an approximation that all customers have the same demand for every kilowatt-hour consumed (in other words, the same load-factor) the demand cost will also be defined by a straight line rising from the origin, OX_{dem} in Fig. A. The size of the angle ν at which it rises, depends upon the average load-factor; a large load-factor results in a small angle and vice versa. Now it has been explained (Section 115 of the main text) that large energy users on the average have a larger load-factor than small ones. Therefore the demand cost is not strictly proportional to the amount of energy consumed, but it increases less and less rapidly as we proceed on the curve from the small energy consumers to the medium and large ones. The demand cost will rise more rapidly for the small energy consumers than indicated by the straight line OX_{dem} and less and less rapidly as we proceed to the medium and large ones. The straight line OX_{dem} will therefore have to be corrected to a shape[2] of the type OX'_{dem}, steadily curving downwards.

Adding the ordinates OX_{en} and OX'_{dem} for every abscissa and adding further the constant customer cost as given by OA results in the curve AY as the curve of the total cost.

---

[1] The angle of elevation μ is obviously the larger, the higher the energy cost per kilowatt-hour is (kw-hr. cost per kw-hr.). Those of our readers who are familiar with elementary mathematics will understand that tan μ is proportional to the kilowatt-hour cost per kilowatt-hour.

[2] The angle of elevation ν of OX'_{dem} towards the horizontal becomes steadily smaller as the energy consumption increases and it converges towards a certain minimum ν'_{lim}, that means, although it always remains larger than that minimum, it approaches that minimum value steadily more and more the larger the energy consumption becomes.

For the energy consumption 0 this curve indicates a certain minimum value of cost—equal to the customer cost OA. The curve rises from the point A and the angle of elevation χ becomes smaller and smaller as the energy consumption increases.[3]

From the curve of the cost we arrive at the curve of the price (charges or total bill) by adding the profit as a certain percentage of the cost. Now it has been shown (Sections 97-99) that the value-of-service principle requires this percentage to be smaller at either end of the curve (that is, for the large and for the small consumers) than in the middle (medium-sized consumers). A constant percentage of profit added would result in the dotted curve[4] for the total charges (bills), whereas these charges under the value-of-service principle would be typified by the heavy line A'Z[5].

Insert XI—Appendix to Section 121.

Theoretical Remarks About the Step Rate—Inaccuracy—Size of the Steps—Size of the Energy Charges Design of a Step Rate.

The sudden reductions of the bill which take place with the step rate when the limit between two steps is exceeded, bring it about that, as we gradually proceed from the lower to the larger energy consumption, the bills are alternately larger and smaller than they ought to be. The same is indicated by the zigzag form of the curve (Fig. 5 of the main text and Figs. A to C of this Insert) which gives the actual amount of the bill (stepped off in vertical direction) for the

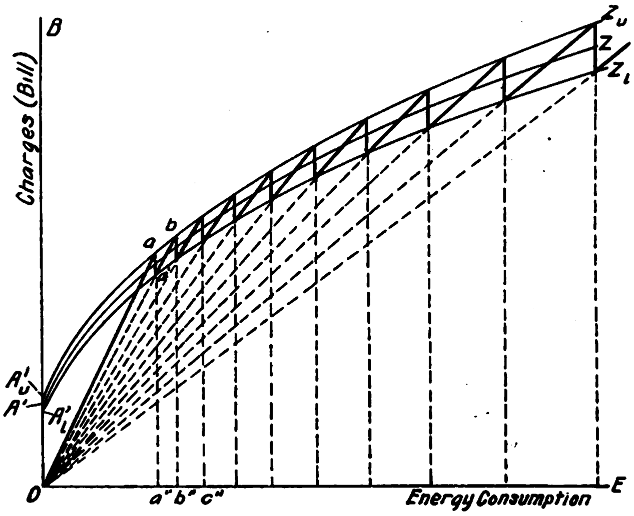


Fig. A (Insert XI).

varying energy consumptions (stepped off horizontally). This zigzag form which brings the curve of the actual bill alternately above and below the curve which shows what the bill ought to be theoretically (see the preceding Insert X) persists even if we stipulate that the bill shall never be greater than what would be billed for any larger energy consumption (Figs. D and E).

It seems logical to require that these periodic positive and negative deviations or inaccuracies should by a proper choice of the rate constants be limited to a certain percentage of the total bill in such a manner that at each and every cycle—that is, at each step of the schedule—the inaccuracy just touches this maximum percentage on the positive and on the negative side.

Supposing, for illustration, that we have given the curve of total charges $A'Z$ as we want them to be (see Fig. A) and assuming further the permissible percentage of inaccuracy at $\pm 5\%$, we draw one curve A'_uZ_u, the ordinates of which are 5% greater than those of the given charge curve $A'Z$ (Fig. A) and another curve A'_lZ_l with ordinates 5%

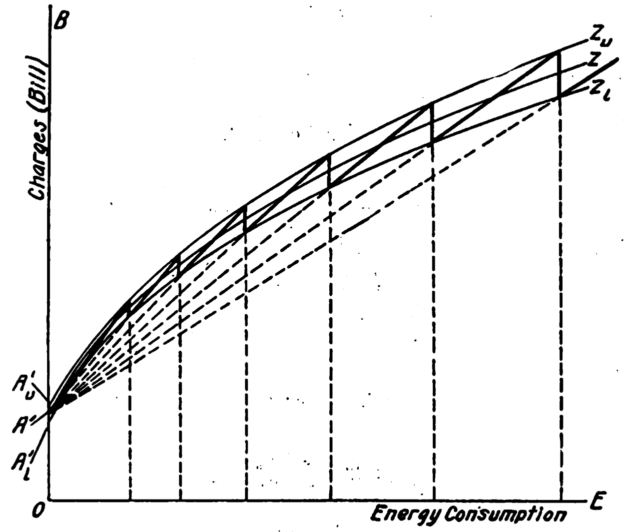


Fig. B.

smaller. Starting with a certain initial straight meter rate given by Oa, we drop a vertical line from the intersection point of that line with the A'_uZ_u curve. This vertical intersects the curve A'_lZ_l at a'; $a''a'$ is now practically 10% smaller than $a''a$. Connecting a' with O gives us the second step of the step rate $Oa'b$, etc.

The drawing Fig. A shows that with the typical shape of the curve of charges $A'Z$ the increments of the steps $a''b''$, $b''c''$, etc., become steadily greater and greater as we advance into the higher steps.

This does not apply, however, to the first step Oa'', as can be seen from Fig. A. Counting *backwards* from the larger energy consumptions to the smaller ones, we see that, in order to satisfy the requirement of a constant percentage change of the bill between steps, the steps would have to become smaller and smaller and finally to become infinitely small. In other words, we would never reach a first step. Therefore, the first step must of necessity exceed the limit of the given percentage of inacuracy, inasmuch as in the lower portions of that step the amount of the bill will be much smaller than permitted by that requirement. (For the energy consumption 0 the percentage inaccuracy will even become infinitely large, since the amount of the bill is 0 whereas it ought to be equal to the customer charge OA'). The size of the first step is not governed by the same law as that of the other steps.[1]

As regards the unit charges per kilowatt-hour it is easy to show that under the above requirement of a constant percentage reduction of the bill between steps the unit charges must decrease in a geometrical relation, which means that the ratio of the kilowatt-hour charge in a given step to the kilowatt-hour charge in the preceding step is constant or, in other words, the kilowatt-hour charge in any step can be found

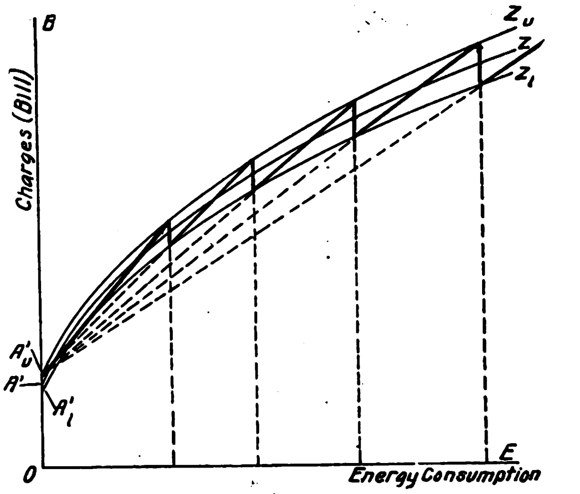


Fig. C.

[3] The angle of elevation K of the cost curve AY also converges towards a limiting value K_{lim} which is the larger the larger μ and the larger ν_{lim} is, $\tan K = \tan \mu + \tan \nu'$ and $\tan K_{lim} = \tan \mu + \tan \nu'_{lim}$.

[4] The angle of elevation λ is given by $\tan \lambda = (1 + p/100)$ $\tan K$ if p is the constant percentage of profit added and it converges towards λ_{lim} where $\tan \lambda_{lim} = (1 + p/100) \tan K_{lim}$.

[5] The electric company is generally interested in an increase of a customer's consumption only as long as such an increase brings about an increase in the profit from that customer in dollars and cents. In accordance with the value-of-service principle the percentage may be reduced incidentally to the increase of the energy consumption, but if—roughly speaking—the reduction of that percentage goes so far that the amount of the profit in dollars and cents remains stationary—not to say decreases—the electric service company will refuse to be interested in such additional business. For that reason the $A'Z$ curve will in every part of its course be steeper than the corresponding part (that is, the part with the same abscissa) of the cost curve AY. In other words, the increment of charges will always have to be larger than the increment of cost.

from the kilowatt-hour charge in the preceding step by multiplying the latter by a given constant percentage.[2]

To summarize: *The gradation of the energy charges is given by the percentage drop of the bill permitted between steps and the size of the steps is determined by the shape of the theoretical rate curve which is to be approximated by the step rate.*

Since the percentage should be constant by which the kilowatt-hour charge is to be reduced between steps, the numerical amounts of the reductions of the kilowatt-hour charges (in cents or fractions of cents) from one step to the next should become smaller as the kilowatt-hour charge itself becomes smaller, that is as the number of kilowatt-hours becomes greater.

However, for obvious reasons simple figures are desirable for the unit charges (either gross or net, see Section 110), that is either whole cents or multiples of half or quarter cents, or decimal figures of cents with one or two digits. In the latter case the second decimal is preferably a figure 5. In consequence of these limitations we have to be satisfied with graduating the unit charges by identical intervals, for instance half cents, over a number of steps and then change to a graduation of, let us say, quarter cents for the next few steps, etc. This will, of course, have the effect that the balance between the percentage drops at the various step limits will be more or less disturbed.

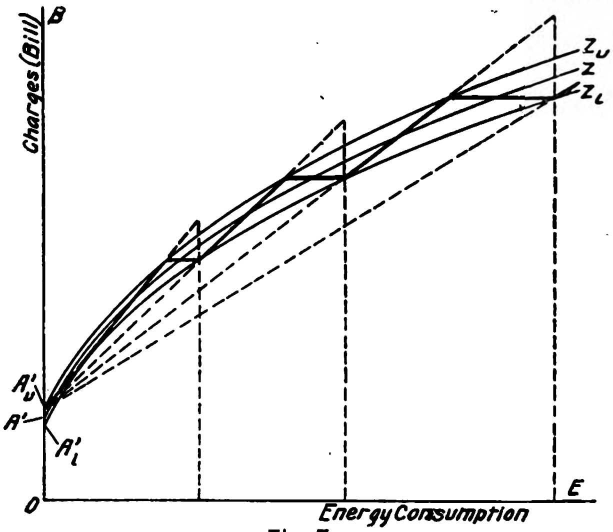


Fig. E.

The following table is an example, taken from practice, of a power step rate (1st and 2nd columns). The units of energy happen to be in this case horsepower-hours and not, as usual, kilowatt-hours. The third column gives the increment in the length of the respective step to the next following one, showing how these increments increase in size. The fourth and fifth columns show the decrements of the energy charges from the respective step to the next, in cents per horsepower-hour and per cent, respectively. In accordance with what has been said above, the percentage of the decrement of the unit energy charge is equal to the percentage decrement of the bill between the same two steps. The table shows that this percentage varies between the limits 5.55 and 10.34%. By strictly carrying out the principles outlined in this Insert, the percentage can be made never to exceed the limit of 9.09%[3] with the same number of steps and no finer gradation of the unit charges (multiples of 0.05 cent per hp-hr.). This is indicated in the three last columns of the table and is done by extending the 0.25 cent per hp-hr. and 0.15 cent per hp-hr. decrements of the unit charge a little further at the expense of the 0.2 cent per hp-hr. decrement.

1	2	3	4	5	6	7	8
					Suggested improvement.		
Cents per hp-hr.	For hp-hrs.	Intervals, hp-hrs.	Interval to next energy charge. c/hp-hr.	%	c/hp-hr.	Interval to next energy charge. c/hp-hr.	%
5	99 or less	...	0.5	10			
4.5	100 to 199	100	0.25	[1]5.55			
4.25....	200 to 399	200	0.25	5.88			
4	400 to 599	200	0.25	6.25			
3.75....	600 to 799	200	0.25	6.67			
3.5	800 to 1,199	400	0.2	5.71	3.5	0.25	7.14
3.3	1,200 to 1,599	400	0.2	6.06	3.25	0.25	7.69
3.1	1,600 to 2,399	800	0 2	6.45	3.00	0.25	8.33
2.9	2,400 to 3,599	1,200	0.2	6.90	2.75	0.25	9.09
2.7	3,600 to 4,799	1,200	0.2	7.41	2.50	0.2	8.00
2.5	4,800 to 5,999	1,200	0.2	8.00	2.30	0.2	8.70
2.3	6,000 to 7,999	2,000	0 2	8.70	2.10	0.15	7.04
2.1	8,000 to 9,999	2,000	0 2	9.52	1.95	0.15	7.69
1.9	10,000 to 11,999	2,000	0.15	7.90	1 80	0.15	8.33
1.75....	12,000 to 14,999	3,000	0.15	8.57	1.65	0.15	9.09
1.6	15,000 to 19,999	5,000	0.15	9.37	1.50	0.1	6.67
1.45....	20,000 to 29,999	10.000	0.15	[2]10.34	1.40	0.1	7.14
1.3	30,000 to 39,999	10,000	0.1	7.69			
1.2	40,000 to 59,999	20,000	0.1	8.33			
1.1	60,000 to 79,999	20,000	0.1	9.09			
1.0	80,000 and over						

[1]Minimum. [2]Maximum

[1] Where we have the customer charge OA' explicitly made in addition to the step meter rate, we can draw a line for the first step as a tangent from A' to the lower curve (Fig. B) and where this tangent intersects the upper curve we get the point a as the end of the first step. Then the rate in its first step will never deviate from the theoretical value by more than the percentage allowed for the inaccuracy. The subsequent construction from Fig. B is self-explanatory. The increments of the steps will be larger than if the customer charge is absent. Larger increments of the steps result in a smaller number of steps necessary to cover a given total range of kilowatt-hours and consequently—*ceteris paribus*—in a greater simplicity of the rate schedule.

We can further slightly increase the size of the first step and of the step increments (and thereby reduce the necessary number of the steps) if we take the amount of the customer charge not at its correct value OA' but enhanced by the permissible percentage of inaccuracy, that is, if we take the customer charge at OA'_u. A comparison of Figs. B and C will explain this without further words. In practice this means that it is better for the simplicity of a step rate with a customer charge to choose the latter too large than too small.

A stipulation that the charges shall never be larger for a smaller energy consumption than for a larger one (Section 120) will also increase the size of the increments of the steps; consequently the number of steps which are necessary to cover a certain range of kilowatt-hours will become smaller. This is shown in Fig. D, which is also self-explanatory. Fig. E finally shows a combination of that stipulation with a customer charge and demonstrates plainly the reduction in the number of steps.

[2] To explain this, let us suppose, for instance, that we have a rate where some one of the steps charges 6 cents per kw-hr. up to 800 kw-hr. and that the drop of the bill between every two steps is required to be 5% of the bill. The drop will then be 5% of (6×800); that means the bill for 800 kw-hr. calculated with the charge of the next following step (to be quite exact we would have to say: the bill for 801 kw-hr.) must be 95% of (6×800). The charge per kilowatt-hour in this following step will then be $\frac{95\% \text{ of } (6 \times 800)}{800}$ or 95% of 6 cents, that is 5% less than the charge in the original step.

For readers who are familiar with algebra: Call S_n the number of kilowatt-hours at the end of the n^{th} step and p the percentage by which the bill is to be reduced when we exceed the limit of the S_n^{th} kilowatt-hour, that is the limit between the n^{th} and the $(n+1)^{st}$ step. Let further c_n and c_{n+1} denote the kilowatt-hour charge in the n^{th} and $(n+1)^{st}$ step, respectively. The bill at the end of the n^{th} step is c_nS_n and at the beginning of the $(n+1)^{st}$ step it is $c_{n+1}S_n$. (To be quite exact we would have to say $c_{n+1}(S_n+1)$ but S_n is always very much greater than 1 so that we can set S_n for S_n+1). We have thus

$$c_{n+1}S_n = c_nS_n(1 - p/100)$$

S_n cancels out, indicating that neither the number of kilowatt-hours at which the step limit is located nor the number of steps is of any consequence, and we get

$$\frac{c_{n+1}}{c_n} = 1 - \frac{p}{100}$$

in other words, c_n and c_{n+1} have the same ratio to each other as the respective bills. The decrease from c_n to c_{n+1} is the same percentage as the decrease of the bills.

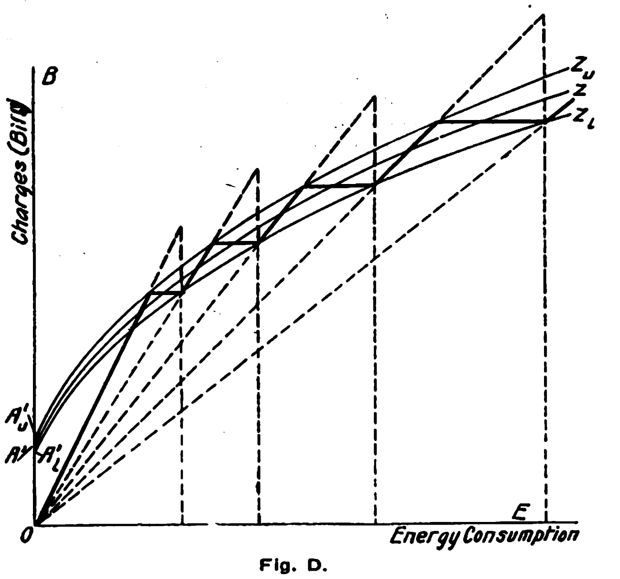


Fig. D.

[3]The first step is not counted for the reason given above.

(*To be continued.*)

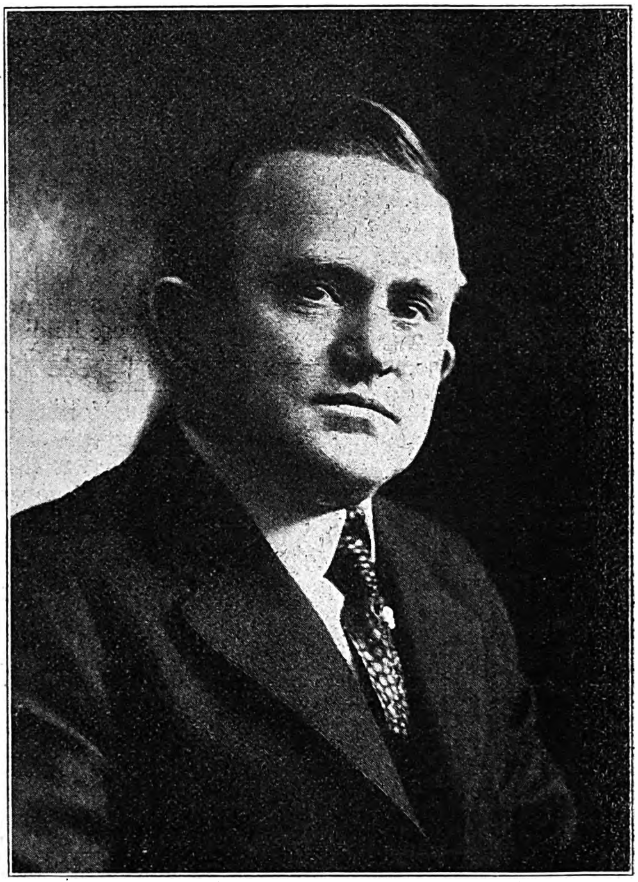
What Electricity Has Done to Help Humanity

The Extremely Varied and Indispensable Services Performed by Electricity in the Great War—Value of Niagara Falls Hydroelectric Development—Direct and Indirect Aid in Winning the War

By J. C. McQUISTON

Manager, Department of Publicity, Westinghouse Electric & Manufacturing Co.

FROM the mouth of a great gun behind the Allies' trenches in France went a shell screaming into the enemy's territory. Dig into the history of that shell and you will find it charged with electricity. From the moment when this powerful little agent of democracy was finally sent upon its mission, back to its very beginning, its trail is crossed and recrossed at a thousand points by electric currents.



J. C. McQuiston.

The guns that fired it, the motor truck that delivered it to the ammunition dump, the trains that brought it from the little French seaport to the trucks, the ships that carried it overseas, the tools that fashioned it, the metals and chemicals that went into its structure—touch the history of any of these factors in the production and progress of that shell, and you will feel the vibrating current of electricity.

And so with practically everything that entered into the waging and the winning of that terrible struggle.

"Ships will win the war," was the cry from many quarters. To almost every phase of ship construction and to ship operation you will find electricity made great contributions.

"Aeroplanes will win the war," came the word from many others. Without electricity we should have had no aeroplanes to help us win the fight.

"Food will win the war," was a popular shibboleth. What a story of electrical accomplishments is to be found in the story of food production.

What is there that man made or did for the cause of democracy and freedom over there or over here which did not, in some measure, depend upon the light, the heat or the power of electricity?

Consider in their broad divisions the various lines of activity that finally converged upon the great battleground. Agriculture, mining, lumbering, manufacture, transportation, communication—every one of these had reached its present stage of development with the immeasurable help of electricity.

The hydroelectric power development at Niagara Falls is perhaps as good a single illustration as any that could be given of the essential part electricity played in winning the war. The cheap electricity produced at Niagara Falls made possible the founding of the artificial-abrasive industry in the United States, and with the natural supply of emery and corundum from Asia Minor cut out by the war, where should we have been without Niagara's artificial grindstones, whetstones, and other grinding implements of carborundum and the like? In every plant where alloy and tool steels were used, Niagara Falls' abrasives helped to win the war. In the munitions plants, in the locomotive works, in the automobile factories, in the foundries, in the machine shops, you will find it did indispensable tasks.

Was there anything more necessary for success in the war than an abundance of high-grade steel? And considering no other phase of electricity's extensive participation in the making of steel, what would we have done without ferro-silicon, another product which comes almost entirely from Niagara where cheap electric power made the commercial development of the ferro-silicon industry possible? As a purifier, ferro-silicon entered into the making of practically all our shell steel as well as steel for divers other purposes.

And there is ferro-chronium, which gives to steel that hardness so necessary in the production of shells and likewise in the making of tools and other steel—it, too, is largely a Niagara Falls product.

Niagara Falls electricity gives us a great part of our tungsten and vanadium. And of the various alloys, what it does not help to produce directly, it contributes to indirectly through the production of aluminum. Think what a factor aluminum was in the winning of the war through its application to the motorcar, motortruck and aeroplane engine alone, and the electric power development at Niagara may truly be said to have made aluminum a commercial possibility.

It has been figured that between Niagara's alloys and abrasives every industry utilizing steel has multiplied its productive powers by three, and that if it had not been for these abrasives and alloys every motorcar factory in America could have reached but one-fifth of its war production.

Niagara's electricity gives us chlorine, one of the greatest life-saving agencies used in the war. For chlorine was one of the commonest and most effective disinfectants used in treating the wounded soldiers.

Niagara Falls' electricity gives us many of the materials from which picric acid and other explosives are made.

And all of this was but the contribution of a single electric power development.

To win the war food had to be produced in quantities sufficient not only to meet our own needs at home and the needs of our soldiers, but also in large part the requirements of our Allies. Electricity was a powerful agent in the maintaining and stimulating of food production.

The farmer fertilizes with chemicals obtained by electrical processes; he depends upon tools and machinery into the making of which electricity has already entered, and in many cases upon machinery, such as tractors, that requires electricity in operation.

In the converting of the farmer's wheat, corn, and oats into bread and cereal products, electricity plays a tremendous part. It helps to grind, to refine and to bake. It is an essential factor in the preparation and conservation of other foodstuffs, such as meat, fruit and vegetables, as a visit to a packing plant or any canning establishment will quickly demonstrate. Without electricity to help, we never could have met the demands for our food resources.

To win the war it was necessary for the Allies to have plenty of power and no lack of raw materials. An adequate supply of power meant an adequate supply of coal. Here again electricity was found to be of considerable help.

Go into almost any of our larger mines, and you will find that the coal in being wrested from the earth with the aid of electric drills, transported to the shaft of the mine under electric power, brought to the surface in hoists electrically operated, while electricity drives the pumps and does various other tasks. Moreover, the use of electric instead of steam power effects a saving of millions of tons of coal.

Electricity is indispensable in the mining and refining of those ores that constitute the raw materials of our iron. From its source to its final destination in any one of the thousands of manufactured iron and steel products that were essential to carrying on the war, you would be astonished at the frequency with which you would find electricity playing a part.

So with wood, with rubber and with other raw materials that went to the battlefront in so many different forms. In the actual manufacture of iron, steel, wood, rubber and other products, its light, its heat and its power were everywhere.

Then there was transportation—one of the most powerful of our instruments of war. Practically everything that was industrially produced had to be transported by rail or by water before it could be of service. What a strain the war had placed upon our transportation facilities everyone knows. Both on land and at sea, directly and indirectly, electricity accomplished wonders in promoting the handling of traffic with efficiency and dispatch.

Every train that moved over the rails represented the application of electricity at countless different points in its construction and operation. Rails, locomotives, cars—in the making of all of these electricity has had a part of no little consequence.

The dispatcher who directed the operation of the trains depended upon electricity to deliver his orders. Electric signals controlled the train's movements. In many cases, electric locomotives took the place of steam, saving coal and hauling heavier tonnage.

Electric interurban lines, by handling freight, relieved the tremendous strain heaped upon the railroads, while the importance of the fact that the country's urban street-car lines were increasing production by the saving of time must not be overlooked.

In the building and the operation of ships electricity played a bigger and bigger role every day, and today you will find great battleships equipped with electric drive, merchant ships propelled by electric power, vessels of all kinds lighted by electricity, protected by electricity and controlled by electricity.

Submarines are driven by electricity and require electric current for various other purposes. Without the electric spark in the engine, the aeroplane would be a dead thing. And this is true, too, of the motorcars, trucks, ambulances, motorcycles and other vehicles that were lending such a helping hand.

Rapid communication of all kinds of intelligence was another phase of war necessity that brought electricity into the foreground. The wireless, the telephone, the telegraph—how vital they were to our success and how vital to them was electricity.

Thus one could go on and on, deeper and deeper, into the maze in which one soon finds himself upon examining into electricity's part in the war. The ramifications are so extensive and the subject so closely related to so many activities that it is possible here to do little more than suggest its scope.

Was there another force so powerful in our war effort as this mysterious force of electricity? Is there another industry of which it can truly be said that it has done so much to help win the war as the electrical industry, which supplied the countless divers pieces of apparatus, appliances and instruments that made possible the widespread use of this force?

As electricity keeps the light shining in the torch of the Goddess of Liberty in New York harbor, so does it lend its potency to keep bright and clear the light of Liberty for all mankind.

ELECTRICAL CONTROL BY SOUND.

The control of electrical machinery by the sound of a whistle at any distance up to a mile was recently demonstrated in England. By the blowing of a whistle a small motor-car was started, directed to the right or left, and stopped by repeated sounds. The model was fitted with the essential batteries and no wires or wireless apparatus are claimed to have been used. Vibration alone was responsible, and the same results are claimed to have been accomplished by means of inaudible vibrations. The inventor, Capt. A. J. Roberts, an Australian flight captain, is said to have produced other inventions connected with wireless in the air and the control of torpedoes.

A New Form of Tank for Static Transformers

The Importance of Preventing Moisture from Entering Tank and Lowering Dielectric Value of Oil—How the Conservator Type of Tank Prevents This and Also Explosion Risk and Sludging of Oil

By W. S. MOODY

Engineer, Transformer Department, General Electric Co.

ENTRAPPED moisture is perhaps the greatest deleterious agent affecting high-grade insulation. The presence of an exceedingly small amount of moisture will reduce the dielectric strength of solid insulation to a mere fraction of its original value, by so changing the distribution of the dielectric stress as to cause a failure of what would ordinarily be a dielectrically strong structure.

In the early days indoor transformers were not even encased and outdoor transformers were placed in cases that were waterproof only under favorable conditions. As operating potentials increased, the necessity for a greater degree of protection against moisture was met by the use of oil and later by the impregnation of the fibrous insulation with moisture-proof compound previous to the immersion of the transformer in oil.

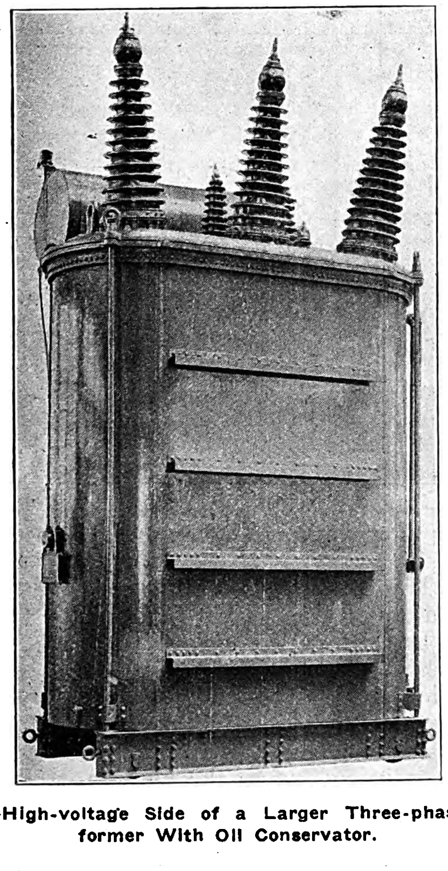


Fig. 1.—High-voltage Side of a Larger Three-phase Transformer With Oil Conservator.

The sensitiveness of oil to water has long been known, the effect on the dielectric strength being shown clearly in Fig. 2. Satisfactory transformer oil when shipped from the factory should stand a test of at least 22 kilovolts between 1-in. disks spaced 1/10 in. apart and is unsatisfactory for high-voltage or large transformers when the dielectric strength is less than 75% of this value; that is, when it is below 16½ kilovolts. By reference to the curve it will be noted that oil of the standard strength, that is, 22 kilovolts, should have not more than 8 parts of water in 1,000,000 parts of oil, and that the addition of 10½ parts of water, giving a total of 18½ parts per 1,000,000, will reduce the dielectric strength to the lowest permissible limit. With increasing capacity and higher voltage, the necessity of almost absolute protection of oil against moisture was appreciated. With the demand for outdoor installations the details in design of tank, cover and lead construction were developed to avoid the possibility of the entrance of snow, rain or merely atmospheric moisture.

Evidently the most completely effective method of accomplishing the necessary protection against moisture is to have the tank cover and terminals air-tight. This requires not only an expensive tank construction but also a large idle space air-filled above the oil level to limit the possibe internal pressure due to the expansion of the oil resulting from increase in temperature.

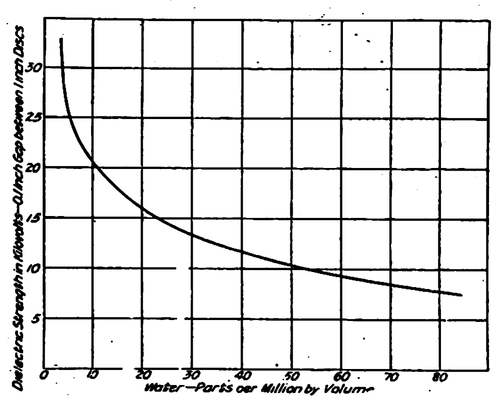


Fig. 2.—Effect of Water on Dielectric Strength of Transformer Oil.

Explosion Hazard.

Due to chemical action in the transformer oil, caused by arcing or static discharges or heavy overloads, combustible gases (mostly hydrogen and light hydrocarbons) are sometimes set free, and in the ordinary tank these gases mix with the air above the oil so that a highly explosive mixture may be formed. This gas may be ignited by sparks of a static or dynamic character occurring along the leads, causing a dangerous explosion. While all General Electric high-voltage leads are provided with grounded shields that make this impossible under ordinary circumstances, an abnormally low oil level may expose the transformer terminals, thus neutralizing the protection of the shields.

Sludging of Hot Oil.

Hot oil, even if carefully selected, will very slowly decompose when in contact with oxygen, and a precipitate will be thrown down. This decomposition or sludging, while it does not affect the dielectric strength of the oil, increases the viscosity and thus retards the transfer of heat from the core and coils to the cooling surfaces. Even more deleterious is the fact that the deposit settles on the coil surfaces, in the ducts and on the cooling coils. This acts as a heat insulator on all surfaces and also will in time clog up the ducts.

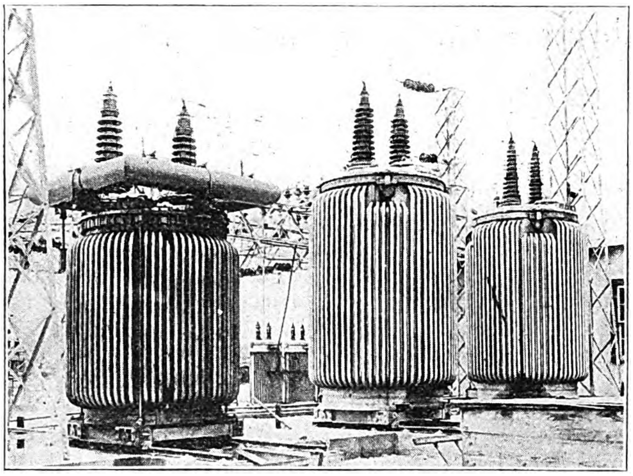


Fig. 3.—Initial Installation of Transformer Provided With Oil Conservator at Laurinburg, N. C.

The result is that the operating temperature gradually increases with consequent acceleration of the sludging. The remedy is found, first, in a method of oil refining that minimizes this action and, second, in a periodic renewal or filtering of the oil and thorough cleaning of the core and coil surfaces. The oil regularly supplied with General Electric transformers is of such a quality as to practically exclude sludging under normal conditions, yet continued service with occasional overloads will eventually produce sludge.

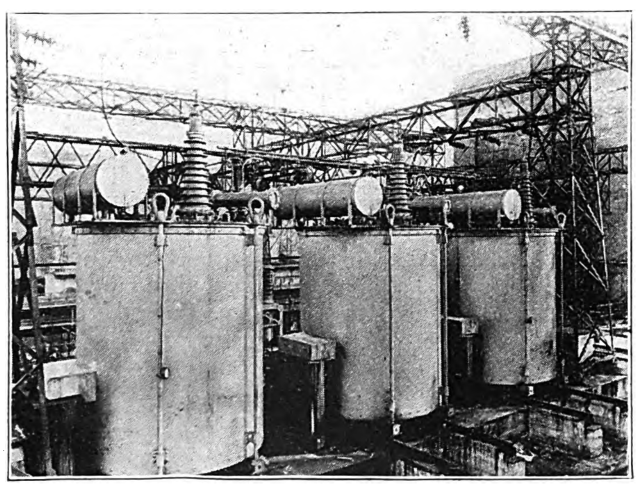


Fig. 4.—Transformers With Oil Conservators at the Windsor Power Plant of the American Gas & Electric Co.

An exhaustive series of tests has demonstrated that when air is not present the oil can be operated continuously at a temperature that would prove disastrous if air were present, with practically no sludge resulting. The results of one very severe test where the oil was subjected to a temperature of 130° C. for 18 days dmonstrated that when air was not present no sludge resulted—only a slight discoloration taking place, also that when air was in contact with the oil a heavy sludge was produced. This test is representative of many others and shows conclusively that for any permissible temperature sludging will not take place in oil so long as air is excluded.

Until recently, the most generally accepted solution of the problem provided for (a) the use of a tank substantially air-tight at all joints with a single vent or breathing point for the interchange of air between tank and the outside atmosphere, this opening being connected by a vent pipe to a chemical drying chamber to remove moisture from the air passing through it; (b) ground shields above the oil level, and (c) the operation with conservative temperature rise.

This construction, until recently the best available, has the following possibilities for improvement:

(1) An immediate indication of the oil-tightness of all joints, thus insuring absolute protection against the entrance of moisture.

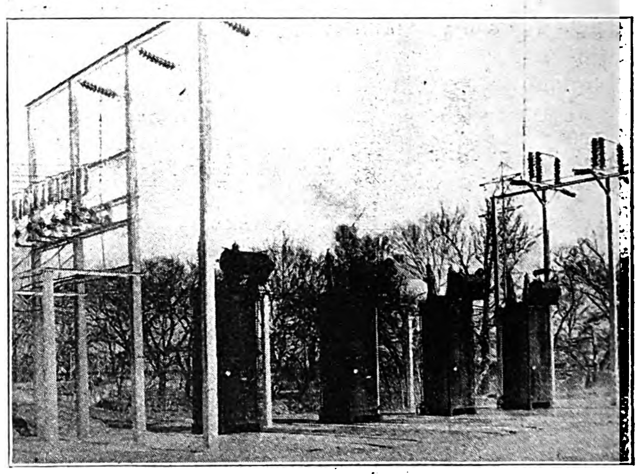


Fig. 5.—Outdoor Installation of Conservator-type Transformers of the Virginia Railway & Power Co., Richmond, Va.

(2) The elimination of all air space between the cover and the oil level.

(3) The reduction in the amount and temperature of the oil in contact with the air.

The indication of oil-tightness of joints will be a source of assurance to any operator of outdoor units. Elimination of the air space will insure protection against explosion due to the ignition of this atmosphere from corona or static between live parts and ground. The coolness of the air-exposed oil and the small surface in contact with the air will avoid the possibility of the oil sludging.

Oil Conservator Tank Construction.

These refinements in tank construction, which will materially reduce the possibility of failure even of apparatus as reliable as the best transformers, are all found in a valuable but simple addition to transformer tanks now extensively used by the General Electric Co. This device is sometimes called the "Oil Conservator." Figs. 1 and 4 show the general appearance of conservator-type transformers.

The engineers of this company have been testing this conservator construction in service during the past three years and are now generally recommending it for all large outdoor units. The conservator consists primarily of an auxiliary tank connected to the top of the main transformer tank by a suitable pipe and mounted somewhat above the level of the oil in the main transformer tank. When the auxiliary tank is supplied with oil the main tank and connecting pipe are completely filled and the only oil that comes in

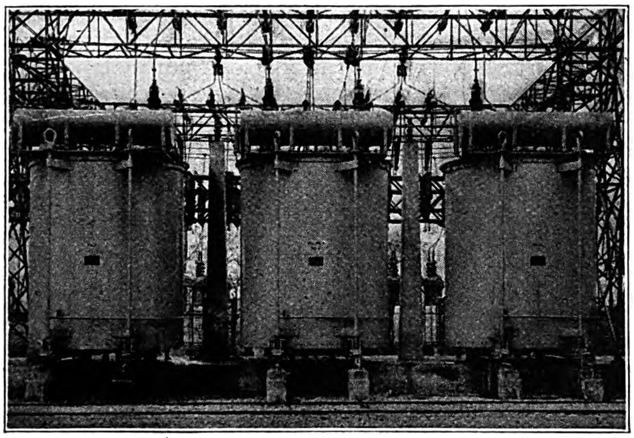


Fig. 6.—View of Transformer Bank No. 1 at Canton Substation of the American Gas & Electric Co.

contact with the air is that in the conservator. This is shown diagrammatically in Fig. 8.

The size of the conservator tank is governed by the expansion and contraction of the oil due to its changes in temperature. At the lowest operating temperature the oil must not contract so as to allow air to enter the main transformer tank, and at the maximum operating temperature the oil must not overflow the conservator. Transformer oil increases in volume about 4% with a temperature rise of 50° C. and this with other necessary allowances brings the volume of the auxiliary conservator tank to about 8% of that of the main tank. In practice, various refinements and

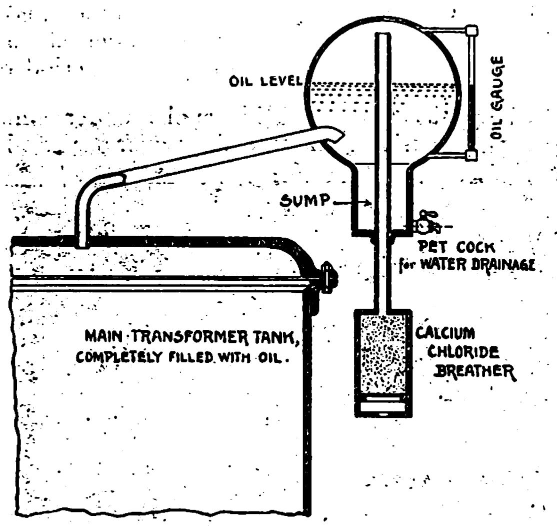


Fig. 7.—Diagrammatic Sketch of Oil Conservator Connected to Transformer Tank.

auxiliary devices are provided such as suitable oil gages, oil valves, chloride breather and sump.

Even a superficial consideration will show that this simple equipment fulfills the general requirements previously enumerated and a closer study reveals the fact that, even in detail, a better solution of the problems involved could hardly be desired.

Transformer Tank Completely Filled with Oil.

The fact that, except through extreme carelessness of the operator, the transformer tank will always be completely filled with oil has many advantages. The reduction in the necessary size of the tank and consequently of the bushings, has evident advantages. Elimination of the air space is of greater importance because with it is eliminated the chance of an explosive mixture of gas and air being trapped above the oil, for with the oil conservator any gas that may form immediately escapes into the auxiliary tank where there is, of course, no possibility of ignition.

Cool Oil in Contact With Air.

Since there is only one oil connection of limited size between the conservator and transformer tank, there is no circulation and the interchange of oil is limited to that due to the gradual expansion and contraction of the whole body of oil. The result of this is that the oil in the conservator is only slightly warmer than the outside air. To cite a typical test on a 95,000-volt conservator-type transformer of 3000-kv-a. capacity: the oil in the main tank reached a temperature of 73° C., while the oil in the conservator was only 38° C. Since the ambient temperature was 24° C., the temperature rise of the oil in the main tank was 49° C. against 14° C. for the oil in the conservator—three and a half times as great a rise. The importance of this on the sludging of oil can hardly be overestimated.

Figs. 3, 4, 5 and 6 are installation views that give some idea of the appearance of the conservator-type transformer in service. Fig. 3 is of especial interest as it shows the initial installation of the oil conservator in 1916 at Laurinburg, N. C.

RADIO CONTROL OF WIRELESS PROPOSED BY SECRETARY DANIELS.

Proposed Plan Calls for National Body to Supervise Private Stations.

A new policy for control and development of radio communication has been laid before Congress by Secretary Daniels.

It provides for maintenance of both naval and private stations, with the latter under control of a national radio commission, and proposes to open existing or new stations to general public correspondence at rates to be fixed by the Navy Department and Congress.

General public transoceanic correspondence through naval stations would not be permitted, however, except during temporary suspension of private service. Private radio stations would be licensed by the national radio commission and under its supervision.

CLEVELAND TO HOLD ELECTRICAL SHOW.

Plans are being made for holding an electrical show in Cleveland, Ohio, in February, 1920, according to an announcement by Matthias Turner, president of the Cleveland Electrical League. The early part of December was considered as a possible time for the show, but because of the rush of Christmas trade, February was selected. G. S. Milner of the Erner Electric Co. is chairman of the show committee.

IMPROVED EFFICIENCY OF MODERN PUMPING UNITS SHOWN.

Latest Installation at Minneapolis Water Works Also Shows Savings of Central-Station Service.

That the efficiency of centrifugal pumps is still improving and that under certain circumstances water works pumps can profitable be operated with central-station power is shown by the report of an acceptance test made upon the latest motor-driven pump installation at the Minneapolis water works.

The results of this test showed that in this pump installation a pump efficiency of approximately 86% was obtained and that the overall efficiency of the conversion of electric power to power measured in the water delivered averaged 82.48% over a period of nine months. A comparison of the costs of operating these pumps with the cost of operating the triple-expansion steam pumping units in the same station also shows the considerable saving obtained by the use of central-station service.

In May, 1911, the city entered into a ten-year contract with the Minneapolis General Electric Co., now the Northern States Power Co., by which that company agreed to furnish current at 2200 volts to operate two or more 20,000,000-gal. pumps against a dynamic head of 240 ft., based upon a pumping set of 72% overall efficiency, at a price of $4 per million gallons pumped, the understanding being that no current would be used between 4:15 p. m. and 6:30 p. m. on week days during the months of November, December, January and February. In November, 1916, a similar ten-year contract was made with the same company for the operation of a 30,000,000-gal. pump against the same head, and with the same pump efficiency, to be charged for at the same rate, with the provision that at a different dynamic head or efficiency the price per million gallons should be adjusted accordingly. It was also specified that the motor to be used by the city should be capable of starting the pump when primed and with the check or gate valve in the discharge closed, and of bringing the pump to full speed without drawing more than 150% of full-load current from the source of supply. In 1910 and 1911 two 20,000,000-gal. pumps were installed and in 1918 a De Laval pump.

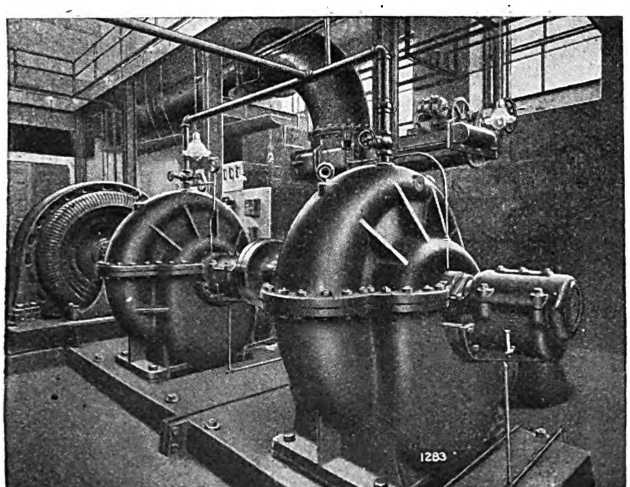
The latter unit consists of a General Electric 1800-hp., three-phase, slip-ring induction motor direct-connected to two De Laval 24-in. single-stage pumps mounted upon the same base plate and connected in series. The unit was specified to deliver 30,000,000 gal. per 24 hrs. against a total dynamic head of 250 ft. It was supplied by the Minneapolis Electric Equipment Co. and is installed at Pumping Station No. 4 in Northeast Minneapolis.

The official acceptance test was made in May, 1918. The discharge was measured by means of a Venturi meter, the capacity being calculated from manometer readings, while the discharge head was measured by two sets of calibrated gauges and the suction lift by means of a mercury column. The power supplied was measured by three sets of watt-hour meters, calibrated by means of a portable set of standard instruments reading during the official test under the conditions of current, voltage and power-factor obtaining. The portable set included two single-phase wattmeters, one polyphase wattmeter, one voltmeter, four ammeters and portable current and potential transformers. The test lasted 28 hours.

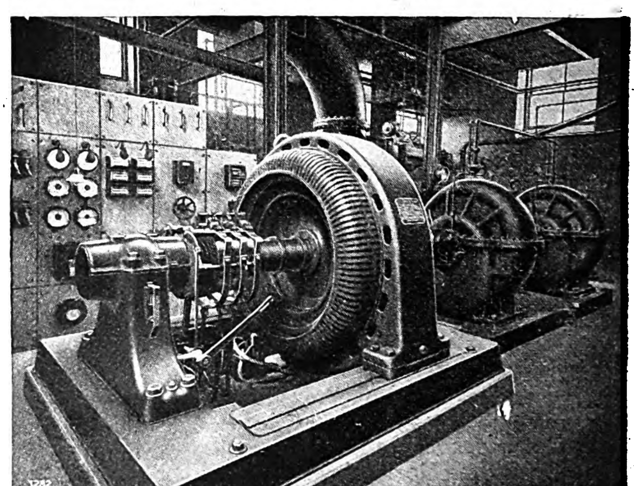
The results were as follows:

Total pumpage in 28 hrs.	37,719,500 gal.
Rate per 24 hrs.	32,331,000 gal.
Discharge head, average	235.13 ft.
Suction lift, average	16.43 ft.
Total dynamic head, average	251.56 ft.
Kw-hr. used	36,307.2
Combined efficiency of motor and pump	82.1%
Average line voltage	2,406
Power factor	90.0%
Motor efficiency under test conditions	95.5%
Slip of induction motor	1.1%
Temperature rise	33.5° C.
Starting current, percentage of full load current	113.0%

The contract of the city with the Minneapolis Electric Equipment Co. provided a bonus of $500 for each 1% efficiency exceeding 76% when pumping 30,000,000 gal. per day against a total dynamic head of 250 ft. The maximum bonus was limited to $2400. A penalty of $500 was provided for each 1% by which the efficiency might fall below 76% and the pump was not to be accepted if the overall efficiency fell below 72%. As the accompanying chart shows, 76% efficiency was exceeded at all loads tested, and the average combined efficiency, including the regular starting and other conditions incidental to a varying load in regular service, should not be less than 82.1% by more than 1%. The overall efficiency of 82.1% divided by the motor efficiency of 95.5% gives a pump efficiency of 85.97%. This is believed to establish a new record and is 6% higher than the results obtained in the tests on the pumps of another make installed by the City of Minneapolis under similar conditions. Service runs extending over a period of



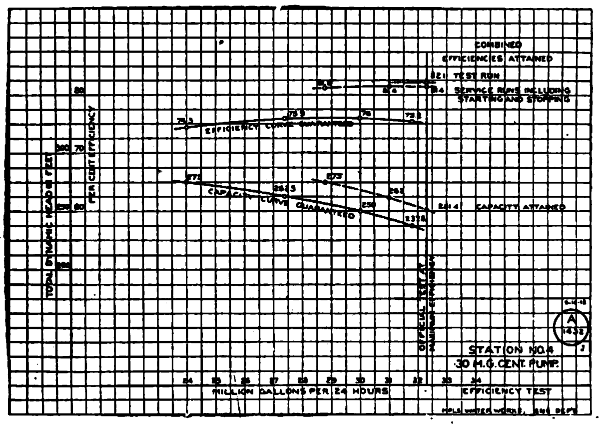
De Laval Motor-Driven Centrifugal Pump, 30,000,000-Gal. Capacity, Installed by the City of Minneapolis.



Motor End of Pump Unit Showing General Electric 1800-Hp. Motor.

three months show an excess of 5% over the efficiencies stipulated in the contract for various heads.

The test was accepted as correct by J. D. Marshall, of the Minneapolis Electric Equipment Co.; Wm. Salt of the De Laval Steam Turbine Co.; J. E. Jensen,



Head, Capacity and Efficiency Curves Showing Results of Tests on De Laval Pump.

supervisor of the Water Works Department, and E. C. York, engineer of Pumping Stations. The foregoing information is taken from the report of the official test by Prof. F. W. Springer of the University of Minnesota.

The following comparative operating data were obtained during the first three months after the test:

De Laval 30,000,000-Gal. Pump.

Gallons pumped	2,797,490,000
Power cost per million gal.	$3.63
Labor and supplies per million gal.	$2.27
Total cost per million gal.	$5.95
Head	253.06 ft.
Overall efficiency	81.4%

Another Type 20,000,000-Gal. Pump.

Gallons pumped	421,340,000
Power cost per million gal.	$4.15
Labor and supplies per million gal.	$2.27
Total cost per million gal.	$6.42
Head	250.57 ft.
Overall efficiency	72.3%

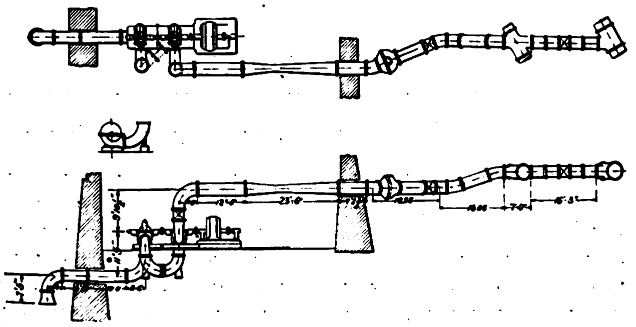
Similar records for the first nine months subsequent to the test are as follows:

De Laval 30,000,000-Gal. Pump.

Gallons pumped	6,526,350,000
Power cost per million gal.	$3.72
Labor and supplies per million gal.	$1.77
Total cost per million gal.	$5.49
Head	255.80 ft.
Efficiency	82.48%

Other Type 20,000,000-Gal. Pump.

Gallons pumped	1,771,930,000
Power cost per million gal.	$4.33
Labor and supplies per million gal.	$1.77
Total cost per million gal.	$6.10
Head	257.80 ft.
Efficiency	71.47%



Line Cut Showing Location of Pump and Force Mains, Minneapolis Water Works.

Figures are also available from two triple-expansion Holly A-frame pumps installed in the same plant in 1903 and 1904, and tested in September, 1904. These pumps have a capacity of 15,000,000 gal. per day each, and on test developed a duty of 162,000,000 ft. lb. per 1000 lb. of steam, reduction being made for slip. During 1908 the two steam pumps raised practically all of the water for the city, namely, 6,518,000,000 gal., against 250-ft. head. The cost of fuel, using Illinois screening at $2.07 per ton, was $3.01 per million gal., the cost of labor $3.33, and other pumping costs 35 cents per million gal., making a total of $6.75. The cost today, with coal at $4.93 per ton, would be approximately $12.74 per million gal.

BRITISH ASSOCIATION FOR ADVANCEMENT OF SCIENCE MEETS.

Necessity of Providing for Power Supply One of Important Questions Discussed.

Until September of this year the British Association for the Advancement of Science has not been able to hold its annual congress since 1916, owing to the attention of most scientific men being occupied in some way or other with the war. This year's gathering therefore provided an opportunity for experts to describe and engineers and scientists generally to discuss some of the great achievements or discoveries of the war period in connection with engineering, electrical, chemical and physical science generally.

The meetings were held at Bournemouth, one of the largest of England's south coast health and holiday resorts, from September 9 to 13, and they were attended by some of the most eminent of British scientists such as Sir Oliver Lodge, Sir Charles Parsons, Sir J. A. Ewing, Sir Robert Hadfield, Sir J. Larmor, Sir Hudson Beare, Sir R. Gregory, Prof. H. E. Armstrong, Dr. A. P. Fleming, Professor Andrew Gray, Prof. W. H. Eccles, Prof. J. E. Petavel; and by leading industrialists and economists such as Sir Hugh Bell, Sir Herbert Morgan, Prof. A. W. Kirkoldy, the Rt. Hon. F. Huth Jackson, and so on.

There was a brilliant address delivered by the president of the association, Sir Charles Parsons, on the evening of the opening day when between one and two thousand members assembled in the famous winter gardens. For discussion of reports and papers members divided off into different sections as usual. The proceedings were full of interest though perhaps there was no special sensation unless it was provided by the excellent accounts that were given of achievements in such matters as aviation, wireless telegraphy, tanks, military bridge construction, turbines for ship propulsion, and other war work.

Sir Charles Parson's Address.

The president, in his opening sentences, said that the meeting was being held at a time when, after a great upheaval, the elemental conditions of organization of the world were still in flux and they had to consider how to influence and mould the recrystallization of these elements into the best forms and most economic arrangements for the benefit of civilization. The British association was capable of exerting a great influence in guiding the nation towards advancement in the sciences and arts. Sir Charles reviewed some of the most important features of engineering advance during the last twenty years. The turbine figured prominently among these. During the 20 years immediately preceding the war turbogenerators increased in size from 500 kw. to 25,000 kw. and the consumption of steam decreased from 17 lbs. per kw.-hr. to 10.3 lbs. Ship construction, tungsten steel and investigations of gaseous explosions were mentioned. In regard to science and the war the speaker said that four years was far too short a time for much scientific invention to blossom to useful maturity, even under the forced exigencies of war and government control. In the past the great majority of new discoveries and inventions of merit had taken many years—sometimes generations—to bring them into general use. The work of the scientists during the war had perforce been directed more to the application of known principles, trade knowledge, and properties of matter, to the waging of war, than to the making of new and laborious discoveries; though in effecting such applications, inventions of a high order had been achieved, some of which promised to be of great usefulness in time of peace.

Sir Charles next discussed some of the important engineering developments made during the war such as tanks, aircraft, directional wireless with special reference to aircraft, emergency bridge construction and so forth. He particularized in regard to sound-ranging and listening devices.

In his section relating to electricity he referred to its rapid development in recent years in lighting, power transmission, in size of plants, etc. At the end of 1918 the central electric stations in the United Kingdom contained plant aggregating 2,750,000 kw., 79% of which was driven by steam turbines. The advantages and disadvantages of superstations were summarized and it was remarked that the greatest element in reducing the cost of electricity was the provision of a good load-factor. It was a far more important consideration than the size of the station. There was no golden rule to secure cheap electricity. The most favorable size, locality, and number of generating stations in each area could only be arrived at by a close study of the local conditions, but there was no doubt that, generally speaking, to secure cheap electricity a widespread network of mains was in most cases a very important, if not an essential, factor. The electrification of main line railways would no doubt result in a saving of coal; at the same time, the economical success would largely depend on the broader question as to whether the volume of the traffic would suffice to pay the working expenses, and provide a satisfactory return on the capital. Turning to consider the future, Sir Charles Parsons spoke as follows regarding the position of England:

"The nations who have exerted the most influence in the war have been those who have developed to the greatest extent their resources, their manufactures, and their commerce. As in the war, so in the civilization of mankind. But, viewing the present trend of development in harnessing water power and using up the fuel resources of the world for the use and convenience of man, one cannot but realize that, failing new and unexpected discoveries in science, such as the harnessing of the latent molecular and atomic energy in matter, as foreshadowed by Clerk Maxwell, Kelvin, Rutherford, and others, the great position of England cannot be maintained for an indefinite period. At some time more or less remote—long before the exhaustion of our coal—the population will gradually migrate to those countries where the natural sources of energy are the most abundant.

"The amount of available water power in the British Isles is very small as compared with the total in other countries. According to the latest estimates, the total in the British Isles is under 1½ million horsepower, whereas Canada alone possesses over 20 millions of which over 2 millions have already been harnessed. In the rest of the British Empire there are upwards of 30 millions and in the remainder of the world at least 150 millions, so that England herself possesses less than 1% of the water power of the world. Further, it has been estimated that she only possesses 2½% of the whole coal of the world.

"England owes her modern greatness to the early development of her coal. Upon it she must continue to depend almost exclusively for her heat and source of power, including that required for propelling her vast mercantile marine. Nevertheless, she is using up her resources in coal much more rapidly than most other countries are consuming theirs, and long before any near approach to exhaustion is reached her richer seams will have become impoverished, and the cost of mining so much increased that, given cheap transport, it might pay her better to import coal from richer fields of almost limitless extent belonging to foreign countries, and workable at a much lower cost than her own."

Sir Charles then went on to explain that "the average capital required to produce electrical power from coal is less than half the amount that is required in the case of water power. The running costs, however, in connection with water power are much less than those in respect of coal. Another interesting consideration is that the cost of harnessing all the water power of the world would be about 8000 millions, or equal to the cost of the war to England. Dowling has estimated the total coal of the world as over seven million million tons, and whether we appraise it at 25 cts. or more per ton its present and prospective value is prodigious. As coal is transportable long distances and, generally speaking, electricity is not so at present, therefore it seems probable that capital will in the immediate future flow in increasing quantity to mining operations in foreign countries rather than to the development of, at any rate the more difficult and costly, waterpower schemes. When, however, capital becomes more plentiful, the lower running costs of waterpower will prevail, with the result that waterpower will then be rapidly developed. As to the possible new sources of power I have mentioned molecular energy, but there is another alternative which appears to merit attention." Sir Charles referred to his proposal of 15 years ago regarding the sinking of a bore hole to a depth of 12 miles—ten times the depth of any shaft in existence, and later to the interesting phenomenon of intense pressure produced by moderate forces closing up cavities in water.

The chairman of the Mathematical and Physical Science Section in the course of his address quoted from his experience as a member of the British Ministry of Munitions, Inventions Department, for three years.

NEW BUSINESS OF BYLLESBY PROPERTIES MAINTAINS RATE OF INCREASE.

All Byllesby electric properties reporting for the week ended Sept. 29 show the following new business gains (net): 969 customers with 503 kw. of lighting and 1366 hp. in motors. New business contracted for but not yet connected includes 1812 customers with 677 kw. of lighting and 1315 hp. in motors. Electric energy output for the week was 9.7% greater than during the corresponding week last year.

Editorial Comment

Better Lighting of Highways

IT IS generally conceded that the lighting of our highways, especially those in the outlying country districts, is woefully inadequate. Of course, it takes time to provide proper facilities to cover the thousands of miles of main highways, let alone those of lesser importance. But with the increasing number of national and state highways and with the strides made in motor-truck and passenger-car transportation there comes a more insistent demand for better lighting to facilitate this traffic and help reduce the large number of accidents occurring at night.

Some progress has been made in automobile headlighting, but on the whole the attempt to light roadways by means of headlights without confusing and blinding drivers coming in the opposite direction is far from satisfactory. The numerous fatal and serious accidents on our roads at night show that the average headlight is by no means the ideal solution of the highway lighting problem.

From the technical standpoint the problem of lighting our highways presents almost no difficulties that have not already been solved satisfactorily in general street lighting. Use of suitable refractors permits the lighting units to be spaced at considerable intervals. On less traveled roads it may suffice to install only enough units to indicate the general lay of the road and illuminate dangerous spots and road signs.

But the problem is not so much a problem of furnishing suitable lighting equipment, installing it and keeping it in good operation as it is a problem of selling adequate highway lighting—of convincing the many county, town and village authorities involved that the need of good lighting is insistent and that the returns in the increased safety, utility and attractiveness of the roads warrant the investment and upkeep

In this case, as in others, it seems that the electrical industry must act as a sort of little father to the laymen—by telling and showing them what is good for them electrically. And so there remains a great deal of pioneer work, especially the central station's, yet to be done before highway lighting in this country is adequate.

Taking the Customer Into Partnership

TAKING the customer into partnership with the utility by the sale of stock to the former by the latter is not a new idea. It is an old idea long advocated in these columns, long followed by many far-sighted utilities with eminent success. But this old idea assumes a new significance these days, when so many new conditions have to be met and so many new and ominous indications are appearing upon the horizon of our industrial and social life.

Take the customer into partnership by selling him stock. Ownership of property is a safeguard against the demagog's denunciation of private ownership, the tirade against the "capital" and the "moneyed interests." Ownership of utility stock by the customer and the public is an anathema to the socialists' and the syndicalists' demand for municipal and state ownership. He who owns property is not given to advocating uncontrolled and radical changes in ownership and civic life. He does not become intoxicated with the idea of taking away from those that have to give to those that have not. He believes in live and let live. He has faith in the durable things of life.

Few factors are more powerful for civic growth than the street cars and the light and power utilities. Civic pride is closely interwoven with the progress and the ideals of these forces in our civic life. The citizen who owns stock in the local utility feels pride the more for a "white way" or electric sign and a scenic railway is the pride of the town. The citizen that owns stock in the local utility is a better citizen, the utility is the better and the city is the better.

What would happen to a strike where every patron owned stock, where every employe owned stock? Who would strike? Would there be a strike? Much is said these days about profit sharing, but the form of profit sharing that comes from stock ownership is the best and the soundest form of profit sharing, for the rise and fall of prosperity affects all alike, hence is equitable and basically sound. The viewpoint of the worker must necessarily be different when he knows his labor brings a reward other than a fee or stipend. The knowledge that his profits depend upon the profit of those for whom he works, of himself and others, is an incentive to honest service, loyalty and stability.

According to the report of the Committee on Sale of Company Securities to Customers and Resident Citizens presented before the annual convention of the National Electric Light Association at Atlantic City, slightly more than $40,000,000 worth of central-station securities, representing 48 companies, have been marketed locally among employes, customers and residents. This is, of course, only a drop in the bucket, but it is indicative of what might be done. Think you, in the localities where this utility stock is owned by the people, that the people are demanding the forfeiture of franchises, are goading these utilities to bankruptcy and harassing them at every turn? Do we fully realize that when the radicals and the socialists and those other scions of labor speak of capital they speak of the worker, of the widow and the thousands of the masses who have invested their dollars? These are "capital"; these are the ones whom the radicals would crush, in eliminating those to whom have been entrusted the dollars of the small investor.

Take the customer into partnership. Take the employe into partnership. Sell your stock, in its entirety, locally. To this extent we believe in public ownership. The sale of utility stock to customer, to employe and to local residents is a policy that is at once sound and wise. It is a policy that is extremely desirable at this time. It is a policy that creates a bulwark of good will in the community. And good will is needed now.

Influence of Extraneous Conditions on Transmission-Line Structures

THERE is often more than one way of doing a thing. Each may be a good way. Sometimes there is little difference in the different ways so far as concerns the results obtained. And yet one way is preferable because it may be safer, it may be cheaper, it may have longer life or may permit of being more quickly or more simply done. When all these factors are taken together, and balanced, that method whose summation comprises the greatest number of advantages with the fewest disadvantages is the best method. Circumstances alter cases, and some factor may carry special weight where some definite condition has to be met, whereas some other factor of little moment under the first condition may be the predominating factor where some totally different condition has to be fulfilled. It is the function of the engineer to weigh the pros and cons in each case, and decide or recommend accordingly.

In the design and construction of transmission lines conditions differ widely in different sections of the country, and sometimes along different sections of the same line. This is more especially the case in mountainous regions, where not only are long spans necessary, but wide variation in loading due to snow and sleet and temperature changes have to be contended with. Boggy country, rock formations are other factors that modify the form of construction used. Notwithstanding these facts, most transmission lines follow along each one much like another.

A closer inspection of these lines and a cursory study of local conditions may show, however, that there is some underlying condition to be met that influences the line in some manner. Elsewhere in this issue is described a form of installing poles for supporting a transmission line of the Western States Gas & Electric Co., that is of interest because none of the poles are embedded in the ground, but are purposely maintained on the surface, so as to get away from rapid butt rot. Each supporting structure utilizes two poles, each unit being guyed in four directions. The form of construction employed has been in use now for more than ten years, and has been found entirely satisfactory for carrying two circuits over long spans, and rugged country and where a high rate of butt rot has to be guarded against. Another rather unique installation presented in these pages some time ago was a case where the overhead steel grounded conductor and the two telephone lines were so installed across a long span that when the emergency arose any one of them could be employed for a phase conductor at 60,000 volts. In this instance, of course, it was a matter of arranging the conductors and jumpers at the anchor towers.

In our last issue, brief mention is made on page 622 of a form of line construction employed in Alabama during those days when it was urgent to construct a transmission line for immediate use, while at the same time foregoing the use of steel because of its high price and relative scarcity. At the same time the line was to be of a permanent nature. The manner of satisfying all these three requirements, rapidity of erection, conservation of steel and reasonably long life, was obtained by adopting what has been called a composite pole.

The composite pole consists of a steel tower braced to and supported by a wooden structure. In this way considerable steel was eliminated without seriously interfering with the permanency of the line, since the life of the line is determined by the life of the joints where the steel section is bolted to the wooden support, and these can be renewed as deterioration makes necessary. The wood-steel structures erected by the Alabama Power Co. are expected to have a life of not less than ten years, and when replacement of the steel-wood joints becomes necessary, or the wood supports are replaced by those of steel, the work can be carried on without service interruptions and excessive cost.

Transmission-line structures have undergone many changes, and different designs have been evolved to meet the many and varied conditions that obtain. So too, line insulators have kept pace with progress, the most radical being perhaps that of changing over from the pin to the suspension type several years ago. Today the suspension type insulator is standard for all transmission potentials of 60,000 volts and above, although it is often used for considerably lower pressures, where high factors of safety electrically and mechanically and similar requirements have to be met.

Although transmission lines have been quite well standardized, and one line looks much like another, there is still ample opportunity for ingenuity in both design and erection. Economy in first cost and operation and safety at all times are always of prime importance. Every innovation or practice that increases the safety, durability and immunity from trouble of a line, lowers the initial and after costs and adds to the flexibility is worth while. And the more engineers know about conditions existing in systems other than their own, and how those conditions were met, the better prepared are they to meet new problems as they arise.

Current Events

Proposed Reorganization of Jovian Order — Time and Place Set for N. E. L. A. Annual Convention Next Year

IMPORTANT PROPOSALS TO COME BEFORE JOVIAN CONVENTION.

Meeting in Chicago Next Month to Consider Revision of Name, Objects and Scheme of Organization—To Be Called National Electrical Board of Trade.

Mention was made in our last issue of the call for a convention of the Jovian Order to be held at the Hotel Sherman, Chicago, on Nov. 5 and 6. It is the general feeling of those interested in the order that it can be revived and reorganized on greatly broadened lines, subordinating to their proper place the social features heretofore so predominant, and developing the constructive business features. In line with these ideas, it is proposed to present to the convention for approval a comprehensive program of reorganization, the chief features of which are the following:

That the name of the Jovian Order be changed to that of "National Electrical Board of Trade."

That the organization, policy, plan of action, and objects and purposes of the National Electrical Board of Trade be so framed, by a revision of the existing Jovian constitution, that they wil be in complete harmony with all that the name implies.

That the suggested revision of the Jovian constitution be prepared by a Committee on Constitution appointed by the Seventeenth Jupiter, who shall, before drafting such revision, carefully survey the organization plans under which are now operating in other channels bodies similar to that of the contemplated National Electrical Board of Trade; as examples, the United States Chamber of Commerce and the International Association of Rotary Clubs.

That the Committee on Constitution (or a separate committee appointed by the Seventeenth Jupiter) shall also survey the needs of the electrical industry (with relation to the possibilities for service to meet those needs inherent within such an organization as outlined here), and shall prepare a standard of performance for the National Electrical Board of Trade, which shall include in specific detail the proposed activities of the board, and a budget covering the cost of operation for its first year and which if accomplished by the board will justify for it a continuance of necessary support from individual members, local boards and the electrical industry as a whole.

That the following suggested activities for the National Board be carefully analyzed by the committee and included, in the practical detail of their application, in the standard of performance, if they are found to be sound and feasible:

1. Public relations.
2. Relations between employer and employe.
3. Trade ethics.
4. Electrical merchandising.
5. Community advertising.
6. Salaried field representatives.
7. Trade data.
8. Foreign trade bureau.
9. Interrelations between electrical associations (hereinafter more definitely outlined).
10. Educational speakers' bureau (a corps of capable men to address monthly evening meetings of local boards).
11. Employment bureau.
12. A monthly publication.
13. Accident and health insurance.
14. Electrical expositions (possibility of traveling exhibits).
15. The Henry L. Doherty plan for the "conservation of human energy."

That the revised constitution and standard of performance be presented for the consideration of and action by a special meeting of the Jovian Order, called for the earliest date consistent with the requirements of the present Jovian constitution.

That the revised constitution provide practical means to permit of two classes of individual memberships, to-wit: One class of members who are also members of local Electrical Boards of Trade and whose dues to the National Board will therefore be paid by such local boards, as hereinafter noted; the other class, individuals who are not members of any local boards and who shall pay dues direct to the National Board, on the same membership classifications as outlined for local board dues.

That both classes of individual members in the National Board shall enjoy equal rights in so far as they deal in a direct line with the National Board, including the holding of national membership credentials inviting the enjoyment of the courtesy of visitors' privileges in all local boards.

That the fundamental scheme of organization as now existing in the Jovian Order be retained—to repeat, that of a vast individual membership whose interests and efforts are held in and invested by a great chain of local chapters, clearing through a central body, which shall have advisory and in proper measure supervisory powers in those matters affecting all local chapters.

That the ideal development shall not fall short of an individual membership of not less than 100,000 desirable, eligible men, working with and through local chapters established in every city and town capable of supporting an active electrical organization, no matter how small it may be.

That all of the present useful activities of the Jovian Order be continued in this evolution of that body, for this plan shall not in any sense be construed as destructive, but in every respect a constructive building upon the excellent foundation heretofore created through years of earnest Jovian endeavor.

That to emphasize the suggestion that one of the major activities of the National Electrical Board of Trade shall be the interrelations between electrical associations, attention be called to the following:

There are vital problems in the internal affairs of the manufacturing, jobbing, contracting, utility and other branches of the industry, each of which interest only indirectly the other branches, in which those other branches could be of small assistance and which are capably handled by the separate associations maintained by those groups.

Also, there exist questions of great moment to all branches, to the entire industry, which should be acted upon by all associations as a unit with standardized policies and methods, to insure harmony, effective results and avoidance of a duplication of effort; there is nonexistent today for such united effort any vehicle completely meeting the need.

As one example of the usefulness of such an agency may be cited a destructive condition generally considered as the problem of the public utility alone but which in reality strikes at the heart of the earning power of every man drawing his income from the field of electricity. This condition is that of the feeling and expression of criticism, suspicion and resentment manifested by press and public in far too many communities and one of the most potent sources of trouble in the industry. It operates directly and indirectly against progress and growth of utilities by inciting unfair, restrictive legislation, cutting down revenue and making necessary capital wary and difficult.

That to remedy that condition should be the fight of every electrical man and association is surely obvious, because, when central stations, street railways and telephone and telegraph companies, the great purchasers of electrical apparatus and supplies, are expanding and prospering, then all down the line, in every branch of the industry, "Business is good." Quite the reverse when the utilities are harassed and depressed to the point of stagnation and retrenchment.

In a great majority, if not in all instances, public distrust is the result of gross ignorance of the policies, basis of earnings, methods of operation, ideals and official personnel of utilities.

The remedy for ignorance is education. Therefore, the whole electrical industry, each man in it, through a standardized, far-reaching plan of action adopted by all electrical associations, should be saturated with educational, preventive and protective propaganda to be by him spread broadcast to the public by every possible means.

This is only one example of the need for a clearing-house for electrical associations; there are many more.

To supply in a satisfactory manner the required agency it is suggested that the revision of the Jovian constitution provide that there be nominated and elected (in a democratic manner representative of all individual members) as the controlling body of the National Electrical Board of Trade, what will be in effect and possibly in name a board of directors, in which shall be included three members selected from each association maintained by each of the recognized groups or branches of the industry, chosen with the approval and co-operation of the respective associations. There shall also be included in this governing body one or more members-at-large and such other members as a thorough study of the plan suggests.

This plan not only furnishes the common ground of contact for all associations, but fairly places in the hands of each branch its share of the control of the National Board, which draws its support from the entire industry.

That the National Electrical Board of Trade be financed by the dues of individual members paid direct to it by those members who are not also members of any local board; also, by payments made quarterly or semiannually by each local board, the amount based on a per capita tax for each member of such board; this local board payment to constitute payment in full for membership of both the local board and each of its members in the National Board.

That the per capita tax for the first year shall be in the sum of $2; at the expiration of that period the tax to remain at $2 or be increased or decreased in harmony with the quality and extent of the service rendered by the National Board, the cost of that service and the gross revenue of the National Body.

That the matters covered herein and as enlarged and made more definite through the procedure and committees recommended be submitted at the earliest possible time as a complete plan, capable of supplying a greatly needed instrument, to the more important electrical interests by a committee named by the Seventeenth Jupiter, with the request that those interests immediately underwrite the necessary operating expense of the National Board during the period in which the plans are being put into effect, these underwriting payments to be repaid in the event and when this reorganization project shall be established on a self-supporting basis.

That the present Jovian constitution be amended to permit action upon constitutional amendments at special meetings called in accordance with the provisions of the constitution.

MISSOURI STATE ASSOCIATION OF ELECTRICAL CONTRACTORS AND DEALERS HOLDS ANNUAL MEETING.

Seventeenth Annual Meeting Taking Place This Week in St. Louis.

The Missouri State Association of Electrical Contractors and Dealers held its seventeenth annual convention at the American Annex Hotel, St. Louis, Mo., Oct. 17 and 18, respectively. The first session was devoted to association business and to the presentation of a paper by R. E. Stewart, of the Stewart Electric Co., St. Louis, on the important subject of "Wiring of Old Houses." The second session on Friday consisted of an address by William L. Goodwin on "The Goodwin Plan." Friday evening the contractors were invited to a dinner given in their honor by the Electrical Board of Trade of St. Louis.

At Saturday morning's session Samuel Adams Chase, of the Westinghouse Electric & Manufacturing Co., made an address on the vital importance of co-operation of the contractor-dealers with the different electrical interests and their effect on the contractor-dealer. A paper on "Cost Finding and Accounting," lack of which may lead to bankruptcy, a proper system of which only can lead to success, was presented by J. A. McShane.

In the afternoon A. Penn. Denton read a paper explaining the objects and aims of the Bureau of Education and Research. Arthur Brandt, Frank Adam Electric Co., read a paper on "Electrical Merchandising." "Operation of Electrical Repair Shop and Sale of Used Electrical Machinery" is the title of a paper presented by Fred E. Briner, of the C. J. & F. E. Briner Electric Co., and two other papers of interest to contractors and dealers given were "Operating a Contractor Business in the Residence Section of a City" by Samuel J. Burke, Burke Electric Co., and "Desirability of Having Electrical Contractors Affiliate, as Associate Members, of the National Fire Protection Bureau" by George Dose.

ELECTRIC CLUB GIVES LUNCHEON IN CONNECTION WITH CHICAGO ELECTRICAL SHOW.

Samuel Insull Makes Address on Development of Electrical Industry, Giving Broad Summary of Conditions Existing in Electrical Field.

Tuesday, Oct. 14, was Electric Club day at the Electrical Show being held at Chicago, Ill., and at a luncheon attended by over 300 members Samuel Insull, president of the Commonwealth Edison Co., Chicago, was the principal speaker.

Mr. Insull first paid a tribute to the members of the electrical fraternity in the army and at home who helped win the war, and said such organizations as the Electric Club of Chicago rendered invaluable assistance.

"The Development of the Electrical Industry" was Mr. Insull's subject and he touched upon it only in a broad way. The capital of electrical manufacturing companies in this country is estimated at $750,000,000, with a yearly turnover of $600,000,000, while the capital of central stations is estimated at $2,750,000,000 with a turnover about the same as that of the manufacturers. Inasmuch as the success of the industry is greatly dependent upon the success of the central stations, and in view of the fact that central stations require such large capitalization for corresponding turnover it is necessary that the stability of the latter be preserved. This can be accomplished by allowing them legitimate profits, secured through intelligent regulation by state commissions. Team work within the industry is also necessary to make central-station stability permanent.

Most utilities, such as electric railway companies, encountered financial difficulties during the war and the situation has not been relieved to any great extent. The nature of their business has made central stations more fortunate in this respect, although much distress has been caused by unfair regulation by public service commissions, resulting in a marked loss of stability by these central stations affected and making it difficult fof them to obtain capital for needy purposes. Stress should be laid upon this situation so that central stations will receive fair regulation, enabling them to make a profit so that investment in them will be stimulated. In this way only can funds be secured to make the line extensions that are needed and which are necessary to the success of the electrical industry as a whole. Mr. Insull said he was sounding no note of alarm, but that increasing labor and material costs made just regulation of utilities imperative and relief was necessary.

In reviewing the development of the industry, statistics on central-station progress were given. Aug. 1, 1919, marked the twenty-fifth anniversary of the opening of the Harrison street power station (now dismantled) of the Commonwealth Edison Co. When first opened it was considered the most modern of any in this section of the country. Its total capacity was one-half that of turbines now purchased by the company. Its total output covering 24 years of operation, about 550,000,000 kw-hr., is less than that of either the Fisk or Quarry stations for one year. The company's maximum load at the time the station was first installed was 6000 kw., while last December it was 400,000 kw. The number of customers has increased from 4000 to 400,000.

In closing, Mr. Insull appealed to those present, as citizens and in the interests of business, to make a concerted effort toward stamping out radicalism and all elements that tend to injure the security and stability of business.

VAIL LIBRARY THIRD LARGEST ELECTRICAL LIBRARY IN U. S.

One of the most notable collections of electrical literature in this country is the Vail Library. It comprises about 20,000 volumes, which includes books on electricity, magnetism, electrical engineering, electrochemistry, electrometallurgy, electrotherapeutics, world expositions and electrical congresses. The collection was originally made in England and was purchased in 1912 by Theodore N. Vail, president of the American Telephone & Telegraph Co., who gave it to the Massachusetts Institute of Technology. It has been cataloged and brought up to date by the addition of about 1000 new books. The institute has given a large room in the main building for the Vail Library, which is open to the public as well as the students for reference and research.

MASSACHUSETTS INSTITUTE WIDENS ELECTRICAL ACTIVITIES.

Need for Research, Application and Other Factors Necessitate Raising Endowment Fund of $10,000,000.

"We have reduced ourselves to a one-tenth-of-a-second world," says Prof. Arthur E. Kennelly, director of the Research Laboratory of Electrical Engineering at the Massachusetts Institute of Technology. One of the greatest achievements of the war, according to Professor Kennelly, was getting around the world by radio. Many times messages were sent successfully from Carnabon in North Wales to Sydney, New South Wales, which is practically at the antipodes. These signals in all probability arrived at the antipodes in less than one-tenth of a second trom the time they started. That means that all our radio communications in the future are necessarily compressed within a period of time which is less than the antipodal period of one-tenth of a second.

The evident result of that shrinkage, the Technology professor believes, will be to force us into close international touch, and this will render necessary a readjustment of our international relations. We will have to maintain an international language, an international system of weights and measures—the metric system—and a code of international law. The League of Nations is just the beginning of the consequences that will have to be thought about as a result of the close electrical communication throughout the world.

The Massachusetts Institute is raising a $10,000,000 endowment fund this autumn to keep abreast of the times, and Professor Kennelly believes this move is justified along many lines. The war has brought about a remarkable development in all branches of applied science and the Institute of Technology needs new apparatus in her laboratories and new blood in her teaching staff to give the students the sort of training they ought to have. In Professor Kennelly's own field, electrical work of all sorts is advancing so fast that it takes the best they can do to keep up with it. Reading and laboratory work—the accomplishments of the research laboratory for one year—furnish the material for teaching in the next. Already electrical courses are given at Technology that would not have been possible had it not been for the laboratory work of the preceding year.

Professor Kennelly is giving a new course on electrical communication this year, a course made necessary and possible by reason of the experience gained in the war, where all kinds of electrical signalling were resorted to under stress. A special group of students is being assigned to it from the Signal Corps of the United States Army. They will study the principles of telegraphy, telephony and radio, together with the numerous methods, both practical and theoretical, that are involved.

Radio and radio methods are coming to be introduced more and more generally into electrical communication in civil life. In radio telephony a very small amount of the energy inside of matter is released so that mankind is just commencing to unlock the enormous stores of energy within matter, very much greater than the energy released by coal in burning. All studies made in the laboratory at any time would be of incalculable value to industry if the secret of unlocking that energy could be revealed. It would probably be unfortunate, howeve, if we did succeed in releasing it all at once.

ELECTRICAL MANUFACTURERS HOLD SECTION MEETINGS.

Many Sections of the Associated Manufacturers of Electrical Supplies Hold Sessions at the New York Headquarters and Also One in Chicago.

On Oct. 14 to 16 of this week many of the important sections of the Associated Manufacturers of Electrical Supplies held regular meetings at the headquarters of this association, 30 East Forty-second street, New York City. Over 300 manufacturers were in attendance. Each of the sections holding a meeting was strongly represented by delegates from its particular group. The general progrems of each of the section meetings included earnest discussions on practical details of manufacturing and marketing electrical supplies. Among the sections which met in New York City were the following: Signaling Apparatus; Lamp Receptacle and Socket; Industrial Lighting Fixture; Snap Switch; Attachment Plug; Outlet Box; Fuse; Knife Switch; Insulating Materials; Panelboard and Switchboard; Molded or Formed Insulation; Line Material and Air Circuit-Breaker. The Heating Appliance Section held a meeting in Chicago on Oct. 14.

N. E. L. A. Selects Pasadena for Next Convention

Convention Will Be at Hotel Huntington May 18-21, Inclusive—M. H. Aylesworth Made Executive Assistant to the President—Other Important Association News

PASADENA, pre-eminent among the beautiful cities of Southern California, was selected as the seat of the next annual convention of the National Electric Light Association. It will be a four-day gathering from May 18 to 21, inclusive, and will have many distinctive features to mark it among the notable meetings held by this influential organization.

Decision as to the time and place of the next convention was reached at a meeting of the Executive Committee of the association held in New York on Oct. 2, at which President R. H. Ballard, of Los Angeles, presided. The Hotel Huntington was selected as the headquarters of the convention. Mr. Ballard obtained an agreement with the hotel to reserve it for the exclusive use of N. E. L. A. members, and stated that if the accommodations at this hotel are not sufficient for all who wish to attend, the western delegates will stay at other hotels in Pasadena so as to give the preference as to the Hotel Huntington's facilities to delegates from distant parts of the country.

Matters relative to the next convention were not the only ones decided at the committee meeting referred to. The presence of President Ballard made it possible to reach conclusions on a number of other very important features, one of these involving the selection of an administrative director of the assocciation's affairs, M. H. Aylesworth, of Salt Lake City, being chosen for this important position. On account of the importance of the matters considered at the meeting, the following condensed report abstracted from the minutes will no doubt prove interesting to all central-station men.

Geographic Sections.

As chairman of the Committee on Geographic Sections, appointed at the last meeting of the Executive Committee, R. J. McClelland reported that the committee had agreed upon a division of the country into geographic sections and presented a map of the United States showing the proposed divisions which had the approval of Vice-President Bump.

President Ballard stated that what he had in mind for the Executive Committee was merely a tentative approval of the plan of dividing the country into geographic sections, that the report of Mr. McClelland's committee might be received and published in the *Bulletin* as representing the best judgment of the committee, subject always to the desires of the members living in the existing and proposed sections. The committee would thus have an opportunity to check up with the members the arguments for and against large and small geographic sections. The adoption of the report along those lines would not commit any section to any definite boundaries. Mr. Ballard added that in order to get an idea of the opinion of the committee's plan in different parts of the country, a number of telegrams have been sent out and very enthusiastic replies have been received from a number of men resident in different sections of the country.

Mr. Ballard reported that the Public Policy Committee had appointed a committee consisting of W. W. Freeman, chairman; Joseph B. McCall and Frank W. Smith to confer with the Committee of One Hundred of the Electric Railway Industry.

Appointment of Mr. Aylesworth as Executive Assistant to the President.

President Ballard advised the committee that he had discussed with the Public Policy Committee the employment of a man to act in an executive capacity with title of assistant to the president and to be located at headquarters. He had suggested the name of M. H. Aylesworth, of Salt Lake City, Utah, and his qualifications and recommendations had been discussed with the Public Policy Committee, with the result that the members of this committee were of the opinion that the employment of Mr. Aylesworth in this capacity would be of benefit to the association and they recommended his employment. Mr. Ballard advised the Executive Committee of the work Mr. Aylesworth had done in the past, stating that the four vice-presidents had all met him, and were favorably impressed with his record and general qualifications for the position. John A. Britton, chairman of the Public Policy Committee, spoke in favor of the creation of the new position and the employment of Mr. Aylesworth. On motion it was voted to authorize President Ballard to engage Mr. Aylesworth as assistant to the president.

Mr. Bump suggested that Mr. Sewall be continued as acting secretary for the present, leaving it to Mr. Aylesworth to make his own organization. The president appointed Mr. Sewall acting secretary and on motion the appointment was confirmed.

T. C. Martin's health having improved, the president, with the concurrence of the Public Policy Committee, recommended his appointment as advisory secretary of the association, devoting part of his time only to association affairs on matters referred to him by the president or his representative, and that in consideration of Mr. Martin's valuable services to the association in the past in the active duties of secretary, this position be offered to Mr. Martin for life. On motion it was voted to approve the president's recommendation. On motion the president was authorized to appoint a committee to draw up suitable resolutions memorializing the splendid work which Mr. Martin has done for the association and the industry at large, these resolutions to be spread upon the records and an illuminated copy to be sent to Mr. Martin. President Ballard then appointed J. W. Lieb, Charles L. Edgar and Henry L. Doherty as this committee.

Mr. Ballard then called upon Mr. Britton, chairman of the Public Policy Committee, to address the Executive Committee, and Mr. Britton made an inspiring address, dwelling upon the wonderful possibilities for good work ahead of the association.

Convention Plans.

On motion it was voted to hold the 1920 convention in the Hotel Huntington, Pasadena, Calif., from May 18 to 21, inclusive. President Ballard stated that the hotel will be reserved for the exclusive use of N. E. L. A. members, and that if accommodations are not sufficient for the entire convention, the western delegates will stay at the other hotels in Pasadena.

President Ballard outlined his plans for the Pasadena convention, confining the general work to morning sessions at which the most important subjects of the national special sections will be presented, the afternoons to be devoted to such parallel meetings of the sections as may be absolutely necessary. Mr. Ballard asked the members of the Executive Committee to write him of any ideas or suggestions they may have regarding the convention plans.

It was voted to appoint George W. Elliott as master of transportation to arrange for special trains, etc., for the nearly 2000 members that may attend.

Committee Chairmanships.

President Ballard reported that Franklin T. Griffith, president of the Portland Railway, Light & Power Company, of Portland, Ore., had accepted chairmanship of the Committee on Water Power Development; that S. M. Kennedy, general agent of the Southern California Edison Co., of Los Angeles, had accepted chairmanshop of the Committee on Service, and that Lee H. Newbert, manager of the commercial department of the Pacific Gas & Electric Co., of San Francisco, had accepted the chairmanship of the Committee on Co-operation in the Industry, all of which appointments were confirmed by the Executive Committee. Mr. Ballard also reported that M. S. Sloan, president of the Brooklyn Edison Co., had agreed to act as chairman of the Committee on Electrical Resources of the Nation, which appointment was confirmed.

Chairman F. A. Birch, of the Company Sections Committee, reported that there were 23 active sections at the present time and that the committee is devoting special attention to the old sections that are inactive or have disbanded, in an effort to induce them to reorganize. A personal visit will be made during the year by some member of the committee to each of the active sections. Mr. Birch emphasized the great value of company sections not only to the individual members, but to the management of the companies on account of the many subjects which the sections can discuss of common interest.

President Ballard reported that Charles B. Scott, H. J. Burton, and Wills Maclachlan had represented the association at the Public Utility Section of the National Safety Council at its congress held in Cleveland, on Oct. 1 to 4.

President Ballard referred to the convention of the Illuminating Engineering Society to be held in Chicago, Oct. 20 to 23, and stated that a number of Commercial Section committee meetings are to be held in Chicago during this same week, thus assuring cooperation as some of the commercial members will undoubtedly attend sessions of the society.

The Convention City.

A keen competition for the honor of holding the convention was participated in by five cities of the southern part of California, these being Los Angeles, Santa Barbara, Riverside, San Diego and Pasadena. The invitations from Pasadena took the form of a telegram to the Executive Committee from all of its civic bodies. The choice fell to Pasadena, because of its excellent hotel accommodations; the fact that it is only nine miles from Los Angeles, the metropolis of the extreme Southwest, and because the Hotel Huntington, beautifully situated in the San Gabriel valley, can provide quiet and restful hospitality for those who attend the convention.

The Executive Committee is in receipt of telegraphic advices from Pasadena that the Maryland

Hotel Huntington, Pasadena, Cal., Where the 1920 Convention of the National Electric Light Association Will Be Held—The San Gabriel Valley, the Sierra Madre Range and Mount Wilson in the Background.

and Green, both large tourist hotels, will reserve sufficient rooms to accommodate the overflow of visitors who cannot be cared for at Hotel Huntington.

Pasadena, known as the crown city of the San Gabriel valley, is world-famed as a summer and winter tourist resort, and the home city of many millionaires, authors, artists, and celebrated people. It lies almost directly beneath Mount Wilson, and the mountains of the Sierra Madre Range from a crescent to the north. In every direction the wonderful automobile roads for which southern California is renowned, lead out through labyrinths of orange groves and down to the Pacific and a dozen of its famous seaside resorts.

President Ballard has received wire advices from Los Angeles, his home city, that the civic bodies of Pasadena and the several large electric corporations which operate in the Southwest will co-operate with the committee of the organization in providing entertainment for the tourists and their families, which will make their visit to southern California an event of unprecedented pleasure.

The Executive Assistant to the President.

M. H. Aylesworth, the newly appointed executive assistant to the president of the association, fills a newly created office with duties amounting to those of operating executive of the association.

Mr. Aylesworth is a young man, a lawyer by profession, being a graduate of the University of Colorado and University of Wisconsin ('06). He has, however, been closely identified with public utility matters most of the time since his graduation. He was for four years chairman of the Colorado Public Utilities Commission; subsequently, and until his present appointment, he was in charge of public relations and public policy work for the Utah Power & Light Co., the Utah Light & Traction Co., and the Western Colorado Power Co., having the position of assistant to the vice-president and general manager.

During the war Mr. Aylesworth was chairman of the Fifth Regional Committee of the National Committee on Public Utility Conditions.

Campaign to Nationalize Work of the Association.

The ambition of the new administration will be to bring into the association every electrical utility in the United States. A vigorous campaign will be instituted to nationalize the work of the association more than heretofore, especially in view of the numerous and difficult after-war problems of the utilities, and to bring its influence into every geographical section of the country. Mr. Aylesworth is a strong advocate of concentrating on service to the public in such a manner as to increase understanding of the business of a public utility among the people at large.

Mr. Aylesworth comes to his new position—he has only been in harness a few days—thoroughly in accord with Mr. Ballard's slogan, "Everybody works." Preparations have already been made since his coming to association headquarters in the Engineering Societies Building to enlarge these quarters and make them adaptable to the campaign work in view. The association has taken an entire floor and this is being rearranged throughout. A very attractive feature will be a large members' room with desks and stenographic facilities. It is hoped that representatives of any of the member companies who will come to New York will make this room their headquarters.

ELECTRIFIED TRAINS TO SEATTLE IN A FEW MONTHS.

Final Arrangements Being Made to Complete C. M. & St. P. Electrification from Othello to Seattle.

All of the heavy work of electrifying the Chicago, Milwaukee & St. Paul railway from Othello to Seattle, Wash., has been completed, but there are innumerable small tasks to be completed to make it possible to handle electric locomotives at all points and to insure operation without a break. None of the remaining jobs is large in itself, but in the aggregate they involve considerable labor and expense, arrangements for which were recently completed by General Manager Earling while in the East.

It is not expected by the company to operate freight trains through to Puget Sound by electricity before the middle of November and the complete electrification of the line will not be finished before January.

Electric locomotives have been in operation west of Othello over the Saddle Mountains for more than a month.

ELECTRIC TRUCK VETERANS STILL IN SERVICE.

Interesting Exhibits at New York Electrical Show Demonstrate Serviceability of Electric Trucks.

That the electric truck gives long years of service was very convincingly shown by the Automobile Bureau of the New York Edison Co. in an exhibit at the New York Electrical Exposition which closed Oct. 4.

Two trucks, one with a 16-year and the other with a 14-year service record, were on view, while a statistical chart showed the number of electrics of all ages that were in service on Jan. 1, 1919.

The 16-year old truck was a lamp wagon used for delivery purposes by the electric light company. The 14-year old vehicle was lent to the exposition by Aitken, Son & Co.

On the statistical chart it was shown that there are now 2044 electrics of at least 5-year service; there are 980 8-year-olds, 221 in the 10-year class, 106 that are 13 years old, 33 in service 15 years, 25 in service 16 years, 11 in service 17 years and 2 that are 18 years old.

The exposition's electric-vehicle display included trucks, a fire engine, passenger cars, industrial trucks, a tractor and storage batteries.

ELECTRIC HEATERS PROVE TO BE GOOD SELLERS IN MINNEAPOLIS.

Sixty-six Electric Heaters Absorbed by Public During Week as New Customers Are Connected Up.

The sales department of the Minneapolis General Electric Co. reports the sale of 66 electrical heaters during the week ended Sept. 29. During the same week the department secured 489 new electric customers with 287 kw. of lighting and 189 hp. in motor equipment.

Net gain in connected load includes 304 customers with 262 kw. of lighting and 565 hp. in motors. Electric energy output for the week was 35.7% greater than for same week previous year.

Commercial Practice

Dayton's Successful Electric Iron Campaign—Store Lighting —Reduction of Fog Electrically—It Pays to Advertise

CHART DRAWN BY PACIFIC GAS & ELECTRIC CO. PROVES ONCE AGAIN THAT "IT PAYS TO ADVERTISE."

Relation Between Advertising and Sale of Utility Stock Emphasizes Value of Maintained Publicity.

It has often been stated that "it pays to advertise." In fact, it is a truism accepted everywhere by practically everybody. The accompanying chart shows in

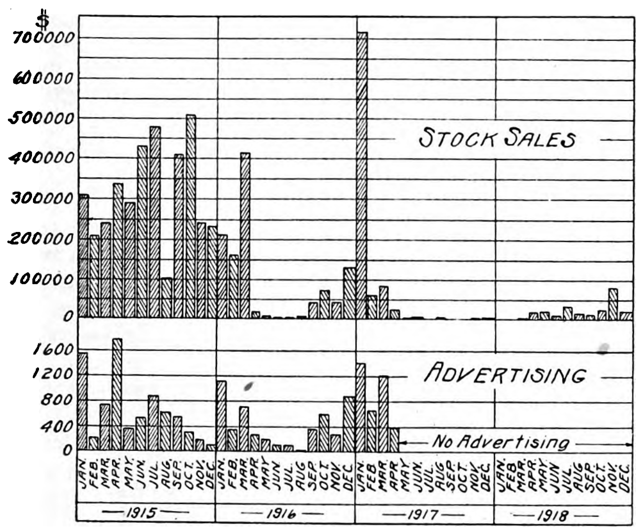


Chart Showing Relation Between Advertising and Stock Sales, Showing Manner in Which Stock Sales Fluctuate With Advertising.

a very interesting and illuminating manner the influence that advertising exerted upon the sale of stock in the case of the Pacific Gas & Electric Co.

The Pacific Gas & Electric Co. has been one of the prominent companies to take to that very sound policy of selling its stock to its employes and its patrons. The company introduced its present policy about June, 1914, and since that time has proved again and again that such a policy is sound basically and advantageous from every aspect. In these days when there is such commotion going on among demagogs for state and municipal ownership, and when bolshevism is creating so much noise, the ownership of property is one of the factors that enables such movements to fail. Ownership in utility stock creates interest and allays friction; it puts a stop once and for all to the cry of municipal ownership and makes the stock owner realize that the term "capitalist" applies to anyone who has one dollar or more in the bank or owns a lot or employs labor to work for him.

The Pacific Gas & Electric Co. has found, as so many other utilities have found—and as the Government has found since inaugurating its campaigns for War Savings Stamps and its Victory and Liberty Loans—that the public will subscribe when sound investments are properly presented. To sell stock to the utility patrons as well as to the employes is sound business, and many are the utilities that could do still more to take the customer into partnership.

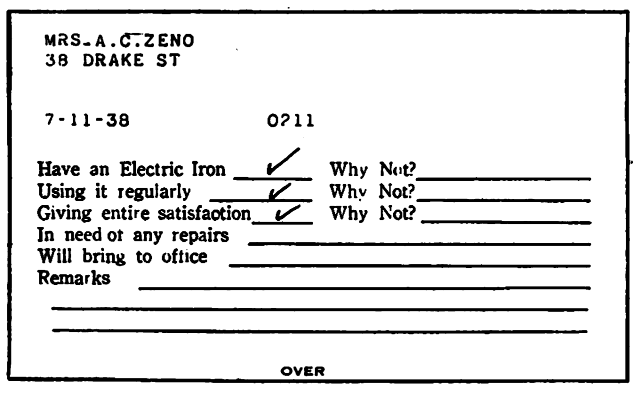
IRON CAMPAIGN BY DAYTON POWER & LIGHT CO. PROVES SUCCESSFUL.

Co-operation with Dealers and Canvassing Methods Mark Merchandising Campaign in Dayton.

The electric flatiron—often called the "glad iron"—is one of the most popular electrical devices with the women folk at home. It is also well at the top of the list when it comes to the load-factor of the various individual electrical appliances, being used oftener and longer than most current-consuming devices. Flatiron campaigns are inaugurated by central stations for the above reasons; the flatiron is a good and easy seller, and, when sold, it is a very satisfactory consumer of current.

When the Dayton Power & Light Co. launched a flatiron campaign in Dayton and some of the surrounding settlements it expected to obtain good results. But it accomplished a great deal more than it had hoped. The campaign lasted one month, of thirty-one days, and was launched at a time when conditions were in favor of success.

At the commencement, and just previously, the company carried on a certain amount of advertising, but comparatively little, stating what it was to do. At the same time the company's high school students' co-operative school was started, by which high school students made a house-to-house canvass for the sale ot flatirons. The accompanying illustrations show the form of card employed by these students when


MRS. A. C. ZENO
38 DRAKE ST

7-11-38

Have an Electric Iron ✓ Why Not?
Using it regularly ✓ Why Not?
Giving entire satisfaction ✓ Why Not?
In need ot any repairs
Will bring to office
Remarks

OVER

Fig. 1.—Front Side of Card Distributed by Dayton Power & Light Co., During Flatiron Campaign.

canvassing from house to house. For the campaign the Dayton company sold a G. E. iron for full retail price of $6.50, giving also as a premium a Rid-Jid folding ironing board. The terms called for a deposit of 50 cents when the customer made the contract and got the iron, and thereafter $1 per month, payable at the time when the electric light bill was paid.

The population of Dayton is about 165,000, and the number of flatirons sold amounted to 1206. In Wilmington, a nearby settlement of 500 persons, 145 irons were sold; in Piqua, with a population of 15,000, some 130 irons were sold, while Xenia with 10,000 persons absorbed 100 irons. During the campaign, and because of it, the company found that there were more than 300 irons that had been sold at different times to customers but were not being used, because they were in need of some small repair such as broken cord, broken terminal clips or open circuit. About the same proportion of defective irons were collected from outlying settlements. These irons were taken up, removed to the repair shop of the company where they were repaired and returned to their respective owners ready for work. The result was that approximately 1500 electric irons were made active consumers of current, 300 being irons that had previously done little toward load building, hence were of as little use to their owners as to the utility.

During the campaign, the Dayton Power & Light Co. found that many of its customers were interested in many electrical appliances other than flatirons, or

Other Electrical Appliances

1 Cleaner ______	8 Motor Pump ______
2 Curling Iron ______	9 Sewing Machine ______
3 Fan ______	10 Stove ______
4. Heater ______	11 Toaster ______
5 Heating Pad ______	12 Washing Machine ______
6 Hot Plate ______	13 Water Heater ______
7 Ironing Machine ______	

Interested In.

______

______

Fig. 2.—Reverse Side of Card Distributed During Flatiron Campaign.

in addition to them. In cases of this kind the company notified electrical dealers and contractors throughout the city. In this way the names of more than one hundred prospective purchasers of electric washing machines, vacuum cleaners, toasters, etc., were brought to the attention of the local contractors. It is policies such as this that breeds friendliness on the part of electrical dealers toward the central station, resulting in reciprocity and general benefit.

After the above-mentioned campaign had closed, and the results obtained determined, it was found that in practically every case of the one hundred interested parties whose names had been forwarded to the dealers, each had purchased the device in which they had previously stated they were interested, in some instances making additional purchases besides. In this way the electric iron campaign might also be called an appliance campaign. But then, when an electric iron is sold it nearly always leads to the sale of other electrical appliances too.

PRECIPITATION OF TAR FOG BY ELECTRICITY PROVES SUCCESSFUL.

According to a communication presented by G. Davidson to the Canadian Mining Institute, the Cottrell process of electrical precipitation is able to deal with the crude gases produced in the distillation of coal, wood and petroleum, even at the high temperature used in modern industrial processes, while the usual methods of tar fog removal in extractors require cooling of the gases. Cleaner distillates were obtained with electric precipitation. The treater chamber used consisted of an iron pipe, 15 ft. high and 12 in. in diameter, provided with fused quartz insulators; approximately a million cubic feet of gas was passed through the heater per day, and the heater required about 2.5 hp. or 3 hp.

STORE AND INDUSTRIAL LIGHTING CAMPAIGNS SUCCESSFUL.

University of Ohio Establishes Educational Course on Industrial Lighting Practice.

Reports from several central-station companies indicate that in a number of cities "better store lighting" campaigns are meeting with excellent results. Storekeepers and owners of establishments having large interiors have been found readily responsive to the advantages of skillfully planned artificial lighting arrangements. It is likely that considerable time will be devoted this winter to the subject, which is made interesting by many improvements completed in lighting practice and in the essential equipment for it by the laboratory and research departments of the large electrical manufacturing concerns.

The Ohio State University, recognizing the practical importance of this phase of central-station service, has established, through its electrical department, a course of 12 lessons on industrial lighting practice. In this course the essential fundamental principles are taught and the best established practice is described, partly through the medium of trade literature and technical bulletins of the lighting equipment manufacturers. The application is illustrated through practical problems, in such a way as to give the student a definite conception of the best methods of treating lighting problems.

JAPANESE CENTRAL STATION INSTALLS TWO LARGE TURBINE UNITS.

Two 25,000-kw. steam-driven turbine units of Westinghouse make, which will complete the largest steam-driven electrical installation in the Far East, are now being erected at Osaka, Japan, for the Osaka Electric Light Co.

Located in an extensive industrial district, this company furnishes light and power to street railways, steel works, shipbuilders, copper-refining plants, paper mills, electrochemical installations and other industries.

It is noteworthy that in 1908 the Osaka company installed three steam turbine units of 3000 kw. each. In 1910 two more units of like capacity were added, and in 1911 two 5000-kw. units. The 25,000-kw. units now being installed will bring the capacity of this plant up to 100,000 hp.

SECTION MEETINGS OF IRON AND STEEL ELECTRICAL ENGINEERS.

The Association of Iron and Steel Electrical Engineers will hold the following section meetings: Pittsburgh, Oct. 25, Chatham Hotel, review and discussion of papers at the recent St. Louis convention; Philadelphia, Nov. 1, Engineers' Club, paper on "Electrical Cleaning of Gases as Applied to the Blast Furnace," by N. H. Gellert and K. V. Laird.

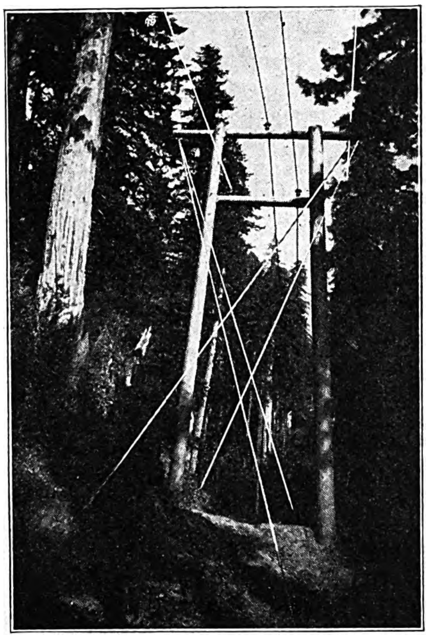
Operating Practice

Special Line Structures—Peculiar Transformer Trouble —Electric Furnace Leads—Mercury Arc Rectifier Tubes

SPECIAL LINE CONSTRUCTION FOR LONG SPANS AND RUGGED COUNTRY.

Pole Setting Adopted by Western States Gas & Electric Co. Proves of Long Life.

Around Eureka, Calif., the Western States Gas & Electric Co. is employing a very interesting form of pole setting for carrying its high-tension transmission lines over mountain ranges and rough country. In building the line in question, and at the time the construction was carried out, it was impossible to secure anything except native timber, redwood. As native timber planted in the ground would completely rot out at the ground line in about three years the company adopted the form of pole setting shown in the accompanying illustration.



Double-Pole Setting That Overcomes Pole Rot and Handles Long Spans Conveniently.

At first a line about one mile was erected, there being two poles set on top of the ground and guyed four ways, as shown. No part of the pole enters the ground, the base of the pole being given sufficient foundation to prevent this even under weight. The form of construction shown has been in vogue now for ten years and to date absolutely no trouble has occurred; it has not even been necessary to tighten any of the guy wires. As it became necessary to reconstruct old lines, this same form of construction has been followed.

The Western States Gas & Electric Co. states that the cost of the two-pole structures is about two and one-half times as much as a single-pole structure. On the other hand, as the spans range from 150 ft. to as high as 3600 ft., with an average of probably 600 ft., this form of construction has been found cheaper than a single-pole installation built for 650-ft. spans. Much of the country traversed is most rugged, passing over several mountain ranges, and the company recommends the above form of construction for this class of work.

RESIDUAL MAGNETISM CAUSE OF UNCOMMON STARTING TROUBLE.

Saturation of Magnetic Circuit Causes Current Rush in Starting 2000-Kw. Synchronous Converter.

By F. B. Johnson.

A 2000-kw. synchronous converter for supplying railway load was connected to a bank of three 750-kv-a. transformers. It was the custom to always start this machine from the alternating-current end by means of one-third and two-thirds starting taps on the transformers. In attempting to start this machine one day a peculiar trouble developed. The primary oil circuit-breaker of the transformers was closed with the starting switch in the customary one-third tap position. The machine did not start up, however, as the relays on the high-voltage side of the transformer bank operated and opened the circuit-breaker.

The alternating-current starting switch was opened and the oil circuit-breaker closed and opened four times. On the first trial the overload relay in one phase of the transformer bank operated, and on the second and third occasions the overload relay on another phase operated, in the second case opening the oil circuit-breaker. On the fourth trial the relays did not operate. The starting switches were then closed and the machine started up and shut down several times, the alternating-current and field break-up switches always being left closed until the machine had come to rest.

The following explanation solves the above-mentioned trouble and is undoubtedly the correct explanation. When the oil circuit-breaker controlling the transformers is opened, the circuit is usually broken at the zero value of the current wave. Because of its retentivity, the iron remains magnetized to some value, which may be as high as 70% of the normal. When the transformer oil circuit-breaker is again closed, the current in part of the first cycle may tend to magnetize the iron in the same direction as that in which it is already magnetized; or it may magnetize it in the opposite direction, depending upon the point of the current wave at which the circuit is closed. When the former occurs, saturation of the iron results, and a current that may be several hundred per cent of the normal value flows. This is the condition that caused the repeated operation of the overload relays above referred to every time the circuit to the transformers was closed.

As to the method of prevention, when the load has been taken off a synchronous converter if the equalizer switch is opened (where converters are operating in parallel) before the oil circuit-breaker controlling the transformer bank is opened, while the alternating-current running knife switches and the field break-up switches are left closed until the machine comes to rest after the circuit-breaker has been opened, the residual magnetism in the cores of the transformers may be reduced to a very low value. This procedure allows gradual diminishing voltages to be generated in the armature of the synchronous converter, hence the magnetization of the transformer cores to die down. Following the above procedure in shutting down large synchronous converters will enable starting difficulties due to residual magnetism as described above to be eliminated.

EFFECT OF CONDUCTOR ARRANGEMENTS UPON INPUT TO ELECTRIC FURNACE.

Shortening of Conductors Necessitating Rearrangement of Furnaces Increases Input from 1500 Kw. to 2500 Kw.

Every operator of the electric furnace is familiar with the effect of low power-factor and the part played by conductor arrangements in holding back energy input to a furnace, hence rate of melting. The effect of inductance is specially marked on 60-cycle

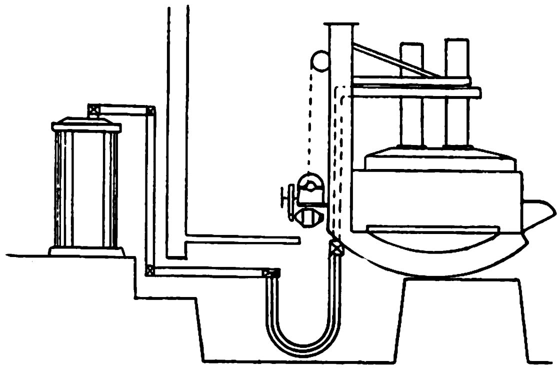


Fig. 1.—Arrangement of Conductors That Limited Input to 1500 Kw.

circuits, so much so that in some quarters 25 cycles is advocated for the very large furnaces.

In one recent instance, as brought out in the report of the Electric Furnace Committee, A. I. & S. E. E., a 15-ton electric furnace obtained its supply through 3000 kv-a. of transformer capacity. The arrangement of transformers, furnace and conductors was as shown in Fig. 1. With this layout it was found impossible to get more than 1500 kw. into the furnace because of

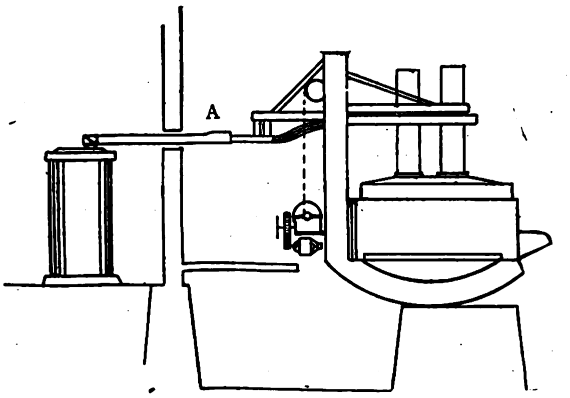


Fig. 2.—Arrangement of Conductors That Enabled Input of 2500 Kw. to be Obtained With Improved Power-Factor.

heating in the conductors. The power-factors were also extremely low. As the limitation to power input was obviously due to the heating and voltage drop resulting from the conductor arrangement, it was decided to modify the existing arrangement.

The furnace was rebuilt to reduce heating troubles in the furnace itself. The conductors were re-arranged as shown in Fig. 2, thereby reducing their over-all length very materially. At "A" a special form of disconnect switch was installed by which conductor length was still further reduced, since the length of flexible conductor ordinarily required when the furnace was tilted was no longer needed. With the arrangement shown in Fig. 2 it was found possible to secure an input to the furnace of 2500 kw. while the power-factor, voltage regulation and efficiency were all materially improved.

VARIATION IN LIFE OF RECTIFIER TUBES INDEX OF OPERATING AND CIRCUIT CONDITIONS.

Experiences of Southern California Edison Co. With Tubes for 2275 Magnetite Arc Lamps.

The question is frequently asked as to what may be considered as being the average life of mercury arc rectifier tubes. It seems to be the general experience that the life of mercury arc rectifier tubes varies quite widely, the causes being partly that the same care is not always given different tubes differently located; all tubes are not, perhaps, of the same quality, and the different classes of service and condition of circuits have different effects upon tube life.

During the year ending July 1, 1919, the Southern California Edison Co. states that the average life of tubes used for supplying its magnetite series street lighting system was 754 hours. There were 2275 series magnetite lamps altogether in service during the year on the company's various street lighting circuits and on this basis the average cost of rectifier tubes for the year was $3.29 per lamp.

The company has found that there is a very wide discrepancy as to tube life in different substations, which means, of course, that the average cost per lamp per year chargeable to deterioration of arc rectifier tubes also varies widely. The average life of tubes obtained in different substations or districts ranged all the way from 205 hours to 1852 hours. This great variation indicates that it pays to give mercury arc rectifier apparatus careful attention and that the circuits should be kept as free as possible from grounds and other causes of surges and wide current fluctuations.

WIRELESS TELEPHONES FOR GEORGIA RAILWAY & POWER CO.

Plans have been made by the Georgia Railway and Power Co. by which communication between their power plants, between substations and power plants and along their transmission lines can be carried on by wireless telephony. The company operates a very extensive transmission system employing high voltage, and the use of the wireless telephone will eliminate those forms of trouble that usually occur when a transmission line is in trouble, and that make the telephone inoperative when most needed. It is proposed that some of the patrolmen's trucks be also equipped with wireless, to facilitate communication and location of trouble.

Contractor-Dealer

Sterling Electric Co.'s Sales Record—Suggestions for Merchandising Appliances—Novel Washing-Machine Display

SALES GOAL FOR YEAR IS REACHED IN EIGHT MONTHS.

Minneapolis Electrical House Succeeds So Well in Attaining Sales Figure That It Sets New Mark for Year.

One of the methods that has been used to great extent by sales managers, especially those of manufacturers, has been to set a "bogey" on sales over a given period. Each salesman is allotted a certain quota of sales, the whole to make up the bogey that has been set. Of course, the underlying scheme is that the bogey gives the sales department a goal for which to strive and makes an incentive for greater sales results.

It has remained, however, for an electrical concern to have its sales department to strive not only for bogey but increase its efforts to equal what is known in golfing parlance as "par" figures. Beginning Jan. 1 of this year the Sterling Electric Co., Minneapolis, Minn., set a bogey of $1,000,000 for its sales during 1919, and used in this connection the motto, "We are growing as you have seen, until our goal is $1,000,000 for 1919."

Believing that it would be necessary to extend its efforts to reach this goal, the sales department endeavored to get ahead of the monthly quota and keep ahead. These efforts were so well directed and gained so much momentum that it became apparent in the six months' period that bogey for the year would be reached away ahead of time. Then came the incentive to see how soon this would be accomplished, with the result of a little less than eight months' time. This was followed by setting a new or "par" figure of $1,500,000 for the year and changing the slogan to "For 1919 we've already put that $1,000,000 through, so we've raised the goal to $1,500,000 to do."

In recognition of the successful efforts in reaching bogey figures the company gave what it called a "Million Dollar Party" to its 230 employes, providing the entertainment for the occasion. The company announced its success in advertisements in the daily newspapers; and in a personal letter to its customers thanked them for their help in making such a showing possible. The letter read as follows:

Mr. John Brown, City.

Dear Sir: Believing in the prosperity of the great Northwest, we set out to do $1,000,000 business for 1919.

We are pleased to announce that in just eight months we have gone over the top.

We have now raised the goal to $1,500,000 for the year.

Without your past co-operation we would not have reached our $1,000,000 mark. Without your future co-operation we will not attain the $1,500,000 goal.

We, therefore, thank you for the part you have played in our past success. We trust that our future service will warrant your patronage.

With your co-operation we can announce at the end of the business year that the $1,500,000 has been reached.

In exchange for your support we offer "Service and Satisfaction with Every Transaction."

Yours for Success,

STERLING ELECTRIC CO.,

W. H. Vilett, President.

Setting a bogey and reaching it are two different things. But the enthusiasm generated by the company enabled its employes to attain the original goal so easily that there hardly remains any doubt but that the new goal will be reached.

BOSTON CONTRACTORS AND DEALERS MEET.

The Boston district of the Massachusetts State Association of Electrical Contractors and Dealers held a meeting Oct. 16 at the City Club, Boston, at which George H. Guest, manager of the electrical appliance department of Bryan & Marsh Co., Boston, and C. E. Greenwood of the Boston Edison Company were the principal speakers.

"Million Dollar Party" Given by Sterling Electric Co., Minneapolis, Minn., to Its Employes After Sales Goal of $1,000,000 for 1919 Was Reached in Less Than Eight Months.

Merchandising Suggestions for the Electrical Dealer

Advantage of Featuring Single Articles in Window Display—Fearing Department-Store Competition—Making Preparation for Christmas Trade—Planning the Sales of Electrical Appliances as Holiday Gifts

THERE is a tendency among dealers to make their window displays appear flat by showing a large number of articles at the same time. This is only natural, because the major portion of the line consists of small devices. Unless a good-sized article, such as a washing machine or a range, is featured, it doesn't seem logical to devote the entire display space to one, or even two, articles, and the dealer is tempted to show samples of everything he sells so those who stop to look at his display won't miss anything. The nature of the dealer's business may demand just this sort of thing, but as a general rule it is better to have displays concentrated on a single article or not more than two or three closely associated articles. The reason is that the mixed display is not so apt to leave a distinct impression on the onlooker's mind as a featured display.

A good example of this principle is given by the accompanying illustration, which shows a window display by the Commonwealth Edison Co.'s Adams street electric shop, Chicago. If window displays were given titles this one would be called "Autumn—and Electrical Appliances" because there is a suggestion of autumn in the whole display. This effect is secured partly by the basket of seasonal flowers but mostly by the colorings of the background and furnishings. Rich, light brown draperies and lamp shades are contrasted with the dark brown upholstered furniture, the blending of colors giving unmistakably an autumnal tone.

In such a setting the use of the vacuum cleaner is forcibly suggested for fall cleaning; likewise the use of an electric radiator for tempering the chilly mornings that come this time of year.

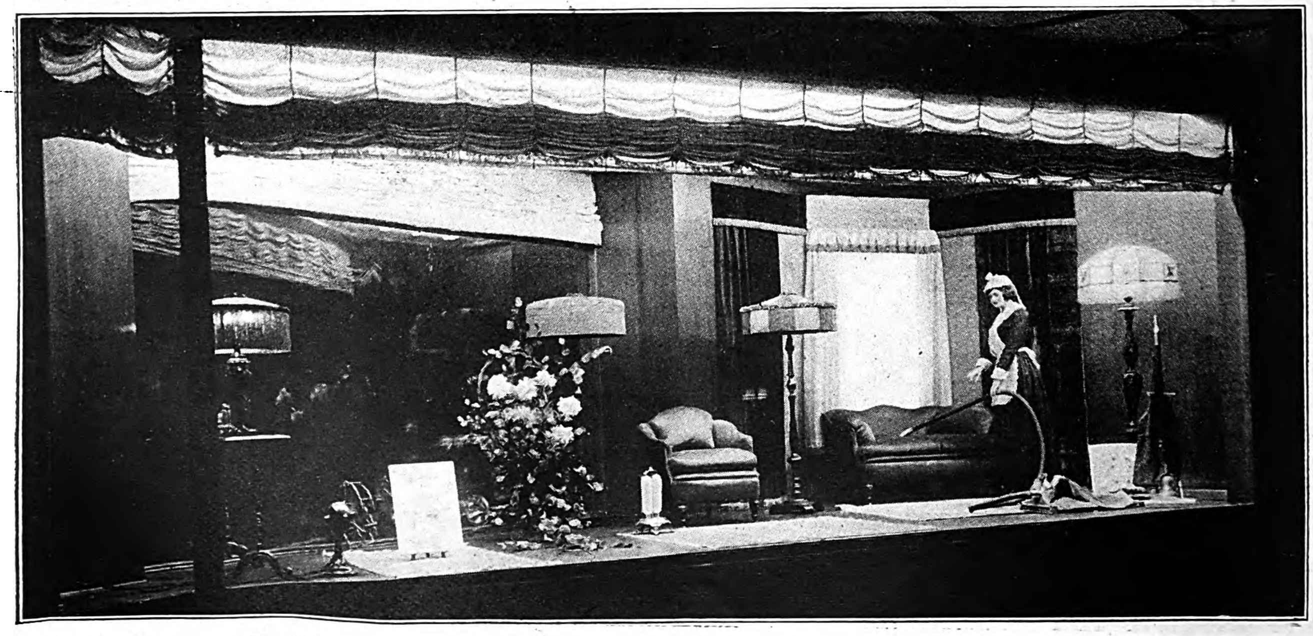
This display is another good testimonial to the fact that featuring an article or two against a suitable background is better than cluttering window space with a lot of devices, no one of which attracts particular attention.

Fearing Department-Store Competition.

Not long ago the writer was talking to an electrical contractor and dealer who happened to be in a pessimistic mood. Chief among his burdensome troubles was an ingrown fear that the department stores were going to corral all the business in electrical appliances and that competing electrical dealers would eventually have to close up shop. His attitude was partly due to the fact that his store was on a side street, a block away from the heavy traffic of the main shopping thoroughfare, and the crowds that didn't pass his door made him feel, particularly on gloomy days, that he didn't have much chance to get business. He figured that the crowds would never come his way, and as long as his contracting business paid pretty well he would be content to take what appliance business he got and rail away at the department stores for taking what he didn't get.

On entering the store we noted that the window display space was devoid of everything but a few lamp cartons, two small motors and several flashlights. The interior of the store was poorly lighted and there was a confusion of show cases, tables, shelving and desks that would nearly baffle any customer trying to make a purchase.

It is hardly believable that such a poor merchant could have the temerity to criticize others, but we

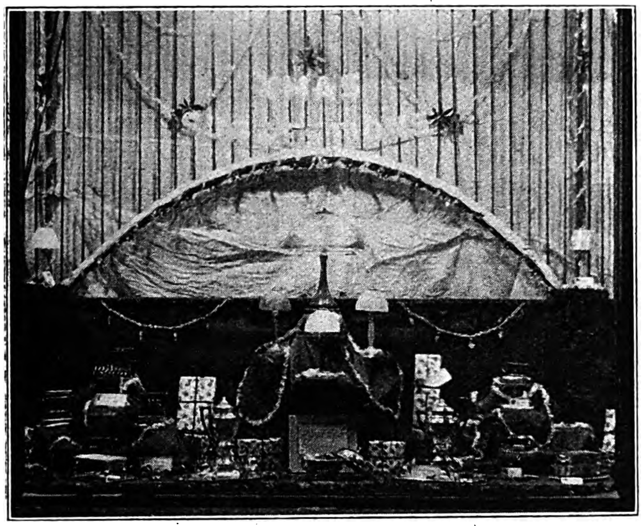


Display in Commonwealth Edison Co. Electric Shop Illustrating Principle of Featuring Small Number of Closely Associated Articles at Same Time.

suppose it was because he was envious of those who were more progressive. Fortunately the number of dealers of this kind is growing less every year, and of course there is a correspondingly smaller number who think they have anything to fear about the competition of the department stores.

Preparing for Christmas Trade.

About 75 per cent of holiday shopping is done in the two weeks preceding Christmas; and this is in spite of all the efforts made to have the public do its Christmas shopping early. The condition is one that probably always will exist, and is one that greatly concerns the electrical dealer in his plans for Christmas trade.



Now Is the Time to Begin Planning Christmas Displays—This One Was Made to Catch the Eyes of Those Who Didn't Know What Kind of Presents to Give.

It generally works out this way: The dealer puts in a stock or orders enough ahead so that he believes he can easily take care of his trade for the season. During November and the early part of December sales will increase, but they do not feel the impetus of Christmas buying. Then sales come on with a rush, the dealer's shelves are cleared of this and that article, and customers are disappointed or are compelled to buy substitutes. This story has been repeated year after year with little variation, much to the detriment of dealers who are slow to admit that too conservative a buying policy is wrong. It is a detriment to the whole industry as well.

When a dealer's stock is pretty well sold out, of course he must feel some satisfaction in having a good season. But it is also an indication that advantage has not been taken of all the sales possibilities.

The solution of the problem is for dealers to do what they advise the public: "Do your Christmas buying early." A large stock of staple electrical appliances suitable for gifts is bound to make any dealer look to turnover and devise plans for producing sales during the early part of the Christmas shopping season. Timely window displays, newspaper advertisements, gift suggestion booklets and circular letters to prospective customers are methods that can be used to make November an intensive selling period as well as December.

Successful merchants in other lines do most of their buying six months ahead of season and quite a large portion of their stocks is carried over from season to season. It would seem that the electrical merchant could afford to do his buying at longer range, especially because most electrical articles are saleable the year around. But if dealers do not find it possible to do their buying for holiday trade six months ahead of time, at any rate they should see the error in having a hand-to-mouth policy regarding buying and selling Christmas goods. Then trade conditions will be relieved for them as well as the jobbers and manufacturers.

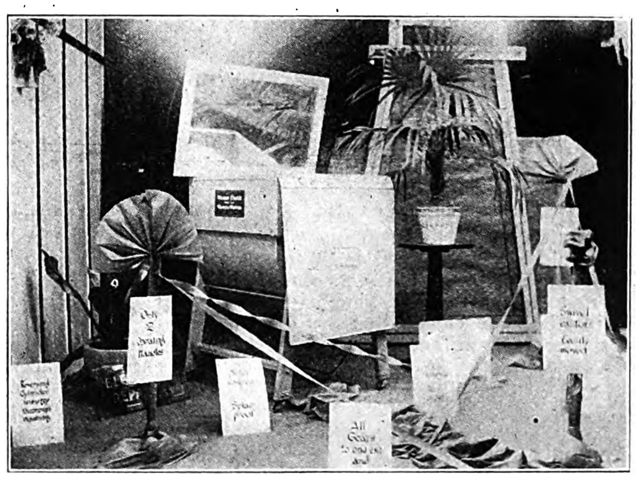
Last year a certain electrical dealer worked out a gift suggestion plan that brought very satisfactory results. In October he started the preparation of a booklet giving a complete list of suggestions for holidays gifts. Such work usually takes two to four weeks, so that he had them ready for distribution the middle of November. This dealer didn't attempt to secure a list of prospective customers, but mailed one of the booklets to his regular list of patrons. His theory was that any customer pleased with an electrical device he was using would be likely to purchase or recommend it or one of the other suggested articles for gift purposes.

Newspaper advertisements featuring electrical gift suggestions were a part of the plan. These were linked with appropriate window displays.

Working out this plan took quite a bit of thought and effort, but a comparison of the season's sales with those of the preceding year showed such a large increase that the plan is being tried again this year.

NOVEL WINDOW DISPLAY SELLS MANY ELECTRIC WASHERS.

Cleanliness is associated with the electric washing machine, and with this idea in mind the Electric Sales & Construction Co. of Cleveland recently had a window that fairly shone with cleanliness and light. The floor was of blue crepe paper with a deep border of white. Screens of brown stood in the background, in front of each being a graceful palm. In the center was a washing machine, behind which was a mirror tilted at an angle so that from the outside of the window the operation of the machine might be observed. Several poles were twined with blue crepe paper, flaring out into a fan-shaped arrangement at the top, while strips of blue paper ran from one to another. Fastened to each pole was a neat card of grey, lettered in blue and white, which told of the advantageous points of the machine.



Washing Machine Display Which Brought Out the Idea of Cleanliness in Connection with Washers.

New Appliances

Unique Features in New Push-Button—Controlled Starting Switch for A. C. Motors and in Swiveling Attachment Plug

Alternating-Current Motor-Starting Switch Operated by Push Button.

It is permissible to start induction motors up to and including 5 hp., and in some localities up to and including 7½ hp., by merely connecting the motor to the power circuit. Small induction motors can be started under these conditions without injury.

In the past it has been customary to start these motors by simply closing a knife switch, or switch similar to a knife switch. For those who wanted something better, it was possible to buy a switch which would short-circuit the fuses while the motor was starting, and then after the motor had come up to speed, the operator could make a second motion with the starting switch that would insert the fuses in the motor circuit to be used while it was running.

A new device for this kind of work has just been developed by the Electric Controller & Manufacturing Co., Cleveland, Ohio, to make the starting of these motors foolproof. It is known as the "A. C. Starting Switch," and is operated by a push button. It is inclosed in a steel box as shown in Fig. No. 1, with conduit connection for all wires. A neat, compact push button arranged for conduit connection, as shown in Fig. 3, is supplied, for starting and stopping the motor. Fig. 2 shows the starting switch with the cover of its box open.

Particular attention is called by the manufacturer to the two wires extending the length of the slate on the left-hand side. These wires give overload protection of the inverse-time-element type, both while the motor is starting and while it is running. The principle used is one entirely new in motor-starting practice. These two wires are stretched and the operating value of this overload protection is adjustable by changing the tension of the wire. If too much current is being taken by the motor, these wires will expand, causing the small contact at the bottom to open and this will in turn de-energize the magnet coil and cut the motor off the power line. It is then necessary to push the start button before the motor can again be started. This same principle is used in ammeters and gives an extremely accurate overload protection, at the same time giving the inverse-time-element feature.

There are no laminations used in any part of this alternating-current starting switch. It is only necessary to push the start button to start the motor, and it is only necessary to push the stop button to stop the motor.

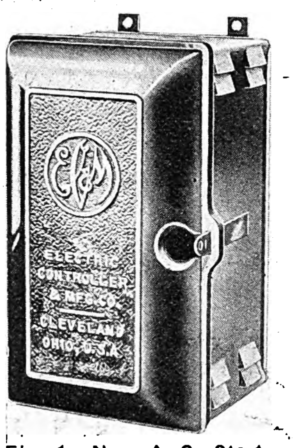


Fig. 1.—New A.-C. Starting Switch With Box Closed.

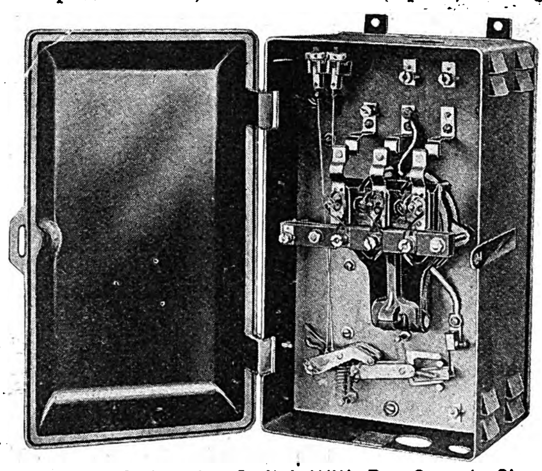


Fig. 2.—A.-C. Starting Switch With Box Open to Show General Construction and Overload Protection.

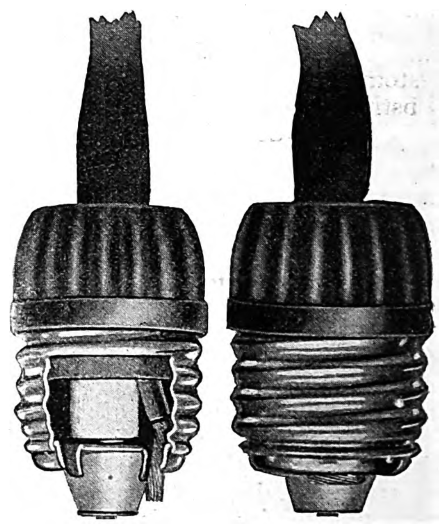
Fig. 3.—Push Buttons for Operating the Switch.

New Cutler-Hammer Swivel Plug.

A new swivel attachment plug has been developed in the specialty department of the Cutler-Hammer Manufacturing Co., Milwaukee, Wis. The design of this new plug is such that several distinct advantages are provided. It is shipped completely assembled and need not be taken apart in order to wire. The work of attaching these plugs is further reduced because there are no binding screws to loosen and untighten. In fact, no screws are used in the construction.

The accompanying illustrations show some of the advantages of the plug and the ease with which the wires may be connected to it. It consists of an inner and outer member which revolve on each other. The wires are connected to the inner member, while the outer member comprises the ordinary screw shell and a knurled head made of heat-proof molded insulation. In wiring, two wires are stripped an equal length, about three-eighths of an inch; one is pushed into a center opening of the inner member and the other through any one of four concentric openings of the same member. By means of a stationary soldering iron, one wire is sweated in the center opening, while the other, after being turned over into a groove on the inner member, is soldered to it. The entire operation, it is claimed, requires much less time than is necessary to wire up any other type of plug, as demonstrated by actual test.

After being attached to a cord there is no possibility of the parts becoming separated when being unscrewed from a socket. This is a very desirable feature when the plug is used under a small shade or where a good grip on the plug cannot be secured. This new plug when shipped to the electric appliance manufacturer, reaches him in one complete piece. It cannot become disassembled nor a portion lost in shipment or in distribution. Trouble and losses due to difference in the number of the component parts on hand are thus avoided.



Two Views of New Swivel Attachment Plug With Quickly and Easily Soldered Connections, Eliminating Binding-Screw Troubles.

Trade Activities

General Electric Leases American Conduit Business—Appleton Electric Extends Manufacturing Facilities—Catalogs

Horace G. Cooke, who has withdrawn from the Connersville Blower Co. after 20 years of service as eastern representative, has announced the organization of Horace G. Cooke, Inc., to engage in designing and marketing a complete line of rotary compressors, gas exhausters, and pumps for the National Marine Engine Works, Inc. The executive and sales offices will be located at 50 East 42nd street, New York City.

Beardslee Chandelier Manufacturing Co., Chicago, is sending a letter to the trade in which is illustrated and described a new and attractive line of portable lamps, and presents to dealers an unusual profit-making opportunity for the fall trade. Owing to fluctuating market conditions and the enormous demand for portables, the company urges that dealers place their orders immediately to insure delivery for the holiday season.

Mechanical Appliance Co., manufacturer of Watson electric motors, with factory and main offices at Milwaukee, Wis., has recently opened up new offices in Buffalo and St. Louis. W. C. Winterroth, formerly connected with the Chicago office, will be located at 318 Prudential building, Buffalo, as district sales manager for western New York. The St. Louis office will be in charge of L. F. Mahler, who has been recently appointed district sales agent for St. Louis and adjacent territory. His office is located at 1039 Syndicate Trust building, St. Louis.

Moran & Hastings Manufacturing Co., 16-18 West Washington boulevard, Chicago, has prepared a new circular which illustrates and briefly describes the "Raymo" adjustable fixture. It is especially adapted to the office, store or factory, and provides a uniform distribution of illumination without glare. It is of excellent construction, pleasing in appearance and has been designed for use with 100, 200 or 300-watt Type C Mazda lamps. This unit has been adopted by many of the country's most prominent industries and has given complete satisfaction wherever installed, according to reports received by the company.

Jackson & Moreland Organize.—Dugald C. Jackson and Edward L. Moreland announce that after their absence in France in the Corps of Engineers, United States Army, they have now resumed their practice as consulting engineers under the firm name of Jackson & Moreland with offices at 387 Washington street, Boston, Mass. They will carry on the practice formerly conducted in association with William B. Jackson under the firm name of D. C. & Wm. B. Jackson. William Jackson has temporarily retired from the firm in order to look after other interests. Associated with the firm is Arthur L. Nelson, who will give particular attention to the design and the supervision of construction of power plants and transmission systems.

Gould Manufacturing Co., Seneca, N. Y., manufacturer of rotary, triplex and centrifugal pumps, has opened a district sales office in Detroit at 804 Dime Bank building. E. B. Gould is in charge.

Multiple Fuse Co., New York, has established a branch office in Cleveland, Ohio. E. C. Newman, who has been appointed district manager of the Cleveland branch, will make his headquarters at 30 Euclid Arcade.

Electric Products Co., Cleveland, Ohio, manufacturer of controllers, switchboards, battery-charging motor generators and rheostats, has opened a branch office in the Dime Bank building, Detroit, Mich., in charge of E. H. Bridge.

General Electric Co., through its Fort Wayne (Ind.) branch, has opened a night school for the benefit of its employes who are working for better wages and promotion. The enrollment is much larger than last year, and the keenest interest is being taken by employes of the Fort Wayne works.

The Norma Co. of America, 1790 Broadway, New York, at a recent meeting of its board of directors, elected O. P. Wilson to the presidency of the company. Mr. Wilson has been assistant manager of this concern for several years. W. M. Nones continues as president and treasurer, in executive charge of the company's affairs.

The American Conduit Manufacturing Co., with general offices anud factory at New Kensington, Pa., announces the leasing of its rigid conduit business to the General Electric Co., who will continue operations at New Kensington by its Sprague Electric Works. Plans are being prepared for the enlargement of the plant and additional equipment will be installed, to the end that the users of American and Galvanite brands of rigid conduit will have the advantage of exceptional service under all conditions. There will be no change in the personnel of this company, but the name will be changed to the American-Wiremold Co., which will concentrate upon the manufacture of Wiremold surface raceway and Wireduct non-metallic tubing, at Hartford, Conn.

H. B. Kirkland, the vice-president of the American Conduit Manufacturing Co., will divide his time between the Sprague Electric Works and the American-Wiremold Co., and will continue to give his personal attention to his old customers. Other officers of the company are D. Hayes Murphy, president, and Guy M. Stewart, secretary. These men have a wide experience in this field, and it is to be expected that with the concentration of their energies upon Wiremold and Wireduct valuable results to the industry will accrue. The former company has established for itself an enviable record and the development of the American-Wiremold Co. at Hartford, Conn., will be watched with considerable interest by all those actively engaged in the industry.

Bailey Meter Co., Cleveland, Ohio, is making distribution of Bulletin No. 30 descriptive of "Fluid Meters for Low Pressure Gas and Air," which points out in a clear and concise manner the advantages of this product. It describes in detail the numerous parts entering into the construction of the Type C10 meter and deals at length with the principles of operation. The text is accompanied with excellent illustrations, including both halftones and line drawings. Four pages of the bulletin are devoted to chart records of Bailey fluid meter installations and partial list of users given, indicative of the wide range of industries which has adopted this type of meter and found it to give complete satisfaction. These meters have been developed and perfected during the past ten years and are particularly adapted to the many and varied needs of modern power plants, gas works, steel mills, chemical works, and in fact all large producers of users of power. In addition to this line, the Bailey company manufactures many other types of meters, including fluid meters, for recording and integrating the flow of steam to turbines, engines, heating systems, low pressure steam, exhaust, etc.; boiler meters, weir meters and radiimeters.

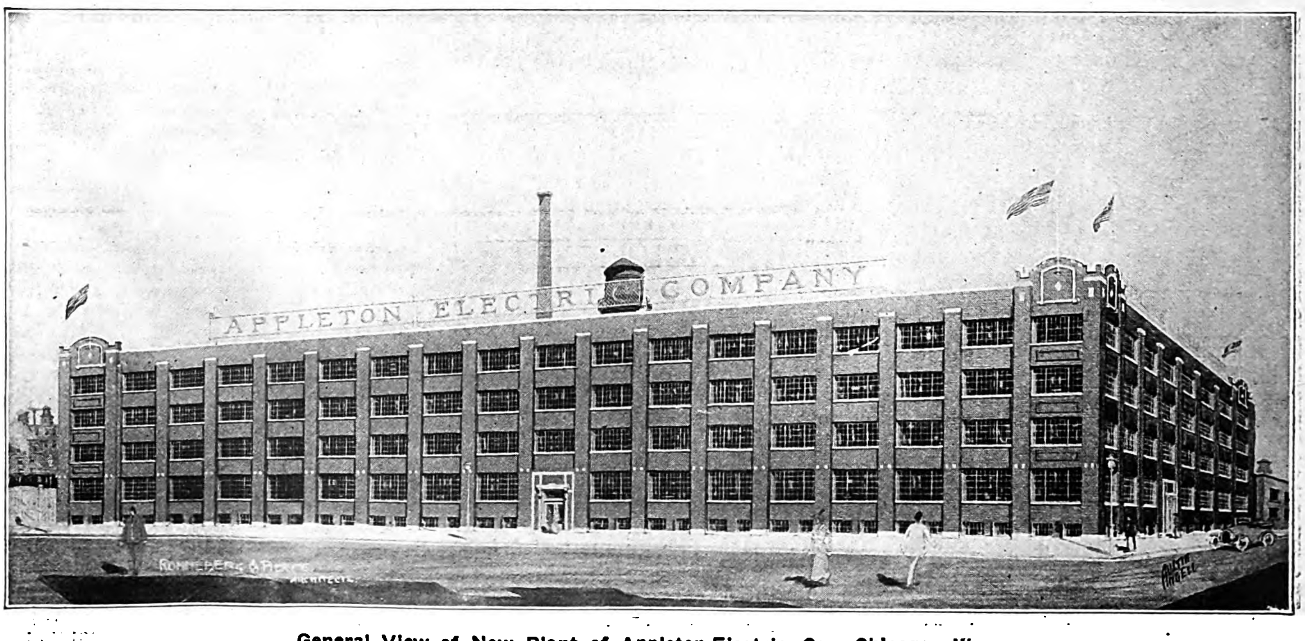
The Electrical Alloy Co., Morristown, N. J., manufacturer of high-grade resistance wire and strips, is sending out a folder relative to its nickel and nickel alloy wire and strips. The company has manufactured these materials exclusively for many years and has established for itself a world-wide reputation. The pamphlet briefly describes its resistance material among which are included electrical alloy calido, electrical alloy rayo, electrical alloy comet, electrical alloy phenix, electrical alloy ideal, electrical alloy lucero, electrical alloy magno spark point nickel, electrical alloy pure nickel and grade "A" Monel metal, and illustrates a few of the articles which contain this wire. The company maintains an export department provided with every facility for promptly despatching ocean shipments to its customers abroad, and a staff of electrical and metallurgical engineers which is capable of assisting the manufacturer in developing his apparatus or to solve any resistance problem with which he may have to contend. The products of the Electrical Alloy Co. have been adopted as a standard specification by many of the largest American companies, the following being perhaps the most representative; General Electric Co.; Edison Electric Appliance Co.; Westinghouse Electric & Manufacturing Co.; Western Electric Co.; Taylor Instrument Co.; General Motors Co., and the Champion Spark Plug Co. The company has now available for distribution the new edition of its bulletin catalog, a copy of which will be furnished upon request.

Appleton Electric Co., Chicago, Ill., manufacturer of conduit fittings, in order that it may adequately meet the large demand for its products, has now under course of construction a new plant, which it is claimed will double its present capacity and result in greatly increased production. The main building, which will be L shaped, is to be a four-story and basement structure covering an area of over 45,000 cq. ft. A building to care for the press room will also be erected. In addition, the company will erect a power house, which will provide 140,000 ft. of floor space. The new plant will be modern in every respect and will be equipped with new and up-to-date machinery. It will be located at Paulina and Wellington streets, with a switch track from the Chicago & Northwestern railroad, affording excellent shipping facilities. The products of the Appleton company are meeting with increasing popularity and the erection of this large plant may be regarded as indicative of the company's optimistic view of the future. A. I. Appleton is president and treasurer of the company; F. H. Merrill, vice-president, and J. V. Painter, secretary, and under their leadership marked progress has been made. Branch offices are maintained by the Appleton Electric Co. in New York City and San Francisco.

Harvey Hubbell, Inc., Bridgeport, Conn., has issued a new catalog of Hubbell reflectors for industrial plant lighting. This catalog carries out the unique scheme inaugurated by this firm nearly two years ago of listing the various sizes and types of reflectors and accessories in systematically arranged columns and rows. At the top of the page are shown the different sizes and types of reflectors with their corresponding distribution curves. In the left column are shown various types of screw collar holders, brass clamp holders, keyless porcelain sockets, extensions, etc. By following the horizontal row to any vertical column there is found an illustration of each particular size and type of reflector equipped with the particular holder or other accessory. Eighteen pages are devoted to this very effective pictorial arrangement. A few pages are also devoted to the company's medium base and mogul base porcelain sockets, also half reflectors and parabolic reflectors. These various reflectors are made with three different types of finish, matte aluminum, porcelain enamel and white paint enamel.

Swiss Mission Visits Westinghouse Plants.—On Friday, Oct. 3, the plants of the Westinghouse Electric & Manufacturing Co., at East Pittsburgh and Wilmerding were honored by a visit from the Swiss Mission for economic studies in North America. This mission is visiting various cities in the United States and Canada, for the purpose of studying American methods and practices, in order that they may apply these methods where practical to their own various lines of business.

The mission was met in Pittsburgh by representatives of the Westinghouse Airbrake Co., and the Westinghouse Electric & Manufacturing Co., and escorted to Wilmerding on special cars attached to one of the regular Pennsylvania railroad trains. Following the reception a trip was taken through the Airbrake Works, where the various processes involved in the manufacture of the airbrake were explained in detail to the visitors, who expressed much interest in the manufacturing methods pursued by the company. After completing the inspection tour, the party was escorted to the Welfare building, where luncheon was served. Immediately following the luncheon A. L. Humphrey of the Airbrake company welcomed the visitors, and turned over the meeting to W. S. Bartholomew, vice-president of the Airbrake company, who extended a further welcome and told of some of the activities of the company in the manufacture of railway equipment. Response was made to these addresses by Commissioner Zweifel of the mission, who expressed his very great appreciation of the reception tendered the mission. He also took occasion to say that the Westinghouse interests need no advertisement, as every man, woman, and child in Switzerland knows Westinghouse from having seen it on the airbrakes which are used on all of the trains in Switzerland. The visitors were then conveyed in special cars to East Pittsburgh. On their arrival in East Pittsburgh, the visitors were met by Acting Vice-President T. P. Gaylord, and other Westinghouse officials, and a number of guides speaking French and German, both of which languages are extensively used in Switzerland. The visitors were then shown through the immense electric and machine works constituting the East Pittsburgh plant. After having completed a tour of the works, the party left for Pittsburgh at 4:40 p. m., having expressed themselves as being particularly delighted with the reception accorded them by the Westinghouse companies. They even went so far as to say that it was the most elaborate reception that had been given them since their arrival in this country.



General View of New Plant of Appleton Electric Co., Chicago, Ill.

Current News

Weekly Record of Construction Activities—Conventions

EASTERN STATES.

Rutland, Vt.—Contract has been awarded to the Western Vermont Power & Light Co. by the New York Consolidated Slate Co. for furnishing additional electric power for the operation of its plant to the amount of about 100 hp., which will include hoists and compressor motors. It is understood that the Consolidated company is planning for the opening of a new quarry for increased operations.

Chicopee, Mass.—Springfield Coach Works has had plans prepared for the erection of a new boiler plant at its works in connection with alterations and improvements to be made in the existing plant. The work will cost about $15,000.

New Britain, Conn.—Landers, Frary & Clark have completed plans for the erection of a six-story factory building, 120x300 ft.

Binghamton, N. Y.—Binghamton Light, Heat & Power Co. has commenced the installation of a new turbine unit at its local plant as well as new condensor equipment.

Binghamton, N. Y.—Johnson City Water Co. is arranging plans for the construction of a new local pumping station to have a capacity of 12,000,000 gal. The pumping equipment will comprise the installation of six 100-hp. capacity motors, electric service for operation to be furnished by the Binghamton Light, Heat & Power Co.

Buffalo, N. Y.—City commission is considering plans for the installation of a new street lighting system in William street. Rapid progress is being made on the installation of new aerial lights in Hertel avenue.

Buffalo, N. Y.—Ericson Manufacturing Co., 1100 Military road, manufacturer of telephones, magnetos, and kindred equipment, has filed notice with the Secretary of State of an increase in its capitalization from $500,000 to $1,200,000, to provide for general business expansion.

New York, N. Y.—United Machine Works, 57 West Third street, will install an electrically driven ice-making plant of 25-ton capacity.

Rome, N. Y.—Rome Wire Co., Railroad street, manufacturer of electrical wires, etc., has had plans prepared for the construction of a new addition to its plant on Railroad avenue. The structure will be one-story and will cost about $30,000. Contract has been awarded to H. C. Beebe, U. C. N. Bank building, Utica.

Annandale, N. J.—Clinton township committee is considering plans for the immediate installation of a new electric street-lighting system throughout the municipality. Electric service will be furnished by the Hunterdon Power & Electric Co., High Bridge.

Dover, N. J.—New Jersey Power & Light Co. has recently commenced the installation of new boiler instruments at its local plant. Rapid progress is being made on the installation of new coal handling equipment and the construction of coal bunkers, to facilitate operations.

Hilton, N. J.—Plans have been completed by H. Boker & Co., New York, for the erection of the proposed power plant, to be constructed in connection with the new local plant of the company to comprise a group of factory buildings. Gilbert C. Higby, 207 Market street, Newark, is architect.

Irvington, N. J.—Irvington Manufacturing Co., 122 Coit street, has had plans prepared for improvements in the boiler plant at its works to facilitate operations.

Jersey City, N. J.—Announcement has been made by Armour & Co., Chicago, that plans are in progress for the construction of the proposed packing plant to be located on a local site comprising two square blocks bounded by Jersey avenue, Monmouth, Seventeenth and Eighteenth streets, advanced some time ago, but deferred due to war conditions. It is said that an appropriation has been made to cover the cost of a large power plant and refrigerating works to be located at Coles and Seventeenth streets, estimated to cost with equipment installation in excess of $1,000,000.

Newark, N. J.—Megaro Electrical Co. has filed notice of organization to operate a general electrical contracting establishment at 11 Clifton ave. T. and C. Megaro, 21 Clifton avenue, and James Megaro, 1131 Broad street, head the company.

Newark, N. J.—Prest-O-Lite Co., Indianapolis, Ind., manufacturer of acetylene tanks, etc., has had plans prepared for the construction of a large new local plant on property recently acquired on Doremus avenue, to comprise a group of about eleven structures. The buildings will include a charging structure, one-story, about 31x351 ft., one-story boiler plant, for works service, about 48x64 ft., as well as main manufacturing building and other structures, the entire project being estimated to cost $140,000.

Newark, N. J.—Board of Freeholders has taken bids for electrical work in connection with the construction of new extensions to nurses' quarters, etc., at the county institution at Overbrook, the low bid being submitted by the Beaver Engineering Co., 59 Mechanic street, Newark, at $14,387. John W. Hooley, 95 Liberty street, New York, submitted the low bid at $26,800 for the installation of new engine and generating equipment at the institution. It is understood that a quantity of new electrically operated laundry equipment will also be required.

New Providence, N. J.—Borough council is arranging for the completion of the installation of new lighting units for the local street lighting system.

Westville, N. J.—Pennsylvania Railroad Co. has had plans prepared for the installation of new boiler equipment at its local power plant. Contract for the construction of the settings has been awarded to Albert Doak, Philadelphia, Pa.

Carlisle, Pa.—J. F. Rogers Co. will erect a one-story power plant, 45x80 ft.

Colfax, Pa.—Duquesne Light Co. is making rapid progress on the construction of the proposed power station at Colfax, to have an initial capacity of about 60,000 kw., which will be increased ultimately to 120,000 kw. It is said that the new station will be one of the largest and most modern in the country.

Easton, Pa.—Pennsylvania Utilities Company has filed notice with the Public Service Commission of the issuance of bonds for $68,500, to be used for general business expansion.

Philadelphia, Pa.—Boyer & Crawford have awarded a contract to the William Steele & Sons Co., 1600 Arch street, for the erection of a new one-story brick engine and boiler plant, about 49x62 ft., at J and Venango streets. The structure, with equipment installation, will cost $40,000.

Philadelphia, Pa.—In connection with the construction of the proposed local buildings by the Sears, Roebuck & Co., Chicago, to be located on the Northeast boulevard, plans have been prepared for the erection of a one-story power house, about 150x183 ft. The other structures will comprise a nine-story brick and concrete warehouse, about 360x442 ft., with two wing extensions, and six-story administration building, about 82x303 ft.

Pittsburgh, Pa.—Fire recently damaged the plant of the Stimple & Ward Co., 518-20 Sandusky street, manufacturer of electrical goods, to the extent of approximately $7000. The company is planning for immediate rebuilding of the destroyed portion.

Pittsburgh, Pa.—Duquesne Light Co. is having plans prepared for the construction of a two-story brick, concrete and steel local substation. Estimated cost $50,000.

Reading, Pa.—Metropolitan Edison Co. has completed arrangements for a bond issue for $96,000, a portion of the proceeds to be used for general business expansion. Notice has been filed with the Public Service Commission.

Sayre, Pa.—Sayre Stamping Co. has recently completed the electrification of its entire plant, the installation comprising about 100 hp. Electric energy for operation is furnished by the Sayre Electric Co.

Wilkes-Barre, Pa.—Wilkes-Barre Light Co. has filed application with the Public Service Commission for a certificate of valuation preliminary to the issuance of bonds for about $1,000,000.

Williamstown, Pa.—Lykens Valley Light & Power Co., operating in upper Dauphin and the western section of Schuylkill counties, has filed notice with the Public Service Commission of an increase in its rates for service. The new schedules also provide for the elimination of the coal clause from contracts as well as the discounts.

Annapolis, Md.—The Bureau of Yards and Docks, Navy Department, Washington, D. C., will erect a power and boiler plant at the local naval academy at a cost of $45,000.

Baltimore, Md. — Samuel T. Williams, 223 North Calvert street, is in the market for a 100 to 200-kv-a. turbine generator, 3-phase, 60-cycle, 2300 volts; one or two 150 to 200-hp. boilers, 135-lb. pressure. Water-tube condenser is preferred for the above unit.

Clearspring, Md.—Clearspring Light & Power Co., recently organized, is planning for the construction of a new electric transmission line from Dam No. 5 on the Potomac river, to Clearspring and Big Spring, with distributing system.

Ware Shoals, S. C.—Ware Shoals Manufacturing Co. will erect an ice plant, 100x125 ft., of 15-ton capacity. It will be of reinforced concrete and standard mill construction. Electrical equipment will also be installed. J. E. Sirrine, Greenville, S. C., architect.

Barwick, Ga.—An election will be held upon issuance of municipal bonds for establishing electric light plant. Address mayor.

Fort Gaines, Ga.—Georgia-Alabama Power Co. has completed negotiations for the purchase of the electric plant of the Cridelle-Fowler Co. It is said that the new owner is considering the enlargement of the plant and the construction of a new dam across Patsual Creek near Cridelle mill, increasing the present capacity to about 1000 hp., as well as make extensions in its transmission system, the entire work being estimated to cost $250,000. Dermott Shemwell is president.

Moore Haven, Fla.—Gladys Telephone Co. will install magneto outfit with 100 instruments.

NORTH CENTRAL STATES.

Barnesville, Ohio—The city contemplates the erection of a power house at the municipal water works.

Fairmount, Ind.—Rigdon Electric Co. has been incorporated by William H. Markle and others to provide light and power for rural districts near Fairmount.

Indianapolis, Ind. — Indianapolis Methodist Hospital will erect nurses' residence to cost $300,000.

Muncie, Ind.—W. E. Wood Co. 1005 Ford building, Detroit, has the general contract to erect a power and assembly building for the Chevrolet Motor Co. Dynamos, motors, and transformers will be purchased.

Portland, Ind.—A petition has been presented to the Public Service Commission for permission to build a new light and power plant and to create a bonded indebtedness against the city in the sum of $120,000 to raise funds to carry out the proposed plans.

Chicago, Ill.—Ed V. Price & Co. will erect a twelve-story building, 100 x200 ft., at the southeast corner of West Jackson boulevard and South Throop street, at an estimated cost of $800,000.

Clinton, Ill.—Plans for the erection of a modern building to house the local telephone company's plant and for the complete reorganization of the system have been submitted to the city council.

Elgin, Ill.—At the November election the question of issuing $200,000 municipal light bonds will be submitted to vote. Address city clerk.

Litchfield, Ill.—The council is considering ways and means to secure ornamental electric lighting.

Quincy, Ill.—An ordinance is before the council providing for improving East Main street by electroliers and underground wiring. Address city clerk.

Springfield, Ill.—Nov. 4 the question of issuing $400,000 electric light extension bonds will be submitted to a vote. Address city attorney D. A. Stevens.

Springfield, Ill.—Sangamo Electric Co. will erect an $80,000 addition to its plant at Converse avenue and Eleventh street. The building will be 80x140 ft. and be of brick and steel construction.

Sterling, Ill.—The council has renewed the contract until May 1, 1920, with the Illinois Northern Utilities Co.

Streator, Ill.—Residents on South Monroe street from Main to Bridge streets are desirous of having that block improved by the installation of boulevard lights. Address city clerk.

Urbana, Ill.—Erection of $50,000 McKinley Memorial Hospital has been authorized by the trustees of the University of Illinois.

Urbana, Ill.—The contract for the central lighting system has been awarded to the Freeman Sweet Co. of Chicago on its bid of $34,300. This company has two contracts already signed in Urbana, one of the Green street lighting system and the other for the Southwestern lighting system.

Bay City, Mich.—Hanson-Ward Veneer Co. has purchased a building to be equipped with additional machinery which will be operated by electricity. F. B. Ward is president of the company.

Detroit, Mich.—Architect G. W. Geares, 41 John Rush street, has prepared plans and will let contracts for a $15,000 power house to be erected by the General Aluminum & Brass Manufacturing Co. The building will be of brick construction, steam heating, plumbing, to be equipped with power house equipment.

Kalamazoo, Mich. — Engineers Woodmansee & Davidson, 208 South La Salle street, Chicago, have prepared plans for $200,000 electric light plant to be erected by the city. Address A. Leuderenk, City Hall, Kalamazoo, Mich.

Saginaw, Mich.—W. E. Wood Co., 1805 Ford building, Detroit, Mich., has the general contract to erect an $800,-000 power building and gear grinding building for the Chevrolet Motor Co. Power house equipment, generators, switchboard, etc., will be purchased. Address C. M. Bigale, president, Flint, Mich.

Hartford, Wis.—Plans are in progress for a city power plant costing $60,000. Architects Cahill & Douglas, Gross building, Milwaukee, have prepared plans.

Oshkosh, Wis.—Oshkosh Gas Light Co. recently entered into a contract with the county to supply light and power to the county home, asylum and sanitorium at Winnebago, which will permit of farmers along the line having electric service. The company is also planning to extend its lines to the rural districts.

Osseo, Wis.—The city council contemplates the purchase of the local electric light plant and the installation of a waterworks system. Address J. W. Smith, city clerk.

Racine, Wis.—The city is planning

DATES AHEAD.

Illuminating Engineering Society. Annual convention, Chicago, Ill., Oct. 20-23. General secretary, Clarence L. Law, 29 West 39th street, New York City.

Illinois State Electric Association. Annual convention, Chicago, Oct. 22 and 23. Secretary-treasurer, R. V. Prather, Springfield, Ill.

Empire State Gas and Electric Association. Annual meeting, Buffalo, N. Y., Oct. 24. Secretary, Charles H. B. Chapin, 29 West 39th street, New York City.

Jovian Order. Annual convention, Chicago, Nov. 5 and 6. Headquarters, Hotel Sherman. Acting Mercury, Eli C. Bennett, St. Louis, Mo.

American Society of Mechanical Engineers. Annual meeting, New York City, Dec. 2-5. Secretary, Calvin W. Rice, 29 West 39th street, New York City.

Electric Power Club. Meeting, Hot Springs, Va., Dec. 11, 12 and 13. Headquarters, Homestead Hotel. Secretary, C. H. Roth, 1410 West Adams street, Chicago.

National Council of Lighting Fixture Manufacturers. Annual convention, Detroit, Mich., February, 1920. Secretary-treasurer, Charles H. Hofrichter, Cleveland, Ohio.

National Electric Light Association. Annual convention, Pasadena, Cal., May 18-21, 1920. Headquarters, Hotel Huntington. Acting secretary, S. A. Sewall, 29 West 39th street, New York City.

an expenditure of $500,000 for enlarging the waterworks plant.

Murdock, Minn.—City council has petitioned to build an electric light plant. Bonds will probably be issued. J. F. Ashbaugh, clerk.

Cedar Rapids, Iowa—An improvement that will cost approximately $40,000 will be the building of an addition to C. R. I. & P. railroad boiler house in this city and the installing of two additional power boilers. Joseph E. Nelson & Sons, Chicago, have the contract and some of the material is now on the ground to start work immediately.

Cameron, Mo.—A number of new motors have been installed and others are to be installed soon at the Cameron electric plant.

Greenfield, Mo.—Colin K. Lee and Jay R. Lee, both of Kansas City, Mo., have purchased a controlling interest in the Greenfield Electric Light Co. and are planning extensive improvements to the plant, including the installation of oil engines, the maintenance of 24-hour service and the extension of lines to other towns in the territory.

Rocheport, Mo.—An electric light plant and a white way are to be installed.

St. Louis, Mo.—Additions to the plant of the Union Electric Light & Power Co., estimated to cost in excess of $7,000,000 will be started next spring to keep pace with the industrial growth of St. Louis and the expansion of the city. Sites for additional power plants are now being surveyed and an announcement of the locations of the buildings will be made as soon as they are decided upon. The contemplated extensions will have an initial capacity of 60,000 kw. a day, with provision for an ultimate output of 100,000 kw. The new plant is expected to provide for the needs of the next five years.

Wellsville, Mo.—Mexico Light & Power Co. has purchased the electric plant here. The Mexico plant will transmit power to Wellsville over a line now under construction.

Arkansas City, Kans.—An election is contemplated to vote bonds for a municipal electric light plant.

St. Francis, Kans.—The council has accepted plans prepared by the Hennington Engineering Co., for an electric light plant. Estimated cost, $50,000.

Kansas City, Kans.—The Kansas City commissioners awarded a contract for the installation of ornamental lights at a cost of $43,988.

Guide Rock, Neb.—Bond issue of $12,000 carried at election for electric lights. Address town clerk.

Mullen, Neb.—The city contemplates bond issues for an electric light system. Address town clerk.

Venango, Neb.—Plans and specifications for a light and water system for Venango have been completed by the Hennesey Engineering Co., Omaha.

Herrick, S. D.—The issuance of bonds for the purchase of the private electric light plant to be converted into a municipal system was authorized at a recent election. New machinery and other equipment will be added.

Carson, N. D.—Election will be held soon to vote on bonds for installing municipal light plant. Address town clerk.

SOUTH CENTRAL STATES.

Benton, Ky.—Electric light bonds have been authorized by vote.

McKenzie, Tenn.—The city will improve and extend its light and water systems. Bonds in the sum of $10,000 have been voted. Address the mayor.

Pascagoula, Miss. — Pascagoula Street Railway & Power Co. will rehabilitate the light and water plant.

Lake Charles, La.—Lake Charles Implement Co., recently chartered, will erect a two-story, fireproof building, 80x80 ft. and will install an electric elevator.

New Orleans, La.—New Orleans Railway & Light Co. is understood to be considering plans for the installation of a new cable system across the local river, estimated to cost $10,000.

Wilmar, Ark.—Arrangements are being made by D. C. Smith for the installation of an electric light and power plant in Wilmar. Electric street lights will be maintained by the town.

Fargo, Okla.—The city contemplates the installation of a water and electric light plant to cost $26,000. Address the mayor.

Enid, Okla.—Enid Pipe Line Co. is planning for the construction of a new electric power plant at its works.

Hooker, Okla.—City commission is arranging plans for the installation of a new electric light plant, to be used for municipal service. Estimated cost, $40,000.

Jenks, Okla.—Oklahoma Gas & Electric Co. is considering the construction of a large new electric generating station on the Arkansas river, to cost in excess of $1,500,000.

Miami, Okla.—The council is preparing to install an ornamental lighting system. Address mayor.

Albany, Tex.—The city proposes to install an ice and electric light plant. Address the mayor.

Fort Worth, Tex.—Dallard-Martin Electric Co. has been granted a permit for the erection of a new building at Macon and North streets to cost $100,000.

Fort Worth, Tex.—Permit has been granted for the improvement of the Texas Power & Light Co., to cost $135,000. A new boiler room is included in other improvements.

Huntsville, Tex.—Huntsville Cotton Oil Co. has purchased the plant and franchise of the Huntsville Electric Light & Power Co. and has taken charge of the concern.

Lyford, Tex.—The installation of an electric plant is contemplated by the Stevenson Motor Co. A. W. Stevenson, president.

San Augustine, Tex.—The city contemplates the purchase of the electric light plant and will make improvements. Address the mayor.

Wichita Falls, Tex.—Wichita Falls Electric Co. has had plans prepared for the erection of large additions to its local generating station, including extensions in its transmission lines to a number of cities and towns. The entire work will cost in excess of $750,000.

WESTERN STATES.

Klemmer, Wyo.—The electrical equipment of the Cowry Coal Co. was destroyed by fire recently. Loss $10,000.

Ririe, Ida.—Utah Power & Light Co. has recently been issued an order by the Public Utilities Commission providing for the extension of its power lines to Ririe.

Mina, Nev.—P. A. Simon has made application to the state engineer for permission to use the water of East Walker river for generation of electric power. It is planned to create 6000 hp. by means of an impounding concrete and rock dam to cost approximately $600,000.

Hardin, Mont.—The Hardin electric plant has been sold by the Hardin Electric Co. to F. V. B. Collins, of Forsyth, Mont., at $35,000.

Missoula, Mont.—Missoula Light & Water Co. has completed arrangements for the remodeling of its power dam in the Missoula river, near Milltown. The work is estimated to cost $85,000. H. L. Bickenbach is in charge of the work.

Chehalis, Wash.—The city commissioner plans the establishment of a new street lighting system in the main business district. Resolutions for the improvements are being prepared.

Chehalis, Wash. — Washington-Idaho Light & Power Co. has filed a bill of sale conveying its Chehalis interests to the Sherman County Light & Power Co. of Oregon. A. Welch, Portland promoter, signed the papers as manager of the first named corporation. Last April the city voted the Welch company a franchise for a duplicate light and power plant here, but the option to operate under it has never been exercised.

Chehalis, Wash.—Property owners of the new street lighting district will be asked to petition for a new improvement district under the law, estimated cost of the change being $10,000, city to furnish the lights.

Hoquiam, Wash.—City commissioners have been petitioned by property owners to improve and extend the lighting systems on Eighth and I streets.

Seattle, Wash. — Thompson & Castleton are installing 600 hp. in motors for the Ferry-Baker Lumber Co. of Everett, Washington; also an electric crane. They are installing about 500 hp. in motors at the Everett Flouring mill, which is being remodeled.

Seattle, Wash.—The city council has appropriated $19,000 to buy motor trucks for the city light department, and $20,000 to finance construction work.

Spokane, Wash.—County commissioners have awarded a contract to F. E. Martin for the immediate construction of a new power plant at the Edgecliff sanitarium. Estimated cost $21,000.

Bandon, Ore.—Plans are under consideration by the city hall for the early construction of a large new local electric plant to be used for municipal service.

Florence, Ore.—Fire recently completely destroyed the local electric plant operated by G. G. Bushman, Eugene, with total loss estimated at about $10,000. Plans are being arranged for immediate rebuilding.

Roseburg, Ore.—Mayor W. S. Hamilton has completed the location of a power site on the North Umpqua river above Rock Creek. Survey was made by Ford Frearer, city engineer. Location of the dam was placed above the larger falls. The plan contemplated by the mayor is to have the power to pump the city's water supply. The estimated cost of the plant contemplated is considerably less than $500,000, and it is believed the amount will be agreed upon by the voters.

Corcoran, Cal.—San Joaquin Light & Power Co. is having plans prepared for extensive improvements in its local electric system to cost about $80,000. Work will be inaugurated at an early date. J. B. Carter is manager.

Durham, Cal.—Pacific Gas & Electric Co. has recently been authorized to negotiate for the purchase of the plant of the Durham Light & Power Co. for a consideration of about $25,000. The plant is owned by J. A. and E. Foster, of Durham.

Los Angeles, Cal.—Fire recently damaged the local shops of the Pacific Electric Co. at Seventh and Alameda streets to the extent of approximately $150,000. It is understood that the company is considering plans for immediate rebuilding.

Los Angeles, Cal.—Electrical Products Corp. has purchased property on which it proposes to erect a new building. The structure will be of brick and steel construction and will cost approximately $30,000.

Modesto, Cal.—Following a resolution recently adopted jointly by the Modesto and Turlock irrigation district directors, a special election will be held for the purpose of voting on the issuance of bonds for $609,000, the proceeds to be used for the construction of a new power plant to have a capacity of about 40,000 hp., sufficient to handle the full capacity of the proposed Don Pedro dam.

Oroville, Cal.—Preliminary work has been inaugurated by the Great Western Power Co. on the construction of a new power line extending from Las Plumas to San Francisco.

Rio Vista, Cal.—Great Western Power Co. has had plans prepared for the immediate construction of a new 22,000-volt power line to extend from Hood to Franklin, with distributing lines to cover approximately twelve miles. Estimated cost $20,000.

PROPOSALS

Electrical Equipment.—Bids will be received by the town clerk of Gunniston, Miss., for 10 miles electric wiring with poles.

Welding Machine.—Bids will be received by the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., for one electric welding machine, for delivery at the Washington navy yard (Schedule 4588).

Press and Pumps.—The Bureau of Supplies and Accounts, Navy Department, Washington, D. C., will receive bids for one motor-driven washer press, delivery at Brooklyn navy yard (Schedule 4719), and 8 turbine-driven pumps, to be delivered at Brooklyn and Mare Island (Schedule 4586).

Electrical Equipment.—Bids will be received until Oct. 30 by Frank A. Vanderlip, 7 Wall street, New York, president of the board of managers, for the construction of eight cottages at the local institution, Letchworth Village, Thiells, N. Y. Considerable electrical equipment will be required in connection with this work.

Electrical Supplies.—Bids will be received by the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., for the following: 60 junction boxes; 3 telephone panels, 1 telephone switchboard, 16 switches, for delivery at Boston navy yard (Schedule 4744); 75,000 ft. cable, delivery at Brooklyn (Schedule 4684); 1604 ft. single-conductor cable, delivery at Philadelphia (Schedule 4728); searchlight carbons, delivery at eastern and western yards (Schedule 4660); steel conduit and fittings, delivery at Boston (Schedule 4746); electric cable, delivery at Boston (Schedule 4745), and turbogenerator sets, delivery at Puget Sound navy yard (Schedule 4855).

FOREIGN TRADE

[*Addresses of firms referred to in these trade opportunities may be obtained by writing to the Bureau of Foreign and Domestic Commerce, Washington, D. C., or its branch and local co-operative offices. Request for each opportunity should be on a separate sheet and the file number given.*]

Electrical Apparatus, Telephone, Telegraph and Alarm Service (30,853).—A business man in Norway desires to secure an agency for the sale of food products and kindred lines, textiles, dry goods, notions, men's and women's clothing, vehicles, leather, boots and shoes, chemicals, tobacco, building supplies, iron and steel, electrical apparatus, telephone, telegraph and alarm service, photographic supplies, rubber, rubber goods, etc. Quotations should be given c. i. f. Norwegian port. Payment through banks. References.

Motors, Cables, Etc. (30,858).—The president of an American trading corporation is soon to sail for the Balkan countries and desires to secure agencies for the sale of automobiles, marine motor boats, motors, agricultural machinery and implements, belting, boots and shoes, perfumery, mowing machines and blades, light motor plows, small electric motors, magnetos, machinists' tools, armored cables, steam engines, and boiler supplies. References.

Electrical Apparatus (30,870).—An organization for the construction of new hotels in a city of France proposes to construct in the near future a hotel of 420 rooms, and desires to get in touch with American firms interested in the export of interior furnishings, such as electric lighting, heating, plumbing, ventilation and sanitary appliances, kitchen equipment, refrigerators, laundry installation, washing and drying machinery, elevators, telephone installation and insulating material.

Power Plants (30,889).—An American consulting engineer located in Japan and acting as buyer for several Japanese dockyards, one steel works, and several government contractors, is prepared to receive catalogs, and prices from manufacturers with a view to establishing agencies for mining machinery, railway and dockyard equipment, power plants and machine tools. Reference.

Electrical Goods (30,891).—A commercial agent from Bolivia will be in the United States for the next few weeks for the purchase, from manufacturers only, of plumbing material and supplies, bathroom fixtures, hardware, tools, paints, zinc, tinware, tin, iron and steel goods, electrical goods and supplies, glass, hardwood flooring, medical and surgical instruments and appliances, tractors, agricultural machinery, paper and machinery for the manufacture of tile flooring. Correspondence should be in Spanish. References.

Electric Torches (30,899).—A municipality in Colombia is in the market for fire department equipment, such as canvas life chute, life nets, telescoping fire ladders, motor chemical engines, motor fire engine tender, gas and smoke masks, uniforms, helmets, fire gloves, etc., suction hose (armored), wheel-mounted hand fire pumps, stretchers, leather hose binders, firemen's tools in complete sets, hand oil lanterns, electric torches, chemical fire grenades, speaking trumpets and whistles. Quotations should cover an equipment for a city of 120,000. Correspondence should be in Spanish. Catalogs are requested.

Electrical Appliances (30,900).—A company in South Africa desires to secure agencies from manufacturers of glass tumblers, wide-mouthed glass fruit jars, domestic electrical appliances, such as cookers, toasters, irons and kitchen stoves. Payment, cash against documents in New York. Reference.

Wire and Wire Rope (30,910).—A firm in England desires to purchase wire and wire rope, specifications of which may be had on application to the Bureau or its district offices. Quotations should be given f. o. b. American port or c. i. f. English port. Payment, cash against documents through bank. Reference.

Personals

John B. Fisken New President of Northwest Association—E. C. White Manager Lighting Department Western Electric

ROBERT P. MCCARTY, formerly connected with the Knox Motors Co., Springfield, Mass., is now associated with the Electric Boat Co., Groton, Conn.

W. E. JONES, district manager for the Economy Fuse Manufacturing Co., Seattle, is visiting the distributing offices of the company at Salt Lake and Denver.

JOHN T. ELLIOTT, for the past 14 years associated with the Commonwealth Edison Co., Chicago, has resigned his position as assistant to chief engineer at Station 11 of the company, to become chief engineer of the Wisconsin Light, Heat & Power Co., Berlin, Wis.

CLARENCE J. BERRY, who for the last six years has been connected with the National Lamp Works of the General Electric Co., Cleveland, Ohio, has tendered his resignation to become associated with Brandt & Fouilleret, Paris, France, in the capacity of electrical engineer.

J. P. SCHROETER, for the past two years connected with the School of Engineering of Milwaukee, has accepted the appointment of designing engineer for the mechanical and electrical equipment of the new food plant to be erected by the Uihlein interests on Port Washington Road, North Milwaukee. The plant is being designed by A. W. Hoffman, 410 Berlin Arcade building, Milwaukee.

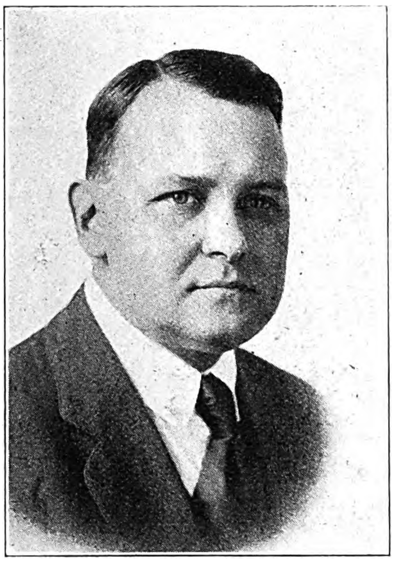
FREDERICK K. COPELAND, president of the Sullivan Machinery Co., Chicago, has been elected first vice-president of the Western Society of Engineers, succeeding Kempster B. Miller, resigned. Mr. Copeland was elected to membership in the organization in 1892, and since that time has zealously worked to promote the interests of the society. He is also chairman of the general committee of the Technical Societies of Chicago.

CHARLES E. WARWICK, superintendent of railway for the Eastern Wisconsin Electric Co., Sheboygan, Wis., has tendered his resignation and will remove to his former home at Hamilton, Ontario. Mr. Warwick entered the public service industry about 24 years ago and his experience in this field of activity has been quite varied, but devoting particular attention to the management of street railway and electric systems. His specialties in the work are the handling of transportation difficulties and the promotion of efficiency and safety for the public as well as the employes. He joined the Wisconsin company as superintendent of railway in May, 1918, and continued in this capacity until the present time. Mr. Warwick will be succeeded by Arthur Kolste, who has been serving the company as chief dispatcher.

FRANK M. EASTMAN has been appointed superintendent of the Montpelier & Barre Light & Power Co., Montpelier, Vt., succeeding Charles J. Cookson, who is now manager of the company.

IRVING E. TUTTLE, formerly associated with Meyer, Strong & Jones, consulting engineers, has become president of the Nate-Earle Co., New York, engineering contractor in power plants, heating and ventilating systems and piping of all descriptions.

E. CANTELO WHITE has been appointed manager of the electric lighting department of the Western Electric Co., New York. This department has recently been added to the general sales organization of the company for the purpose of fostering the propaganda for better lighting in factories, offices, hotels, clubs and residences. Mr. White's experience in the electric lighting field covers a period of almost fifteen years, during which time his activities have covered both the United States and Canada as a salesman and designer of lighting equipment. Particularly in Canada, many of the most important lighting installations have been planned and sold by Mr. White and installed under his supervision. Mr. White is also well known to the electrical industry as the originator and designer of the "Duplexalite" line of lighting fixtures. In this connection Mr. White has done a great deal of standardization work and it will be his aim to carry on this standardization of lighting fixtures to such a degree that planning efficient lighting installation and merchandising the equipments will be greatly simplified.



E. Cantelo White.

C. C. WILCOX, until recently in the service of Hodenpyle, Hardy & Co., as assistant to consulting electrical engineer, has become chief engineer of the Durant Building Corp., Detroit, Mich.

FRED J. QUERIPEL, formerly with the Electric Furnace Construction Co., Philadelphia, as chief draftsman, is now engaged in plant engineering work for the National Aniline & Chemical Co., Marcus Hook, Pa.

R. E. BURGER has tendered his resignation as president and general manager of the Richland Public Service Co. of Ohio, to become chief engineer of Henry L. Doherty & Co., New York, public utility operators.

J. R. PERKINS has recently been appointed assistant to J. S. Pevear, general manager of the Birmingham Railway, Light & Power Co., Birmingham, Ala. Mr. Perkins is an engineer and an expert operating man who has been connected with the operating department of the American Cities Co. since 1913.

G. P. GOODMAN, for several years representative of the Hisey-Wolf Machine Co. in the East, has joined the staff of F. H. Niles & Co., Inc., and will take charge of their portable tool department. The latter company not only handles the Hisey-Wolf line of electric machine tools, but the Canton pneumatic hammers and drills manufactured by the Pittsburgh Pneumatic Co.

MISS M. GRACE BUXTON, who has been engaged in a secretarial capacity with the Westinghouse Electric & Manufacturing Co. and recently returned from its New York office, has been appointed registrar at the school of social work, Duquesne Unversity. While at the Pittsburgh offices of the company Miss Buxton was in charge of the commercial department of the vocational school for girls, conducted by the Westinghouse interests at Turtle Creek.

CHESTER A. GAUSS, until recently advertising manager of the Crocker-Wheeler Co., Ampere, N. J., has resigned his position with that company to become a partner in the newly formed firm of Robertson, Gauss & Co., engineering sales and advertising counsellors, with temporary offices at 59-61 Pearl street, New York. Mr. Gauss is a graduate electrical engineer with over seven years' experience in electrical advertising, sales investigation and promotion work and trade-paper editing. Among his former connections, before joining the Crocker-Wheeler Co., were the General Electric Co.'s publication department and the editorial staffs of the ELECTRICAL REVIEW and the *Electrical World*. Mr. Robertson has specialized for over eighteen years in the illustrating of mechanical products and in the printing of engineering literature. The newly formed firm will specialize in engineering advertising accounts of all descriptions and formulate engineering sales-promotion plans for its clients.

GORDON CAMPBELL, president and general manager of the Edison Light & Power Co., York, Pa., was recently re-elected president of the Pennsylvania Railway Association. Mr. Campbell has been identified with the management of the activities of the association since December, 1916, first as a member of the executive committee, then as vice-president and as president since June, 1918. Prior to joining the York company in 1908 he was associated with public utilities in Denver, Colo., Newark, N. J., Providence, R. I. and Washington, D. C. He is also president and general manager of the York (Pa.) Railways.

COMMANDER FREDERICK G. SIMPSON has returned to civilian life and resumed his duties as vice-president and general manager of the Kilbourne & Clark Manufacturing Co., Seattle, Wash., manufacturer of radio apparatus. Early in the war he volunteered and was commissioned lieutenant-commander of the Boston navy yard, and shortly after was promoted and made district radio material officer with the rank of commander. He was later placed in charge of all radio material activity on the coast from Connecticut to Novia Scotia. Prior to entering the service Commander Simpson won renown as the inventor of the radio telegraph system now being produced by the Kilbourne & Clark Co.

R. H. RUTH has opened up a business in Rochester, N. Y., which will probably be known as the "Ruth Electric Shop," and will specialize on household electrical appliances. Mr. Ruth was for 15 years with the Benjamin Electric Manufacturing Co., working in contact with the New York office of the concern at 247 West 17th street, New York City, but in complete charge of the Pittsburgh territory. He has spent many years in traveling in western New York State and Pennsylvania, and his thorough acquaintance with the trade should stand him in good stead in his new business venture. Mr. Ruth has had large experience in merchandising electrical goods and his knowledge of household appliances, and lighting and wiring devices, should prove to be of great value in the business which he is entering.

JOHN B. FISKEN, chief engineer of the Washington Water Power Co., Spokane, Wash., who was elected president of the Northwest Electric Light & Power Association, at the annual convention held at Seattle in September, was born near Glasgow, Scotland, Nov. 2, 1861. He received early training in a private school, and after obtaining valuable experience in office work he took a four-years' course in the College of Science and Arts at Glasgow, and the City and Guilds of London Technical Institute course in electric lighting, graduating in 1886.

Soon after graduation, he came to the Pacific Northwest, engaging in electrical work in Seattle, Wash., and Victoria and Vancouver, B. C. He served as manager for the Victoria Electric Illuminating Co., and later supervised the installation of the lighting system in the C. P. railway hotel, then under construction at Vancouver. He has been a resident of Spokane since 1887, and during the years that have intervened he was engaged successively by the Spokane Falls Electric Lighting Co., by its successor, Edison Illuminating Co., then by the Spokane Street Railway Co. and the Washington Water Power Co., the last named having absorbed the other concerns. During a 12-months' interim in 1905-6, he was construction engineer for the Consumers Light & Power Co., and then reentered the employ of the Washington Water Power Co., and has continued his connection therewith since that date.

Mr. Fisken's work for the Washington Water Power Co. has comprised engineering, construction, maintenance and operation, affording a wide range of practical and technical experience. He was made chief engineer in June, 1918. His membership in the American Institute of Electrical Engineers began in 1903, and he assisted in organizing the Spokane section at a later date. For several years he has been a member of the Hydroelectric and Technical Committee of the Northwest Electric

John B. Fisken.

Light and Power Association. The presidency of that association, to which he has been elected, entitles him to a membership in the executive committee of the N. E. L. A. He is vice-president of the Employers' Association of the Inland Empire, and is a member of the University club of Spokane.

GEN. GEORGE H. HARRIES, after 27 months' active service in the Army, has returned to civil life and resumed his duties as vice-president of H. M. Byllesby & Co. in its eastern offices, 111 Broadway, New York. General Harries was released in August from the exacting duties which he filled in Berlin as the United States representative of the Inter-Allied Commission for the Repatriation of War Prisoners. With the American Expeditionary Forces General Harries for the third time served his country with distinguished success. As a boy his first military experience was received as a scout under Generals Miles and Crook in the Indian campaigns and so well did he grasp frontier problems that he was made a member of the Sioux Commission, having in charge the final adjustment of the differences with the Indians. In the Spanish War he led the First District of Columbia Volunteers as colonel, and was retired with the rank of brigadier general. He entered the Great War in command of three regiments of the Nebraska National Guard, brought them to war strength, at Deming, N. M., and after a short time at an Atlantic Coast port, sailed for France in command of a brigade, arriving early in 1918. His brigade was sent to the front near Verdun where it served gallantly. General Pershing, however, called upon General Harries for service as commandant of the port of Brest, where his organizing and executive ability established a record in the disembarkation of troops and the handling of both men and munitions.

When the armistice was declared General Harries, as assistant chief of staff to General Pershing, was a member of the Armistice Commission, and upon its conclusion was sent to Berlin, enjoying the distinction of being the ranking American officer first in the capital of the enemy. His position in Germany, having in charge the repatriation of war prisoners—American, Roumanians, Serbs and Russians—was one of extreme peril for months calling for the utmost resources of firmness and tact. The measure of success which rewarded his efforts is reflected by the following among other decorations: From General Pershing General Harries received the Distinguished Service Cross; from the French he received the rare distinction of the order commander of the Legion of Honor; the Russian government conferred upon him the order of St. Stanislaus; the Serbs, the order commander of the White Eagle; Italy made him a commander of St. Maurice and Greece presented him with the Grand Cross of George I. With all of his honors modestly borne, General Harries expresses unfeigned gladness to return to the field wherein he has long been prominent—the operation, engineering and financing of public utilities.

Obituary.

DAVID PERCY HARTZELL, Cumberland, Md., secretary and treasurer of the Cumberland & Westernport Electric Railway Co., died recently at his home at the age of 54 years. Mr. Hartzell was connected with the company for 14 years.

WILLIAM HARRINGTON ANDERSON, Brooklyn, N. Y., a well known electrical engineer and formerly connected with the Brooklyn Rapid Transit Co. and the Public Service Commission, died recently at the home of his parents, 1358 President street, at the age of 30 years.

WILLIAM SOFFE, vice-president of the Inland Electric Co., Chicago, Ill., died Oct. 10 after an illness of only a few days. Mr. Soffe was 32 years old and began his electrical career with the Illinois Electric Co., Chicago, remaining with that company until 1910, when he joined the sales organization of the Harter Manufacturing Co., Chicago. In 1917 he entered the employ of the Emergency Fleet Corp., acting as western buyer of supplies, and in February of this year became connected with the Inland Electric Co. Mr. Soffe was widely known in the electrical field and his many friends regret his untimely death.

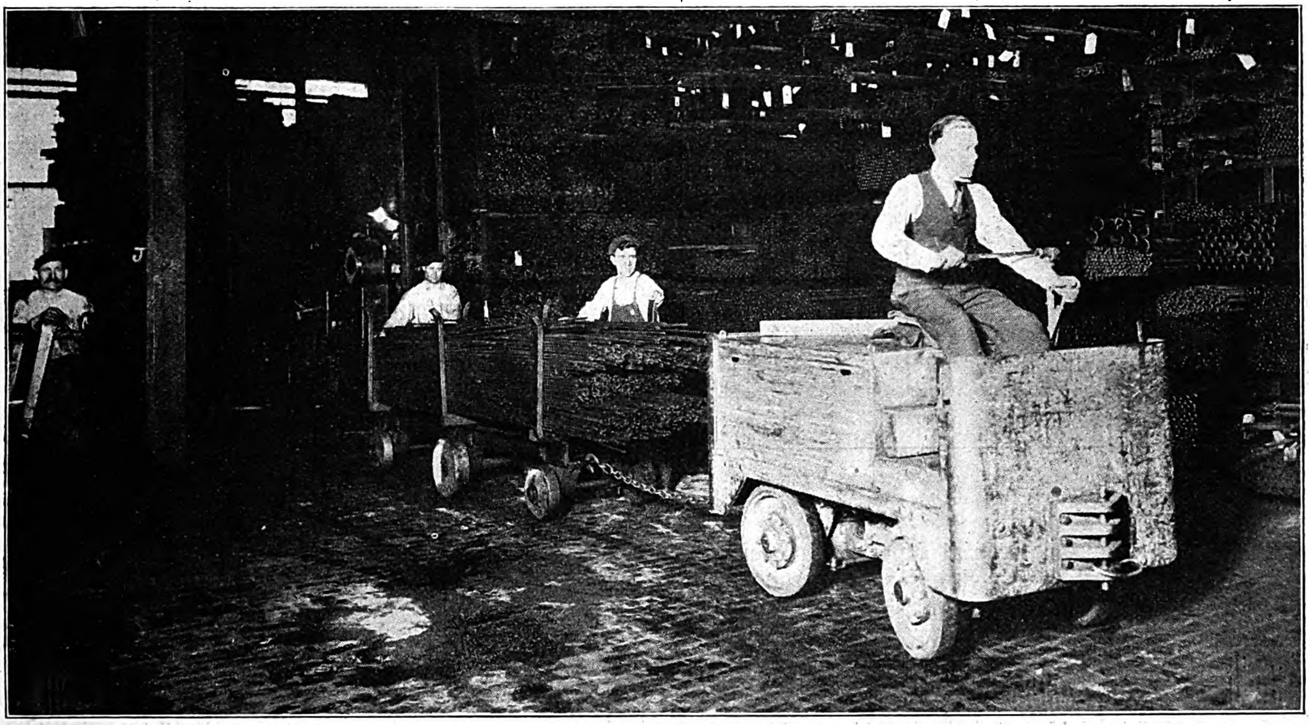
Electrical Review

Vol. 75. No. 17. CHICAGO, OCTOBER 25, 1919 Three Dollars a Year

Electrical Review

WITH WHICH IS CONSOLIDATED WESTERN ELECTRICIAN AND ELECTROCRAFT

VOL. 75—No. 17. CHICAGO, SATURDAY, OCTOBER 25, 1919. PAGE 683.



For Hauling Materials From the Stock or Receiving Rooms to the Machines the Electric Industrial Tractor Offers Many Advantages.

Industrial Electric Trucks and Tractors in Machine Shops

Special Advantages of This Apparatus in Increasing Efficiency and Reducing Costs in Machine Shop Work — Its Application for Such Work—Special Opportunities for Adoption at This Time

By BERNARD J DILLON

MODERN machine shops are perhaps a better illustration than any other line of industry of the practicability and advantages of up-to-date efficiency methods. Already the majority of such shops have adopted these methods to some extent at least, and almost daily the use of them is increasing. For in order to compete economically with the newer shops the older ones are forced to adopt every conceivable method to increase production and reduce costs.

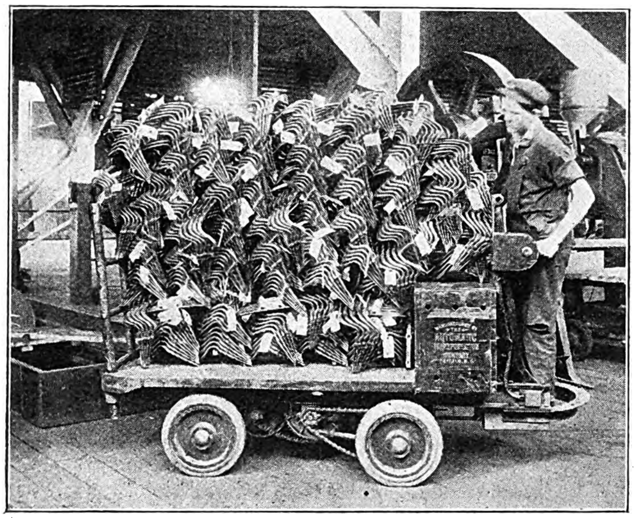
Compared with shops of a few years ago the modern shop is a revelation of progress. Efficient machines driven by the most efficient power methods take the place of many hands. These machines are so arranged or grouped as to facilitate production as much as possible.

Such machinery, however, represents a considerable investment. In order to secure an adequate return on this investment they must be operated to their fullest capacity. Specialized workmen are employed for this purpose. Such workmen are highly paid, which adds to the necessity of obtaining the utmost production. In a word, the machines and operators must be kept busy.

Formerly, when the average working day or week was considerably longer than it is now this was not so essential, for machines could be run from 10 hours per day to practically continuous operation. Under present conditions with labor everywhere demanding shorter hours, more pay, and also comparatively scarce, this feature must be considered carefully for it constitutes one of the most difficult and important problems facing such industries.

The application of an electric industrial truck or tractor offers one of the best means of solving this problem. By their use handling costs are, of course, reduced, but, more important than this, machines and their skilled operators can be kept constantly supplied with material and tools and no time is lost in waiting or going for such articles.

In most machine shops the handling may be roughly divided into two classes.



The Elevating Platform Truck Is Used Extensively for All Kinds of Handling In and Around Machine Shops.

First, bringing the material from the storerooms or receiving room to the machines or stockrooms and taking from the machines, completed, to the shipping or assembly rooms.

Second, taking it from one machine or operation to another.

Application of Electric Industrial Trucks and Tractors to Machine Shop Handling.

In the first of these the problem is simply one of handling and is similar to that of many other industries. Receiving or storerooms are located at points convenient for unloading. From here the material must be transported either directly to the machines or to stockrooms. The use of industrial electric for such work reduces the labor necessary for it, relieves congestion, is quicker and safer and in general provides many economical and productive advantages.

Likewise in hauling from the machine shop to the shipping room the problem is more often one of handling, although here the ability of the electric to handle heavy loads without any unnecessary jarring or extra handling is often a decided advantage.

The electric industrial tractor or elevating platform truck is generally used for such work. By loading the materials directly upon skids or trailers to be picked up and taken to the proper unloading point a large amount of hand labor can be eliminated. Where the haul must be made between different buildings and steep grades are encountered in the route, their advantages are particularly desirable.

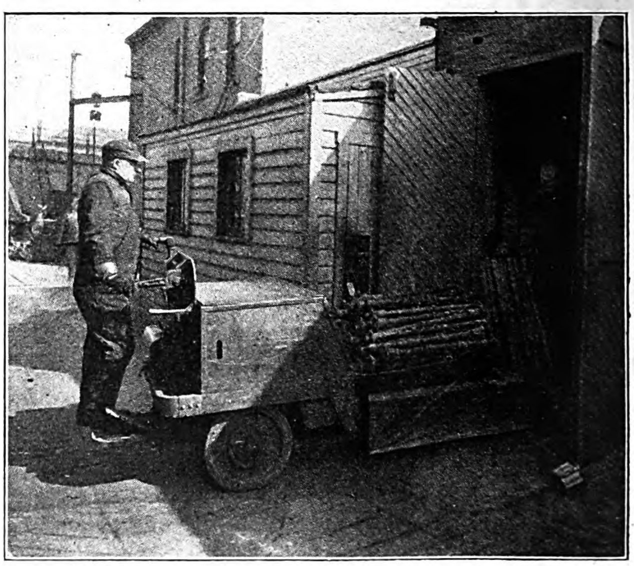
The lift truck can handle loads weighing up to two tons at a speed of from 2 to 6 miles per hour. An electric tractor can haul a trailer load of 10 tons or more at about the same speed. Either of these can negotiate ordinary grades easily.

The steering and control of all types of this apparatus is very flexible and positive. Narrow aisles and passageways can be negotiated as easily as with a hand truck and as the operator has more power at his command than the hand trucker and can stop or start without any effort on his part, there is less danger from collisions or unnecessary jarring.

In the transporting of materials from the stockrooms to the machines and from one machine, operation or department to another the application of industrial electrics as a means of increasing production and efficiency is especially important. By their use there is no necessity of the operator leaving his machine to go to the stockroom or another machine for materials and delays or lost time due to lack of materials can be eliminated. By giving proper consideration to the routing and operation of the electrics and employing good, reliable operators the lower cost obtained by increased efficiency will often pay for the cost of the apparatus, leaving the saving in handling as profit.

Any type of apparatus may be adopted for such work but the lift truck or tractor is particularly desirable. With the former a number of skids can be made for a very small amount which can be arranged to accommodate the materials. These skids are loaded in the stockroom, picked up by the truck and carried to the machine. Here they can be placed in the most advantageous position for the machine operator. After completing the work on the material it can be placed in another skid which in turn is picked up by the truck and taken to the next machine. In the meantime another skid loaded with material can be brought to the first machine and the emptied skid used to receive its load.

When a tractor is used, trailers replace the skids. Heavier loads can, of course, be hauled but they can not be spotted as accurately as the skids. The selection of the type of equipment will depend largely upon local conditions. Where the quantity of materials to be handled is large, such as when a group of machines must be served at once or when the material to be handled can not be readily loaded onto skids, the electric tractor with trailers is perhaps most desirable. Where the materials consist of rather small pieces



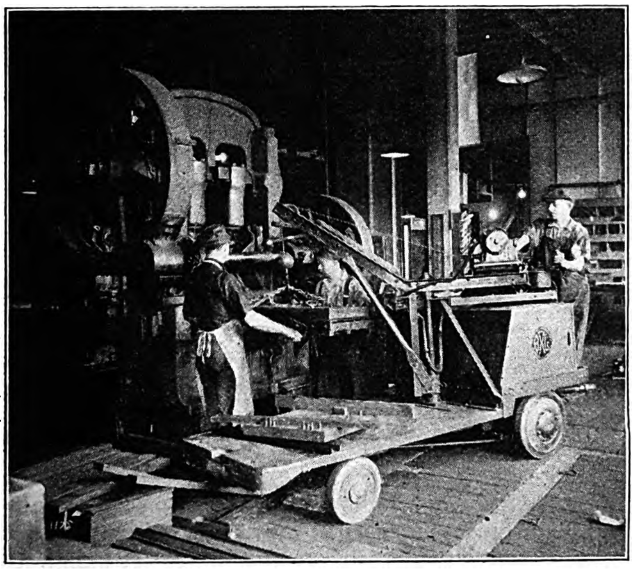
The Utility Truck Can Also Effect a Saving in Handling Costs.

that can be dumped or loaded onto skids the lift truck is preferable. In addition, the utility or load carrying truck can also be used to advantage, especially in the smaller plants where the amount of work is small and the general utility features of this type desirable. When heavy materials must be lifted up on machines an electric truck equipped with a crane can be used. These cranes are operated electrically and have a capacity of one ton or more.

The general utility features of any type of electric are also valuable in machine shops. These features include the hauling of extra heavy materials, moving machinery, the spotting of freight cars, etc.

The question of passageways and the average length of haul must, of course, be given consideration. But the mere fact that the passageways appear difficult or crowded or the length of haul exceptionally short does not necessarily prohibit their use. As already stated, most of these machines can be operated wherever a hand truck is used. The steering arrangement is very flexible and the machines can be driven in either direction. This allows them to be driven into small corners, unloaded and backed out. Moreover, the handling of materials efficiently and profitably by electrics depends more upon the quantity and type of material handled than upon the distance over which it is to be carried.

Most manufacturers of the equipment maintain capable engineering staffs who can be called upon in difficult cases to explain the features of their apparatus and point out the features and saving of an installation. Machine shop officials who are contemplating changes or additions to their plant or equipment should avail themselves of this service.



An Electric Truck With a Crane Attachment Can Be Used for Lifting Heavy Materials Onto Machines.

Opportunity for Electrical Men at Present.

At present the opportunities for promoting the installation of electric industrial trucks and tractors by electrical contractors and engineers and central-station men are particularly good. The majority of machine shop managers are now seriously considering all sorts of methods of increasing efficiency and reducing costs. Many of these methods involve changes of power, installations or additions. For example, increased lighting facilities are being required by a great many such shops. In considering such methods electrical men are usually consulted. In this capacity they are given an opportunity to study conditions in the shop and their suggestions are given great consideration.

For the central-station company the installation of electric trucks or tractors offers a most desirable load. The machines are generally charged at night when the rest of the plant is idle, which makes this an off-peak load and one for which central-station service offers many advantages. To the electrical engineer or contractor they offer an opportunity to perform a real service for the customer which will result in added profits for both. It is therefore important that these branches of the electrical industry should encourage the adoption of these machines wherever there is an opportunity to do so.

GERMAN ELECTRIC POWER NATIONALIZED.

A law nationalizing the electric power of the German Empire has been published by the government. Germany has over 4000 power establishments, and the splitting up of their activities is held to cause serious waste. The scheme is made imperative by the loss of the Saar coal fields and the obligation to supply coal to the Allies. The water power, which is mostly to be found in south Germany, is primarily to serve local industries, but an agreement will be made with those generating electricity from coal in central Germany. Power stations belonging to states and municipalities will not be disturbed, but the large plants belonging to private capital will be taken over and nationalized by the central government. The government will buy up shares, so that the present organizations can remain intact. The nationalized works are not to be considered as a source of revenue, as the government holds that cheap power for industry is more important than fiscal interests. The private capital in electrical power works in Germany is estimated at 1,000,000,000 marks and the use of electrical power in that country has increased from 4.43 billions of kilowatt-hours in 1907 to 22 billions in 1917.

ADDITIONAL GENERATING CAPACITY FOR NORTHERN STATES POWER CO.

The industrial growth of Minneapolis, St. Paul and southern Minnesota is brought into sharp relief by the action of Northern States Power Co. which will install an additional 40,000-hp. steam turbine unit in its Riverside station, Minneapolis. Within the past few weeks a new 40,000-hp. unit has been completed and placed in operation, but the electrical demands during the coming winter in the Twin City district will probably absorb this new capacity to the limit. No additions to the present Riverside station building will be necessary to house the generating and condensing equipment and boilers as ample reserve space was provided during the construction of 1918-19. This station in 1911 had a total capacity of 16,000 hp.; it will produce 116,000 hp. when the unit now authorized is completed in September, 1920. The 1918-19 addition has been referred to variously as a 33,000-hp. and 35,000-hp. unit. Under load it has tested out to 40,000-hp. capacity.

ROCHESTER SECTION, A. I. E. E., MEETS.

A meeting of the Rochester (N. Y.) Section, American Institute of Electrical Engineers, was held Oct. 24. E. B. Craft, assistant chief engineer, Western Electric Co., was the chief speaker, his subject being "Wartime Electrical Communications." He described some of the accomplishments and developments made by the army and navy in means of communication.

Central-Station Rates in Theory and Practice

Sixteenth Article — The Block Meter Rate and Its Combination with Other Rates—Customer Charges—Detailed Studies of Block Rates and Combinations — Average Charges with Meter Rates

By H. E. EISENMENGER

This is the sixteenth article of this series, which began in the issue of July 12. In the first seven articles, constituting Part I, the cost of rendering electric service was discussed. The next six articles, Part II, dealt with the general policy to be followed in selection of a rate system. Part III began in the Oct. 11 issue and will include three more articles in the next few weeks treating with the various rate systems in more or less common use. The remaining articles of the series will appear weekly until the close of the present volume (Dec. 27). They will comprise Parts IV to VI and discuss rate analysis, accuracy of rates and rate regulation by commissions.

PART III—SYSTEMS OF CHARGING—Continued.

II. The Various Types of Rates—(Continued).

B. Rates Based on Energy Consumption Only.

2b. Methods for Applying Lower Average Kilowatt-hour Prices for Larger Consumers.

3. The Block Meter Rate.

SECTION 122. The block meter rate is the third method we can use to make the average kilowatt-hour charges lower for the larger energy consumer. The range of kilowatt-hours, beginning from zero, is here also divided into a number of ranges corresponding to the steps of the step meter rates. These ranges are in this case called "blocks." A certain unit charge per kilowatt-hour is made for all energy used within the first block, and that part of the energy which reaches into the second block is charged at a certain lower rate per kilowatt-hour. After the number of kilowatt-hours which are contained in the second block and are charged at that lower rate, the excess of energy over the second block is charged at a still lower rate until the third block is filled, etc. The difference from the step rate is that the charge connected with a certain block applies only to the kilowatt-hours within that block and not to those of the preceding blocks, whereas with the step rate the total bill is always calculated at one single rate.

Let us assume, for instance, that the first 100 kw-hr. be charged at 10 cents per kw-hr. and all excess energy over 100 kw-hr. at 5 cents per kw-hr. We have then in the range of 0 to 100 kw-hr. a straight meter rate of 10 cents per kw-hr.; for the consumers of 100 kw-hr. and more the charges (total bill) will be as given in the second column of the following table:

1. Kw-hr. consumed.	2 Charges. Block rate.	3 Charges. Straight meter rate, 5 cents per kw-hr.
100	$10.00	$5.00
101	10.05	5.05
102	10.10	5.10
103	10.15	5.15
.......etc.......		

Supposing now for a minute we had a straight meter rate of 5 cents per kw-hr. in the range both below and above 100 kw-hr., then the amounts will be those of column 3 of the above table. The block rate (column 2) is just $5 higher in every instance than the 5-cents-per-kw-hr. straight meter rate (column 3), regardless of the amount of energy consumed (provided, of course, that we remain within the second block). We can say, therefore: This block rate corresponds in the range of its second block to a combination of a straight 5-cent meter rate with a customer charge of $5. Where we have more than two blocks in the rate schedule the same general rule applies for all blocks: The block rate is equivalent to a combination of a straight meter rate with a customer charge. The customer charge is zero in the first block and increases with every successive block, whereas the energy charge decreases. This is more fully and more generally discussed in Insert XII, which also describes the resulting simplification of the method of figuring the bills of the block meter rate.

The block meter rate furnishes us with the first examples of what might be called a "concealed charge" or a "disguised charge." This means that one of the three "fundamental charges" (energy, demand, customer) is expressed by one or both of the other two charges so that it is not visible on the surface.

The block meter rate is the most frequently found

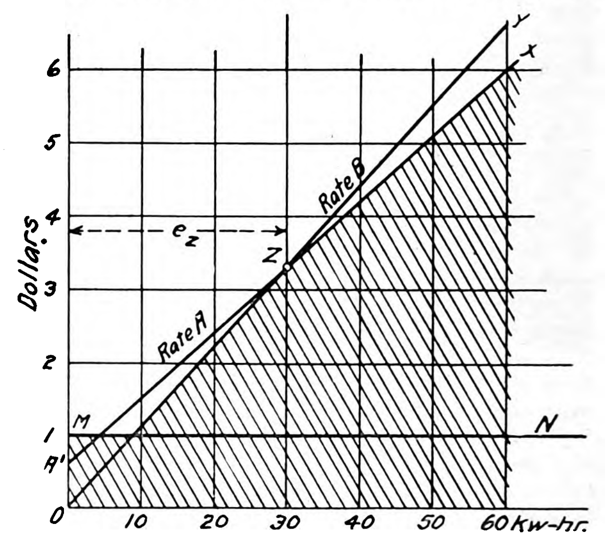


Fig. 7.—Stipulation of a Maximum Charge per Unit Results in the Equivalent of a Block Rate.

type of the pure meter rates. The number of the blocks does not go up as high as that of the steps in case of step rates; it ranges generally between two and eight, a larger number is a rare exception and no greater number of blocks than eleven[1] has been found in a very large number of schedules examined.

The block meter rate is also found combined with a minimum charge or a customer charge.

A block meter rate is sometimes briefly described by simply stating the successive kilowatt-hour charges and omitting for the sake of brevity any mention of the size of the blocks. Thus the Sacramento rate described and analyzed in Insert XII would be called "a 6-5-4-3-cent block meter rate." The same applies to step meter rates.

4. Combinations of Block Meter Rates With Step Meter Rates and Straight Meter Rates.

123. A block meter rate may be combined with a step meter rate in such a way that the lower energy consumptions are charged under the block meter system and anything above a certain amount of energy consumption is charged under the step meter system. The step rate may also contain one single step only, which means that it reduces to a straight meter rate. The order can also be reversed, which means that the step rate applies to the lower range of kilowatt-hours and the block rate to the higher one. (If we again consider the special case of the step rate comprising one step only, that is a straight meter rate, every plain block meter rate can be considered as a combination of a straight meter rate with a block meter rate, where the unit charge of the straight meter rate equals the unit charge of the first block of the block meter rate and where the straight meter rate extends over a portion, but not the whole, of the first block.)

These combinations do not occur frequently. Examples and their full discussion are given in Insert XIII.

5. Explicit Customer Charge.

124. A further method of doing away with or reducing the inequity which lies in the use of equal unit charges per kilowatt-hour to large and small consumers alike by the straight meter rate is to make an explicit customer charge in addition to either a straight meter rate[2] or a step rate[3] or a block rate[4]. This combination with a customer charge (especially if applied to the block system) can make the curve of actual charges follow very closely the curve of the theoretical charges as demonstrated in Section 4 of Insert XII, and is the most accurate pure meter rate, especially for small energy consumers. Notwithstanding this it is not very popular, probably because the public has not yet been educated to understand the equity of a fixed customer charge.

c. The Average Charges per Kilowatt-hour for Various Customers.

125. It has been shown (Section 117) that it is desirable to get lower average charges per kilowatt-hour for larger energy consumptions than for smaller ones. It will, therefore, be of interest to see how with the different systems discussed above (Sections 118-124) the average charges per kilowatt-hour vary as the amount of the energy consumption increases. This is fully discussed in Insert XIV, to which the reader is herewith referred.

Insert XII—Appendix to Section 122.

GRAPHICAL REPRESENTATION AND ANALYSIS OF THE BLOCK METER RATE.

1. A graphical representation of the block meter rate gives a most vivid insight into its nature. Let us take as an example the Retail Power schedule of Fort Wayne, Ind.:

---

[1] General Power Schedule, Salem, Mass.

[2] Battery Charging rate of Springfield, Ohio; customer charge 60 cents, energy charge 3 cents per kw-hr.

The General Lighting Rate of the New York and Queens Electric Light & Power Co. (customer charge 60 cents, energy charge 9 cents per kw-hr.) is only an apparent example of this combination because this rate contains a stipulation that the average rate per kilowatt-hour shall not exceed 11 cents per kw-hr. This makes the rate in effect a block rate. This example will be treated more fully here as it is typical for those schedules which make a stipulation that, no matter what is said elsewhere in the schedule, the average rate shall never be more than a certain specified amount per kilowatt-hour (compare Section 109).

Fig. 7 illustrates this rate. *OA'* is the customer charge of 60 cents and *A'χ* is the 9-cent-per-kw-hr. rate added to this customer charge. This combination will be called Rate A hereafter. *Oy* is the straight 11-cent-per-kw-hr. meter rate (Rate B) which limits the amounts of the bill under Rate A. The drawing shows that Rate B is lower than A for all points to the left of the intersection point *Z* between the two rates. This means Rate B will apply for all energy consumptions smaller than the energy consumption e_z belonging to that point *Z* and A will apply to all energy consumptions exceeding that amount; e_z can either be read off from the drawing Fig. 7 directly, or with greater accuracy and as a check it may be figured out arithmetically as follows: The amount of the bill for e_z kw-hr. under the Rate A is $60 + 9e_z$ and under Rate B it is $11e_z$. These two amounts are equal to each other because the point *Z* is situated on both rate curves and we have $60 + 9e_z = 11e_z$, from which $60 = 2e_z$ and $e_z = 30$ kw-hr. The combination of Rates A and B is therefore identical with a block rate as follows: 11 cents per kw-hr. for the first 30 kw-hr.; 9 cents per kw-hr. for the excess over 30 kw-hr.

In addition to this the rate states that a minimum charge will be made of $1 per month, which is represented by the straight line *MN* and applies to the equivalent block rate as well. The resulting curve is shaded in Fig. 7.

[3] General Lighting, York, Pa.: Customer charge 10 cents per month (this is the smallest customer charge the author could find in any rate) plus an energy charge of 10 cents per kw-hr. The bill is reduced by stepped quantity discounts as follows:

5% on bills from $1.01 to $ 2.00
20% on bills from $2.01 to $ 5.00
25% on bills from $5.01 to $10.00
etc.

These discounts change the apparent straight meter rate into a step meter rate as explained at the discussion of the step rate (Section 120).

[4] General Service Schedule of Lincoln, Neb.: Customer charge 40 cents per month plus an energy charge of
5 cents per kw-hr. for the first 10 kw-hr.
4 cents per kw-hr. for the next 30 kw-hr.
3.5 cents per kw-hr. for the next 460 kw-hr.
3 cents per kw-hr. for the excess over 500 kw-hr.

The General Lighting rate of Memphis, Tenn., is interesting in this connection: Customer Charge 30 cents per month plus an energy charge as follows:

$$\left.\begin{array}{l}\text{6 cents per kw-hr. for the first 80 kw-hr.}\\ \text{5 cents per kw-hr. for the next 120 kw-hr.}\\ \text{4 cents per kw-hr. for the next 300 kw-hr.}\\ \text{3 cents per kw-hr. for the excess}\end{array}\right\}\text{To be called Rate I.}$$

Now the rate further provides that no customer's bill for service through one meter shall exceed 7.5 cents per kw-hr. on the average in any calendar year. If this clause could be read "on the average per month" we would have a case parallel to that of the New York & Queens Co. treated in the preceding footnote and the above rate would be simply reduced by that clause to a block rate as follows:

$$\left.\begin{array}{l}\text{7.5 cents per kw-hr. for the first 20 kw-hr.}\\ \text{6 cents per kw-hr. for the next 60 kw-hr.}\\ \text{5 cents per kw-hr. for the next 120 kw-hr.}\\ \text{etc., as above.}\end{array}\right\}\begin{array}{c}\text{Rate II}\\ \text{(monthly average)}\end{array}$$

As the clause applies, however, to the *yearly* average charge it is possible that the monthly bill of a certain customer exceeds this average charge of 7.5 cents per kw-hr., without reduction, for instance during the summer months, if his winter consumption is large enough to bring the yearly average charge below 7.5 cents per kw-hr. (It can easily be shown that this is the case if the average monthly consumption of the consumer over the whole year is greater than 20 kw-hr. See preceding footnote, third paragraph.) This means that the reduction of the bills by the maximum of the average energy charge takes place in more cases if the maximum energy charge applies to the monthly average than if it applies to the yearly average. The monthly average for the maximum energy charge is on the whole more favorable to the customers than the yearly average.

The maximum-average-charge clause is in a certain measure the opposite of the minimum-charge clause (see Sections 107 and 108). The former is a guarantee on the part of the *electric service company* that the average charge per kilowatt-hour over a certain period shall never be *greater* than a specified amount in cents per kilowatt-hour and the latter is a guarantee on the part of the *customer* that the payment for a certain period shall never be *smaller* than a specified amount in cents or dollars. That period may be a month or a year, and the choice of the larger period (the year) will have the opposite effect in the case of the maximum-average-charge clause than in case of the minimum-charge clause. Whereas, for instance, a yearly minimum charge of $12 has the tendency to make the customers' bills, as a whole, lower than a $1 monthly charge (see Section 107, first footnote), a maximum-average charge of, for instance, 10 cents per kw-hr. will tend to make the payments of the customers, as a whole, higher, if applied to the yearly average than if applied to the monthly average.

The first 50 kw-hr. are charged at 5 cents per kw-hr.
the next 100 kw-hr. are charged at 4 cents per kw-hr.
the excess over 150 kw-hr. at 2 cents per kw-hr.

We choose as horizontal axis the number of kilowatt-hours consumed and step off vertically corresponding the amounts of the customer's bill (Fig. A). A vertical line *I* drawn at the distance 50 kw-hr. from the vertical axis and another one *II* 100 kw-hr. further to the right will then give us the various blocks. In the first block we have a straight meter rate of 5 cents per kw-hr., which is represented by a straight line Ox, where x is, for instance, the point corresponding to 100 kw-hr. and \$5. From the point A, where that line crosses the dividing line between the first and the second blocks, every additional kilowatt-hour is charged at 4 cents only and consequently we have to proceed from this point along a line with a smaller angle of elevation, corresponding to 4 cents per kw-hr. We can get this angle by joining O with, for instance, the point y (100 kw-hr., \$4). Drawing a parallel to this line Oy through A will give us the amount of the bills in the second block, line AB. It is evident, if we produce this line backwards towards A_o that the rate in the second block corresponds to a straight 4-cent meter rate increased by a constant amount OA_o, that is by a customer

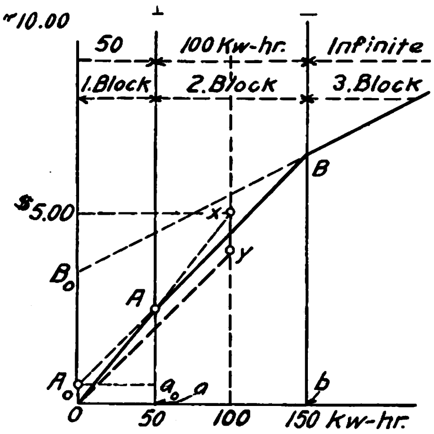


Fig. A (Insert XII).—Block Rate.

charge. It is obvious from the drawing that with every successive block this equivalent customer charge increases as the kw-hr. charge of the block rate decreases. It is also evident that the kilowatt-hour charge of the straight meter component of the equivalent rate is identical with the kilowatt-hour charge of the block meter rate in the respective block.

2. The numerical value of the equivalent customer charge in a given case can be found either by measuring the values OA_o, OB_o, etc., in the chart, or by purely arithmetical operations in the following way. The customer charge of the second block in Fig. A is OA_o, which obviously equals aa_o. Now $aa_o = aA - a_oA =$ (50 kw-hr. × 5 c/kw-hr.) — (50 kw-hr. × 4 c/kw-hr.) = 50 cents. Similarly we get the customer charge for the third block as: (50 kw-hr. × 5 c/kw-hr.) + (100 kw-hr. × 4 c/kw-hr.) — (150 kw-hr. × 2 c/kw-hr.) = 350 cents or \$3.50.

In general, to find the equivalent customer charge of the n^{th} block, figure the products of each preceding range in kilowatt-hours by the energy charge in the respective range and from the sum of all these products subtract the product of the sum of all ranges in kilowatt-hours, preceding the n^{th} range, in kilowatt-hours, by the kilowatt-hour charge of the n^{th} range.

An example will make this clear. Take, for instance, the Commercial Light rate in Sacramento, which is a block meter rate charging:

6 cents per kilowatt-hour for the first 50 kw-hr.
5 cents per kilowatt-hour for the next 400 kw-hr.
4 cents per kilowatt-hour for the next 600 kw-hr.
3 cents per kilowatt-hour for the excess over 1050 kw-hr.

How large is the equivalent customer charge in the 4^{th} block? Answer: (6 × 50) + (5 × 400) + (4 × 600) — 3(50 + 400 + 600) = 1550 cents or \$15.50. We can thus figure the bill of any customer with more than 1050 kw-hr. simply as \$15.50 plus 3 times the total kilowatt-hour consumption of that customer. For instance, if the customer has used 2000 kw-hr. his bill will be \$15.50 + (3 × 2000 cents) = \$75.50.

This method is a simplification of the obvious method of computing the bills by figuring out the charge for the energy in each block and adding them, as this method does away with the subtraction of 1050 from 2000.

We can therefore make up a little table as follows:

Range in kw-hr.	0—50	51—450	451—1050	1051 and over
Customer charge ...	\$0	\$0.50	\$5.00	\$15.50
Energy charge (cts. per kw-hr.)	.06	.05	.04	.03

From this table we can calculate any bill with not more than one multiplication and one summation, without any subtraction.

Algebraic Analysis of the Block Meter Rate.

3. An algebraical investigation for those readers who are familiar with algebra will supplement this. Calling c_1 the energy charge per kilowatt-hour in the first block, that is from 0 to e_1 kw-hr., c_2 the energy charge per kilowatt-hour in the second block, that is between e_1 and e_2 kw-hr., etc., we get the amount of the bill in the first block (less than e_1 kw-hr.) as

$$a_1 = c_1e \quad \text{.....................} \quad (1)$$

where e is the number of kilowatt-hours consumed. If the customer's energy consumption e reaches into the second block we have to pay for the first e_1 kilowatt-hours at the rate of c_1 cents per kw-hr. and for the balance of $(e - e_1)$ kw-hr. at the rate of c_2 cents per kw-hr., so that the whole bill a_2 becomes

$$a_2 = c_1e_1 + c_2(e - e_1)$$
$$= (c_1 - c_2)\,e_1 + c_2e \quad \text{.....................} \quad (2)$$

The constant term $(c_1 - c_2)e_1$ is obviously the customer charge and the part which is proportional to e is a straight meter rate. The unit charge of that straight meter rate is the factor by which e is to be multiplied, that is c_2.

If the energy consumption e becomes greater than $(e_1 + e_2)$ and therefore reaches into the third block we have first to pay for $(e_1 + e_2)$ kw-hr. as per equation (2), that is $(c_1 - c_2)\,e_1 + c_2\,(e_1 + e_2)$ and for the remainder of $e - e_1 - e_2$ we have to pay at the rate of c_3 cents per kw-hr., in other words

$$a_3 = (c_1 - c_2)e_1 + c_2(e_1 + e_2) + c_3(e - e_1 - e_2)$$
$$= (c_1 - c_3)e_1 + (c_2 - c_3)e_2 + c_3e$$

In the same manner we get

$$a_4 = (c_1 - c_4)e_1 + (c_2 - c_4)e_2 + (c_3 - c_4)e_3 + c_4e$$

. . . . etc. . . . .

The terms in brackets are constant and represent always the customer charge in every one of these equations, whereas the co-efficient of e (that is c_1, c_2, c_3, . . . etc.), is the energy charge of the straight meter rate component of the equivalent combinations of rates. If we write this in the form

$$a_4 = c_1e_1 + c_2e_2 + c_3e_3 - (e_1 + e_2 + e_3)\,c_4 + c_4e$$

we see that the result is the same as the one obtained above for a special numerical case. The results can also easily be verified graphically.

4. We see from the figures of Insert XI on the one hand, and from a comparison of Fig. A of this Insert with Fig. A of Insert X on the other hand, that the block meter rate follows the theoretical requirements of the pure meter rate more closely than the step meter rate. Especially if we add an explicit customer charge to the block meter rate[1] (which would mean that the duct of straight lines of Fig. A of this Insert will have to be raised parallel to itself by the amount of the customer charge) we see that we can with a very limited number of blocks approach the theoretical curve to any degree of approximation which is desirable in practice.

Insert XIII — Appendix to Section 123.

Combinations of Block Meter Rates with Straight Meter Rates and Step Meter Rates.

These combinations do not occur frequently. An example for the combination of a block meter rate with a straight meter rate is the General Lighting schedule of Cambridge, Mass. This rate charges

9 cents per kw-hr. (net) for the first 500 kw-hr.
8 cents per kw-hr. (net) for the next 500 kw-hr.
7 cents per kw-hr. (net) for the next 1094 kw-hr.
3.875 cents per kw-hr. (net) for the next 2856 kw-hr.
5.5 cents per kw-hr. (net) for 4950 kw-hr. or over.

The last line of this table is a straight meter rate. The price per kilowatt-hour in this rate is chosen in such a way that we arrive at the same bill for the limiting number (4950 kw-hr.) of kilowatt-hours, whether we figure it according to the last, or to the last but one line. The curve of the rate (see also Insert XII) is shown in Fig. A.

The Municipal Wholesale Power rate of Fort Wayne, Ind., is a combination of a block rate in the lower ranges of energy consumption and a straight meter rate in the higher

[1] See Section 124 of the main text.

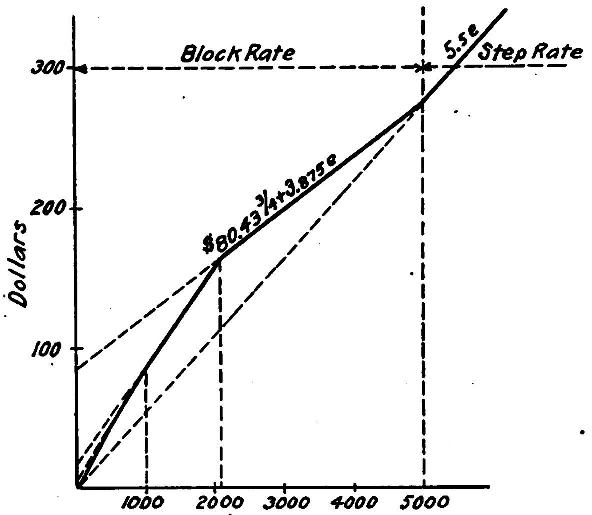


Fig. A (Insert XIII).—Block Rate Followed by Step Rate.

ones. Steps are worked into the rate by discounts which extend back into the range of the block rate as follows:

The rate charges: 3 cents per kw-hr. for the first 350 kw-hr.
2 cents per kw-hr. for the excess over 350 kw-hr.
If over 5000 kw-hr., 2 cents per kw-hr. for all the energy consumption.

Quantity discounts: 10% on bill of $ 25
15% on bill of $ 50
20% on bill of $ 75
25% on bill of $100
30% on bill of $150

Fig. B shows the curve of this rate and Fig. C that of the Retail Power rate of New Britain, Conn., which is the reverse of the rate just discussed, inasmuch as it contains a step rate in the lower, and a block rate in the higher ranges. The last one of the 15 steps charges 2.5 cents per kw-hr. in the range from 4000 to 5000 kw-hr. The block rate begins nominally at 5000 kw-hr., charging in the first block (5000-10,000 kw-hr.) the same unit rate of 2.5 cents per kw-hr. as the last step of the step rate. Therefore the curve is an unbroken straight line from 4000 to 10,000 kw-hr. and we might choose any point between 4000 and 10,000 kw-hr. as the end of the step rate and the beginning of the block rate. The block rate has very large blocks (5000 kw-hr. each) and the difference between the unit charges of successive blocks is only 0.1 cent, so that the curve of the block rate is very nearly an unbroken straight line.

Insert XIV — Appendix to Section 125.

Average Charges per Kilowatt-Hour with the Pure Meter Rates.

The only graphical representation of pure meter rates

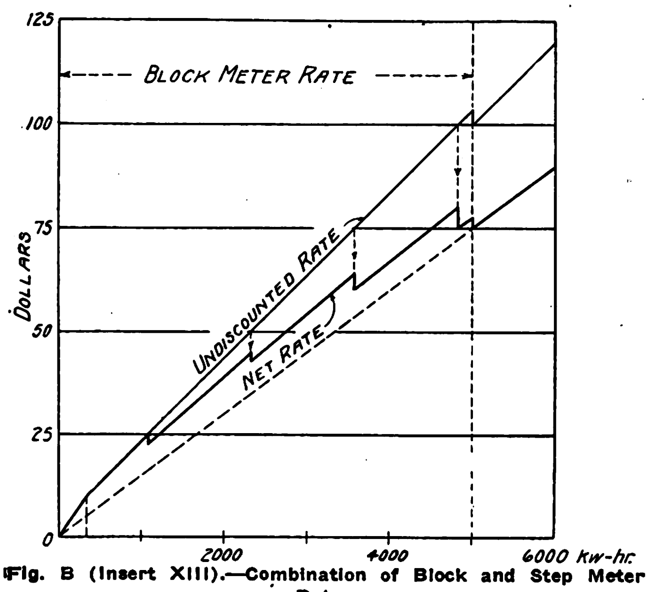


Fig. B (Insert XIII).—Combination of Block and Step Meter Rates.

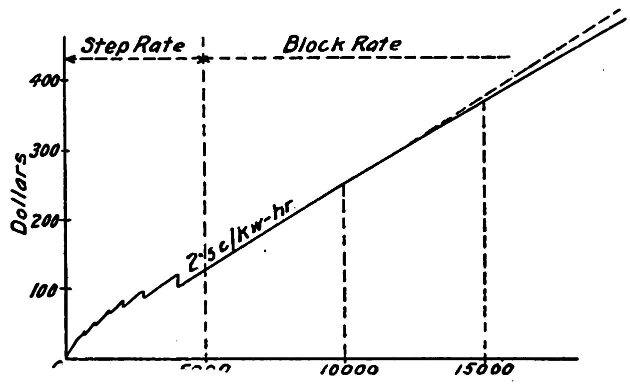


Fig. C (Insert XIII).—Step Rate Followed by Block Rate.

used so far was that of showing the amount of the customer's bill with varying energy consumptions (Inserts X-XIII and Figs. 4-6 of the main text). In this method of representation we get ducts of straight lines for the block and the step meter rate, and each of these straight lines is the equivalent of a combination of a straight meter rate with a customer charge. The energy charge of the schedule in cents per kilowatt-hour is given by the angle of elevation ϵ of the respective straight line from the horizontal[1]. (Fig. A) The larger the energy charge, the steeper the line will be. This energy charge can also be defined as the increment cost (to the consumer) per kilowatt-hour, that is, the price of every additional kilowatt-hour and must not be confounded with the average price per kilowatt-hour. This average price is given by the total bill divided by the number of kilowatt-hours consumed. If we connect a point P of the rate curve (duct of straight lines) with the origin O (Fig. A) the angle α which this connection line includes with the horizontal is a measure of the average price per kilowatt-hour. The steeper that angle is the higher is the average price[2].

We can thus by a glance at the rate curve easily form an idea how large the average price per kilowatt-hour is for every number of kilowatt-hours and how it varies. We need only estimate the variation of the angle α.

In many cases we find employed curves of the average price per kilowatt-hour rather than of the total bill. The curve of the total bill is, however, not only more instructive as regards the nature of the rate, but generally also simpler, because it almost always consists of straight lines only. Nevertheless, since, in spite of this, the curve showing the average price per kilowatt-hour is still frequently being employed, it will be shown in the following how the average price per kilowatt-hour varies in case of the block rate and of the step meter rate.

It has been shown that both the block rate and the step meter rate are composed of the two elements of the straight meter charge and the customer charge, and no other elements. These two elementary charges will be treated first and their combination afterwards. The total bill under a straight meter charge is represented by Fig. B_a. The average price per kw-hr. is, of course, constant. It is therefore represented by a straight horizontal line (Fig. B_b) the height of which above the axis is given by the kilowatt-hour charge. (The full lines in Figs. B_a and B_b belong to one another, likewise the dotted lines and the dash-and-dot lines.) In the other one of the two elementary rates, consisting of a pure customer charge, the curve which represents the customer's bill is a straight horizontal line (Fig. C_a), the height of which above the horizontal axis corresponds to the amount of the customer charge in dollars or cents. The curve for the average charge per kilowatt-hour is less simple (Fig. C_b).

[1] Speaking accurately and in mathematical terms: By the tan ϵ.

[2] Speaking accurately and in mathematical terms: The average price is given by tan α.

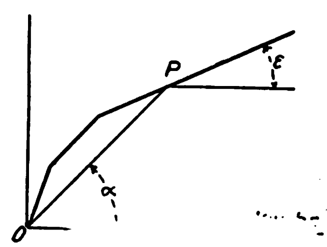
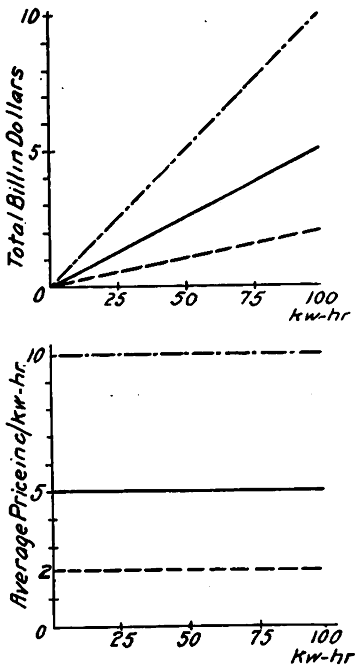
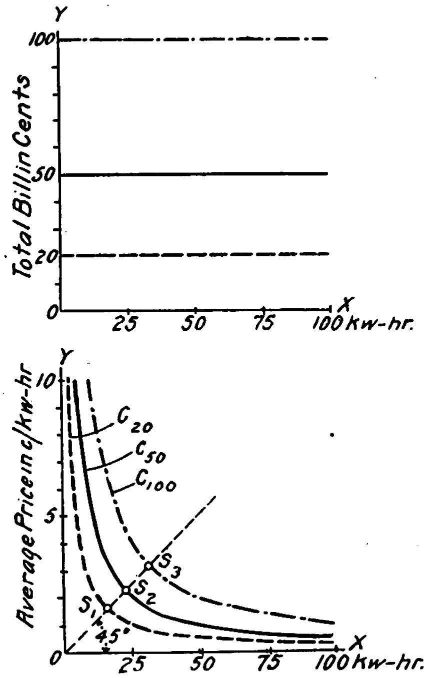


Fig. A (Insert XIV).



Figs. B_a and B_b.



Figs. C_a and C_b.

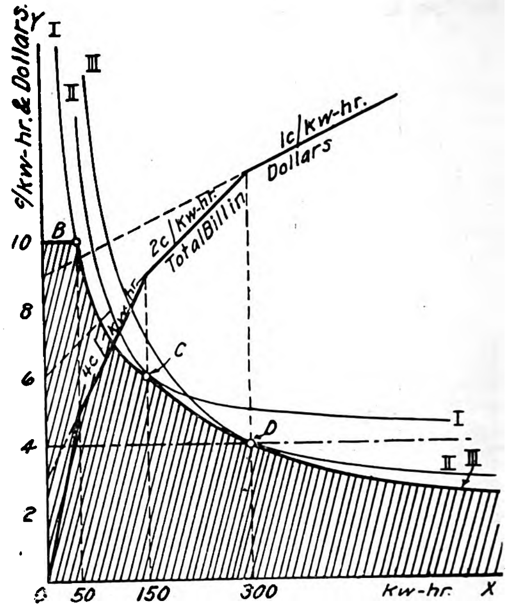


Fig. D.

If the bill is constant, for instance 50 cents (full line) the average price per kilowatt-hour will be

10 cents per kw-hr., if energy consumption is 5 kw-hr.
5 cents per kw-hr., if energy consumption is 10 kw-hr.
2 cents per kw-hr., if energy consumption is 25 kw-hr.
1 cent per kw-hr., if energy consumption is 50 kw-hr.

The curve which results from plotting these values is shown as curve C_{50} in Fig. C_b. The other curves for $1 and for 20 cents customer charge are also shown in the same figure. All these curves are equilateral hyperbolas with asymptotes OX and OY; this means that the curve steadily straightens out from O towards X and towards Y and it approaches the axes OX and OY more and more the further out we extend it, but it never touches them.

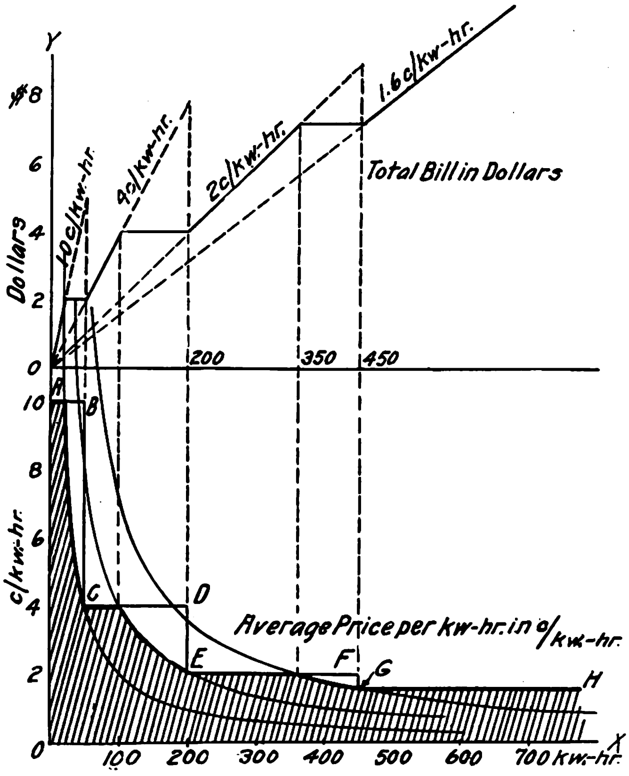


Fig. E.

If we now add these two elements, the straight meter charge and the customer charge, as in the block rate, the average-price curve will be a summation of the respective curves of the two elements, Fig. B_b and C_b, this means we will get the hyperbola in Fig. C_b, but the horizontal line of Fig. B_b will express itself by raising the hyperbola into a higher position. We thus get the curve of the average price per kilowatt-hour for a block rate (Fig. D, shaded area). It consists in the first range of the block rate of a horizontal straight line as the block rate itself in that range is nothing but a straight meter rate. In the following ranges a series of hyperbolas will result (*I, II, III*), one for each range. The axis of ordinates is the common vertical asymptote for them all and the respective horizontal asymptotes are located at distances above the horizontal axis which are given by the energy charge in the respective block. Thus, for instance, the horizontal asymptote of the hyperbola *I* (dash-and-dot line) is located at 4 cents per kw-hr. above the axis OX[3].

As regards the unmodified step rate, the average charge per kilowatt-hour is evidently indicated by the curve (duct) *ABCDEFGH* (Fig. E) resembling steps on a flight of stairs (hence probably the name "step rate"). Where we modify the step rate by the requirement that no greater total charge shall be made for a smaller number of kilowatt-hours than for a larger one the corners at *B*, *D* and *F* are cut off by hyperbolas, the asymptotes of which are always given by the axes OX and OY, as will be easily understood from the foregoing.

(To be continued.)

JAPAN'S ELECTRICAL INVESTMENT.

According to Y. Ishikawa, manager of the commercial department and chief engineer of engineering department of the Kyoto Electric Light Co. of Kyoto, Japan, that country has now a total electrical investment of $500,000,000. At present Mr. Ishikawa states, hydroelectric plants are capable of producing a 1,000,000 hp. but in the near future they will be enlarged to five times that capacity. He says that nearly every ship now sailing for Japan has about 150 Americans aboard; many of them are investing capital in Japan or are helping to direct industries in that country.

[3]It could be easily shown with a little mathematics that the length of the "axis" of the hyperbola (OS_1, OS_2, OS_3, respectively, in Fig. C_b) is proportional to the square root of the customer charge. This means that as the shape of the hyperbola is the more rounded off, the larger is the equivalent customer charge.

Equipment for Handling Coal and Ashes in Power Plants—II.

Influence of Methods Upon Plant Operation—Classification of Mechanical Methods of Handling Coal and Ashes—Power Calculations

By ROBERT JUNE

Mechanical Engineer.

THE power plant owner, who is considering the installation of mechanical coal and ash handling systems, is confronted by a number of fundamental problems which must all be solved correctly if he is to make a satisfactory decision. If the solutions require time and study, he will do well to refuse to be hurried in his investigations.

Prominent among the questions to be answered, are the following:

(a) What type, or types, of equipment are best adapted for the conditions in the industrial plant under consideration?

(b) Shall the coal and ash handling systems be divorced?

(c) Granted that questions (a) and (b) are correctly answered, will the equipment chosen meet the requirements of the $O\ M\ I < H$ formula; that is, will the operating costs O, which include power, labor to operate, oil, etc., plus the maintenance costs, M, which include repairs of any nature, labor to make repairs, depreciation, etc., plus interest, I, on total money invested, which must include not only equipment and parts purchased from manufacturer, but cost of labor to install, cost of foundations, bunkers, and other changes, be less than the cost of doing the same work by hand, H?

In order to arrive at some understanding of the factors entering into the first of these three problems, a brief survey of the different types of coal and ash handling equipment appeared last month. Continuing this description.

Apron Conveyors.

The apron conveyor was developed with the idea of obtaining a self-supporting continuous belt for handling heavy material. It consists of a double strand of roller chains, on which are mounted steel plates, the width of which corresponds to the pitch of the chain. These plates are beaded or curved over each other to form a closed joint. The sides are also made overlapping so as to produce a closed trough.

Apron conveyors are commonly used for conveying coal from track hoppers to the main conveyor and elevator. Only end discharge, of course, is possible, and thirty degrees inclination is the practical limit in elevation. Owing to its construction, this type of conveyor is comparatively expensive to install. However, since the load is carried and not dragged, less power is required than with the scraper type, and the maintenance is lower.

In estimating power requirements, the formula previously given for flight conveyors may be used with a reduction of 10% in the final figures.

In the pan conveyor, the flights are omitted, and the trough itself is made in sections and mounted on the chains. By this change the material is carried, with consequent reduction in wear.

This type of conveyor is used where pans, deeper than those of an apron conveyor, are required, as on inclines too flat for elevators and too steep for efficient operation of flight, or apron conveyors. The usual speed is 30 to 50 ft. per min. when supported by self-oiling roller wheels, the power consumption is but little above theoretical load requirements. For purposes of estimate, the power may also be assumed as 10% less than that of the formula previously given.

In passing, it should be noted that on account of the abrasive character of the materials, the employment of pan and apron conveyors for ashes is apt to result in excessively high maintenance costs.

V-Bucket Conveyors.

In this type the buckets are rigidly fastened to the conveyor chain, with the result that on the vertical runs, the material is lifted, whereas on horizontal runs, it is dragged through the trough ahead of the bucket.

V-buckets are one of the less expensive forms of chain conveyors, and should be given consideration in the smaller power plants, while not as popular as in the past there are a goodly number of fairly representative medium sized plants that employ them to good advantage.

Power requirements may be approximated from the following equation, supplied by courtesy of Professor Gebhart.

$$HP = \frac{AWL^1S}{1000} + \frac{BL_1T}{1000} + \frac{TH}{1000} + \frac{1}{2}x^1$$

in which

A,B = constants as in Table II.
W = weight of conveyor per ft. of run, lbs.
S = speed of conveyor, ft. per min.
T = capacity of conveyor, tons per hr. (Note, figure 50 lbs. coal per cu. ft. and 40 lbs. of ashes.)
L^1 = horizontal length of conveyor, ft.
L_1 = total horizontal length traversed by the loaded bucket, ft.
H = total vertical traverse, ft.
x^1 = number of 90° turns to the conveyor.

Pivoted Bucket Conveyors.

This is the most popular form of chain conveyor for both medium and large sized power plants. The pivoted bucket carrier is composed of a continuous series of malleable iron buckets, pivoted between two strands of roller chain, of approximately 18-in. pitch. There are several different forms of this carrier on the market. The differences in these carriers are principally in the method used to empty the buckets at the discharge point, the method used to close the gaps between adjacent buckets to prevent spillage, and the method of driving the conveyor. In one form of carrier, the buckets are made with an overlapping lip, in a second, a roller is introduced between adjacent buckets, etc. The roller chain is carried and guided by a track composed of standard tee-rails. This rail is mounted on special cast-iron rail chairs, both horizontal and vertical runs. The buckets can be dumped at any desired point by means of an adjustable dump mechanism, which may be set wherever desired.

As the buckets are pivoted and always remain in the horizontal position, except when being dumped, this conveyor can be used for handling material both horizontally and vertically. The pivoted bucket carrier is generally installed in power plants, so arranged as to handle both coal and ashes in the same carrier. It is installed in the form of a loop, running through the basement up one end of the boiler house, over the top of the overhead coal storage bunkers and down the other end to the basement. Coal is discharged from the receiving track through a track hopper, feeder and crusher, into the pivoted carrier in the basement, and carried up to the overhead storage bunkers. Ashes are dropped from the ash pits into the horizontal run in the basement and carried up to an overhead bunker for storage.

Pivoted bucket conveyors possess the following advantages:

1. The material is carried and the buckets are supported by rollers. Destructive friction and injury to the material itself is therefore eliminated, and the power required for operation reduced to the minimum.

2. The ability of the one machine to elevate and convey avoids transfers, which are always troublesome, take up valuable space, and necessitate deep pits. The driving connections are also correspondingly simplified.

3. The material is readily discharged at any desired point.

4. The operation is comparatively silent, and as they are run at slow speed, there is little vibration.

One type used is the Peck Carrier pivoted bucket conveyor, as manufactured by the Link Belt Co. Coal is fed to the crusher by the "reciprocating feeder" which is usually placed directly under the track hopper. The feeder consists of a heavy steel plate, mounted on rollers, and having a reciprocating movement, effected by a crank mechanism from the carrier. The amount of coal delivered depends upon the distance the plate moves, and this can be varied by changing the throw of the eccentrics. The number of strokes corresponds to the number of buckets. Any size coal can be readily handled. When the distance from the track hopper to carrier is so great that the reciprocating feeder is not practicable, a continuous or "belt" feeder is used to supply the crusher with fuel. The "equalizing gear" is designed to impart a pulsating motion to the driving wheel, which will counteract the natural pulsation to which long pitch chains are subject, producing violent increase of the normal strain at frequent intervals. This is accomplished by driving the spur wheel with an eccentric pinion, causing the pitch line to describe a series of undulations, corresponding to the number of sprockets on the chain wheel.

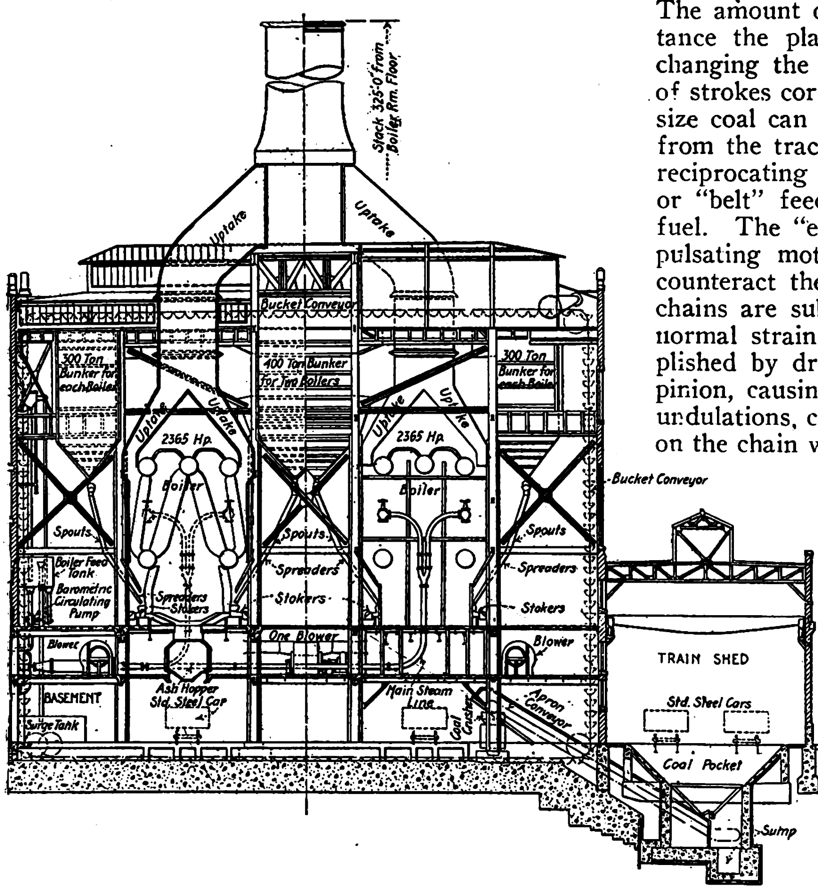


Fig. 1.—Combination of Coal-Handling Systems at Detroit Edison Co.'s Connors Creek Station.

In Fig. 1 is illustrated the use of a combination of conveying systems at the Connors Creek Plant of the Detroit Edison Co. The coal enters the train shed in drop-bottom cars, usually of the 50-ton size. The cars dump into the hopper under the tracks in the train or coal shed, there being one hopper for each unit of one turbine and two boilers. A motor driven variable speed flight conveyor with a capacity of 120 tons per hr. receives coal from the hopper, carries it up a rather sharp incline and discharges it into a four-roll motor driven crusher of similar capacity. This crusher breaks from 18-in. cube to 100%, through a 1¾-in. ring.

The crusher discharges into a motor driven variable speed hopper bucket conveyor, with 30 by 36-in. buckets. This conveyor forms an endless chain which entirely encloses the section of the boiler house. It carries the coal up on the side nearest the coal shed and discharges it into any one of the three coal bunkers which serve the two boilers of one unit.

The hopper, pan conveyors, crushers and bucket conveyors for each unit of one turbine and two boilers, are so located that they can deliver through chutes to one adjacent range of bunkers, serving thus as a spare for that range.

An estimate of the power required for any proposed installation of pivoted bucket conveyors can be obtained by reference to the formula given for V-bucket conveyors, subtracting 10% from final figures.

(To be continued.)

COURSE IN COMBUSTION ENGINEERING TO PROMOTE FUEL CONSERVATION.

Central Stations and Others Given Chance to Reduce Fuel Consumption Through Education.

Coal may never be cheap again. In any case it will be a long time before such is the case; and meanwhile every influence is exerting pressure toward fuel-saving measures.

Every user of fuel, of coal, oil and gas, can help save it. Saving it, as understood at the present time means minimizing waste. Minimizing waste in turn, means eliminating the preventable losses and therefore needless losses, and reducing to the lowest possible value the unpreventable losses. The first thing to do toward this end of fuel saving, is, obviously, to understand the characteristics and properties of fuel and the chemistry of burning it. The next requirement is to understand the art or science of applying the heat obtained by the chemical reaction of combustion, that the heat so obtained may be most fully utilized.

In other words, knowledge of combustion and its applications and a thorough understanding of the principles involved, are the requirements for conserving fuel by using it most usefully. And everyone concerned in the use of fuel can help conserve it by possessing a knowledge of fuel. Some can do more than others toward this end, of course. Executives, and power-plant designers, plant owners and managers are morally responsible for the fuel consumed in their plants. Combustion and efficiency engineers, superintendents, watch engineers and firemen are the ones most closely and directly instrumental in saving fuel. To all alike, knowledge is power.

Keeping Up the Good Work of the U. S. Fuel Administration.

In the winter of 1917, the fuel situation necessitated heroic steps being taken by the U. S. Fuel Administration to reduce fuel consumption, to relieve congested and overtaxed railroads and keep rate of consumption down to rate of production. Everything was done to strike at the root of waste of fuel. The less necessary plants were shut down. Assistance was given to help improve plants that were wasteful through ignorance and poor maintenance. But perhaps the greatest saving in fuel was brought about through education and inspiration. Moreover, this was the most permanent way of saving because forced shutdowns could be only temporary whereas education is permanent in effect.

Education through publicity in newspapers, bulletins and letters was the master stroke of the Fuel Administration toward fuel saving. As an example, the administrative engineer for Illinois, Joseph Harrington, sent out personal letters of instruction to every one of the 10,000 power plants in Illinois. These letters were simply, tersely and interestingly written, and to the point. Each letter covered some specific subject. Each letter was studied hungrily by plant owners and operators alike—for each needed desperately to save fuel.

The startling results obtained in the way of power-plant betterment and the manner in which request was made from all quarters for these letters and more letters brought realization in an amazing manner as to the need these letters of instruction were filling. Instruction by mail thus aided in fuel conservation.

When the armistice came, the purpose for which the Fuel Administration had been formed ceased to exist, legally. The intensive methods previously employed could no longer be continued. On the other hand, while the war's demands had ceased, the demands of peace are just as real and just as exacting, with the difference that the requirements of peace are permanent while those of war were transient. With no prospect of fuel going down in price—all conditions favor rising prices—and with a better understanding gained of what a valuable asset are our natural resources, sufficient incentives and economic factors combine to make it worth while, nay imperative, to continue to save fuel.

Those closest in touch with the fuel situation, and the ways of consuming it, wasting it and saving it, obviously would know most about the best way to tackle the pressing problem of making true conservation practical and effective. And no one better than they can appreciate the urgent need for saving fuel now; and of making fuel saving permanent. This means that the men who did so much to save fuel when the insatiate demands of war made saving vital, could still do what they did before to save fuel.

Joseph Harrington. Joseph W. Hays. David Moffat Myers.

And now a few of the men who made the Fuel Administration what it was, men whose work and skill enabled them to stand out in those days when it was said that coal would win the war, have tackled this problem of making fuel conservation permanent. These men have adhered to the policy that brought success before. They have found a way to keep up many of the tactics that have been proven successful, namely, distribute knowledge and instruction in combustion and the consumption and utilization of fuel. The course in combustion engineering has been named after its author, Joseph W. Hays, known to Electrical Review readers for his famed little book "Combustion Efficiency" and his numerous articles on combustion problems. Those collaborating and co-operating with him upon the educational staff are David Moffat Myers, Joseph Harrington, Prof. S. W. Parr, Fred R. Low, A. L. Rice.

Each of these men has placed his skill, his knowledge and reputation upon this course on combustion engineering without charge. Each has devoted his time and effort toward making possible the education of thousands most closely concerned with the purchase and use of fuel, without payment. Each states that he considers his part in this educational movement, as his contribution to the cause of fuel conservation. Each looks to the results obtained—fuel conserved through knowledge in its use—as his full reward.

It is but natural that those best appreciating the urgent need for fuel conservation should have taken the initiative in this movement to save fuel by knowing how to use it.

Each has co-operated not for financial gain but because they have seen the vital need for some active steps being taken to save coal now. The standing of these men, each a master of his subject, should be a guarantee that the subject of combustion is treated in an effective manner.

Course in Combustion Engineering.

The course is divided into twelve sections. Each section must be mastered before the subsequent lessons or sections are tackled. Moreover it is necessary to attain a marking of 75% in any section before passing on to the next lesson. The course covers its subject gradually, at first by taking up the subject in a broad way. Gradually the matter becomes more and more specialized, the later lessons each having a special subjective.

A better idea can be obtained by naming the various lessons in the order in which they will be taken up by the student. The first is an introduction on the history of steam and economical steam production. The second deals with boiler furnaces and general rules of practice, a discussion of the plain furnace and its many modifications and stoker types. Third is a lesson embracing a general discussion on drafts, natural and artificial. The fourth lesson takes up natural fuels and all about them, including methods of coal, oil and water analysis. Physics and the chemistry of combustion and combustion analysis is covered in the fifth lesson. In the sixth, operation of boiler plants is taken up; also applied combustion analysis. Smokeless combustion and applied combustion analysis occupies lesson seven. The eighth lesson deals with testing of boiler and furnace and applied combustion analysis. In the ninth lesson is taken up in detail such important specific matters not fully covered in preceding lessons. Industrial gases and the gas producer and applied combustion is dealt with in the tenth lesson. In the eleventh lesson, gas and oil engines and applied combustion analysis for this phase of the application is covered. In the twelfth lesson the work of the combustion engineer, and the keeping of charts and cost data are fully covered. The above is only a bare outline of the course, but suffices to show the length and thoroughness to which the author has gone.

The aim of the course is to equip men concerned with the application and use of fuel with the knowledge of how best to use it. Only when this obtains will the interests of fuel conservation be best served. Several interesting features of the course assist toward this end.

Everything has been done to make combustion attain the prominence and encouragement it deserves. Graduates and students may, if they choose, register for positions. In this way openings and positions may be filled and employers gotten quickly into touch with good men, graduates of combustion engineering. Skilled combustion engineers thus are offered every opportunity for improving themselves; plant owners of obtaining men that can be trusted to use up their fuel, safe in the knowledge that they come to them meeting a definite standard of fitness. The choice of a combustion or efficiency engineer need no longer be a hit or miss process.

As a further incentive, provision is made, when desired, to notify employers from time to time as progress in the course is made. In this way remuneration or position may keep pace with ability, a personal interest between employer and employe develops and pay tends to go up with worth. By taking such a course, a graduate is able to know his own worth based upon a standard rating and can thus capitalize his training equitably.

The course, when completed, will enable anyone to have acquired a very complete and practical training in the combustion and application of fuels. The course, so far as we can ascertain, is the only one in existence that deals exclusively with combustion engineering. The diploma won upon graduation is the only standard of merit awarded at the present time in this important branch of the engineering profession. The conclusion is obvious and inescapable. It is inevitable that such a course must prove a prominently vital factor in furthering fuel conservation by creating men who are vastly more valuable to themselves and to the country. The greater the number that take up this course, the greater will be the fuel saving, and the greater the gratitude of the country and of everyone to those that have fitted themselves to consume a national resource, and to those who have enabled them to do so from patriotic motives.

Knowledge is power. Power brings ability to do. And never was the need for fuel saving greater than it is today. The course in instruction on combustion engineering fathered by Joseph Hays and his collaborators is a radical and most hopeful forward step taken toward reducing the colossal and needless waste of three of our most valuable natural resources, coal, oil and gas. To save fuel by teaching its use seems to be the soundest method of conservation yet advanced. Education has done more for the advancement of the race, for the uplift of nations and formation of habit than all legislation, threat and punishment combined. And in education rests the only hope for fuel conservation. Interested readers should address the Hays School of Combustion, Chicago

Editorial Comment

The Illuminating Engineering Society

IF evidence were needed of the distinctive need for the Illuminating Engineering Society and the soundness of its organization, it was furnished by the thirteenth annual convention held in Chicago this week. A somewhat extended report of this gathering is given on other pages of this issue. The large and very representative nature of the attendance and the eagerness with which the papers and addresses were absorbed and discussed showed conclusively that the field of illumination is a very broad and attractive one and that the society is the only forum where its problems can be discussed on an unbiased basis, regardless of the source of light and the commercial origin of the lighting equipment. For over thirteen years the society has held steadfast to fair and scientific consideration of lighting questions free from commercialism. Its success in this field has stimulated the formation of similar societies in three other countries: Great Britain, Germany and Japan. Members of two of these societies addressed the Chicago convention.

At times it has been advocated in this country that the work of the society could readily be taken over by the National Electric Light Association and the similar gas organization. These latter associations, however, have as their main function the discussion of public utility problems, among which is the extension of the sale of their respective services. It has been shown that the Illuminating Engineering Society is not interested in selling more light but in urging better lighting practice. Of course, this involves in many cases use of more artificial light, but the distinction is a vital one that we are glad to see is being recognized.

The incoming administration of the society under President S. E. Doane has splendid plans for extending its educational work and co-operation with other organizations concerned with lighting. This is no reason why these broadened activities may not be undertaken with profit to all if they are conducted on the broad plane of freedom from commercialism so well carried out by the society in these many years.

Combustion Engineering

CONSERVATION of fuel, and of coal especially, is a pertinent matter at this time because of the threatened strike of the bituminous coal miners at a season of the year when the demand and need for coal is approaching its height. However, the urgent need for saving fuel—some of our most precious buried treasure—is a pressing matter at all seasons. It is with us always.

The higher cost of all fuels and the threatened shortage of coal brings the problem of coal saving very close to most of us. But the gradual diminishing supply, while one that appears to be less near, is, nevertheless, one that will affect us all commercially and economically some day, not by extinction, of course, but by increased costs due to having to go deeper into the ground for it and because of other causes contributing to higher costs. Fuel in some form or other enters into so many phases of our industrial, commercial and economic life that it is one of the vital factors in our lives today. Fuel conservation is, therefore, not a partisan matter. It is one that concerns each and every one of us, and closely.

The best way to save fuel—coal, oil and gas—is to thoroughly understand how to use it. That this may be accomplished, a knowledge of the characteristics of fuels, the chemistry of combustion, the science of applying the heat of combustion and the engineering knowledge necessary to choose equipment best fitted for the purpose and operate it at all times so as to obtain high combustion efficiencies and utilize to the full the heat obtained is implied. On the surface, the problem appears simple. Actually, the problem is complex.

Knowledge is power. Knowledge, in the case of the use of fuel, is the power to save. It is to the combustion engineers and to those versed in combustion engineering to whom we must look to save our fuels by using them efficiently and without waste.

Ice and the Hydroelectric Development

ICE IS one of the banes of the hydroelectric plant located in northern latitudes during the cold season. Its form and quantity are so uncertain, as also are its severity and its duration. It may cause stoppage or restriction of water flow. It may reduce output by changing the effective head. It may injure the wheels and cause even more extensive damage.

Frazil ice forms in large quantities on open water under moderate degrees of coldness. It often forms at temperatures of 20° F. and even higher when there is sufficient wind to cause agitation. When the operator sees ice of a leaden hue like saturated snow floating in patches over the water he looks for trouble, for frazil ice clings tenaciously to metal parts such as racks, wheel guides, the wheels and gates. The collection of this spongy mass always restricts and frequently obstructs entirely the flow of water to the wheels, and this condition persists until the sun's rays or artificial application of heat to the metallic parts or rising temperature of the water cause a thaw. Fortunately this trouble disappears as soon as surface ice forms in the forebay, as anchor and frazil ice passing under water have less affinity for metal than when they are exposed to currents of air. Anything done to reduce the circulation of air around metallic parts is just so much gain, therefore, toward eliminating the difficulties of frazil ice.

Loss of output often occurs because the discharge becomes clogged with ice, the tail-water backs up and the effective head is reduced. Boulders, shoals and similar obstructions in the river channel on the upstream side are other frequent causes of reduced output, since these act as nuclei for the formation of ice, which in turn obstructs the channels, causing the backing up of water and variation of stream flow. Effort made to clear river channels and keep them free is effort well made at this time, and may prevent much concern when the ice commences to "come down."

Where a whole river is dammed, and a series of rapids exist above the dam, difficulty in maintaining flow of water may be expected because of decreased area under the surface ice due to the formation of frazil ice and the combining of anchor ice from the rapids with the floating ice. Dams installed to drown out the rapids and sluices to permit the impounded water to be drawn off from the river's bottom are sound practices and ones that eliminate many troubles. Where protecting works cannot be built, channels should be cut in the surface ice of sufficient width to permit the frazil and anchor ice carried down underneath the surface ice to rise and discharge through the dam. Power-house openings should, preferably, not be used for this purpose as the ice may cause trouble to the wheels.

Where only a part of the river is dammed, considerable variation in water flow may result from floating ice, a condition made worse by some wind conditions. The wind may blow the surface ice against the surface ice along the forebay entrance. Here floating ice may be drawn under the surface ice, to become frozen to it. Then the ice begins to increase in size downward, gradually reaching the channel bottom. Often the channel may become so blocked that little water can flow. In such cases uniform cross-section at the entrance to the channel and for some length thereafter, low velocity of the water and a surface of water free from obstructions all tend to combat cause and effect. Channels, forebays, sluices and dams cannot be built in a day. But channels can be cleared of obstructions before the ice appears, booms can be installed and tugs can sometimes be kept at work in long channels to help keep the ice moving and the channel open.

The time will soon be here when frazil ice, floating and anchor ice, ice jams and allied troubles will be with us again. The time to take most effective action to minimize these troubles is, of course, when designing the hydroelectric development. Precautions taken now, however, and during the next two months in anticipation for what may come with the coming of cold weather may later save much concern for reduced outputs, damaged wheels and structures and service interruptions.

Wireless Telephony and the Transmission Line

WIRELESS telephony for making possible communication between power plants and substations separated by long distances, by difficult and rugged country, has long been recognized, and now that the restrictions that came with the war are lapsing, one may expect the wireless telephone to be taken advantage of more fully as time goes on.

Many are the transmission lines that traverse country where river gorges and inaccessibility by foot make a telephone line expensice to install and difficult to maintain. Extreme weather conditions, sleet and ice, long spans with consequent expensive construction, are other conditions that combine to work disfavor with the telephone line and add to its cost and uncertainty of reliability. The fact that in cases of trouble, which is the time the telephone is most used and most urgently wanted, the metallic telephone line is usually out of service is a powerful factor and an immensely favorable argument for wireless telephony.

As far back as 1913 telephony through the air was employed on the Pacific Coast instead of along the metallic telephone line paralleling the transmission line, and since that time a number of installations have been made and operated with perfect satisfaction. Nor is the wireless telephone installation confined for use with the long-distance transmission lines traveling over sparsely populated and rough country. In fact one company operating a transmission line of only some 30 miles and traversing a well-populated territory with its receiving station within city limits, took to wireless before the war put a prolonged stop to its use. Even now, preparation is being made by several large transmission companies to adopt wireless in their systems.

In some cases the topography of the country traversed makes wireless very advantageous. In some cases there may be a very real financial balance in favor of telephony by air instead of by wire. But the supreme advantage to the operating company of telephoning wirelessly is that communication can be carried on regardless of electrical or mechanical troubles to the transmission line, whereas such troubles usually interfere with, if not preclude altogether, the use of telephony over wires. Wireless is more reliable, it is more safe, and may be more economical financially, than metallic telephony.

Current Events

Section Meetings of Electrical Manufacturers—Illuminating Engineers and Inspectors Hold Successful Conventions

ELECTRICAL MANUFACTURERS DISCUSS STANDARDIZATION.

Association to Appoint General Committee on Standards—Tariff and Exports Also Considered at New York Meeting.

The regular fall section meetings of the Associated Manufacturers of Electrical Supplies were held Oct. 14-15 at the association headquarters, 30 East Forty-second street, New York City. The membership of the sections combined is approximately 300 and this number was in attendance.

In addition to the general work of the sections in standardization of various materials and devices coming under their special attention, much time was given to the matter of the adoption of the standards approved and recommended by the different sections and to the suggestions that these standards should be issued as the standards of the association. A desire to this effect on the part of the sections has been somewhat encouraged by the fact that other bodies have from time to time suggested joint meetings for the consideration of subjects of mutual interest, these suggestions coming from such associations as the American Institute of Electrical Engineers, Standards Committee, N. E. L. A. Wiring Committees, the Underwriters' Laboratories, Western Association of Electrical Inspectors, Compressed Air Society and others. This led to the suggestion that a general committee be formed from the sections, same being approved by the board of governors and counsel, the duties of the committee to be to represent the association in matters of standardization and to evolve procedure by which section standards may become standards of the association and generally to centralize the association's standards work to the end that all interested parties may be advised of proposed action and the necessary provision for same made. Subjects which may come under consideration are substantially as follows:

1. The determination of the relation of the Bureau of Standards at Washington to the initiation of codes, etc.
2. The proposed broadening of the American Engineering Standards Committee.
3. The proposed legislation conferring on the Bureau of Standards the power to establish standards of quality for manufactured product.
4. The desire of other national associations, such, for instance, as the American Institute of Electrical Engineers, to confer and co-operate with the association in the adoption of standards in which there may be mutual interest.
5. The determination of what shall be a standard of the association and the evolution of an orderly process by which, when desirable, the standards adopted by a section may become the standards of the association.
6. The desirability of the collection and preservation of standards already adopted by the various sections in form which shall make them readily available.

All such work would naturally come under the advice of counsel and every possible means taken to avoid complications or anything which might be considered illegal. Work of this kind has been done heretofore, notably in the case of the American Society of Mechanical Engineers in the adoption of a standard for special threads of fixtures and fittings, and it would seem that work of this kind would be of inestimable value to the manufacturers and to the public generally in the adoption of the very best and the elimination of superfluous types, etc.

The matter of the tariff schedule was also considered by all the sections and in arriving at a fair basis for fixing tariff many figures as to costs of material and labor were considered. At a meeting of the chairmen of the tariff committees as appointed from the various sections a resume of the work accomplished was gone over and new plans made for the future advantage of the supply industry.

The matter of exports was also taken up and considered under the supervision of the international trade committee of the association, in which special committees for both tariff and export are doing progressive work.

A dinner meeting of the Wire and Cable Section was held Oct. 15 at the Yale Club, about 65 members attending. As is usual at the meetings of this section, much constructive work was arranged, followed by a most enjoyable dinner and get-together entertainment.

INDIANA CONTRACTORS HOLD PROFITABLE CONVENTION.

State Association Has Interesting Program of Papers and Addresses at Convention.

The Indiana State Association of Electrical Contractors closed its annual convention, held at the Claypool Hotel, Indianapolis, last week, with increased interest in every phase of the work. Electrical dealers and contractors from all parts of the state attended the conference.

Some of the important addresses at the conference were as follows: "The Heating Device License Schedule," by Charles A. Payne; "Live and Let Live," by Samuel Adams Chase, Westinghouse Electric & Manufacturing Co.; "The Work of the National Association," by W. H. Morton, New York, general manager of the National Association of Electrical Contractors and Dealers, and "Electrical Merchandising—Address and Exhibit," by William L. Goodwin, of the General Electric Co.

Members of the executive committee, which is the governing body of the organization, were elected as follows: A. L. Swanson, Evansville, chairman; G. M. Sanborn, Indianapolis, and A. B. Harris, Gary.

Chicago Convention of I. E. S. Proves Most Successful

Large Representative Gathering at Four-Day Meeting on October 20-23—Wide Range of Lighting Topics Discussed

REVIVAL of keen and widespread interest in lighting was shown by the large attendance, close attention at sessions and active discussion of many live illumination topics at the thirteenth annual convention of the Illuminating Engineering Society, which was held at the Hotel Sherman on Monday to Thursday of this week. About 400 members and guests were registered and many others in attendance. All parts of the country, also Canada, England and even distant Japan were represented. The attendance comprised not only illuminating engineers, representatives of lighting equipment manufacturers and purveyors of lighting service, but also numerous public authorities, educators, architects and others concerned with lighting matters.

Over twenty-five papers and addresses were presented in five busy technical sessions held during the four days of the convention. Judiciously interspersed between these sessions were several delightful entertainment features, affording relaxation, good fellowship and pure fun. The convention was not only successful but one of the most profitable ever held by the society.

Opening Session.

The convention was opened Monday afternoon by Homer E. Niesz, chairman of the General Convention Committee, who called on Louis A. Ferguson, vice-president of the Commonwealth Edison Co., to deliver the address of welcome. Mr. Ferguson spoke of Chicago as a big engineering laboratory where many innovations are tried out on a large scale. Some of these, like the use of steam turbines in power generation, the introduction of Mazda lamps, differential rates for central-station service and the campaign for better industrial lighting were referred to. The advance in these lines, as well as in lighting particularly, since the society's last convention in Chicago eight years ago has been very great and the city's lighting interests felt pleased to have the society come here to observe it. In replying on behalf of the society, Louis B. Marks, of New York, dwelt on the prominent part taken by Mr. Ferguson's company in calling attention to the value of productive lighting.

Dr. Hoadley's Presidential Address.

In his presidential address G. A. Hoadley referred to the last two conventions held under the stress of war and he reviewed in a general way the lessons of the war. First was its injustice in devastating so many lands, whereas those of its instigators were scarcely touched by the scourge of war. Another was the miscalculation of the would-be conquerors of the world in assuming their plans would be executed before there could be any formidable opposition. Still another lesson was the splendid co-operation of all our people when we finally became involved in the war.

The I. E. S. membership contributed 101 men to active military service and of these four made the supreme sacrifice. The society's Committee on War Service was very active and through various subcommittees comprising 43 members all told it handled a great variety of lighting problems of great importance in the conduct of the war. These included design of lighting of aviation training camps and buildings thereon, lighting of balloon hangars and grounds, lighting of navy gun and machine shops, protective lighting of various grounds and works, lighting of government workmen's cottages, war-time lighting economies, factory lighting, hotel lighting restrictions, lighting of coal mines, metal conservation in reflectors, etc.

Of the various efforts to combat high prices Dr. Hoadley pointed out the effectiveness of doing so through increase of production and how this may be largely brought about by changing the present inefficient lighting systems in many factories into those that are really good. As an outcome of both men of means and men of toil being thrown into camp together during the war, Dr. Hoadley looked forward to an era of better feeling between capital and labor, an era of real peace but which will have its own old problems largely in new form. Their solution will devolve upon the thinking men, such as compose the major part of the membership of technical and scientific societies.

"The fundamental purpose of this society is to teach the people of this country the necessity for good lighting," said Dr. Hoadley. To those who know the influence proper illumination has upon the mental and moral attitude of those who make use of it, this is a matter of the greatest importance. Good lighting has as its foundation the work done in research laboratories. Research has had a wonderful development in the last 20 years. Modern investigators not only find the truth of any matter being studied, but proceed to show how it can be carried out and applied in practice. Everyone connected with lighting should be keenly interested in the work of the society, which co-operates with all agencies, from the manufacturer of the light source to the user of the light, and which is interested in the discovery and improvement of light sources and the proper use of light.

President S. E. Doane, Cleveland, Ohio, was called on for a few remarks. He touched on the importance of the lighting developments in Chicago and the society's possibilities for doing good in bringing to the attention of the public the need for better lighting. Formerly the matter of lighting was looked upon just as janitor service—a desirable but very minor feature. Now we recognize it as an essential element in production. Its value in this line is shown by the fact that about 65% of incandescent lamp output is used in places where the productive value of good lighting has immediate benefit.

Clarence L. Law, New York City, general secretary, presented the report for the council of the society. The membership is 1145, a slight decrease from last year, due to the abnormal conditions prevailing. The four sections have maintained their regular activities. Aside from their meetings, there were held several group meetings by local representatives distant from the centers of the regular sections. The finances of the society are in excellent condition.

Report on Progress.

F. E. Cady, Cleveland, Ohio, as chairman of the Committee on Progress, presented the annual report on this subject which as usual was a classical review of the most important developments of the year in the illuminating field. The report also had its customary completeness, comprising 78 printed pages. Among especially noteworthy features mentioned was the growing use of tungsten lamps and decrease of carbon filament lamps. Miniature tungsten lamps have made surprising increases. Two tungsten lamps for motion-picture work are now standardized. Among new units are the 50-watt white Mazda and the 25 and 50-watt mill type Mazda. In England standardization of lamp voltages is now actively proposed.

Some new types of vapor arc lamps are reported, among them another neon lamp. Much headway has been made in searchlights. Electric headlights are being rapidly installed on locomotives and an effort is under way to standardize them. A new arc of considerable promise is being developed for motion-picture projection. Important developments in electric miner's lamps are reported in England.

War restrictions on lighting are reviewed in the report, especially as enforced abroad. Many ingenious expedients were resorted to. Numerous new or changed installations of street lighting are referred to. Unique effects have been produced in spectacular illuminations connected with victory celebrations in New York, Chicago, Portland, Ore., etc.

The campaign for better industrial lighting conducted in Ohio has had good results. Interesting uses of colored lighting are being introduced in numerous theaters. The unfortunate use of the term "fixture" for lighting fittings is being recognized. Fixtures giving several varieties of lighting effects are becoming popular. The report also touches on developments in photometry, physics of light sources, legislation and lighting codes, physiology of lighting, daylight saving, gas lighting, etc.

The progress report was discussed by P. S. Millar and D. McF. Moore, of New York; J. R. Cravath, Chicago; C. M. Masson, Los Angeles; C. O. Bond, Philadelphia; L. C. Porter, Harrison, N. J.; Dr. Louis Bell, Boston, and Geo. H. Stickney, Harrison, N J. Mr. Masson asked for suggestions on lighting of golf links and Mr. Stickney recommended high towers such as formerly used in Detroit. Mr. Porter called attention to the Society of Motion Picture Engineers as eagerly studying lighting problems of their industry and worthy of aid from the I. E. S.

Automobile Headlighting.

A report of the Committee on Automobile Headlighting Specifications, C. H. Sharp, New York, chairman, was presented by W. F. Little, of New York City. At the instance of this committee a three-day session was held in January of all interested in the automobile headlight problem. The outcome of this was that the committee drafted a model headlight law which was slightly revised by the Committee on Lighting Legislation. Further consideration was given to the subject of specifications for acceptability tests for headlights. Four test positions were recommended as follows:

Position 1.—Some point between road level and a point on a level with the lamps in the axis of the car—4800 cp.

Position 2.—In the axis of the car 60 in. above the roadway at 100 ft.—2400 cp.

Position 3.—60 in. above the roadway, 7 ft. to the left of the axis of the car at 100 ft.—800 cp.

Position 4.—At 100 ft. at some point between road level and a point on a level with the lamps and 7 ft. to the right of the axis of the car—1200 cp.

At the suggestion of the authorities in Connecticut these new specifications were offered. Within the past month the authorities in Pennsylvania have requested the committee for specifications to be used in that state. It was suggested that each device manufactured and sold must be accompanied with adequate instructions as to installation. Both Connecticut and Pennsylvania have established an inspector system in which their inspectors use a foot-candle meter.

The discussion was opened by J. R. Cravath, Chicago, who pointed out that positions 1 and 4 give minimum requirements. The work of the committee is of a pioneer character; formerly no one had a conception of what the requirements should be. Educational work on this matter is extremely necessary and in some parts of the country it has been carried out much further than in others. The inspector system should be a valuable means of improving the headlight situation. The use of test stations in connection with garages or oil-filling stations may prove desirable. Dr. Louis Bell, Boston, urged testing with standardized lamps properly adjusted. He believed that it will be possible to get a much better class of headlights through use of the new specifications.

H. P. Gage, Corning, N. Y., spoke of the necessity for teaching three classes that are interested in this matter, namely, the manufacturers of these devices, legislators and users. The manufacturers will be glad to produce better devices if told how to do so. The committee's report should prove of great value of legislators and he believed the public should be educated through garage men, distributors and dealers of headlight devices. L. C. Porter, Harrison. N. J., spoke of the desirability of uniform laws in the different states. The report should help in making the same more effective. He commended a pamphlet published by the Motor Vehicle Department of California in instructing the public on this matter. The difficulties in making lamps uniform were described. Some flexibility in the specifications is therefore necessary. G. B. Nichols, Albany, N. Y., said that lenses vary greatly in quality, some being very highly developed and others very inferior. He felt that the New York legislators will gladly improve the existing law. Norman Macbeth, New York City, believed there is great need for improving the lamp assembly as a whole. Ward Harrison, Cleveland, Ohio, thought it might be desirable to have all headlights tilted down slightly as this would permit use of a simpler lens. Mr. Little said that the greatly varying practice of different automobile manufacturers has prevented this. Therefore, the horizontal setting was assumed to be standard. F. H. Murphy, Portland, said that Oregon is trying to make regulations similar to those of California. He believes that the public is anxious to meet any requirements that solve the problem properly. To secure uniform legislation it may be necessary to have Federal legislation. L. C.

Norton, Los Angeles, said that oil-filling stations in that city frequently have test stations for the use of their patrons. J. A. Hoeveler, Madison, spoke of the new law in Wisconsin which holds that headlights not in accord therewith are prima facie evidence of the unsafe use of highways. This has put "teeth" into the law. C. O. Bond, Philadelphia, said it was possible to use road signs as convenient test stations.

Mr. Little closed the discussion by explaining the inspector system used in Connecticut. Motorcycles are used and when a driver is held up for the first time the headlight situation is explained to him in considerable detail. In Pennsylvania inspectors are to be trained for similar service. He thought that it would be desirable to have an expert adjust the head lamps in all cases.

Street Lighting.

On Tuesday morning three papers dealing with street lighting were presented, the first being by C. A. B. Halvorson, West Lynn, Mass., and A. B. Oday, Harrison, N. J., and entitled "Street Lighting with Low-Mounted Units—Kensico Dam Roadway." The Kensico reservoir is one of the storage reservoirs connected with the water supply of New York City. It includes a massive dam behind which the waters are impounded. At the top of the dam is a roadway 2200 ft. long and 26 ft. wide with a 4-ft. sidewalk on one side and a stone parapet wall 4 ft. high forming the border. This dam is of imposing architectural design and it was desired to illuminate the roadway along its top without use of the ordinary lighting standards. After considerable study it was decided to use lighting units imbedded in cast-iron boxes placed in the parapet wall. This involved special designs for these boxes, for mounting of the lamps, reflectors and a baffle to cut off the direct light of the lamps, which were 6-volt, 108-watt, Mazda C units. The lamps were staggered on opposite sides of the wall and give quite a uniform and pleasing illumination of the entire roadway. The installation is unique in this respect and has been found entirely satisfactory.

The second paper, entitled "Recent Developments in Street-Lighting Units (Electric)," by A. D. Cameron, Schenectady, N. Y., and C. A. B. Halvorson, was read by the former and supplemented by illustrations described by Mr. Halvorson. In pendent units for series Mazda lamps an important addition is the combination of dome refractors and stippled or rippled outer globes. These have some advantage over the use of the refractor alone, on account of appearance and making it easier to clean the single outer surface. A new form of bowl refractor is being brought out with a closed diffusing base. In ornamental units the tendency is strongly toward single units of high candlepower instead of clusters and the standards are being made more slender and unobtrusive. An installation is being made in Saratoga, N. Y., of duplex units in which within the single outer globe there are two lamps superposed. The lower lamp is 600 or 1000 cp. and is expected to burn until midnight, whereas the upper lamp is 100 or 200 cp. and by means of a simple cutout replaces the lower lamp after midnight, thus reducing the operating cost from then on. In parkway and residential lighting there is no need for having upward light as in case of white way lighting. Hence, the use of dome refractors and suitable globes is becoming more common. A new type of one-piece molded porcelain unit is being developed which includes a radial wave reflector and refractor holder. For luminous arc lamps electrodes are now being made under pressures of 500 tons per inch, which give 30 to 40% more light than the standard electrode and an increased life of from 30 to 40%. It is also expected to use glass mirror reflectors with these lamps to still further improve their efficiency. This should make it possible to use rippled outer globes in place of the clear globes now so common. The increased efficiency of the electrodes also permits the use of a lower wattage adjustment on each lamp, thus saving 40 watts per lamp and increasing the capacity of the rectifier. In Detroit 90 to 94 lamps are now operated on each 75-light rectifier. The paper concludes with a warning that the very simplicity and flexibility of the Mazda lamp, which has made it so popular in street lighting, tends toward neglect of proper cleaning and maintenance.

The third paper in this group was presented by F. V. Westermaier, Philadelphia, and was entitled "Recent Developments in Gas Street Lighting." It was pointed out that the police value of street lighting is its greatest importance to the public, and municipalities usually look to this protective value rather than to the illumination secured. Although this should be a municipal concern, the matter is left largely to the utilities furnishing the lighting service. Street-lighting rates are usually on a unit price contract basis and the specifications are rather infrequently changed. A constant tendency is toward cutting down expense. Taking up gas street lighting particularly, the author showed that this is usually separated into supply of the fixtures and operation and maintenance. He described several new types of muutiple mantle lamps and high-pressure lamps. The latter, although considerably used abroad, have found little application in America due to the expense of separate mains and the low revenue derived from street lighting alone. Other units described were traffic guide posts, lamps for viaduct lighting and the interchangeable units used in Milwaukee.

The discussion was opened by Dr. L. Bell, Boston, who showed that both the Mazda and the luminous arc are keeping on developing although it was predicted that one of these would gain ascendency. Both have distinctive fields of their own, that of the luminous lamp being for high-intensity lighting. This lamp has also increased the efficiency considerably and, moreover, has the advantage that it must be cleaned regularly, whereas incandescent units are so commonly neglected. F. R. Mistersky, Detroit, said that in that city the use of the newer magnetite electrode enabled the city to add 1100 new lamps to the former 7000 without adding to the capacity of the station. Ward Harrison, Cleveland, said it is necessary to impress on the authorities that cleaning must be done regularly, regardless of the type of lamp used, and efforts should be made to make cleaning easier. It has been found that the absorption of light by the globes is negligible as compared with that due to dirt. He also called attention to a study made in Cleveland of the relation between street lighting and accidents; the article describing this appeared in the Electrical Review of Oct. 11, 1919. H. B. Vincent, Philadelphia, emphasized the need for discarding lamps that had been blackened from long use just as is the practice in interior lighting. J. W. Cowles, Boston, dwelt on the value of sparkle in street-lighting units. One objection formerly raised to incandescent units was that they lacked this, but this is now taken care of by the new ripple glass which gives the unit life and animation. Cleaning cannot be laid down in a definite schedule applicable to all streets since it depends on the amount of traffic and dirt met with. Others who discussed the subject were C. O. Bond, Philadelphia; W. T. Dempsey, New York; G. G. Cousins, Toronto, Ont., and C. M. Masson, Los Angeles.

C. A. B. Halvorson closed the discussion on the electrical papers by stating that the lighting of the Kensico dam has been found very satisfactory and meets all requirements. Naturally, he would not recommend it for universal application because the presence of crowds on sidewalks would obviously shut off the light and mud and dirt spattered by passing traffic would likewise obstruct the light. In the particular installation neither of these conditions existed. Mr. Westermaier briefly closed the discussion by calling attention to the fact that stret lighting has not developed as fast as other branches of lighting, especially in the matter of maintenance.

Military Matters.

At this point Gen. Geo. H. Harries was presented to the convention to give some impressions of his experiences in service abroad. He was the first American officer to enter Berlin after signing of the armistice and said that the much-talked of Germany military efficiency, which was supposed to have provided for everything, did not provide for possible defeat. Consequently when this came the army was almost completely demoralized and everything seemed to go to pieces. He told of the lack of records, especially as to prisoners. The conditions in the war-torn countries to the east of Germany were far more deplorable than the American public has any conception of. He said that the German people apparently did not seem to realize that they met defeat. They need light to show that they sinned in making war and to expose their folly in thinking that they were even partial victors. On the other hand, we also need illumination to remind us that the laws of supply and demand and the survival of the fittest still hold, and that the folly of wastefulness, the need to be industrious, loyal to our government and to respect the law and its officers should not be forgotten.

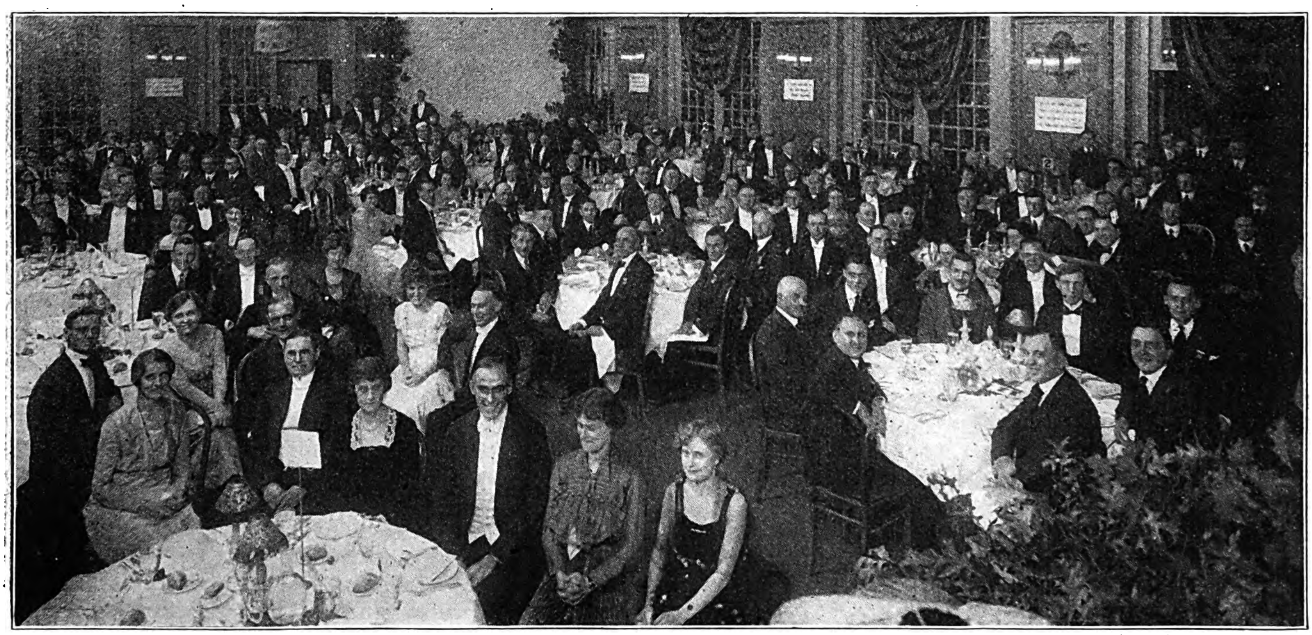
Capt. Chester Lichtenberg, Washington, D. C., presented a paper entitled "Military Searchlights," in which the recent developments in this important line were reviewed at considerable length and many illustrations show. Great advantages were made in this line in making searchlights more powerful, lighter in weight and more portable. Methods were described for testing searchlights. The searchlights in use by the Germans were comparatively clumsy and heavy. Those developed by the Allies and the United States were frequently mounted on light chassis which could be quickly rolled upon a motor truck and transported. This truck carried the generator for furnishing the current. Searchlights were not used close to the front because they could so easily be detected and smashed by heavy gun fire. They were used chiefly back of the lines for finding hostile airplanes at night. frequently in conjunction with parabolic listening devices which picked up the general direction in which the plane was likely to be found.

Two papers on photometry prepared for the convention were read by title only due to the lateness of the hour. They were "A Universal Photometric Integrator," by Frank A. Benford, Schenectady, N. Y., and "A Photoelectric Photometer," by Arthur H. Compton, East Pittsburgh, Pa.

Glare Tests.

The session on Wednesday morning opened with the presentation of a paper on "Glare Measurements" by Ward Harrison, Cleveland. This paper gave the results of tests made with a considerable number of observers viewing an opening illuminated by a lamp until this opening became objectionably glaring. Fair consistency was found in the results, and among the conclusions reached was that the use of an opalized bulb cut down the glare, as compared with a clear lamp, by half as much as an opal inclosing ball. One of the most important findings that the results indicate is that the total light flux that reaches the eye from a source is the most important single factor in the production of glare.

The discussion was opened by J. R. Cravath, Chicago, who said that there have been three kinds of



Members and Guests of the Illuminating Engineering Society in One of Their Lighter Moments During the Thirteenth Annual Convention in Chicago, Oct. 20-23.

glare tests, the first being test of eye fatigue after long exposure; the second, interference with vision, and the third, momentary or snap judgment tests. These latter that Mr. Harrison tried are worthy of being seriously considered on account of their simplicity, speed and convenience. A. J. Sweet, Milwaukee, said it is necessary to judge between the ocular discomfort and the actual depression of visual power. It is interesting in observing that Mr. Harrison found the total flux much more important in glare production than intrinsic brilliancy. F. C. Caldwell, Columbus, Ohio, reported having made similar tests and believed that by using many observers results of considerable value can be obtained. G. H. Stickney, Harrison, N. J., emphasized the need for setting up glare standards so as to permit of drawing a dividing line between what is objectionable and passable in this respect.

Symposium on Industrial Lighting.

L. B. Marks, New York, chairman of the Committee on Lighting Legislation, opened the symposium on application of industrial lighting codes that took the rest of the session. Six states (New York, Pennsylvania, New Jersey, Wisconsin, California and Oregon) have now enacted such codes. Ohio, Massachusetts, Oklahoma, Utah and some ten others either have already provided codes or are seriously considering the subject. This committee has been actively co-operating with the Divisional Lighting Committee of the National Council of Defense and with representatives in practically every state. It is difficult to draw the line as to what is ample for safety and health and as to what is desirable for vision and protection. The society has hesitated to draw a definite line as to just what the glare and other standards should be and has left it to the states to try out various novel features. Many years ago there were made quite a few installations of productive lighting and it was found that many manufacturers were eager to adopt better lighting when its value was called to their attention.

John A. Hoeveler, Madison, Wis., presented a paper on the application of the Wisconsin Industrial Lighting Code. The 1913 lighting rules adopted in the state were completely revised in the 1918 code which now applies to new installations only but after July 1, 1920, will also apply to existing installations. Provision is included for either natural or artificial lighting and suggestions are made for both in the second part of the code. Plans for new factory buildings must be approved as to lighting. Suggestions have freely been made for betterment in such plants and the illuminating engineer also visits existing plants and offers suggestions for lighting. The inspectors try to secure voluntary compliance in existing installations. An effort is being made through meetings, conferences and lectures to educate the contractors since to them is left much in the matter of the designing of an installation. Lectures are also given to factory managers, superintendents and foremen. The factory inspectors hold monthly meetings. Lighting surveys were made in different factories while the code was under revision and these were successful in improving the lighting in all cases. Difficulties may be met when it comes to putting the code in full effect as regards shading local lamps and emergency lighting in existing installations.

John H. Vogt, Albany, N. Y., said that the state labor laws of New York were greatly strengthened after a very disastrous factory fire in New York City in 1911. While the state code was in process of formulation about 18,000 tests were made in various factories during a comprehensive survey. The New York Code in its revised form includes recommendations not only for minimum but recommended practice for various industries. These intensity requirements as to work spaces become mandatory after July 1, 1920, the remainder of the code as to general spaces being already in effect. The inspectors meet frequently and receive instructions through lectures. About 68,000 industrial plants are involved in New York state.

A. L. Powell, Harrison, N. J., read a paper prepared by R. H. Leveridge, of the Department of Labor, Trenton, N. J. In order to make the lighting code effective in New Jersey it was felt that education of the factory inspectors was necessary and therefore a special course of lectures was given in 1918. Meetings of contractors were also addressed at which the code was explained and the essentials of good factory lighting set forth. In all of this work the public utility companies have very freely co-operated. There is being undertaken the education of manufacturing companies so that they may have a more complete grasp of what the problem is, and the advantages to be derived therefrom by good factory lighting. In connection with a safety exhibit it is proposed to have some displays of good industrial lighting.

J. S. Spicer, of the Pennsylvania Department of Labor and Industry, read a paper describing the application of the code in that state where the effort to improve factory lighting has been carried on for about five years. Many accidents showed the need for this work and then the question arose as to what is "adequate" lighting. Adoption of the state code based on that of the I. E. S. cleared this up. Now the manufacturers accept it as a valuable aid in laying out good lighting systems and the inspectors find it invaluable in bringing definite information before the industries, especially in foundries where the need for good lighting was so urgent. The labor interests are showing pleasure at seeing the improvement in lighting. Some complaints have been made of "too much light." These invariably were due to excess glare. The improvement in lighting of plants within the last five years is quite impressive, even to a casual observer looking at the same from passing trains. Some plants find tungsten lamp installations more economical in operation and maintenance than the former arc lamps. Six districts have been established for carrying out factory inspection as to lighting. The details of the work of the inspectors was explained. The code has been found very effective in lighting betterment but it will take several years before all factories are well lighted.

F. H. Murphy, Portland, explained how Oregon secured the law giving the labor commissioner authority to draft a lighting code. Both labor interests and employers' organizations took kindly to the proposed law, which includes a broad definition of places of employment to cover offices also. The commissioner appointed a committee to draft a code and it has reported one which became effective last July. Its enforcement is not drastic.

Romaine Myers sent a letter that the California code is being printed and will become effective Nov. 1, 1919.

A. H. Taylor, Washington, D. C., read a paper by M. G. Lloyd, of the Bureau of Standards, describing the Federal Code. It includes not only intensity requirements but also definite statements as to cleaning and maintenance, and gives many suggestions as to proper practice. Dr. Lloyd described many installations in arsenals, navy yards and other government plants showing that compliance with this code is not yet what it might be, but it doubtless will be much more complete in the future.

F. C. Caldwell, Columbus, Ohio, described the status of the Ohio Code, which now is in its third proposed form and has been turned over by the committee to the commission. Doubtless it will be made effective in the near future. It includes comprehensive tables of recommended lighting intensities. Professor Caldwell noted that all the codes are almost exclusively educational at present. Their legal aspects have not yet been called into effect, and it may not be necessary to resort to very drastic measures to convince manufacturers of the value of doing the work voluntarily.

Dr. Louis Bell, Boston, described the progress of preparing a code in Massachusetts. The commissioner of labor and industry is very sympathetic and the factory inspectors are also exceptionally keen to have something done. Dr. Bell was requested to draw up the code, which he did, based on that of the I. E. S. After certain hearings it can be adopted with the force of law.

R. E. Simpson, Hartford, Conn., presented a brief paper entitled "Insurance Inspectors and the Code." In this he set forth that the object of all lighting codes is to make conditions safe as to lighting. Experience of the inspectors is that the greatest need for betterment is respecting reflectors on drop lamps and the better illumination of stairways and unfrequented places. The dark surfaces on stairways require much higher illumination than ¼ ft-cdle. Data show there are more fatal accidents due to falls on stairways than are due to traffic accidents on streets. During the war all our military casualties amounted to about 400,000, but at home there were more casualties due to poor lighting alone.

George C. Keech, Chicago, spoke briefly of the prospect of initiating action on a code in Illinois.

Dr. E. P. Hyde, Cleveland, a member of the International Commission on Illumination, said that an American committee composed of P. S. Millar and J. R. Cravath had prepared a very voluminous report to the commission on what has been done by our various states and the I. E. S. in the matter of lighting codes. It was intended to present this to the European countries that have been torn by war as an aid in their reconstruction work.

G. B. Nichols, Albany, N. Y., spoke briefly on the difficulty of getting appropriations for additional activities by state departments; consequently he warned against making the work of enforcement of the codes too expensive.

Prof. C. E. Clewell, Philadelphia, submitted a written communication strongly recommending educational work in extending the influence of the codes rather than strict legal enforcement.

Commercial Aspects of Lighting.

The Wednesday afternoon session was devoted to commercial possibilities, the first address being by R. M. Searle, Rochester, N. Y., on "Opportunities for Extending Lighting Through New Applications." He called attention to the opportunity for bringing up the lighting of side streets to approximately the standard of main streets so as to reduce the danger of accidents from automobiles. Highway lighting is only in its infancy and presents wide opportunities for electric lighting companies. All-day lighting of store windows has extremely high commercial value not only to the lighting company but to the merchant. Mr. Searle also touched on color lighting to reproduce the effects desired in millinery and cosmetic shops. Stairways need much more lighting than has ever been used to reduce accidents. Large possibilities lie in floodlighting of banks, monuments, playgrounds, etc. A very favorable load can be developed from lighting of railroad freight classification yards. Higher candlepower lamps with their higher efficiency should be applied with suitable screening devices. Many other fields for lighting business development were pointed out. Mr. Searle said that perhaps less than 25% of the lighting possibilities have as yet been developed. Lighting companies have shown too much of an effort to keep down the bills of their customers instead of pointing out to them what may be done by greater use of lighting.

Discussion was opened by L. Friedman, Chicago, who called attention to the timeliness of boosting highway lighting. J. D. Israel, Philadelphia, spoke of the high advertising value of store lighting, especially that in display windows. It is necessary to show the merchant that the use of more light pays. J. R. Cravath, Chicago, said that store-window lighting requires higher candlepower to overcome street reflections by day than have hitherto been used. N. Macbeth, New York, spoke of a merchant who reported window lighting as giving him better returns than newspaper advertising; the latter cost him $10,000 a year against $500 for all-day lighting for the windows. He spoke of the possibilities of using daylight lamps in millinery stores and in many other places. O. B. Oday, Harrison, N. J., said that railroad lighting offers a large field for color matching in car painting, for large classification yards and large erecting shops.

Lighting in England.

F. W. Willcox, London, England, made an address on "Lighting in England." When he came to London from this country some eight years ago he found lighting conditions very backward and almost deplorable. These slowly improved but there is still room for a very large improvement. The people are more conservative and not ready to take up innovations. During the war in the effort to minimize the destruction from air raids it was necessary to resort to drastic restriction of all outdoor lighting especially and at first this was done in an unfortunate way with serious results. Later the advice of illuminating engineers secure some modifications of the depressing conditions. Mr. Willcox showed a large number of views of war-time lighting in government munition and airplane works and also in commercial establishments and institutions. Numerous special fittings were shown that were devised to meet Admiralty specifications in some of these plants.

The discussion of Mr. Willcox's address was opened by E. D. Tillson, Chicago, who was glad to see that rugged fittings were being used in at least one country. Here excessive competition leads to the use of light and insubstantial fittings in many places, such as foundries, where they are entirely unsuitable. S. G. Hibben, Pittsburgh, reported some of his observations both in France and in England while in military service the last few years. He also said that the first impression one has is the extreme backwardness of these countries as to lighting, and yet on closer study he finds many innovations that are worthy of being given serious consideration. At any rate, it is valuable to get the viewpoints on this subject of other countries. Others who discussed the subject briefly were G. H. Stickney, Harrison, N. J., and F. H. Bernhard, Chicago.

Mr. Willcox in closing said it was possible to use air-tight instead of ventilated fittings if ample provision is made for radiation of heat. In English cities one finds higher intensities than are the general practice here, but there is practically no highway lighting. Locomotives are run without headlights; therefore, if abundant road lighting were provided, automobiles could do so likewise. He briefly described the use of adjustable drop and rise lamps which are very popular in England and give no trouble. He hopes to see an industrial lighting code of national scope adopted in that country. He also spoke of the British Illuminating Engineering Society and the possibilities of further development through its existence.

R. O. Eastman, Cleveland, Ohio, presented a paper entitled "A Survey of Industrial Lighting in Fifteen States." This survey was carried out for the National Lamp Works, of Cleveland, in the effort to study the lighting conditions actually prevailing in factories throughout the country. It was carried out by laymen to get commercial results. It involved the study of 446 plants and was intended to be qualitative rather than quantitative. Very valuable data were presented in the paper, which will be reproduced in an early issue of the ELECTRICAL REVIEW.

The discussion of this subject consisted chiefly of questions by H. B. Vincent, Philadelphia; F. W. Willcox, London; P. C. Burrill, Milwaukee; A. B. Spaulding, Harrison, N. J.; M. Luckiesh and E. A. Anderson, Cleveland. Mr. Eastman answered these questions in closing.

E. W. Leeper, representing the Chamber of Commerce of the United States, made a brief address asking the Society to co-operate with the Chamber in extended propaganda aiming to help solve the most important business problems now before the country.

Closing Session.

On Thursday morning, the first paper presented was by O. R. Hogue and J. J. Kirk, Chicago, entitled "Factory Lighting—A Central-Station Problem." This paper gave the experience of the Commonwealth Edison Co. in a campaign for better industrial lighting. During this campaign a very extensive survey of the conditions in Chicago industrial plants was conducted, the results of which are given. A more extended abstract of this paper will appear in an early issue. This paper was discussed by C. M. Masson, Los Angeles; O. L. Johnson, Chicago; R. E. Harrington, Harrison, N. J.; J. E. Hoeveler, Madison, Wis.; A. L. Arenberg, Chicago, and Mr. Hogue.

A paper on "Illumination of Artistic Interiors Without the Use of Pendent Ceiling Fixtures," by A. D. Curtis and J. L. Stair, was then presented. It showed that recent developments in the use of cove lighting, wall boxes and special brackets, floor lamps and pedestals, urns and special devices make possible the lighting of interiors by equipment that is practically concealed. Many unique effects are thereby obtainable and the architectural scheme frequently enhanced through the absence of the customary ceiling fixtures. Numerous installations of this method of lighting were illustrated and described, these dealing with theaters, hotels, banks, homes and the new House of Parliament Building in Ottawa, Can. The paper was discused by A. L. Powell, Harrison, N. J.; F. W. Willcox, London, and Mr. Curtis.

Utilization Coefficients.

A paper by Ward Harrison and E. A. Anderson, Cleveland, Ohio, entitled "Coefficients of Utilization" was presented by Mr. Anderson. It described a simple method for the direct determination of these coefficients applying to installations of all types of lighting units in rooms of varied proportions and different ceiling and wall colors. Data were tabulated from a series of several hundred illumination tests made in a room with reflectors having three fundamental forms of light distribution. Typical coefficient of utilization tables as determined for different reflector types in common use were included.

The last paper presented was by V. R. Lansingh, Cincinnati, on "Walls and Floors—Their Effects on Lighting." The paper was read by W. F. Little, New York. It gave the results of experimental tests in a small room to determine what influence walls and floors of different colors have on utilization factors. Conclusions reached were that the floor color may affect the illumination as much as 15% and the wall color may produce as much as 25%.

The last two papers were discussed by A. H. Taylor, Washington, D. C.; J. L. Stair, Chicago; N. Macbeth, New York; W. Harrison, Cleveland; A. L. Powell, Harrison, N. J.; F. W. Willcox, London, and Messrs. Little and Anderson.

Prof. Gitaro Yamakawa, of Tokio, Japan, made a brief address on lighting conditions in that country. In illumination Japan is far behind but is trying very hard to catch up. A few years ago an illuminating engineering society was formed in Japan. It has about 750 members. Japan is very much indetbed to America for science in general and for facts regarding lighting.

D. McF. Moore reported the findings of the Committee on President's Address and J. D. Israel presented the report of the Committee on Resolutions. M. B. Webber, Boston, in moving the adoption of the resolutions, said that it was the most successful convention ever held by the society. Before adjourning the convention, Dr. Hoadley turned over the stewardship of the society to President S. E. Doane, who also spoke of the convention as the most valuable one yet conducted by the society.

Entertainment Features.

For relaxation there were provided a number of entertainment features. These included the president's reception and dance on Monday evening, a visit to the Chicago Electrical Show on Tuesday afternoon, a theater party Tuesday evening, a special automobile tour and luncheon for the ladies on Wednesday, the annual banquet Wednesday evening, and inspection trips to lighting installations on Thursday evening. Each of these features was marked by numerous innovations and heartily enjoyed by all who participated. The theater party on Tuesday was made a celebration of the fortieth anniversary of Edison invention of the incandescent lamp—Oct. 21, 1879.

On Tuesday President Doane gave a luncheon to the officers of the society, at which plans for the year's work were discussed.

N. A. E. I. Holds Convention at Springfield

Revision of National Electrical Code from Field Data Principal Topic at Reconstruction Meeting

AMONG the subjects under consideration at the reconstruction convention of the National Association of Electrical Inspectors, held at Springfield, Mass., Oct. 13-14, were those concerning the relation and value of electrical inspection to the various branches of the industry, and the necessity of obtaining information from the field regarding the working out of the rules of the National Electrical Code so that the revision may be consistent with practice. The subject of polarization and protective grounding received consideration along with other papers, discussions on all of which were at some length.

The convention was called to order Monday morning, Oct. 13, by Allen W. Hopkins, past president of the Western New England Section, National Association of Electrical Inspectors. He introduced Arthur A. Adams, mayor of Springfield, who welcomed the association and its friends to the city. Response was made on behalf of the association by President Washington Devereux of Philadelphia.

Past-president Thomas H. Day, chairman of the committee on arrangements, gave a brief explanation of the different committee activities and plans for the routine business of the convention and for the entertainment of the members and their friends.

Beginnings of the Code.

President Devereux then introduced F. Elliot Cabot, secretary of the Boston Board of Fire Underwriters, who gave an address upon "The Beginnings of the National Electrical Code." He was the first chairman of the electrical committee and, with C. M. Goddard, secretary of the New England Insurance Exchange, made the initial efforts toward bringing into existence the National Electrical Code. Mr. Cabot told the convention of these early efforts. There was a brief discussion initiated by A. E. Braddell of the Sprague Electric Co., who was one of the earliest inspectors in the field, after which on motion of Mr. Day a committee consisting of H. S. Wynkoop, A. E. Braddell, Washington Devereux, G. S. Smith and E. S. Francis was appointed to draw up a suitable set of resolutions recognizing the past services of Messrs. Cabot and Goddard in the creation of the Code, to be engrossed and presented to the above-named gentlemen in the name of the association.

Clarence D. Tuska, Hartford, Conn., read a very interesting paper on "Radio Developments and Their Relations to the Code." At the close of the paper it was voted that the secretary forward to the secretary of the electrical committee, National Fire Protection Association, the recommendation of the association that wherever in the Code the words "wireless telegraph apparatus" appear they be replaced by the words "radio apparatus" and that the word "antenna" be similarly substituted for the word "aerial."

At the Monday afternoon session T. Commerford Martin read a paper on "Electrical Inspections and Their Beginnings," which was largely reminiscent and brought out many interesting facts in connection with bygone days. The speaker exhibited a selection of antique fittings which occasioned much interest; there were wooden cleats, cutout bases, receptacles and similar curiosities. He stated that it was proposed to establish a museum of relics in New York to perpetuate the methods of early days. If any of the association members or others have in their possession any of such or other interesting samples of bygone fittings and appliances it is much desired that they communicate with Mr. Martin and if possible send such to him for the above purpose.

Symposium on Electrical Inspections.

Gilbert S. Smith of Philadelphia, president of the Pennsylvania Association of Electrical Contractors and Dealers, read a paper on "Electrical Inspections and the Electrical Contractor." He outlined from the contractor's point of view the relations existing and which should exist and gave a very interesting description of the methods of promoting good relations, clear understanding and co-operation among the contractors, wiremen and inspectors by Washington Devereux in Philadelphia through the workings of his weekly conferences.

"Electrical Inspections and the Power Company" was the title of a paper by Percy H. Bartlett, engineer of installations of the Philadelphia Electric Co. He began by stating that he could present only his own personal viewpoint and that he felt one of the association's principal aims should be to iron out differences of interpretation of the Code. He spoke of the possibility of some "safety inspection" by the state or similar body unless the present inspection authorities control this as well as fire dangers. As to inspections by power companies, he felt that being in the business primarily to manufacture and sell electrical energy, these should confine themselves closely to that business and could do it better if inspections were not included in the companies' functioning. He stated that out of 8000 reports of interruptions of service in one month by his company, 7000 were found to have originated in fuses blown by domestic appliances improperly operated.

Mr. Bartlett told the method by which the Philadelphia Electric Co. was kept informed of inspection progress. After an application for inspection was received by the department the inspector made his visit and sent a copy of his report not only to the contractor but the company as well; similarly when any defects found were corrected and when a temporary certificate of approval was sent the contractor a copy was left in the main service switch box, which was the direct authorization for the company's representative to connect the service. He stated that he approached the question of municipal versus insurance inspection with some diffidence, but that in his opinion on account of the financial leverage (among other reasons) the insurance departments were the more logical and suitable of the two.

The next speaker was Ralph Sweetland, assistant secretary of the New England Insurance Exchange and secretary of the electrical committee, National Fire Protection Association, who addressed the convention on "Electrical Inspections and Their Value." He made six subdivisions: value to the property and owner, to the municipality, to the insurance company, to the manufacturer, to the jobber, and to the contractor.

Under the first head he stated that although some owners of property at first looked upon it as a hardship it was usually not the case with the larger owners and that when it was the owner was regularly brought to see the immediate value to him not only in security but in proportionate increase in income-earning power of the property. Although large buildings were built under supervision of an engineer and strict specifications, still the engineer was strongly impressed with the value of an outside and wholly unprejudiced inspection.

As to the municipality, it has a very direct interest because the use of electricity is so widespread, and there is the probability that faulty equipment in one building may have an injurious effect upon neighboring holdings and may further cause innocent citizens damage, as well as expose the municipality as a whole to fire hazard. The importance of the work of electrical inspection was frequently overlooked and minimized by the public because, while the police department was always on view, the fire department more or less spectacular, the electrical inspection department was distinguished by the fact that when its work was well done nothing happened, so that the more efficient it was the less it appeared before the public at large.

As to the insurance company, it would be enough to compare the permit for the use of electricity as it formerly was written in the policy with the simple form used today which was practically "permission is granted for the use of electricity for light and power purposes in the insured property," the broad, unconditional form being largely due to the results of careful inspection.

The manufacturer is assisted because through careful inspection he is furnished with a mass of field data and similar information which materially assists him in the detection of weaknesses and in the maintenance of standards.

The jobber is benefited because he does not have to carry in stock a lot of cheap material in order to meet thoughtless demands or keep business, since he knows that poor grade non-approved material will not be passed and therefore need not be carried in stock, however beguilingly the salesman may present it to him.

Inspection is of value to the contractor who does high-grade work because he is protected therein. It is also of value to the cheap fellow because he is either forcefully pulled up into the other class, where he becomes a credit to himself and makes a success of his business, or he is on the other hand rapidly eliminated from the field, to the great benefit of others and also to himself as he is prevented from losing what little money he may have through his slipshod methods.

Lastly, Mr. Sweetland disagreed with the preceding speaker in that he believed electrical inspection was distinctly the function of the municipality; he did not believe in a single state inspection, however, keeping in mind that the closer most things are kept to the community interested the better. He realized that there were many small towns which could hardly afford to employ a competent man for this purpose, but saw no reason why several should not combine and employ one jointly, precisely as they do today in the case of a superintendent of schools.

In the discussion which followed there was a very interesting argument over the matter as to how far a power company would be justified in refusing to supply current to installations which they believed dangerous. President Devereux stated that this right was established and that they had the full power; in fact, would be held criminally liable if current was supplied to a service known to be dangerous to life and property. Mr. Devereux cited a case in the New York courts to substantiate his proposition. Harry Blood disagreed and cited a case, also in New York, where a company decided to cut off certain bad risks and the Public Service Commission of the Second District said this was not the company's affair and ordered it to supply current. After some argument, A. M. Paddon, Syracuse, N. Y., took a hand and lucidly distinguished between the two cases. First, in Mr. Devereux's case, there had been serious trouble in the risk and the company had given warning and received a promise that the difficulty would be corrected. This was not done, however; the company thereupon cut off the supply and was, as Mr. Devereux stated, sustained by the courts. In Mr. Blood's case the company suspected some bad risks, ordered all its customers to have their installations inspected and that if this was not done within 30 days current supply would be cut off. As a result the Public Service Commission made the ruling precisely as Mr. Blood stated.

Outside Wiring and Building Services.

The final paper of the afternoon was presented by Dr. Morton G. Lloyd, Bureau of Standards, upon "Outside Wiring and Building Supply and Services." Dr. Lloyd discussed the present regulations of the Code from the standpoint of the sub-committee of the electrical committee, National Fire Protection Association (which must have prepared any proposed revision by Dec. 1 of this year), of which President Devereux is chairman. The following questions were expounded:

Shall the service switch be invariably inclosed? If so, shall the switch or the service fuse come first? Should there be a fuse at the service end of the service conduit? What should be the proper protection for the service conduit and service wires?

In outside wiring cleats are not allowed; knobs are allowed where wiring is not exposed to the weather and petticoat insulators where it is exposed. How about iron racks with porcelain cleats and brackets? Is there any field experience that these are not safe and allowable? If permitted, what should be the limitation?

What requirements should be specified and what regulations for the use of multiple-conductor cable for service? Are the present requirements of Rule 12*b* satisfactory or onerous? Are they being strictly followed or are they not? If not, why not?

At present all line wires must be insulated. Is this desirable, and, if not wholly so, then to what extent? Should the limit be, say wires for 2300 volts and under? What is the field experience and opinion?

Rule 13 is obsolete and in process of revision.

What information can inspectors in the field give that will help?

Finally, how about oil-filled transformers in buildings or attached to the walls outside? What light can be thrown on Rule 14 and others in this connection?

It is strongly felt that the inspectors of the country are in possession of a very great mass of information which would be of material help in the revision of the Code. It will be too late to present this in March. Such material must be in the hands of the committee by Dec. 1. It is very hard to get it from the men in the field. Opinions are not wanted so much as facts—what actually happened in the field and what were the circumstances. Anything that members of the association and others have, not only on the matters specially mentioned above but on any others, they are urgently asked to send promptly, either to the secretary (addressing Prof. William Lincoln Smith, Northeastern College, Boston, Mass.), who will forward it to the proper authority, or directly to Ralph Sweetland, secretary, electrical committee, National Fire Protection Association, 141 Milk street, Boston.

At the Tuesday morning session H. S. Wynkoop, electrical engineer of the Bureau of Gas and Electricity of New York City, read a paper on "Inter-building Service Connections." This practice is found where a block of buildings separated each from each by a fire wall is put up as a unit. Each individual would require, say 15 amperes from a three-wire service, and usually it is found that the installation of individual service for each unit from underground mains would be prohibitive; therefore the company installs a single service manhole with fuses and switch at one corner, the builder runs a conduit straight through the basements of the block, and in each unit is placed a branch service with fuses, switch and meter. The question as to how much this construction or similar schemes are being used throughout the country and whether it should be encouraged is one on which the electrical committee desires as much information as possible.

Code Problems.

Dana Pierce, vice-president of Underwriters Laboratories and chairman of the electrical committee, National Fire Protection Association, presented a paper on "Some Code Problems of Present Interest." He explained the development of the Code from a pamphlet of 36 pages in 1895 to one of 132 pages in 1905 and further to one of 210 pages in 1915, and stated that this roughly measured the increase of use of electricity in 20 years and the increase in hazard; further, that now the size and complexity of the Code had reached a point where these were the principal causes of present Code problems.

The chief problem is how to obtain data and field experience absolutely necessary to keep the Code in the forefront of the profession. It is imperative that the committee receive results of field experience in the form of facts as to the working of the Code—not opinion as to what one or another would like to see inserted or omitted, but facts as to how a given rule has worked or failed in a particular case, with exact information as to the conditions and then a suggestion to improve this condition. Mr. Pierce outlined the new form of procedure of the electrical committee which has been fully and widely detailed in the technical press and with which every inspector is supposed to be familiar by this time. It is the hope and purpose of the committee to make the Code rather a record of good practice than an imposition of requirements upon the business.

Standards are of two kinds. There are, first, inspection rules, such as *26j*, "must be rigidly supported, etc.," and, second, "weasel rules," such as "borders must be suitably stayed and supported, etc.," and as in 37A*c*, "installed in a workmanlike manner." Great judgment must be used in framing these rules. There are the following points among the many which arise:

Heaters—How can the flatiron problem be dealt with? There are now 100 fires a day in the United States due to these alone.

Gas-Filled Lamps—How does its hazard compare with that of the old type? Does it need all the present precautions, or others? How about its use in dusty places?

Varnished Cambric, Paper Cable and Similar Insulations—How about their use in buildings? How support them for risers? What are the difficulties? What rating shall they have compared to older types?

Renewable Fuses—How shall they be handled?

Insulating Joints—This question is being handled by a sub-committee of which J. C. Forsyth of New York is chairman.

Grounding—This matter was supposed to have been settled but now is more vital than ever. One of the largest hotels in New York wired in strict Code accordance had a measured maximum demand last year of only 27%. There is copper in that installation which, as one might say, never sees an ampere. Consider the economic question of tying up all that copper and the financial burden, and then try to visualize the economic responsibility of the makers of the rules. Again take the case of 200 closely adjacent buildings for government housing, each calling for only about 11 outlets for light, all fed from one bank of transformers, with 200 No. 6 service grounds and 200 separate No. 6 service conduit grounds—400 in all; there probably is more copper in the grounds than in the circuits.

Mogul Sockets—How can a mogul socket rated at 1500 watts be used when the present inside branch circuit is limited to a maximum of 1320 watts by special permission? How can one use 500-watt lamps when the 660-watt circuit will only take one and the special 1320-watt circuit but two? Is it reasonable or what sort of circuit should be allowed?

Motor Fuses—Does the Code require that motors shall be protected by fuses? If the answer is "yes," then where is the prescription to tell what fuse should be used to protect a motor of given rating?

Low-Voltage Limit—The committee has been requested to raise the low-voltage limit from 550 volts or less to 750 volts or less. What does field experience say?

Farm-Lighting Plants.—These usually operate at about 33 volts, requiring light insulation and considerable cross section of wires. If insulated suitably for this, and later power from a public service supply is substituted, there is the question of new wiring and scrapping of the old; on the other hand, if originally insulated and installed for 110 volts, there is the burden of higher cost useful only if certain future events come about. What sort of rules shall be made?

The committee, through its several sub-committees and technical sub-committees, urgently desires field experience bearing on these and kindred matters.

J. C. Forsyth, chief inspector of the Board of Underwriters of New York City, presented a paper on

"Insulating Joints; What of Their Future?" As Mr. Forsyth is chairman of the sub-committee on this subject, which was to meet the following day, the paper was more of a running commentary on the matter in general and did not contain matter of a definite nature so much as a probe for information. Mr. Forsyth's committee is earnestly seeking for field experience in this matter and all members of the association and others are urged to help out again with facts and conditions found in the field.

A paper on "Time Lag in Motor Protective Devices" was presented by F. A. Barron, electrical engineer, wiring sales department, General Electric Co., and dealt principally with the methods of protecting small motors individually from overload when the motors are grouped together under the line protection of one set of fuses in accordance with the provision of Rule 8*c*.

George C. Lawler, electrical engineer, Associated Factories Mutual Insurance Companies, read a paper on "High Potential Wiring." This was too detailed and technical to be summarized here, but probably will be published in full in one of our coming issues.

Polarization and Protective Grounding.

Tuesday afternoon W. J. Canada, electrical engineer, Stone & Webster Co., Boston, read a paper upon "Polarization and Protective Grounding." Mr. Canada, as is well known, has given many years of study to this subject and the result was a paper replete with detailed information. The discussion which followed was prolonged and participated in by many present, turning principally upon the question of polarization. Thomas H. Day suggested a rule to the effect that "on secondary systems having five or more grounded services connected thereto, service conduit grounds may be connected to the service ground wire."

Dana Pierce commented in detail upon the whole economic question of the present (but temporarily suspended) polarization rule. He touched upon the hinted cost to the manufacturer for changes in the machinery, as to whether all types and sizes of wire should be marked or only the small branch wires, spoke of the customary manner of buying wire and installing circuits, of sizes like 500,000 circular mils purchased almost inch by inch. He suggested trying the plan for a year or so of marking the wires on the job at the outlets. He thought the provision must be justified economically and said that while manufacturers generally were ready to accept it, they felt that before making changes they should be sure it would go into effect and be strictly enforced. Again there was the question of the marking of devices.

Dr. M. G. Lloyd said the difficulties were much exaggerated, that the wires of whatever size could be amply polarized by banded marking at outlets, or at very small expense colored braids could be used, as has been done for years in telephone work, where one can go anywhere and always identify the wire. For bare wire there could be black and gray rubber; for Bx or duplex wire two dyes, and as to the cost of marked fittings how much would a plus and minus sign on the die or mold cost.

Visual Marking of Fuses.

The final paper, which was presented by Past-president Thomas H. Day, dealt with "The Visual Marking of Fuses," excerpts from which appear on other pages of this issue. The speaker brought out the faults of the present system. It is frequently the case that the pasted label or ferrule marking on cartridge fuses is not visible without turning them in the clips, which, because of the rivet heads, tends to spring and loosen the contact. The marking of plug fuses is often obscured by the size and amount of other stamping, trademarks, etc., and there is often objection to inspectors opening the circuit even long enough to examine the fuse bottoms. Several methods of improved marking were discussed and the matter recommended to the Underwriters Laboratories for further consideration.

The association annual banquet, held Monday evening, was attended by 130 members and friends. A. E. Braddell presided as toastmaster and responses were made by H. W. Blood, Boston; J. C. Forsyth, New York; Washington Devereux, Philadelphia; Thomas H. Day, Hartford, and G. S. Smith, Philadelphia.

LARGE ATTENDANCE AT CHICAGO ELECTRICAL SHOW.

Exhibitors Pleased with Merchandising Results at Show and Vote to Hold Another One, Probably Next Year.

Attendance figures for the Chicago Electrical Show, which opened Oct. 11 at the Coliseum and closes Oct. 25, indicate that over 80,000 people paid to see the show. The crowds, especially in the evenings, taxed the capacity of the immense auditorium, and demonstrators were kept busy introducing to the public the many electrical devices on display at the show.

At a meeting of the exhibitors held this week, E. W. Lloyd, manager of the show, asked for expressions of opinion concerning the exhibition. Replies from representative manufacturers, jobbers, and contractors emphasized the success of the affair from a merchandising point of view. It was the concensus of opinion that another show be held, probably next year.

One of the features that attracted a great deal of attention at the show was the wireless telephone apparatus. A government aeroplane was equipped with wireless telephone and the words spoken by the flyer were received in the booth of the Signal Corps at the show. So that the visitors to the show might gain an idea of the unlimited opportunities of the wireless telephone, the Signal Corps exhibit arranged a number of microphones through the hall in order that the words of the flyer be heard distinctly all over the Coliseum.

DISCUSS TRACTION PROBLEMS AT NEW YORK MEETING.

Speaking at a monthly luncheon meeting of the New York Electrical League, held Oct. 14, Lewis Nixon, New York Public Service Commissioner for the First District, indicated that a compromise between the New York City traction companies and the city authorities might be reached whereby the companies would relinquish some of their special privileges in return for an increased fare. Mr. Nixon stated that he believed the solution of the problem lay in the application of a flexible fare. The zoning system, he believed, is impractical in New York City because much of the city's growth and industrial expansion was effected on the principle of a universal transit fare.

Commercial Practice

Sufficient Outlets Advocated — Enormous Market for Electric Household Devices—Electrical Dehydration of Oil

CENTRAL STATION ADVOCATES USE OF SUFFICIENT OUTLETS.

Canadian Company Advertises to Contractors and Dealers to Urge Customers to Provide for Additional Outlets.

The doctrine urging the home builder to provide sufficient outlets for all demands is one that is being preached by all branches of the industry. In a recent advertisement, the Toronto Hydro-Electric System made these suggestions to contractors and dealers:

"When wiring buildings don't cut the size of wires to a minimum. Educate your customers to provide spare capacity for the increasing demands which are sure to follow. Show the consumer, say by means of alternative prices, the small cost of providing for future demands in the original installation. Nor does your interest in a customer end when the wiring is completed. He is still a prospective customer, and a satisfied customer is the best advertisement—an unsolicited testimonial, a talking sign, that walks, too!

"When wiring residences don't fail to urge an adequate number of outlets, and be sure they are conveniently located. A customer may not be sure just what he needs in advance, therefore sound advice is welcomed, and when it works out in practice as you promised, the customer will tell his friends of your ability.

"Standardize your outlets. It means efficiency and true economy, which benefits you in the long run."

ENORMOUS MARKET FOR ELECTRICAL HOUSEHOLD DEVICES POINTED OUT.

Address Before American Washing Machine Manufacturers' Association Emphasizes Opportunity.

Speaking before the American Washing Machine Manufacturers' Association on October 16, Raymond Marsh pointed out the vast field existing now and in the future for electrical household appliances. In part he said, after telling of the number of wired houses, rate of increase in wired houses per year, and the number of appliances sold annually: "At the very outset I ask you to note that present day conditions make 'electrical household specialties' a necessity—and not a luxury—in every one of the seven million homes wired for electricity. In addition, the remaining fifteen million homes in this country are now demanding household specialties, not electric, such as hand, water, and gasoline-power washing machines, gas ironing machines for household use, etc.

"'The electrical household specialties' industry is still in its infancy. Americans are noted for the ingenuity they have used to develop labor-saving devices and machinery; but, although leaders now in the development of household labor saving devices, their reputation in this respect is as nothing compared to what it will be five or ten years from now.

"In 1919 there were 3000 manufacturers of electrical devices.

"Out of about 15,500 hardware dealers rated at over $5000 in this country only about 2500 or 16% are selling electrical household appliances.

"In the early days of the washing machine business the manufacturers distributed a large proportion of their production through the hardware trade, jobber and dealer. The relation which was developed between the hardware dealer and jobber and the manufacturer was, and still is, equitable and profitable to all parties concerned.

"During the last several years, however, the proportion of the production of the washing machine industry distributed through the hardware trade, dealer or jobber, has declined and not increased. This is an unfortunate condition; and, yet, it is a fact which you gentlemen should face and endeavor to remedy. If the manufacturers are at fault for this condition, they would like to know it. If the hardware trade is at fault, then, surely, you, gentlemen, would like to know it.

"The present demand for household labor saving devices, electric or driven by other kinds of power is far in excess of supply. Numerous manufacturers of these devices have doubled their producing capacities and deliveries within the past year. They are using every intelligent, legitimate effort to increase production and they are getting results in spite of handicaps merely suggested by the phrases—labor problem, transportation difficulties, shortage of basic materials such as motors, wringers, polished and trimmed copper sheets, etc. In our industry, alone, we can show results in the way of increase of deliveries, by units and not money, of over 95%—comparing our deliveries by units second quarter 1918 to second quarter 1919. These are facts beyond dispute which show that the household specialty industry is a growing one which you gentlemen cannot and dare not neglect.

"Today, with all of the increase in production, the manufacturers of household labor saving devices are far behind on orders. The demand for these devices has just started. The hardware trade, to some extent, is cashing in on the demand, today, but it must prepare itself to meet the demand of tomorrow and the conditions of tomorrow.

"What will the demand be tomorrow and what will the conditions be tomorrow?

"Every user of a hand, water or gasolene power household labor-saving device is an excellent prospect for an electric power device as soon as the home is wired. The rate at which homes in this country are being wired is remarkable.. On this point, I suggest that you get in touch with the Society for Electrical Development from which you will get figures which will astound you. Here is a perpetual motion proposition; and one on which you should plan to make money. You have already made money in selling the hand, water, gasolene power devices; now turn around and sell the same customer the electric power device.

"The women of this country are directing their energy toward the factory and the office and away from the household duties. 'Uncle Sam' is urging increased production to reduce the cost of living. Women are doing more than their bit in this job to increase production; and as the scope of their work develops and broadens they will have less time to devote to household drudgery—and, under present conditions, drudgery is exactly the word to use in describing household work. These women are learning about machinery, production, labor-saving machinery, the planning of factory work—and they are fast losing their fear of machinery of any kind or description.

"Who or what will clean and iron the clothes, wash the dishes, clean the rugs, cook the meals, etc.? Household servants and washwomen are now so scarce, in a relative way, that they are demanding and getting fortunes for their services. The sky only is the limit by which they set their daily wage. The answer is—washing and ironing machines for household use, electric dish washers, vacuum cleaners, toasters, ranges, etc.—the whole series of electrical household specialties for use in the city and in farm homes by reason of individual farm-lighting plants.

"The demand for these devices will greatly expand because we are not developing a servant class in this country. Unlike in England and in France your wife or my wife cannot find a servant who is or will be proud of her job and proud of the fact that she works for you or for me. Servants' and maids' unions may be formed here as they have been in England and France, their hours of work and rates per hour may be standardized here as they have been in England and France; but the fact remains that, in a relative way, good household servants are as scarce as hen's teeth and that we are not developing a servant class in this country.

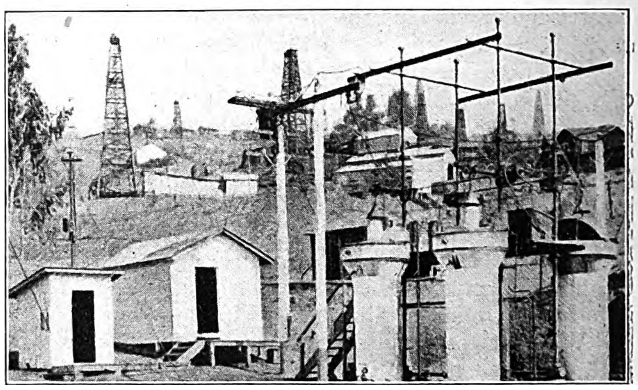
"Household servants are making it a condition that the home be furnished with labor-saving machinery if they are to stay. The housewife, if she has no servants, now realizes how much more of a necessity these labor-saving devices are. On the point of solving the problem of clean clothes for the family, she knows, only too well, that the most economical and the most sanitary way of getting clean clothes for the family is to have the washing and ironing done in her own home. She has had all she wants of the public laundries.

"The jobber or the dealer handling most of these articles today is in a position to pick and select his customers. Demand exceeds supply. Deliveries because of shortage of certain basic raw materials in many cases are slow and uncertain. The jobber or the dealer who takes his discounts is getting the better service. He, in turn, selects the customer who takes the discount and who pays cash. The whole industry is being placed on a more solid basis and foundation. Plans for financing customers who purchase on deferred payment plans have been developed which will adequately and properly protect both dealer and customer. Here is an industry with unlimited powers of expansion, with possibilities indescribable. Its product is an absolute essential under modern living conditions. Properly planned, the industry will develop on a most solid foundation. Manufacturers of automobiles now sell their product cash against documents. Why should not the manufacturers of these electrical household specialties do likewise? By so doing they will develop for themselves a most responsible group of jobbers and dealers who can adequately cover their respective territories and who will make out of their distributive function real profits commensurate with the opportunities now open in this great field of industrial endeavor."

ELECTRICAL DEHYDRATION OF CRUDE OILS SUCCESSFUL.

Removal of Water from Crude Oils by Electrical Method More Efficient Than Former Methods Used by Oil Producers.

Petroleum producers have been confronted with the problem of removing water from crude oils ever since oil was discovered. It can be accomplished by the application of heat, centrifugal force or by chemical action, but electrical dehydration has proven so



Electrical Apparatus for Dehydrating Crude Oil.

much superior to the other methods that its adoption is virtually a necessity, says H. N. Sessions in an article in *Edison Current Topics,* published by the Southern California Edison Co., Los Angeles, Calif.

The presence of water in crude oil is natural and inevitable, and is caused by the infiltration of water into the strata of oil-bearing sands. Water may be present in crude oil in the form of large free globules which settle out in time if allowed to stand, due to their greater specific gravity, or small particles of water may be held in suspension or trapped in emulsion with the oil and these will not settle out at normal temperatures and pressures even if the mixture is allowed to stand indefinitely.

The weight and volume of the water particles carried in suspension depends upon the viscosity, temperature and gravity of the oil; hence there is no fixed ratio between the water held in the free globules and that contained in the particles of water in emulsion. Some producers dispose of their crude oil without extracting the water from it and the purchaser is allowed a rebate on the percentage of water he is able to prove the oil contains. Such practice is characteristic of the early-day wastefulness in the oil fields, when little regard was given to economy and efficiency in handling and marketing crude oil.

Not to dehydrate at the wells works an injustice to all concerned. The carload freight rate on crude oil from Bakersfield to Los Angeles is 4 cents per bbl. and the shipment of a 12,500-gal. car of undehydrated oil which carries 35% water in emulsion means that some one must stand the transportation expense for 4000 gal., or 30,000 lbs., of water in the car. This reduces the useful capacity and purpose of expensive rolling stock and makes the freight cost of the oil delivered, less the water, 6 cents per bbl. The oil could be dehydrated electrically before shipment, including all costs and royalty, for less than 2 cents per bbl. with electricity at 2 cents per kw-hr.

There are 17 electrical dehydrating plants now operating in the Whittier district in California. The first electrical dehydrator was installed by the Standard Oil Co. in 1913 on the Murphy-Coyote lease. The oil companies using the electrical equipment are enthusiastic over the results obtained and in many cases oil heretofore unfit for use and rebellious to other methods of dehydration is made marketable by the process of electrical dehydration.

The oil treated in the above-mentioned 17 plants ranges from 15 to 50% water, and the average amount of oil net after treating is approximately 18 bbls. per kw-hr., or one-ninth of 1 cent per bbl. for electricity at the rate of 2 cents per kw-hr. Electrical dehydration causes practically no loss of gasoline and the records show that after treatment the gravity of the oil is raised from one to two degrees, giving it in consequence an increased market value. This increase in market value in some cases is enough to pay the cost of dehydrating. The opposite is true in the heating process because crude oil containing any appreciable gasoline will suffer evaporation under the temperature necessary to break down the emulsion, and naturally the loss of gasoline means less dehydrates, less gravity and less market value.

The heating process necessitates close watchfulness, the electrical practically none. The heating process discolors the oil, impairing its market value; the electric dehydrator clarifies the oil, leaving its natural color. The low fire hazard with electricity is also important.

A record run of 7000 bbls. of the same grade of crude oil was made, first by the heating process, then by the electrical, 18 hours being required with the heating process and only 7.5 hours with the electrical. The net amount of oil was 5150 bbls. with the former process and 5160 bbls. with the latter. The total cost of the heating process for this run was $387, or 7.5 cents per bbl., while the entire expense with electricity, even including a royalty of 0.5 cents per bbl., was $102, or slightly less than 2 cents per bbl.

The electric dehydrator effectively treats oils of different grades at the same time without in any way impairing their efficiency. On a test, 28 gravity crude oil containing 25% emulsion at a temperature of 70° was cleaned simultaneously and separately with 13 gravity oil containing 30% emulsion at a temperature of 180° by the same electric dehydrator and the dehydrates showed only 1.3% water and foreign matter in suspension, a limit of 2% being permissible.

Oil containing 85% emulsion has been successfully dehydrated electrically. The Quintuple Oil Co. in the Whittier district electrically dehydrates oil as it comes from the well from a mixture of 12% water to only 0.1%.

The electric dehydrating plant is made up of units called treaters. The usual size is a four-treater plant and the cost installed is about $2000 per treater. The cost of installation is generally borne by the oil companies and the ownership of the dehydrator is retained by the manufacturers, who also exact a royalty from the oil companies on each barrel of dehydrate produced. There are several successful electric dehydrators on the market. One manufacturer claims to have placed machinery which is now cleaning about 2,000,000 bbls. of emulsion per month.

In general, the electric dehydrator operates on a single-phase alternating current at a pressure of 11,000 volts. The emulsion is passed between highly charged electrodes and in this electrostatic field the small globules and particles of oil, by static attraction for each other, form in chains which in turn coalesce into free water that readily settles to the bottom of the treater and can be drawn off. In certain leases where water is very scarce, the water electrically removed from the oil is of considerable value.

Due to the condenser effect caused by the highly charged electrodes, the electric dehydrator operates at about 98% leading power-factor. The average maximum demand per hydrator is 4 kw., the average load-factor 50%, and the average gross income approximately $25 per month.

LAST ISOLATED PLANT IN CITY OF PUEBLO GOES OVER TO CENTRAL STATION SERVICE.

Arkansas Valley Railway & Light Co. Takes Over Plant That Had Been Landmark.

The last isolated plant to operate in the city of Pueblo, Colo., has gone over to central-station service, a process that has been going on surely and steadily for a long time. One by one the isolated plants have shut down and purchased service from the Arkansas Valley Railway & Light Co., until only one isolated plant—isolated in every sense of the word—remained. Now there are no more isolated plants, the last one to go having a capacity 138 hp.

Word also comes from Pueblo that an interesting development in the new business being taken on is an increasing demand for electric ranges. One 36-apartment building to be constructed soon will have an electric range in every kitchen. The electric appliance business of the company and dealers continues to break records.

A canvass recently made of the prospective new business in the territory served by the company shows that during the next 12 months more than 4500 hp. of additional business will probably be added to the company's lines, of which amount 1450 hp. is for the city of Pueblo for water pumping. The balance is divided among the industries of Pueblo, irrigation and power and lighting in the valley districts.

EFFICIENCY IN PUBLIC SERVICE SHOULD BE REWARDED.

Ruling of Illinois Public Utility Commission Points Out Mutual Benefits Should Accrue.

The Illinois Public Utility Commission in a case involving the Monmouth Public Service Co. has made the following statement:

"It would obviously be improper to base rates for utilities service upon a hard and fast rule of the actual expenses of operation and fixed rates of return without regard to the efficiency displayed in the conduct of the business. Such procedure would offer no incentive for improvement and no reward for accomplishment. The public has the right to expect efficiency of operation of utilities engaged in public service and has the right to share in its benefits, but accomplishment merits a tangible and genuine compensation for its achievements."

Operating Practice

Neutral Resistor in Four-Wire Three-Phase Feeders—Locking Circuit-Breakers Open Safely—Welding Trash Racks

REDUCING DAMAGE AND DISTURBANCE DUE TO CABLE BREAKDOWNS ON FOUR-WIRE FEEDERS.

Experience Indicates Correct and Incorrect Location for Current-Limiting Resistor.

When an underground conductor breaks down there are several forms the breakdown may assume. The failure may have occurred between phases, being then a three-phase or single-phase failure, as the case may be; or it may be that the breakdown has taken place between any one phase and the cable sheath.

In cases where the cable is four conductor, serving four-wire three-phase supply, a very common form of cable failure is between any of the three phases and the fourth conductor or neutral. When the former forms of breakdown occur the potential difference at the location of failure just previous to the breakdown is about 4000 volts, with the latter forms of breakdown about 2300 volts.

One operating company having a very large number of four-wire three-phase feeders in use and employing about three hundred induction type feeder regulators, decided to take steps to limit the flow of current in a fault when it occurred. Experimentation showed that there were two aspects to the case, one to limit the current when breakdown occurred between phases or any phase and the neutral conductor, between which exists a pressure of 2300 volts, and the other to limit the current when the breakdown occurred between any phase and the cable sheath. Limiting the current when the breakdown occurred between phases, at 4000-volt potential difference was only a matter of relay adjustment. On the other hand, the setting of the relays for the phase-to-phase failure

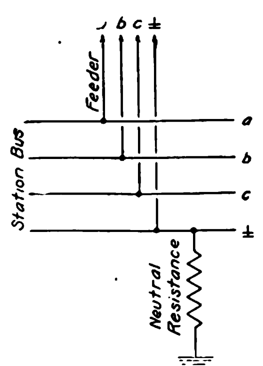


Fig. 1.—Diagram Showing Station Bus, One Four-Wire Feeder and Earthing Resistor.

also was effective for the phase-to-neutral and phase-to-sheath failures.

The circuits of this company has a cross-section corresponding to No. 0 copper; each feeder has a rating of 150 amperes at nominal full load and 4000 volts delta pressure. The relays were adjusted to trip the circuit-breakers instantaneously at 500 amperes, this value having been decided upon as one that would not cause needless service interruptions, and yet would not ordinarily open up transformer banks in the station nor cause excessive disturbance to the station pressure.

At first attempt, a resistance of various values was inserted in the neutral or fourth conductor, between

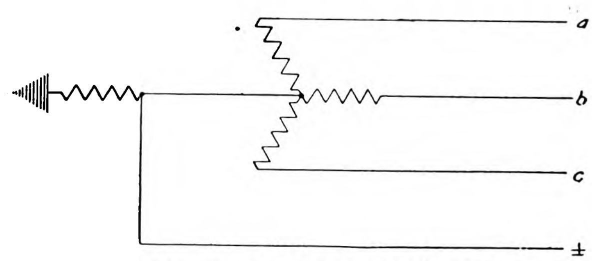


Fig. 2.—Diagram Showing Location of Resistor With Respect to Station Transformer Bank, Neutral Conductor and Transformer Neutral Point and Earth.

the neutral bus and the neutral point of the station transformer banks. With this arrangement, all current passing through the neutral conductor passed through the neutral resistor, causing voltage unbalance, the magnitude of which increased as the current in the neutral conductor increased, which it does as the unbalance in the various circuits increases. This unbalance not only interferred with voltage regulation, but made parallel operation of static transformers on the 60-cycle system with frequency-changers operated from a 25-cycle system almost impossible at times.

The position of the neutral resistor was then changed, as shown in the accompanying diagrams, so that instead of being inserted in the system neutral between the neutral bus and the neutral point of the station transformer banks, it was in circuit between the neutral point of the transformers and the ground. In this way the normal current flowing in the feeder neutrals back to the transformer neutral point was not affected at all, but only that current which flowed through earth back to the transformer neutral. Current can only so flow when a phase conductor breaks down to the cable sheath, because the neutral conductor is earthed at only one place, namely, the station, and then through the resistor; likewise the cable sheaths of the various feeders are rigidly grounded at the station, at various manholes through bonds, and more or less through their contact with the duct line, water, etc.

The accompanying diagrams indicate the final scheme of connections. Fig. 1 shows the station 4-wire bus, one 4-wire feeder and the grounding resistor. Fig. 2 shows the station transformer bank, the neutral resistor and its location with respect to the transformer and feeder neutrals. The resistance eventually adopted has a resistance of 0.8 ohms, a value that was found to suffice for limiting the magnitude of current rushes in time of trouble, yet not sufficient to raise to a dangerous value the potential above earth of the transformer or feeder neutrals.

The location of the resistor, as shown, does not affect the current rush when a cable breaks down between phases or between any phase and neutral. But it does limit the current when a failure occurs between phase and cable sheath, hence reduces the damage done to the cable and disturbance caused the system. The effect of this location is to lessen the current rush that previously occurred when an overhead phase wire supplied through an underground conductor fell to ground.

MECHANICAL BLOCKS FOR BLOCKING DIFFERENT TYPES OF OIL SWITCHES.

Forms Employed by Philadelphia Electric Co. to Enforce Safety.

The Philadelphia Electric Co. has spared no effort and thought to make conditions safe for its employes and the public. Many ingenious methods and devices have been evolved by which the hazards of electricity have been reduced so that accidents can be prevented. In the operation of its circuits and machines, the company has adopted several precautions to accomplish the same thing, increasing thereby the factor of safety.

In the manipulation of oil current-breakers the company not only compels tags or cards to be placed,

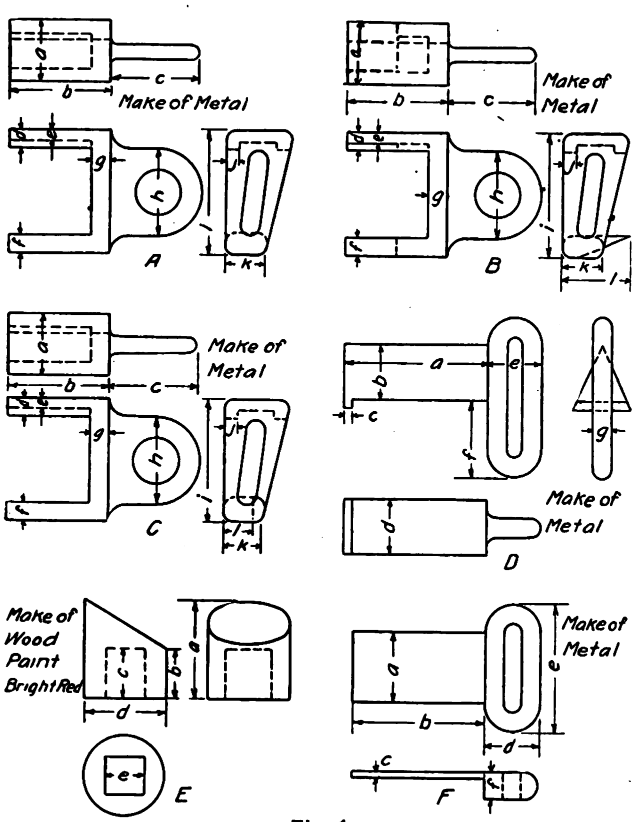


Fig. 1.

stating why and for whom and by whom a circuit-breaker is opened, but it also employs a green light to indicate at the circuit breaker when it is open, in addition to the usual pilot lights on the switchboard. As a further precaution to prevent a circuit-breaker being inadvertently closed, the company uses blocks so that once a circuit breaker is opened it cannot be closed again until these blocks have been deliberately removed. Removing these blocks must be a deliberate act, their design being such that they cannot fall out

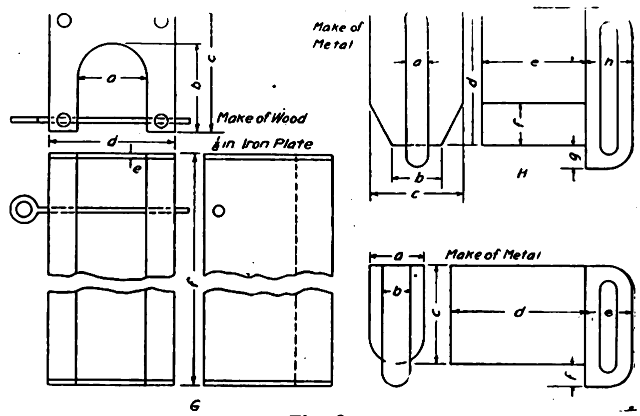


Fig. 2.

of position by vibration, accident, or any other inadvertent cause.

Different types of circuit breakers require different forms of blocks.

Figs. 1 and 2 show the different forms of blocks employed by the Philadelphia Electric Co. The different blocks have been made for the different forms of circuit breakers as shown in the accompanying tabulation:

Block specification.	Type of Circuit-breaker.
A	G. E. Co.'s K5.
B	G. E. Co.'s K5.
C	G. E. Co.'s remote control lever type.
D	G. E. Co.'s K5.
E	Conduit oil switch.
F	Conduit oil switch.
G	G. E. Co.'s H2, H3 and H6.
H	Westinghouse Type B.
I	Westinghouse starting switch.

The above mechanical blocks were described, as were also many other phases of the safety movement as carried on by the Philadelphia Electric Co., in a paper entitled "Tagging, Barriers, Markings and Practices of Operators" presented before a recent meeting of the National Safety Congress at Cleveland by Walter C. Wagner.

WELDING OF CORRODED TRASH RACKS PROVES ECONOMICAL.

Electric Welding Preferred to Other Forms of Welding in Georgia Hydroelectric Plant.

Because of corrosion that had taken place, it became necessary to renew the trash racks protecting seven water turbines at the Morgan Falls hydroelectric plant of the Georgia Railway & Power Co. Altogether seven trash racks required being rebuilt.

The manner of making repairs consisted of cutting off all the corroded bars, in fact all bars, and welding new bars in their place. The welding was done electrically, energy being obtained from the station, of course. The company has found that electric welding is cheaper and less troublesome for work under existing conditions than welding by oxy-acetylene.

Where oxy-acetylene is used, transportation, storage and handling precautions have to be taken which are absent when using electricity.

Contracting-Construction

Suggestions for Marking Fuses — Industrial Lighting Exhibit at Safety Congress — Tennessee Contractors Meet

THE VISUAL MARKING OF FUSES.

Excerpts From a Paper by Thomas H. Day at the Reconstruction Convention of the National Association of Electrical Inspectors.

If necessity is the mother of invention, then the fuses in an electrical installation may be considered as being one of its many children. We cannot consider any phase of applied electricity more important and the evolution of which is fraught with greater interest and more perplexities than the fuses of today.

The final inspection of an installation is frequently made after it is connected to the electric supply and its complete equipment in operation. The inspector is concerned as to the sizes of the several conductors for a given amount of current, and the rated capacity of the fuses installed to protect the conductors and the equipment to which they are connected.

That his final certificate of approval may be accepted as something more than a mere piece of paper, he makes a conscientious effort to examine the visual markings on the fuses. The equipment, power or light, or possibly both, is in use, and to remove each fuse from the cutouts, which he must do so that his inspection may be complete and intelligent, brings a vigorous objection from the manager or superintendent of the plant, building or store, because of the shutdown, even if it be of only short duration.

Difficulty of Reading Fuse Ratings.

This is one of the perplexing experiences of the field, it frequently being impossible for an inspector to quickly ascertain the markings of the rated capacity of fuses. There is no reason for it, but it is nevertheless true that the labels on cartridge fuses of a rated capacity of 30 amperes or less are most frequently on the under side of the fuse when installed. An examination of almost any cabinet will make any one recognize the difficulty of the inspector when he endeavors to ascertain the rated capacity of cartridge fuses.

Emphasis should be laid on the possibility of shock when one is standing on grounded conducting material, or from contact, through the hand and arm, with the side of a metal cabinet which is grounded, in which fuses under examination are installed. The ferrules of some makes of cartridge fuses are secured to the fiber tubing by means of small round-headed pins which project beyond the ferrules. Endeavoring to ascertain the rated capacity of the fuse, the printed label of which was on the under side of the fuse, I have turned the fuse around and, in so doing, have spread the opening between the two clips of the cutout base, thus making a poor contact with the fuse ferrules.

While the personal accident hazard is not so great with the inspection of installed plug fuses, the difficulty in reading the rated capacity with, perhaps, but three exceptions, is readily apparent. Some of the manufacturers are greatly concerned in taking up the greater part of the top of the fuse cup with an announcement of their patent rights, date of granting, etc. This is their legal right, against which it would be unwise to object. The exercise of this right, however, renders it extremely difficult for the inspector to ascertain the rated capacity without removing the fuse from the cutout base. Still, the inspector feels that he should know, while the plant superintendent refuses to have his operations disturbed and instructs the inspector to call after the plant has ceased operations. The temptation to make an incomplete inspection presses down heavily upon the human side of the inspector and who shall blame him if the fuses are not examined.

If I am correct in my analysis of the present requirements for the marking of fuses, there would then seem to be no opportunity for criticising the present practice of the manufacturers. The willingness of the manufacturers to come abreast of the needs of the day is manifest and their present markings on the plug fuses, bewildering as they sometimes are, and the printing of the rated capacity on the required labels of the cartridge fuses, even though the most of the labels are on the under side of the fuses and readable only with an effort, are purely gratuitous on their part, which leads one to think that they would consider any suggestion that would benefit the science and thus assist the inspector.

It is somewhat easy to outline a condition but rather difficult to suggest a remedy. It can hardly be conceived that any one would object to the need of marking fuses with their rated capacity. The opinion is expressed that many desire the marking be such as to make it visual whenever the fuse can be seen. I seriously question the use of small figures stamped on the ferrulese of the cartridge fuses or the printing of the capacity on the labels, because labels do fall off in time.

Color Scheme to Distinguish Capacity of Fuses.

That cartridge fuses of the several rated capacities from 0 to 30 amperes might be readily recognized, the following color scheme is proposed, the color to be permanently applied to the fiber casing when the latter is in the making. These colors might be applied as follows:

0 to 6 amperes, yellow.
8 to 10 amperes, black.
12 to 15 amperes, red.
16 to 20 amperes, brown.
20 to 25 amperes, gray.
25 to 30 amperes, green.

For cartridge fuses from 31 to 60 amperes a similar color scheme could easily be evolved, the difference between terminals indicating that the fuses belonged to the second classification. For cartridge fuses of great capacities there is not the same difficulty of identifying them and the present method of marking would seem adequate.

The color scheme would not work so well with plug fuses, although the vacant center of the top of the fuse could be marked with the selected color for its capacity. In the absence of a color, it is suggested that the rated capacity of the plug fuses appear in large figures in the center of the top, similar to the method adopted by at least three makers of plug fuses.

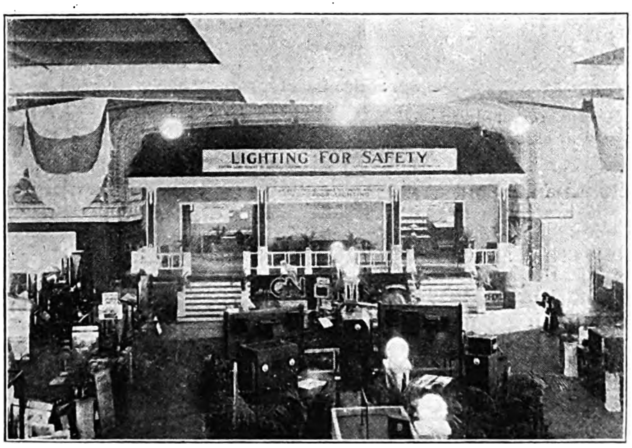
While there is an element of personal accident hazard in examining fuses which are in use, indistinct markings will hardly introduce a fire hazard. Over-fused wires will create a fire hazard but we have not endeavored to contest that fundamental. If we are facing a possible personal accident hazard when examining the fuses in an installation, should it be the function of the standards in the National Electrical Code to reach out and correct such possibility, more especially when it is becoming so difficult for an inspector to separate the two hazards when applying the principles of the Code?

It cannot be claimed that the above will solve the problem completely, but bringing up the subject and suggesting a possible solution may lead to clearing up the situation.

PREVENTING ACCIDENTS WITH GOOD INDUSTRIAL LIGHTING.

Exhibit at Cleveland Meeting of National Safety Congress Shows Value of Good Lighting in the Prevention of Industrial Accidents.

"Twenty-four per cent of 91,000 accidents analyzed by the Travelers Insurance Co. of America have been shown to be directly or indirectly due to inadequate lighting." With these figures in mind, the most prominent space in Grays' Armory, Cleveland, where the National Safety Congress Exhibition was held during the week ending Oct. 4, was set aside for a "lighting for safety" exhibit. This demonstration occupied the entire stage and overlooked all other exhibits on the main floor. It was arranged under the joint auspices



General View of Lighting Exhibit at Cleveland Meeting of National Safety Congress.

of the Edison Lamp Works of General Electric Co. and the National Lamp Works of General Electric Co.

Appreciating the effectiveness of contrasting lighting conditions in bringing out the value of "better lighting," the exhibitors modelled the display after the N. E. L. A. exhibit at Atlantic City earlier in the year, which was described in the July 12 issue of ELECTRICAL REVIEW. Three systems of lighting were installed to show poor lighting, fair lighting and very good lighting. The poor lighting system consisted of bare lamps on drop cords, so commonly found in small shops. The fair lighting system, such as installed

Exhibit of Industrial Lighting Which Showed Contrast Between Good and Poor Lighting.

by the individual who realizes the necessity for better light but who does not know how to get it, consisted of a combination of general illumination and localized lighting using enameled bowl reflectors. The third system of very good lighting consisted of standard RLM dome reflectors equipped with "C" lamps with opal cap diffusers and bowl-frosted lamps, giving general illumination of good quality and productive intensity.

An interior view of the "shop lighting" room is shown in an accompanying illustration. Each lighting system was on a separate circuit with an automatic switching device which alternately connected each system for a short period, thus making an effective contrast and showing to advantage the value of better lighting.

Supplementing this feature on shop lighting was an educational room showing the latest developments in factory, office and home lighting units. Due to its scope, the lighting exhibit created much general interest. It brought before the safety engineers in attendance at the show the fact that good lighting in a shop or factory is very effective in reducing the number of accidents as well as in increasing the productiveness of the workmen.

TENNESSEE ELECTRICAL CONTRACTORS MEET AT MEMPHIS.

With 65 electrical contractors from Tennessee and adjoining states in attendance, the tenth annual convention of the Tennessee Electrical Contractors' Association was opened last week at the Hotel Gayoso, Memphis, with S. P. Watson, president, in the chair.

The convention was addressed by Samuel A. Chase, Westinghouse Electric & Manufacturing Co., on "Modern Practices in Electrical Merchandising"; J. A. Fowler, Memphis, secretary of the association, on "The Electrical Contractor and the Club Plan of Selling"; W. R. Herstein, Memphis, on "The Jobbers' Job," and William L. Goodwin, General Electric Co., on "Live and Let Live."

New Appliances

Sprague Electric Works Brings Out New Line of Dead-Front Panelboards and Cabinets — New Soldering Stick

New Design of Safety Panelboards and Cabinets.

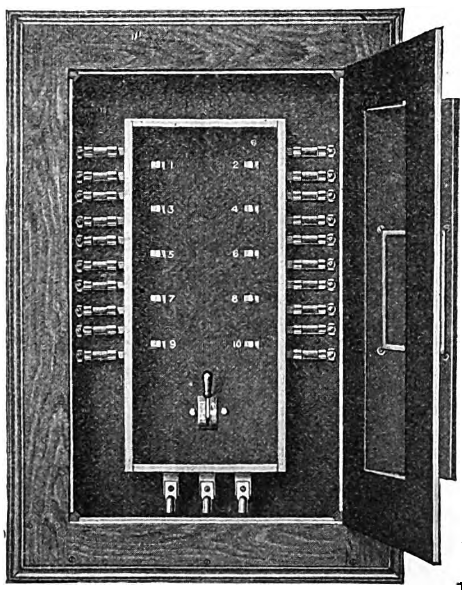
To meet the increasing demand for devices providing for a maximum amount of safety to the operator, the Sprague Electric Works of General Electric Co., 527 West 34th street, New York City, has developed a new line of panelboards which are designed to be applicable wherever the live-front type of panelboards has heretofore been used.

The distinctive features of these panelboards are the branch circuit switches and the main switches, both types of which are simple in design, of strong construction and positive in action. They were designed especially for safety panelboard use. The accompanying illustration shows the type of tumbler switch used for the branch circuits. The blades of these switches make direct contact with the branch connection bars and the brushes of the main switches make direct connection with the main buses, providing a minimum number of electrical joints. The main switches are of the laminated brush contact design, with the toggle locks and with non-retardable, quick-break, double-break action. The brushes are of curved construction, providing a wiping contact when closed, and are designed similar to circuit-breaker brushes. A secondary contact tip and removable control plate is provided for each contact to prevent burning of the main brush. All steel parts used are galvanized to prevent corrosion. The branch circuit switches are rated at 30 amperes, 125 volts, and are of the two-pole tumbler type, with indicating molded handle and of quick-made and quick-break design.

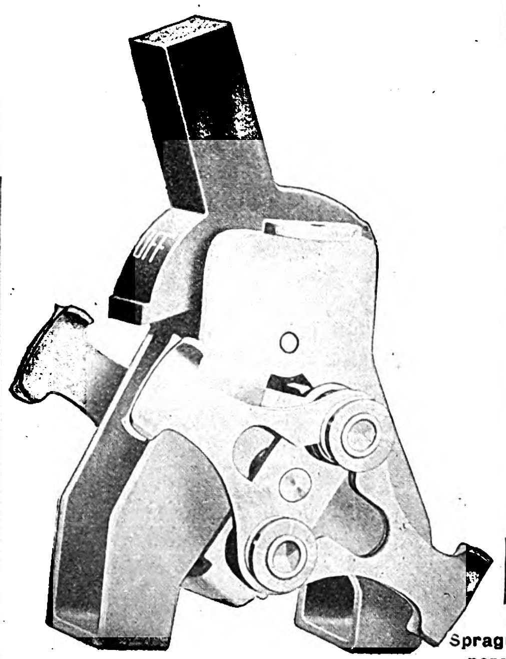
Fuses are placed between the switch and outgoing circuit, and consequently the switch and fuses are dead when the switch is open. The manufacturer also makes this panelboard with plug fuses in branches between the main bars and the branch switches.

Parts which are subject to wear are removable from the front of the panel and can be replaced without adjustment. The panelboards are manufactured to meet the requirements of the National Board of Fire Underwriters.

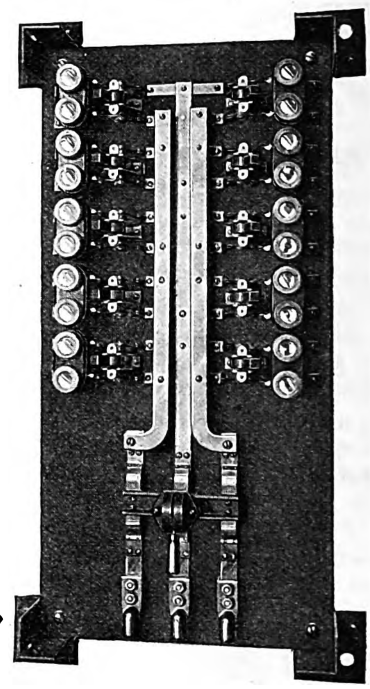
The line of cabinets is made of No. 14 U. S. gage sheet steel with doors and trims of No. 12 gage sheet steel, except boxes over 48 ins. in height which are made of No. 10 gage sheet steel with doors and trims of the same thickness. Doors are furnished with rabbet and substantial flush butt hinges. Doors 48 ins. in height and over have a three-way catch. Cabinets are furnished with one row of ½-in. conduit knockouts, top and bottom, or may be drilled for conduit. Cabinets for panelboards with plug fuses in the branches, with main plugs or unfused main switch, have a single door opening over the entire panel, this door being equipped with a spring catch. Cabinets for panelboards with N. E. C. inclosed fuses in the branches have a door covering the entire panel and a small door hinged on this door to cover the compartment containing the operating handles of branch switches and main switch. The large door is equipped with a combination lock and catch and the small door with a spring catch only. Cabinets for panels with plug fuses in the branches, with main fuses or with fused main switch, have one door equipped with spring catch covering the compartment containing the branch switches, main switch and branch fuses, and a separate door equipped with a combination lock and catch covering the main fuses. Boxes, doors and trims for these cabinets are finished inside and outside with black enamel.



New Type of Sprague Safety Panelboard.



Tumbler Type Switch Used on New Type of Sprague Safety Panelboard.



Sprague Safety Panelboard with 30-Ampere, Tumbler Switches in Branches Arranged for Plug Fuses Outside of Switches.

New Soldering Stick Combines Solder and Flux.

The firm of Hess & Son, 2910 North Sixteenth street, Philadelphia, Pa., has recently developed a new soldering stick known as the Tinol tinning stick. It is a new form of solder and flux combined; when the stick begins to melt it deposits a film of tin which enables the solder to flow freely. This has the advantage of not only fluxing the surface to be soldered, but tinning it as well. This feature enables any one to make a perfect solder joint without previous tinning, it is said.

This new stick can also be used for tinning all kinds of metal surfaces without the use of solder. The flux contained in the stick is of the same composition as that used in the company's other Tinol fluxes and can be used on all metals without any danger of after corrosion, it is claimed.

Trade Activities

Anderson Electric Specialty Co. Extends Facilities—Hurley Machine Conducts Co-operative Campaign for Dealers

Joseph L. Skeldon Engineering Co., Cleveland and Toledo, Ohio, builder of complete steam, electric and hydraulic plants, announces the appointment of W. N. Brown as sales engineer. Mr. Brown will make his headquarters at Cleveland.

McAlear Manufacturing Co., 1901-7 South Western avenue, Chicago, manufacturer of specialties for all steam heating and power plants, is making distribution of a new catalog (No. 25) covering high-grade and modern steam, water and air specialties for high and low pressure heating and power plants. Another catalog on "25 Years of Know How" dealing with vacuum, vapor and air line heating specialties has also been prepared by the company.

The Trumbull Electric Manufacturing Co., Plainville, Conn., announces the appointment of M. L. Spaulding as manager of its Chicago office, 40 South Clinton street. Mr. Spaulding was formerly a member of the sales force of the Chicago office, having left two years ago to accept a position as general sales manager of one of the large electrical supply jobbers in the Middle West. Mr. Spaulding has been in the electrical business for many years and is widely known among the trade of the Middle West.

Change in Name of Universal Battery Service—Considerable confusion among purchasers has been caused through similarity in trade names of the Universal Battery Service Co., adopted by James B. Shafer, Chicago, dealer in automobile storage batteries, and the Universal Battery Co., the name of a previously established Illinois concern. In order that the general public may not be further deceived and misled, the Federal Trade Commission has ordered the former company to discontinue use of the word "universal" in connection with the manufacture or sale of storage batteries.

Alamo Light Plant & Machinery Co., Memphis, Tenn., has been organized for the purchase, sale, manufacture and repair of all kinds of machinery, hardware, specialties, electrical supplies and accessories, and for conducting a general merchandise business in wholesale and retail quantities. Offices and warerooms for distributing electric plants and machinery for store lighting have been opened in the McCall building. The territory of this company will embrace Arkansas, north Mississippi, and middle and west Tennessee. L. E. Curtis, of Calhoun City, Miss., is president and general manager; J. R. Runnels, of Memphis, vice-president, and L. G. Milan, Tupelo, Miss., secretary-treasurer.

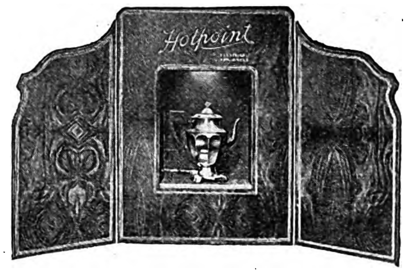
Sherwin-Williams Co., Cleveland, Ohio, has established an Atlanta division in its arrangement of sales territory, with offices at 52 North Broad street, Atlanta, Ga. The new division includes Georgia, Florida, South Carolina and a portion of North Carolina. Warehouses are maintained by the company in both Atlanta and Savannah.

Anderson Electric Specialty Co., Chicago, in order that it may care for its rapidly expanding business, has leased from the Ilg Electric Ventilating Co., the six and seven-story building, 100x100 ft., at 154-160 Whiting street, Chicago, for 15 years from May 1, 1921. The Anderson company had 3000 sq. ft. of space three years ago, and later moved to its present quarters at 118 South Clinton street, which provide 18,000 sq. ft. This space has proved entirely inadequate and has necessitated the leasing of the Ilg plant, which will provide 75,000 sq. ft.

Edison Storage Battery Co., Orange, N. J., has commenced the quarterly publication of a house organ to be known as "The Grid," whose purpose, in the words of the company, is "to disseminate some sense and a little nonsense among users of storage batteries." The initial number, dated October, comprises 25 pages and is gotten up in an attractive manner. A feature of this edition is an interesting article by Ellwood Hendrick, entitled "The Road to Arcad." Item of interest regarding storage batteries are included, interspersed with choice bits of humor.

Allis-Chalmers Manufacturing Co., Milwaukee, Wis., has issued bulletin No. 1104 which has for its subject "Steam Turbine Blading." The design and construction of turbine blading is of prime importance and is a feature to which the Allis-Chalmers organization has devoted much time and thought. Considerable research work has been involved in producing its present efficient and reliable unit, and the manner in which this has been attained is described in detail. It was the aim of the company to devise some means for securing the blades which would largely eliminate the human element and insure uniform accuracy and resulted in its adoption of the swaging method. Further progress has been made in this connection by the Allis-Chalmers Co., which may be briefly summarized as follows: The channel shroud protection, followed by the brazed lacing strip, which it is claimed materially increases the life of the blading; brazing the channel shrouds to the tips of the blades, resulting in blade sections and affording great strength and ability to resist vibration, also the process of casting the foundation rings around the ends of the blades. This, together with its present method of securing channel shrouding to the blades results in a blading construction superior to many. The bulletin is replete with illustrations and present conclusive evidence of the efficiency of the swaging method of blading construction.

Edison Electric Appliance Co., Chicago, advises that in view of the constant need of its distributors for a display which will serve as a more or less permanent background for its window display of appliances, this company will have ready for distribution by Nov. 15 the display illustrated herewith. It consists of a center panel, 23 ins. wide by 30 ins. high, with hinged wing side pieces 15x30 ins.; size over all, 53x30 ins. The center panel has an opening which provides



Window Display for "Hotpoint" Appliances.

a niche with a very substantial floor on which nearly any appliance may be displayed. An ordinary Mazda lamp may be inserted behind the display to illuminate the appliance displayed in the niche. As this company manufactures both the Hotpoint and Edison line of appliances, this display is also available with the name "Edison" shown instead of the name "Hotpoint."

The Hurley Machine Co., Chicago, manufacturer of the well known Thor line of electrical labor-saving devices, is conducting a co-operative advertising campaign for the benefit of its dealers throughout the Middle West. The principal feature of this campaign is a series of advertisements to be run in the attractive rotogravure section of the *Chicago Sunday Tribune*. The first of this series appeared on Oct. 19 and will continue to appear until Dec. 17. Another series of advertisements similar to the *Tribune* also has been prepared for use by dealers of Thor appliances in towns reached by this paper. These are specially arranged to tie in with the former advertisements. Two portfolios, one containing the *Tribune* ads and the other the dealer's advertisements, have been distributed in order that all Thor dealers may have sufficient time to make the necessary arrangements for newspaper space, etc.

Current News

Weekly Record of Construction Activities—Conventions

EASTERN STATES.

Lewiston, Me.—Work has been started upon an additional development at the Deer Rips power station of the Androscoggin Electric Co., which will increase the available horsepower by 2500, making a total development at this plant of approximately 8500 hp. of electrical energy available for the needs of Lewiston and Auburn. The cost of this development will be $200,000.

Belchertown, Mass.—The Commission on Mental Diseases, State House, Boston, has taken bids on miscellaneous contracts in connection with the construction of the local hospital building to be located on the Boston & Maine Railroad. The new institution is estimated to cost $500,000, and large quantities of electrical equipment will be required in connection with its erection. Kendall, Taylor & Co., 93 Federal street, Boston, is architect.

Worcester, Mass. — Worcester Pressed Steel Co. plans the erection of a one-story, 90x150-ft. storage building to be equipped with an electric traveling crane.

Lewiston, N. Y.—Plans are under consideration by the town council for improvements in the electric street-lighting system. Service to be furnished by the Lewiston & Lake Shore Power Co.

New York, N. Y.—Import Sales Co., 27 West 20th street, has filed notice with the secretary of state of a change in its corporate name to the Diamond Electrical Specialties Corp.

New York, N. Y.—Western Electric Co. has completed negotiations for the leasing of the entire second floor of the building at 141-45 West 17th street.

Port Henry, N. Y.—Port Henry Light, Heat & Power Co. is considering plans for the construction of a large local hydroelectric power plant, estimated to cost $150,000. The company has filed notice with the secretary of state of an increase in its capitalization from $150,000 to $350,000.

Salamanca, N. Y.—About $5000 will be expended to extend the electric light system.

Elizabeth, N. J.—In connection with the proposed local plant of the Willys-Overland Corp., to be located at Newark and Frelinghuysen avenues, preliminary plans are being prepared for the construction of a large power plant to be used for general factory operation. The proposed plant will comprise a group of buildings, including main manufacturing structure and assembly works, 4-story, steel and reinforced concrete, about 120x440 ft.; four-story and basement stock building, 320x400 ft., a number of shop buildings, one and two-story, with power plant, as well as other small auxiliary structures. Considerable electrical equipment will also be required throughout the entire works, including motors for individual drive, mechanical equipment, etc. The project is estimated to cost $1,000,000. The company maintains offices at 52 Vanderbilt avenue, New York.

Kearny, N. J.—Ford Motor Co. is having plans prepared for the construction of a one-story brick and steel power and heating plant, about 140x160 ft., at its local assembly works. The structure will cost about $150,000, including equipment installation.

Newark, N. J.—Kaltenbach & Stevens, Inc., has awarded a contract to Frederick Kilgus, Inc., 13 South 6th street, for the erection of a new one-story power plant, about 47x75 ft., at 46-56 Bigelow avenue. Plans have also been arranged for the construction of a garage building on the site, the entire work being estimated to cost $35,000.

Newark, N. J.—In connection with the construction of the proposed laundry plant of the New York Linen Supply & Laundry Co., 232 East 32nd street, New York, to be located on High street, Newark, extending to Summer avenue, considerable new electrical and mechanical equipment will be required. The works will cost about $45,000.

Newark, N. J.—Holophane Co., 340 Madison avenue, New York, has developed plans for extensions in its lighting survey work in different cities of New Jersey. The activities include broad investigations of industrial plants and public buildings, with view to increasing the efficiency of the lighting installation.

Newark, N. J.—Colonial Stamping Co., 63 New Jersey Railroad avenue, has had plans prepared for the construction of a new one-story brick boiler plant addition, about 25x32 ft., to be located at the foot of Brill street. Frederick Nobbe, 142 Market street, is architect for the company.

West Long Branch, N. J.—Western Electric Co. has recently completed negotiations for the leasing of property on Whalepond road, and has started the construction of a large wireless plant, estimated to cost in excess of $400,000.

Cheltenham, Pa.—Town council is understood to have completed arrangements for the installation of an electric street lighting system on the Old York road.

Jenkintown, Pa.—Town council is said to be considering plans for the installation of an electric street lighting system.

Johnstown, Pa.—Penn Public Service Co. will issue $20,000,000 of bonds for improvements. Thus far the construction of a large power house in Johnstown is the only improvement planned, but others will follow soon. The Penn Public Service Co. now furnishes power to Cambria, Somerset, Indiana and Westmoreland counties. Extensions throughout the present districts are contemplated and when these are completed it will make the local company one of the largest in the state. Address General Manager P. J. Morrissey.

North Catasauqua, Pa.—Borough council is considering arrangements for the installation of an electric street lighting system throughout the municipality, power to be furnished by the Lehigh Valley Light & Power Co. It is understood that the plans call for the completion of the work by the middle of December.

Philadelphia, Pa.—City has awarded a contract to the Ames Iron Works, Commercial Trust building, with works at Oswego, N. Y., for the furnishing and installation of four turbocentrifugal pumping units at the Queen Lane pumping station of the city waterworks plant, at $127,390. The new units will have a capacity of 40,000,000 gals. of water per 24 hrs.

Philadelphia, Pa. — Breyer Ice Cream Co. has awarded a contract for the construction of a one-story brick boiler plant, about 49x78 ft., to be located at Eighth and Cadwallader streets. The structure is estimated to cost $10,000. William F. Koelle & Co., 26th and Oxford streets, are the contractors.

Smethport, Pa.—M. S. Geary desires data and prices on small plant for light and power.

Wilmington, Del.—In connection with the construction of the municipal paving plant located on Thatcher street, between 12th street and Brandywine creek, the city has arranged for the immediate installation of the necessary boiler equipment for operation.

Baltimore, Md.—Consolidated Gas, Electric Light & Power Co. has completed plans for alterations and improvements in its buildings at 22-30 South Eutaw street and at 1050-90 Front street.

Federalsburg, Md.—Eastern Shore Gas & Electric Co. has recently completed work on the rebuilding of its lines between Federalsburg and East New Market, changing it from a single-phase to a 3-phase system, to provide for increased operations. The company has arranged for the purcase of property on the state road, near the city limits, and is planning to utilize the site for the construction of a new outdoor substation. In connection with the expansion plans of the company, work is being pushed on the installation of considerable additional equipment at its Hurlock and East New Market stations.

Ocean City, Md.—Charles A. McGregor desires prices on electrical equipment.

Martinsburg, W. Va.—Fire, originating in the boiler and engine plant of the C. H. Whiting Milling Co. works at Shepherdstown, near Martinsburg, completely destroyed the plant, with a total loss estimated at approximately $125,000.

Lenoir, N. C.—Falls Manufacturing Co., Granite Falls, will establish an additional hydroelectric plant. It will be located on Middle Little river, about two miles from Granite Falls. The plan calls for a dam 54 ft. in height, and will cost about $40,000. A two-mile transmission line is to be built to connect with the present line, making the total distance 12 miles and the total cost $65,000. The new plant will generate about 600 hp.

Denmark, S. C.—Edison Public Service Co. contemplates increasing the capacity of its lighting plants.

Atlanta, Ga.—Thomas F. Seitzinger's Sons, operating a local foundry, are considering plans for the rebuilding of their works, including boiler plant, recently destroyed by fire, located at North avenue and Marietta street.

Columbus, Ga.—It is proposed to install at the Goat Rock station of the Columbus Power Co. an 8000-hp. horizontal water wheel with direct connected 6250-kv-a., 500-kw. generator, complete, with penstock, electrically operated headgate and switchboard extension. A new 11,000-volt transmission line will be constructed from Goat Rock to Columbus, about 11 miles. The line is to be insulated and spaced for 33,000 volts. Estimated cost, $358,000. G. F. Harley, constructing superintendent. Stone & Webster Engineering Corp. will be in charge of the work.

Homestead, Fla.—The city plans to enlarge the capacity of its electric light and water plant. An issue of $15,000 has been voted for the purpose.

Tampa, Fla.—Peninsular Telephone Co. will improve the lines at Ybor City and Seminole Heights. Address W. G. Brobein, president.

NORTH CENTRAL STATES.

Berea, Ohio—At the November election the question of issuing $48,000 in bonds for the construction of a municipal light plant will be submitted to vote. Address city clerk.

Chillicothe, Ohio—Plans have been completed by officials of the Chillicothe Railway, Power & Light Co. for extensive improvements to their plant in this city.

Independence, Ohio—At the November election the question of issuing $20,000 in bonds for a municipal light plant will be submitted to vote. Address city clerk.

DATES AHEAD.

Jovian Order. Annual convention, Chicago, Nov. 5 and 6. Headquarters, Hotel Sherman. Acting Mercury, Eli C. Bennett, St. Louis, Mo.

Electrical Supply Jobbers' Association. Semi-annual meeting, Cleveland, Ohio, Nov. 18-20. Headquarters, Hotel Cleveland. Secretary, Franklin Overbagh, 400 South Clinton street, Chicago.

American Society of Mechanical Engineers. Annual meeting, New York City, Dec. 2-5. Secretary, Calvin W. Rice, 29 West 39th street, New York City.

American Institute of Chemical Engineers. Annual meeting, Savannah, Ga., Dec. 3-6. Secretary, J. C. Olsen, Brooklyn, N. Y.

Electric Power Club. Meeting, Hot Springs, Va., Dec. 11, 12 and 13. Headquarters, Homestead Hotel. Secretary, C. H. Roth, 1410 West Adams street, Chicago.

National Council of Lighting Fixture Manufacturers. Annual convention, Detroit, Mich., February, 1920. Secretary-treasurer, Charles H. Hofrichter, Cleveland, Ohio.

National Electric Light Association. Annual convention, Pasadena, Cal., May 18-21, 1920. Headquarters, Hotel Huntington. Acting secretary, S. A. Sewall, 29 West 39th street, New York City.

Minerva, Ohio—Engineers Froelich & Emery, Second National Bank building, Toledo, Ohio, are preparing plans for erecting a $50,000 power plant and distributing station for the village of Minerva. Specifications include brick and concrete construction, plumbing, electric lighting and composition roofing. Address H. A. Pennoth, manager, Minerva, Ohio.

Hillsdale, Mich. — Alamo Farm Light Co., manufacturer of farm lighting outfits, is enlarging its present plant by an addition, 200x240 ft. Contract has been awarded to the Austin Co., Cleveland.

Garrett, Ind.—Important changes in the management and maintenance of the municipal light, water and steam heating plans will be made, following recommendations of the Indiana Public Service Commission. The company will probably purchase new equipment consisting of a boiler and connections, employ a manager with complete authority to operate the plant and place all service on a meter basis.

Wabash, Ind.—Service Motor Truck Co. will begin work at once on a new building, 75x775 ft., to cost $150,000.

Chicago, Ill.—Apex Appliance Co. will erect a two-story plant to cost $135,000.

Chicago, Ill.—Chicago Electric Manufacturing Co., 2811 South Halsted street, will build a two-story plant, 100x133 ft., to cost $60,000. E. S. Preston, president.

Chicago, Ill.—Electric Machinery Equipment Co., 714 West Van Buren street, plans to install a 50 to 75-kw., 440-volt, 60-cycle, 3-phase, direct connected unit.

Jacksonville, Ill.—Jacksonville has voted to issue bonds in the sum of $210,000 to pay off the floating indebtedness, build a filtration plant and remodel the municipal lighting plant.

Peoria, Ill.—Central Union Telephone Co. will erect four-story telephone exchange building to be ready for occupancy July 1, 1920.

Urbana, Ill.—A contract for the installation of two 500-hp. boilers in the new power plant of the University of Illinois has been let to the Laclede-Christy Boiler Co., St. Louis, Mo. Complete installation is expected by Dec. 15. At present the four new boilers are being used in connection with the two old ones in the old power house. When the two new boilers are installed only the new plant will be used. The new boilers will increase the capacity of the plant 50%.

La Crosse, Wis.—Architect J. R. Law, Strand Theater building, Madison, Wis., is preparing plans and will let the contract for erecting a $150,000 power house and office building for the P. Lourland Co., La Crosse, Wis. Specifications include power house equipment, steam heating, plumbing and brick construction. The building will be 50x300 ft.

Osseo, Wis.—Augusta Light & Telephone Co. has taken over the Osseo electric light plant and franchise from J. N. Lee & Son. The new owners will take possession just as soon as the new line can be built from Augusta to Osseo, which will carry light and power from the Wisconsin-Minnesota main line.

Milwaukee, Wis.—Res Manufacturing Co., 2907 Meinecke avenue, is taking bids for a two-story plant addition, 30x75 ft., and is in the market for some new equipment.

Chaska, Minn.—The city council has ordered 3 street lights to be installed on Augusta road. Address J. M. Aretz, city clerk.

Minneapolis, Minn.—The installation of an additional 40,000-hp. steam turbine unit in the Riverside station has been authorized by the board of directors of the Northern States Power Co. The engineering and construction department of H. M. Byllesby & Co. will have charge of the new work.

Montevideo, Minn.—Contract has been secured by the Northern States Power Co. covering the electric energy required for the operation of a grist mill at Sacred Heart, Minn. A 20-hp. motor will be installed at once for feed grinding, and a larger motor will be installed later to operate flour milling machinery.

Red Lake Falls, Minn.—Red River Power Co. will make improvements to the local plant. Specifications include generator, exciter, panel on switchboard and water wheels. Address E. F. Wheeler, manager.

Beatrice, Neb.—Farmers and business men of Rockford, Filley and Virginia have pledged $9000 for the proposed electric line from Holmesville through these three towns.

Plymouth, Neb.—The sum of $21,000 has been raised by business men for a lighting system. The town and local electric company will build a line from Beatrice to this point.

Hankinson, N. D.—H. L. Cotry, of Aberdeen, has completed estimates for a $200,000 light and water system for this town.

Beresford, S. D.—Considerable progress is being made in the construction of a new municipal electric light plant. Poles are being set preparatory to the stringing of wires.

Watertown, S. D.—The city council has authorized the erection of a municipal power plant. Site has been purchased and will be rebuilt for a power plant.

SOUTH CENTRAL STATES.

Louisville, Ky.—Commercial department of the Louisville Gas & Electric Co. during the week ended Oct. 7 secured 62 new electric light and power customers with 43-kw. of lighting and 31 hp. in motors, and took orders for wiring 7 already built houses. New business connected shows an increase of 57 customers with 52 kw. of lighting. There was a temporary loss of 33 hp. in motors. Electric energy output was 12.7% greater than during the same week of 1918. During the week the company and dealers combined sold 79 electric vacuum cleaners, 54 flat irons, 31 washing machines and 54 miscellaneous household appliances.

Carthage, Miss.—Establishment of municipal electric light and light plants is contemplated; Williams & Lebby, engineers, Yazoo City, Miss. Address the mayor.

Pascagoula, Miss. — Pascagoula Street Railway & Power Co. is arranging plans for extensions and improvements in its local light and water plants, to facilitate and increase the present operations.

Broussard, La.—The village has let a contract to A. C. Boyd to furnish a 25-hp. generator for furnishing electric current. The Lafayette Electric Co. will install the wire and erect the poles.

Horatio, Ark.—City council is arranging plans for the installation of an electric light and water works system for municipal service.

Fargo, Okla.—The council contemplates the installation of electric light and water plant. Cost $26,000. Address mayor.

Miami, Okla.—Plans are under consideration by the city council for the installation of an ornamental street lighting system.

Nowata, Okla.—The council will make electric and water work improvements. Burns & McDonell, engineers, Interstate building, Kansas City, have made estimates.

Ochelata, Okla.—An election will be held Nov. 4 to vote on bonds for the building of a water works system and an electric light plant in that city. The water works system will cost about $13,000 and the light plant about $7000.

Sapulpa, Okla.—Sapulpa Electric Co. has closed two-year contract with the Sapulpa Refining Co., covering all its power and light requirements. The connected load is estimated at 225 hp. motors.

Tulsa, Okla.—Oklahoma Gas & Electric Co., Oklahoma City, contemplates the extension of its electric transmission lines from Kiefer to Bixby to Jenks. Estimated cost, $70,000.

Dallas, Tex.—E. P. Turner, of Dallas, and associates plan to construct an interurban electric railway between Ranger and Eastland, as a part of a through line that is planned to run between Dallas and Abilene, about 175 miles.

Dallas, Tex.—Burt C. Blanton, of Dallas, and associates are promoting the construction of an interurban electric railway between Sherman and Whitesboro, with branch line to Gainesville and possibly a number of other towns of North Texas. It is stated that the proposed road is to be financed by Eastern men. The project involves the construction of an electric power station.

Fort Worth, Tex.—Fort Worth Light & Power Co. is installing new boilers and other equipment in its plant at a cost of $135,000.

San Antonio, Tex.—The commissioners court of Bexar county has granted a permit to Lieut.-Col. F. G. Chamberlain, construction quartermaster at Camp Travis, to build a high-tension electric transmission line from San Antonio to Camp Stanley and Leon Springs, 18 miles, for the purpose of supplying these places with light and power.

San Augustine, Tex.—Plans are under consideration by the city council for the purchase of the local electric light plant, to be converted to municipal service. It is understood that extensive improvements and alterations will be made to facilitate operations.

Wichita Falls, Tex.—Wichita Falls Electric Co. will improve the central power station and enlarge the transmission lines. Furnish electric power to Burkburnett district and will purchase engine.

WESTERN STATES.

Livingston, Mont.—Western Power Smelting Co., owning extensively developed copper properties and a 250-ton copper matting plant that is almost completed at Cook county, has commenced the survey of the route for its electric power transmission line, a distance of four miles from its completed power plants to the smelters and mines.

Thermopolis, Wyo.—Hot Springs Light & Power Co. has sold the plant supplying Thermopolis with electricity to M. Singer and B. V. Hole, representing a New York concern. The new owners of the plant will at once reconstruct it, adding machinery required to give better light and power service to Thermopolis.

Seattle, Wash.—A steel pump and power house, 16x64 ft., will be constructed by the Petroleum Co. at 1710 16th avenue.

Richmond, Cal.—Western States Gas & Electric Co. has closed contract with the California Wine Association for 150 hp. in motors for the Fresno Cooperage Co., which is establishing a plant at Richmond to employ about 200 men.

Sespe, Cal.—Sespe Light & Water Co. proposes to develop 35,000 hp. electric energy for irrigating purposes. Address Frank Buren, president.

FOREIGN TRADE

[*Addresses of firms referred to in these trade opportunities may be obtained by writing to the Bureau of Foreign and Domestic Commerce, Washington, D. C., or its branch and local co-operative offices. Request for each opportunity should be on a separate sheet and the file number given.*]

Boiler-House Machinery, Etc. (30,856).—The electrical commissioners of a city in Australia desire to receive quotations and full information for the purchase of boiler-house machinery, including boilers, economizers, etc.; coal and ash handling machinery; coal-mining machinery; turbogenerators; condensing plants; electrical storage batteries; machine tools; traveling cranes, electrical instruments; switch gear; switches and all accessories; synchronous condensers; water turbines for direct coupling to generators; briquetting machinery; gas producers; and coal-pulverizing machinery. Description of machinery and equipment required may be had on application to the bureau or its district offices.

Railway Equipment (30,918).—Material and equipment for a railway to be built in one of the Scandanavian countries, including construction machinery, rails, rolling stock, etc. Locomotive power may be steam or electrical traction (probably the latter). Track and rolling stock will be standard gauge (1.435 meter). Information, description, illustrations, etc., are earnestly desired. Reference.

Electrical Goods (30,932).—An engineer in Italy desires to secure an agency for the sale of mechanical and electrical goods and industrial chemical products. Correspondence may be in English. References.

Power Equipment (30,939).—The English representatives of a worsted spinning firm in Poland desire to purchase scouring, carding, combing, drawing, twisting, and spinning machinery for short and medium wools; also motive power machinery, boilers (Lancashire and tubular for steam raising 240°), engines and turbines for a 2000-hp. plant. This machinery is needed for the reconstruction of mills in devastated regions formerly occupied by the enemy. Reference. Further information may be had upon application to the Bureau or its district offices.

Engineering Supplies (30,964).—A Russian civil engineer desires to represent in Latvia (Lettland) American manufacturers of automobiles, typewriters, elevators, engineering supplies, cement, concrete machines, machine tools, etc. Correspondence may be in English. References.

Motors, Pumps (30,966).—The purchase is desired by a manufacturing company in Belgium of motors, 3 phase, 40 cycles, 220 volts; controllers, starters, resistances, distribution tables, transmission equipment, railroad equipment, narrow gauge (60 centimeters); centrifugal pumps, steel cables, steel balls for grinding, lime and cements, and office equipment and supplies. Quotations should be given c. i. f. Antwerp. Correspondence may be in English.

Electrical Fixtures (30,992).—A firm in Norway desires to secure an agency for the sale of automobiles and supplies, tires, engineering and building supplies and equipment, heating furnaces, electrical fixtures, elevators and hoisting machinery, painting and decorating supplies, and brewing machinery. Quotations should be given c. i. f. Norwegian port. Terms, preferably 90 days. Reference.

PROPOSALS

Street Lighting.—Bids will be received by J. A. Fitzgerald, village clerk, Newburgh Heights, Ohio, on Oct. 28, for the lighting of the streets and public highways within the village, in accordance with plans and specifications on file.

Electric Light Plant.—Bids will be received until Nov. 15 by the town council, Vona, Colo., for installing a waterworks system and electric light plant, to cost about $25,000. R. D. Salisbury, 1415 East Colfax avenue, Denver, engineer.

Boiler.—Bids will be received until Oct. 28 by the Treasury Department, Washington, D. C., for installing a 200-hp. water-tube boiler at the Bureau of Engraving and Printing. J. A. Wetmore, supervising architect.

Generator, Motor.—Bids will be received until Oct. 27 at McRae, Ga., for a 90 or 150-kv-a., 3-phase, 60-cycle, 2300-volt engine type alternating current generator with exciter and switchboard; 35 to 40 hp., 3-phase, 60-cycle, 2200-volt slip ring motor with overload relay panel and ammeter. Plans, etc., may be secured from W. H. Singleton, engineer, 915 Chandler building, Atlanta. C. A. Ryals, mayor.

INCORPORATIONS

New York, N. Y.—Build-Craft Electric Manufacturing Co. Capital, $10,000. To manufacture electrical appliances, etc. Incorporators: C. Kriser, F. Sauozuk, and V. J. Lohn, 25 Church street.

New York, N. Y.—Brooks-Harrington, Inc., Capital, $20,000. To manufacture engines, boilers, and kindred equipment. Incorporators: A. S. Marselis, R. E. Brooks, and W. G. Harrington, 50 Church street.

New York, N. Y.—Atlantic States Electric & Supply Co., Inc. Capital, $10,000. To deal in engines, motors, electrical supplies, etc. Incorporators: B. W. Sandback, W. Poklop, and S. Graham, 108 West 95th street.

New York, N. Y.—Radio Bulb Co. Capital, $25,000. To manufacture electric bulbs, reflectors, and kindred specialties. Incorporators: H. H. Walter, G. Boger, and J. H. Taylor, 644 Eighth avenue.

New York, N. Y.—DeMatteis Boiler System Co. Active capital, $24,000. To manufacture boilers, etc. Incorporators: E. Fasani, A. DeMatteis, and C. L. Zucca, 118 West 49th street.

New York, N. Y.—The Talty Corp. Capital, $50,000. To engage in a general electrical engineering and contracting capacity. Incorporators: J. J. Alexander, I. B. Canfield, and T. W. Burke, 240 Riverside drive.

New York, N. Y.—Solar Light Corp. Incorporated under Delaware laws with a capital of $10,000,000. To manufacture gas arc lights and electric and gas fixtures, etc. Incorporators: Cornelius A. Cole, Hackensack, N. J.; Arthur R. Oakley, and Robert A. Van Voorhis, New York.

New York, N. Y.—Stander-Lindenbaum Co. Capital, $20,000. To manufacture electric and gas fixtures, etc. Incorporators: P. Lindenbaum, and B. and L. E. Stander, 819 Hunts Point avenue, New York.

Syracuse, N. Y.—Onondaga Auto Electric Service, Inc. Capital, $75,000. To manufacture electric apparatus, automobile accessories, etc. Incorporators: W. H. Craig, W. N. Henderson, and J. M. Dunne, 704 Midland avenue.

Newark, N. J.—Newark Armature Works, Inc. Capital, $15,000. To manufacture electrical specialties, etc. Incorporators: Fictor A. Rohner, Adolph W. Sherriff, and James K. Elderkin.

Baltimore, Md.—Thomas Engineering Co., 211 Key Highway, Capital, $50,000. To engage in a general electrical contracting capacity. Incorporators: M. H. White, Thomas W. Thomas, and Irvin Griggs.

Shull's Mill, N. C.—Boone Blowing Rock Light & Power Co. Capital, $50,000. To operate a local plant for the generation and distribution of electric energy. Incorporators: W. S. Whiting, Shull's Mills; and George P. Hageman, Boone.

Allentown, Pa.—C. M. Walter and associates have incorporated the following electric companies, each with a nominal capital of $5000: Allen Township Electric Co., Northampton; Hanover Township Electric Co., Lehigh; East Penn Township Electric Co., Carbon; Mahoning Township Electric Co., Carbon; Mauch Chunk Township Electric Co., Carbon; North Whitehall Township Electric Co., Lehigh; and Washington Township Electric Co., Lehigh.

Hampton, S. C.—Twin City Light & Power Co. has incorporated with a capital of $30,000. Incorporators: R. H. Gibson and others.

New York, N. Y.—F. W. Billet, J. A. Trimble, and R. A. Barton, 2024 80th street, have incorporated the Syracuse X-Ray Laboratories, Inc., the Utica X-Ray Laboratories, Inc., and the Rochester X-Ray Laboratories, Inc., each with a capital of $10,000, to operate X-ray laboratories, etc.

New York, N. Y.—Horace G. Cooke, Inc. Capital, $100,000. To manufacture exhaustors, pumps, blowers, and kindred equipment. Incorporators: B. N. Bishop, G. P. Breckenridge, and H. G. Cooke, 300 West 109th street.

New York, N. Y.—Fox-Reynolds Co., Inc. Capital, $10,000. To engage in a general electrical contracting capacity, etc. Incorporators: F. L. Reynolds, Henry E. Fox, and Samuel F. Frank, 170 Broadway.

Amenia, N. Y.—Amenia Electric Light & Power Co. Capital, $25,000. To operate in Dutchess county. Incorporators: L. F. Eaton, E. J. Chaffee, and E. B. Thompson.

Newark, N. J.—Niola Electric Manufacturing Co. Capital, $50,000. To manufacture electrical goods. Incorporators: Albert Niola, August B. Gutman and Joseph R. MacLear.

Philadelphia, Pa.—Willys Light & Power Co. Incorporated under Delaware laws with a capital of $250,000. To manufacture light and power appliances, etc. Incorporators: David H., Alfred S., and Alfred Harner Miller, all of Philadelphia.

Washington, D. C.—Washington Electric Co. Incorporated under Delaware laws with a capital of $50,000. To manufacture electrical goods. Incorporators: Charles D. Kenny, Harry Kapneck, and Leonard A. Block, Washington.

Norfolk, Va.—Norfolk Electric Manufacturing Co. Capital, $15,000. To manufacture electrical supplies, etc. Joseph E. Johnson is the principal incorporator.

Charleston, W. Va.—Kalmerten-Warner Electric Co. Capital, $10,000. To manufacture electrical goods. Incorporators: J. A. Herman, D. C. Warner, O. W. Kalmerten, J. E. Hanley, I. W. Belcher, and G. E. Warner, Charleston.

Lynchburg Va.—Neld-Electric Corp. Capital, $25,000. To manufacture electrical specialties. Charles B. Easley is the principal incorporator.

East Alton, Ill.—East Alton Public Service Co., has been incorporated with capital of $25,000 by F. W. Olin, J. M. Olin, and J. L. Donnelley.

Ashley, Ind.—Farmers Light & Power Co. has been incorporated for $10,000 to distribute electric light and power. The directors are I. D. Deller, Walter Mortorff and E. Hissong.

Quincy, Ill.—Quincy Battery & Electrical Testing Co. has been incorporated with capital of $10,000 by Milton E. Breder, Albert W. Henry and Bessie M. Henry.

Hammond, Ind.—Hammond Manufacturing Co. has been incorporated with capital of $75,000 to manufacture and construct machinery. The incorporators are Thomas A. Munro, Harry P. Munro and P. J. Foy.

Indianapolis, Ind.—Milholland Machine Co. has been incorporated with capital of $1,200,000 to manufacture machinery of every kind. Address H. T. Benham.

Personals

F. H. Bethell Becomes Vice-President of White Oil Corp. — U. N. Bethell Retires from Business — Other Changes

C. C. WILCOX, assistant to consulting electrical engineer of Hodenpyle, Hardy & Co., Jackson, Mich., is now chief engineer of the Durant Building Corp.

F. W. LEAHY has resigned from the Emergency Fleet Corp. to assume charge of the marine department of the Diamond Power Specialty Co., Detroit, Mich.

CHARLES D. EMMONS, formerly manager of the Northern Indiana Railway Co., South Bend, Ind., has been made president of the United Railways & Electric Companies, Baltimore, Md.

WIRT J. WILLS, who has been connected with the Memphis Artesian Water Department for over 13 years as chairman of the Commission and general superintendent, has resigned, resignation to take effect Nov. 1. Mr. Wills will devote his entire attention to the manufacture of the "Wills Pumping System" of which he is the patentee.

E. W. WAGENSEIL, engineer of the stoker department, Westinghouse Electric & Manufacturing Co., East Pittsburgh, Pa., on October 20 gave a very instructive address on combustion and an illustrated lecture on mechanical stokers as applied to stationary steam boilers, before the mechanical engineer members of the Duluth Engineers' Club.

CURTIS M. LINDSAY, manager of the advertising and sales promotion department, Edison Electric Appliance Co., Chicago, has resigned to join the McGraw-Hill Publishing Co., New York. Mr. Lindsay is a graduate in electrical engineering of Armour Institute of Technology. After several years with the J. G. White Engineering Corporation, he joined the Hotpoint Electric Heating Co., Ontario, Calif., in 1912. Two years ago he came to the Chicago Hotpoint office.

FRANK H. BETHELL, first vice-president of the New York Telephone Co. and active head of the eastern group of telephone companies of the American Telephone & Telegraph Co., has resigned his office to become vice-president in charge of finances of the White Oil Corp., a new combination of oil interests recently formed by a group of New York bankers. Mr. Bethell has been connected with the Bell system since 1890, when he entered the Newark office of the New York & New Jersey Telephone Co. Some years later he removed to New York, serving in the auditing department of the Metropolitan Telephone & Telegraph Co. In 1899 he became a salesman, and from 1901 to 1904 was contract agent for the New York Telephone Co. In 1904 he was made general manager of the Chesapeake & Potomac Co., and held positions with other companies until 1911, when he became vice-president of the New York Telephone Co.

FRANK TALBOT, Danville, Va., superintendent of local public utilities, has been elected city engineer, to succeed J. O. Magruder.

HARRY C. BUFFINGTON, formerly motor engineer, Minneapolis Steel & Machinery Co., Minneapolis, has accepted the position of chief engineer of the Holt Manufacturing Co., Peoria, Ill.

A. H. KEHOE, for the past eight years connected with the United Electric Light & Power Co., New York City, has been appointed superintendent of transmission and distribution of the company.

H. B. BRYDON, of the engineering department of H. M. Byllesby & Co., Chicago, has been appointed a member of the Prime Movers Committee of the Technical and Hydroelectric Section, National Electric Light Association.

CARLETON A. ORR, formerly connected with the Arkansas Valley Railway, Light & Power Co., Pueblo, Colo., in the capacity of superintendent of power plant and shops, has become associated with the Baker Steam Motor Car & Manufacturing Co., Inc., Pueblo, Colo.

THOMAS A. EDISON, West Orange, N. J., visited New York on Oct. 11 to view a bronze tablet placed at 257 Pearl street in 1917 in commemoration of the building of the New York Edison Co. station at that location in 1882, when electric lights were introduced in New York. It is set forth that upon the unveiling of the tablet two years ago, Mr. Edison was too engrossed in war problems to journey to New York, this being Mr. Edison's first visit to the city during this length of time. On the same day, Mr. Edison attended a luncheon held in honor of Cardinal Mercier at the Waldorf-Astoria Hotel.

J. E. MELLETT, commercial engineer, electrical department of the Georgia Railway & Power Co., Atlanta, Ga., has become associated with the Carter Electric Co., Atlanta, Ga., in an executive capacity. His long experience in public service and his previous technical training in electrical engineering eminently qualify Mr. Mellett for his new position with one of the largest wholesalers and retailers of electrical supplies in the South. Previous to joining the Georgia company, he was manager of the Chattanooga office of the Georgia Power Co., prior to which time he was manager of the General Electric Co.'s branch in the same city.

UNION N. BETHEL, who resigned as senior vice-president of the American Telephone & Telegraph Co., has tendered his resignation as chairman of the board of directors. Mr. Bethell contemplated retiring from business life some time ago, but the war and its resultant claims upon telephone service and telephone experts called him to Washington as chairman of the Operating Board for the operation of the telegraph and telephone service under Government control. He was born in Newburgh, Ind., Sept. 12, 1859, and was graduated from Hanover College. He entered the telephone business about thirty years ago, when the telephone was in its early stage of development, and began his career at Brooklyn with the New York & New Jersey Telephone Co. In a short time he was elected secretary and treasurer of that company, and in 1893 was made general manager of the New York Telephone Co. In 1901 Mr. Bethell was made president of the company operating in Washington, Baltimore and surrounding territory, and later became president of the Philadelphia & Eastern Pennsylvania Co. By successive steps he assumed the management of the companies in New York state, New Jersey, Pennsylvania, Delaware and Maryland. In 1909, these companies, with Mr. Bethell at their head, were formed into an operating unit extending from Washington, D. C., to the Canadian border, and from New York as far west as Pittsburgh. In 1910 he was made vice-president of the American Telephone & Telegraph Co, and later became senior vice-president of that company as well as president of the New York Telephone Co. In December of 1911 he was elected chairman of the board of directors of the Bell system. Mr. Bethell is considered one of the world's leading authorities on questions of telephone policy, finance and management. In 1909, he was decorated with the Order of the Rising Sun by the Emperor of Japan for his services to science. N. C. Kingsbury, senior vice-president of the American Telephone & Telegraph Co., succeeds Mr. Bethell as a director and as a member of the executive committee.

Obituary.

CHARLES FRANKLIN SNYDER, for 14 years superintendent of light, heat and power with the Bloomington & Normal Railway & Light Co., passed away recently at the age of 52 years. Mr. Snyder was born near Saybrook, Ill., Jan. 11, 1867. He began his public service career 28 years ago, entering the service of the old Bloomington Light Co. as arc lamp trimmer, and worked up through the various branches of the business and acquired an intimate knowledge of the power house and lines. By reason of his efficient and faithful service he was rapidly promoted from one position to another until his appointment as superintendent of light, heat and power 14 years ago. Coming into daily contact with people in all walks of life for many years past has given him a wide circle of friends and acquaintances who will regret to learn of his untimely death.

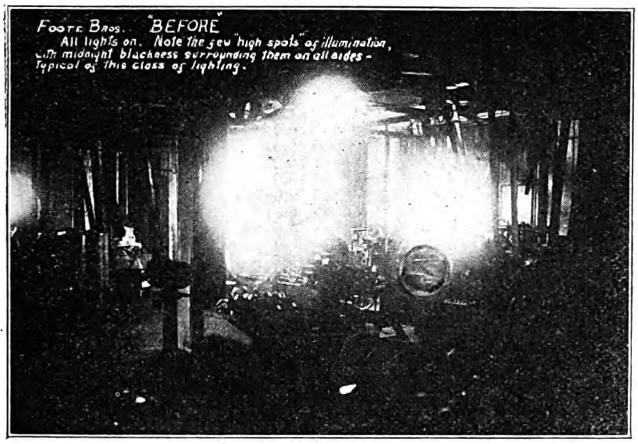
Electrical Review

Vol. 75. No. 18. CHICAGO, NOVEMBER 1, 1919 Three Dollars a Year

Electrical Review

WITH WHICH IS CONSOLIDATED WESTERN ELECTRICIAN AND ELECTROCRAFT

VOL. 75—No. 18. CHICAGO, SATURDAY, NOVEMBER 1, 1919. PAGE 725.



Foote Bros. Gear Works Before Lighting Was Modernized—Note Few "High Spots" With Midnight Darkness Surrounding Them on All Sides.

Foote Bros. Gear Works After Lighting Was Rehabilitated—Milling-Machine Graduations in Plain Sight—No Dense Shadows—All Floor Space Utilized.

Factory Lighting—A Central-Station Problem

Results and Observations of a Year's Campaign for Better Factory Lighting Conducted by Commonwealth Edison Co.—Abstracted from Paper Before Illuminating Engineering Society Convention

By O. R. HOGUE and J. J. KIRK

Head Lighting Agent and Illuminating Engineer, Commonwealth. Edison Co., Chicago.

PROBABLY no other single lighting subject has received as much recent attention from the society at large and from the technical press as has that of factory lighting. It is not the purpose of this paper to go into the technical details of scientific illumination as qualified engineers have fully covered the subject. Our aim is, rather, to indicate the experience of the Commonwealth Edison Co. in an extensive campaign for better industrial lighting.

To the Illuminating Engineering Society is due the credit for first fostering the idea of better lighting in industrial plants. Many years of effort on the part of the society and its individual members have shown tangible results in the adoption of lighting codes by a number of the states. To merely have a code adopted has not been the single aim of the society, but persistent endeavor has been made to have the new codes as they are adopted reflect present practices of good lighting, as is evident from a comparison of the recent codes with the earlier ones.

A great deal of work has been done to educate the several reflector manufacturing companies and central stations to the value of good industrial lighting, but as yet the real object has not been attained—we have failed to carry this educational work to the average plant owner, who in the final analysis has the sole power to improve lighting conditions.

Impetus was given to better lighting by the standardization of lamps by lamp manufacturers, which has been furthered by a combined effort of the lamp manufacturers and reflector manufacturers in the adoption of a standard reflector. This standardization has made it possible for those who are called on to make recommendations to agree on types of equipment and thus avoid confusing the customer by a multiplicity of equipment. The confidence of the customer is thereby inspired and progress, which is dependent upon sales effort, made easier.

The central-station companies in general have been the ones who have failed primarily to "carry on," this failure on their part being due to a lack of appreciation of the value and extent of this business.

To demonstrate what can be done to consistently improve lighting conditions, it is only necessary to compare intensity and other values given in the paper on "Factory Lighting" by O. R. Hogue and A. O. Dicker, presented before this society at the Cleveland convention in 1914, with the values given in this paper.

In Table No. 1 are data on a number of the larger installations made by the Commonwealth Edison Co.

during the past year, which will serve to show the tendency toward improvement in artificial lighting. It will be noted that the average intensities are more than double those in the installations listed in the former paper. Very little local lighting is used and such local lighting in all excepting one case is a remnant of the old lighting and was not recommended by the central-station engineers. Of course we recognize that some local lighting is needed but it is our aim to reduce this to a minimum.

Where local lighting is needed at intervals, it is suggested that wall receptacles be provided and that extension cords be checked in and out of the tool room just like a special tool. In this way the superintendent is given a chance to control its use and to prevent its becoming a permanent part of the lighting arrangement.

To show the value to the central stations, we have included data on income. In every case the new installation resulted in an increased monthly bill although a few were new customers. This is the sort of business that is most profitable in that it adds no cost to metering and billing and but slightly to the cost of service. Since there is always some other lighting or power-consuming device in use, it is difficult to get an accurate figure on income, but the amounts given are the result of careful study of the customers' accounts before and after the new system was installed.

This indicates conclusively that illuminating engineering service not only benefits the customer, but renders his account more profitable to the lighting company.

The accompanying illustrations showing "Before" and "After" photographs of installations which we have made will help to show the change effected by our efforts.

Table No. II shows the business secured during the different months of the year. It will be noted that during those months which have the greatest amount of darkness, the average watts per unit are more than 200, and the average foot-candle intensity was over 6, indicating that industrial lighting is a seasonal business.

If the efforts of the society to promote good practice are to meet with tangible results, they must be supported by active selling campaigns. The central stations, through their present contact with the customer, are in a better position to push industrial lighting than anyone else. It has been the experience of those who have actively engaged in this work that the entire time of men with special illuminating engineering training must be given to the work if any real progress is to be made.

Although the services of our engineers are always available to architects and owners who wish advice as to the lighting of a new building, our field, as always, has been the established institutions with inadequate lighting. On this account we have the primary difficulty of convincing the customer that a change will prove profitable to him, and this requires a large amount of educational work. Next, he must be shown that the installation proposed is not unreasonable and that the company is not merely trying to get a big income at his expense. As a rule, we must convince

TABLE I.

No.	Class of business.	Kind of work.	Supplementary local ltg.	Units 60 w.	Units 200 w.	Units 300 w.	Units 400 or 500 w.	Total kw.	Ft. above floor.	Aver. foot-candles.	Estimated monthly bill for current.	Estimated increase in per cent.
1	Glove mfg.	Bench	No	—	19	—	—	3.8	8½	8.5	$16.50	New
2	Mach. shop	Screw mchy.	No	—	29	—	—	5.8	9	10.0	64.00	New
3	Mach. shop	Mach. and bench	No	—	70	11	—	17.3	9	9.5	85.00	466
4	Boiler shop	Floor	No	—	—	11	—	3.3	12	10.0	18.00	New
5	Mach. shop	Mach. and bench	Some	—	49	—	—	9.8	8	6.0	50.00	400
6	Mach. shop	Mach. and bench	No	—	20	7	2	7.0	8 & 11	11.0	35.00	133
7	Awning mfg.	Cut and sew	Some	—	14	10	—	6.0	8 & 10	6.0	35.00	200
8	Oven mfg.	Floor and bench	Some	—	—	18	—	5.4	10	6.0	22.50	200
9	Tailor shop	Cut and sew	Some	—	12	—	—	2.4	8	10.0	20.00	New
10	Tailor supl.	Table	No	—	—	14	—	4.2	9½	10.0	15.00	New
11	Weighing mchy.	Mach. and bench	Some	—	34	—	—	6.8	8½	6.0	35.00	250
12	Foundry	Floor and bench	No	—	—	—	44	22.0	16	6.0	180.00	New
13	Foundry	Floor and bench	No	—	13	5	—	4.1	11	5.5	15.00	New
14	Cork mfg.	Mach. and bench	No	—	—	14	—	4.2	10½	11.0	10.00	233
15	Furniture	Floor	No	—	27	—	—	5.4	8½	5.5	30.00	New
16	Electrotypes	Mach. and bench	Some	—	57	1	—	11.7	8½	9.5	70.00	366
17	Candy mfg.	Bench	No	—	—	40	—	12.0	10½	6.0	65.00	1200
18	Paper boxes	Mach.	No	—	86	1	—	17.5	8½	8.0	110.00	120
19	Fdy. and mchy.	Floor and bench	No	—	—	—	21	9.9	10 & 14	7.0	75.00	650
20	Iron and steel	Floor and bench	No	—	10	5	2	4.5	8 & 15	6.5	30.00	New
21	Tool mfg.	Mach. and bench	Some	—	—	55	—	16.5	10	9.0	100.00	300
22	Elec. controller	Mach. and bench	No	—	32	8	—	8.8	9	6.0	30.00	500
23	Wagons and autos.	Floor and bench	No	—	16	—	—	3.2	9	5.0	18.00	46
24	Auto bodies	Floor and bench	No	—	—	27	—	8.1	10	12.0	60.00	300
25	Motor trucks	Mach. and bench	Some	10	28	—	—	7.2	9	8.0	40.00	166

TABLE II.

Month.	No. of units 200 w. or less.	No. of units 300 w.	No. of units 400 and 500 w.	No. of units on rental basis.	No. of units on sale basis.	Total units.	Average watts per unit.	Total kw. connected.	Estimated monthly current cost.	Minimum foot-candles.	Maximum foot-candles.	Average foot-candles.	Average burning hours.
August	296	44	14	140	214	354	192	68.22	$ 245.35	3.0	9.0	5.1	4.5
September	601	54	7	340	322	662	192	127.00	687.30	2.0	12.5	6.4	5.3
October	850	134	2	789	197	986	191	188.73	985.10	3.0	15.0	6.3	4.7
November	691	138	15	475	369	844	214	181.06	876.17	3.0	12.0	6.6	5.0
December	592	73	61	515	211	726	210	152.11	943.00	4.0	15.0	6.7	5.2
January	1,033	146	42	786	435	1,221	228	278.30	1,634.00	3.0	11.0	6.0	6.0
February	644	123	5	642	130	772	207	159.50	932.00	3.0	14.0	6.1	6.0
March	573	59	11	594	49	643	204	131.20	730.25	4.0	10.0	6.0	5.0
April	846	85	8	572	357	939	213	200.30	1,285.17	3.0	12.0	5.9	5.1
May	655	50	0	472	233	705	191	134.68	902.78	3.0	18.0	5.9	4.8
June	958	28	0	347	639	986	212	210.80	1,078.68	3.0	11.0	4.9	4.7
July	801	40	0	709	133	842	180	128.30	667.16	3.0	13.0	3.7	4.0

him that the drop cord is poor economy for general lighting. Then, having sold the idea and the layout, we come to the task of selling the installation, and in this we often fail, for the small contractor, uncertain of his costs at best and willing to hold profits to a minimum to keep his men working, is very likely to underbid us. However, as we furnish blueprints and specifications for each job, if the installation is made along the lines of our recommendations, we do not count the labor lost, for we have made a convert to good lighting and incidentally added a good load to our lines.

One sales point which we have found very effective and which may prove of value to someone is the figuring of the installation down to unit costs. The total price for the job or for the operation of the proposed system may be high enough to discourage the prospect but if it is figured on a basis of cost per square foot and compared with his rental charge, or as cost per employe per month and compared with the payroll, it assumes relatively minor importance.

Our rental and maintenance proposition for factory lighting has met with very gratifying results, appealing to the large as well as to the small plant. In this connection we feel that the maintenance is of great importance. Not only do we give the customer a good installation, but we keep it efficient during the two-year period of the contract and after that we aim to continue maintenance even though the equipment then belongs to the customer.

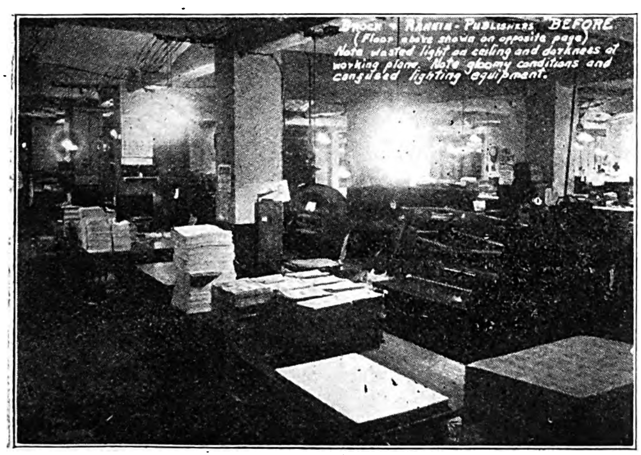
It has been found by experience that regular cleaning periods must be established, the frequency depending upon the character of the factory or shop, but in no case exceeding 30 days. Since this company uses a lock socket on all its equipment, it has complete control of the lamps, and after the equipment is turned over to the customer he is in a position to place the maintenance in the hands of one man, who should have entire charge of lamp renewals. This method not only prevents the theft of lamps, but also prevents the misuse of equipment by the installation of lamps of wrong size.

In order to raise the standard of lighting and induce plant owners to install systems with high intensities, it was necessary that we have data in the way of actual figures. With this end in view we selected a number of industrial plants where accurate cost records were kept and obtained permission to make a test. First a month's run was made with the old lighting system in use. Then a complete lighting system was laid out and installed by and at the expense of the company, and another month's test made. Finally, with a return to the original conditions, a third month's test was made. The results obtained were highly gratifying and in every case the customer was anxious to retain the new installation. In a number of cases we were not even permitted to go back to the old lighting for the third month's test, for the customer realized that it would mean actual financial loss to him. In making these installations we used so-called triple intensities; that is, about three times the intensity ordinarily recommended, and although few installations are now made with that high a standard, still the average illumination intensity has been very materially raised.

The figures in Table III show the advantage obtained by increasing from the ordinary low standard to a moderate intensity, and also the still further advantage of increasing to a real production intensity. With such facts before us, it seems certain that in productive intensities we have the greatest possibility of service to industry and wide adoption of such intensities is only a matter of getting the truth before the responsible executives.

TABLE III.

Class of business.	Old installation. Equipment.	Watts per sq. ft.	Foot-candles.	New installation. Equipment.	Watts per sq. ft.	Foot-candles.	Average increase in % production.	Total cost in % of payroll.
Iron pulley finishing shop.	Drop cords. 60-w. lamps. Bare or tin shaded.	0.27	0.2	200-w.-C. Reflectocap units..	1.90	4.8	20	5.5
Soft metal bearing machine shop.	25 100-w.-B. deep bowl reflectors.	1.00	4.6	25 200-w.-C. deep bowl reflectors	2.00	12.7	15	...
Heavy steel machine shop.	13 100-w.-C. 23" eye-shield units.	0.60	3.0	13 300-w.-C. in same units....	1.70	11.7	10	1.2
Carburetor assembling shop.	84 40-w.-B., 2 100-w.-C., 14 40-w. drops.	1.00	2.1	19 300-w.-C., 10 200-w.-C. eye-shield units.	1.90	12.5	12	0.9



Brock & Rankin's Bindery Before Lighting Was Brought Up to Date—Note Variety of Lighting Equipment, Dense Shadows and Inferior Lighting Effect.

Brock & Rankin's Bindery After Lighting Was Overhauled—High Intensity and Good Distribution of Illumination With Minimum Number of Units.

Central-Station Rates in Theory and Practice

Seventeenth Article—Rates Based on Demand—Flat Rates for Display Lighting and Small Consumers—Advantages of Flat Rate—Theory of Rates Based on Energy and Demand

By H. E. EISENMENGER

This article is the seventeenth of a series which began in the issue of July 12. The first seven articles dealt with the cost of central-station service and formed Part I of the series. Part II comprised six articles on the general policy governing the selection of a rate system. Part III, of which this is the fourth article, discusses the various systems of rates in use; there will be two more articles in this part. Parts IV to VI will treat of rate analysis, accuracy of rates and rate regulation by commissions. The articles will continue weekly until the last issue of the volume (Dec. 27).

PART III—SYSTEMS OF CHARGING—Continued.

II. The Various Types of Rates—(Continued).

C. Rates Based on Demand Only.

1. *Nomenclature.*

SECTION 126. Rates which are based on the demand only of the customer (in watts, kilowatts or some other unit or substitute) are called flat demand rates or simply flat rates.[1] The customer is charged simply in accordance with his maximum demand in watts, kilowatts, etc., and no explicit charge is made for the energy consumption in kilowatt-hours. The latter may be more or less strictly defined by the maximum demand, as in the case of display lighting (see later), or it may be only loosely connected with the maximum demand, as in some cases of residence lighting.

2. *Types of Service for Which Flat Demand Rates Are Used.*

a. Flat Demand Rates for Display Lighting, Etc.

127. The flat demand rate adapts itself most naturally to display lighting service, that is, advertising signs, outline lighting, store windows, etc. This kind of lighting is in use during a certain definite number of hours every day or month, either with all the lamps burning all the time or a certain prearranged percentage of the total capacity burning on the average (flashing signs). The number of kilowatt-hours per year (or per average month) is therefore, with a given kind of sign and use of the sign, proportional to the capacity of the sign, that is, to the maximum demand, and the energy charges can be most naturally averaged into the demand charges, thus doing away with the necessity of employing a meter.

Not infrequently the electric light company furnishes a patrol service for lighting and extinguishing the sign lights at the correct prearranged time. The lapms are, of course, lighted at dusk and they are extinguished usually at 11 o'clock, at midnight or at dawn, as local conditions warrant or the customer desires. The charges for this patrol service are then included in the flat rate charges.

The ways in which the payments are made to depend on, and vary with, the maximum demand are very diversified. One group of rate schedules makes the charges proportional to the capacity of the sign in watts. We may have then what might be called a straight demand flat rate, in analogy with the straight meter rate[2], usually with a minimum charge. Or the rate may be framed as a block demand rate, in analogy with the block meter rate[3]. An explicit customer charge may also occur[4].

Another group of display lighting schedules make the charges depend not directly on the number of watts connected, but they charge a certain specified amount for every standard size of lamp. This is not quite the same, if the charges per lamp are not exactly proportional to the wattage of the lamp. The charges

[1] In England the term "flat rate" is used to designate straight meter rates.

[2] Erie Pa.: 1.5 cents per watt connected, with minimum charge of 75 cents. East St. Louis: 0.85 cents per watt connected, with minimum charge of $3. Both rates are charges per month for lights burning from dusk to midnight.

[2] St. Joseph, Mo.:
8 cents per 10-watt lamp, first 100 lamps
7 cents per 10-watt lamp, next 100 lamps } from dusk to 11 p. m.
6 cents per 10-watt lamp, excess lamps
For another example see footnote 6 (Macon, Ga.).

[4] Rockford, Ill. (optional): Customer charge $12 per year added to the demand charge of
$ 5 per year per 25-watt Mazda lamp
$ 8 per year per 40-watt Mazda lamp
$12 per year per 60-watt Mazda lamp
$20 per year per 100-watt Mazda lamp
$30 per year per 150-watt Mazda lamp
$50 per year per 250-watt Mazda lamp
As the demand charges are strictly proportional to the wattages of the lamps, this rate is the equivalent of a straight demand rate with a customer charge superimposed.

[5] Peoria, Ill.:

Size of Lamp, Watts.	Cents per Lamp per Month. Dusk to 11 p. m.	Cents per Lamp per Month. Dusk to midnight.
5	5.1	6
10	8.5	10
20	17	20
25	21.25	25
30	25.5	30
40	34	40
60	51	60

This is a straight demand rate with exception of the 5-watt lamps where the charge per watt is greater than with the rest of the lamps.

South Bend, Ind.:

Size of Lamp, Watts.	Cents per Week.	Equals Cents per Watt per Week.
2.5	2.5	1
5	3	0.6
10	5	0.5
15	7.5	0.5
20	10	0.5
25	12.5	0.5
40	18	0.45
60	25	0.42
100	40	0.40
150	50	0.33
250	80	0.32
500	150	0.30

Minimum charge 25 cents per week. Here, as the last column shows, the charges per watt decrease pretty regularly from 1 cent per watt per week down to 0.3 cent per watt per week.

per watt of lamp capacity are generally smaller for the larger lamps than for the smaller ones.[5] This deviation from strict proportionality is occasioned by the fact that the charges in these cases include the renewals of burnt-out lamps. The price of a large lamp per watt is smaller than that of a small one, whereas the cost of labor for renewing the lamp is independent of the wattage of the lamp and this labor cost is by no means small on roof signs, etc. Moreover, the signs with the larger lamps are on the average the signs of greater total capacity and their users are therefore the larger consumers.

Some central stations diversify their flat rate schedules for display lighting according to the time during which the sign is being used, or, since all signs are lighted at dusk, according to the time when the sign is extinguished.[6]

The charges are generally figured per month, but occasionally display lighting schedules can be found which charge per year[7] or per week.[8]

In a few instances flashers on the signs are quoted in the schedules as bringing about a reduction of the charges.[9] From the theoretical point of view this is correct as it reduces not only the energy consumption of the sign but also the kilowatt demand on the central station and its lines on account of the diversity between a number of flashing signs. This means that the period of lighting of the sign will coincide with the period of darkness of some other sign, so that the total demand of all the flashing signs is smaller than the sum of the maximum demands of the individual signs in the ratio of the periods of darkness to the total time the flasher is connected, that is in the ratio of the energy consumption saved by flashing.

The great majority of electric light companies which have special schedules for display and sign lighting employ flat demand rates for that purpose.[10]

There are some other kinds of service which share the characteristic of the display and sign lighting service inasmuch as the number of burning hours per month can be predicted with a fair degree of accuracy from the size of the installation, so that for a given demand the monthly or yearly energy consumption is fairly well known without employing a meter. These services are chiefly commercial lighting[11] (stores) and all-night porch lighting.[12] The employment of flat demand rates based on the rated capacity of the installation is, however, by no means as general for these purposes as it is for display lighting; on the contrary, it is rather the exception than the rule.

b. Flat Demand Rates for Small Customers.

128. Flat demand rate schedules are used also for the service of residences, small stores, etc. Whereas with the display lighting customers, treated in the preceding Section 127, the advisability of the flat-rate lighting schedule is based on the fact that for every consumer the energy consumption is practically proportional to the maximum demand, no such statement can be made for the small customers, such as residences, etc. The energy consumption of various residence consumers with the same maximum demand may indeed vary within rather wide limits. The reasons which recommend the employment of a flat demand rate for small residences and stores are entirely different from what we saw in the case of display lighting.

The chief reason is the large reduction of the "customer cost" which can be effected by the flat demand rate through elimination of the customer's individual meter. From what has been previously explained (Sections 54-55) about the "customer cost," it is obvious that a large part of the "customer cost" consists of the expenses incidental to the meter, that is, capital charges on the meter, meter reading, meter maintenance, computing of the bills, etc., and this is eliminated by using a flat demand rate. Now the customer cost, as stated in Section 56, has the order of magnitude of 50 cents or one dollar per month per customer and therefore constitutes a large part of the total cost of serving a small customer. Consequently, if we are able to reduce the "customer cost" of the small customer, we will reduce the total cost of that customer's service in a proportion which is not much smaller than the percentage reduction of the customer cost. Therefore the charges to the small customer for a certain service can be made lower under a flat demand rate than under a meter rate, even though the profit to the company is not reduced or possibly even enhanced as compared to the profit from the same service if furnished under a meter rate. It has been shown before (Section 97) that cheapness of the service to the small customer is essential since money is of greater value to those customers as a class.

In addition to the cheapening of the service for the reasons just discussed, the flat demand rate permits of simplification in the office work of the company for the small flat-rate customers, especially if certain wattages are standardized for the capacity of flat-demand-rate installations to the exclusion of all

---

[6] Macon, Ga.:

Watts Connected.	Cents per Watt Connected. Burning till midnight.	Burning all night.
First 500	1.8	3.3
Next 500	1.4	2.5
Next 1000	1.1	2.0
Next 2000	1.0	1.8
Excess	0.9	1.6

See also footnote 5 (Peoria, Ill.).

[7] See for instance footnote 4 (Rockford, Ill.).

[8] See for instance footnote 5 (South Bend, Ind.).

[9] Topeka, Kans.: 5.5 cents per 5-watt Mazda lamp instead of 6 cents; Birmingham, Ala., states that a flasher discount is made in proportion to the current saved, usually about 40%.

[10] Among the few exceptions to this rule are the following: New York City (three of the companies operating in the territory); Rockford, Ill., (one of the optional display lighting rates); Sacramento, Cal., (Pacific Gas & Electric Co.). All of these employ straight meter rates for that purpose. Birmingham, Ala., has a step meter rate for display lighting, in which the lower kilowatt-hour charge takes place not after a certain energy consumption has been reached but after the connected load exceeds 3000 watts. Muskogee, Okla., has a block meter rate for display lighting.

[11] Commercial Lighting, Pueblo, Colo.:

Hours per Night.	Price per 100 Watts per Month.
6	$1.00
8	1.15
10	1.25
12	1.35
14	1.45
16	1.55

The company reserves the right to set check meters and to bill the excess at 5 cents per kw-hr.

Flat Rate Commercial, Canton, Ohio:

Tungsten Lamps.	Daily Use in Hours. 6	10	15
250-watt	$2.50	$3.30	$4.00
150-watt	1.75	2.00	2.50
100-watt	1.10	1.30	1.60
60-watt	.75	.85	1.00
40-watt	.50	.60	.75

[12] Flat Rate for Porch and Hall Lighting, Waterbury, Mass.:

$1 per 10-watt lamp per month.

Porch and hall lights, being intended as all-night lights for protection against burglars, etc., should be charged at lower rates—reduced per kilowatt-hour—than the ordinary residence lamps because otherwise no customer would avail himself of that rate and that kind of lamps would be burned under the ordinary residence rate, if at all. The electric light company can afford to give cheaper rates—reduced per kilowatt-hour—for that kind of service not only on the basis of the value-of-service principle but also because the cost per kilowatt-hour is lower on account of the good load-factor. A kilowatt-hour consumed in the regular residential lamps will be largely used during the peak hours of the central station, whereas if consumed in an all-night porch light the largest part of the energy will be demanded at off-peak hours. On the other hand, the cost will be enhanced by the cost of inspection, or in the absence of these, by the use—fraudulent or otherwise—of larger lamps than contracted for by some of the customers.

other wattages. Thus, for instance, it might be stipulated that the maximum demand of every flat-rate installation must be rated at a multiple of 25 watts between the limits of 75 and 300 watts. This would mean that the customer has ten different standard wattages to choose from if he wants to be served under the flat demand rate. Then we might have ten different sets of bills, receipts, etc., printed, each with the correct amount imprinted, thus saving clerical work.

The simplification can be carried to such an extent that neither bills nor collectors are sent out to the flat-rate customer. The flat-rate customer is required to take care himself that his monthly or quarterly payments reach the company before a certain day of the month (or quarter) without waiting for a bill as the other customers.[13] Payments can be made at the company's offices or at the agencies appointed by the company all over the city.

Finally the company's dealing with individual consumers on the company's books in the monthly routine work can be eliminated altogether, as far as the small flat-rate customers are concerned. This is done by assigning to each flat-rate customer an identification number within a group. Each group comprises all customers whose demand amounts to a certain one of the standardized numbers of watts (see above). Each customer of a certain group has then to pay the same amount per month as every other customer of the same group. The electric light company then deals only with the entire groups of customers on the company's books, at least in the regular course of operations, that is, if the customers pay regularly, or do not change their contracts, etc. Those customers who do not pay in time or who change their contract, etc., must of course always be singled out and dealt with individually, which causes extra expense; but even there the schedule could be framed in such a way that the customers who require individual dealing are charged a little additional fee in that month to cover the extra expenses.

These simplifications with their incidental cheapening of the service are not used as much in this country as they might be and as they are in Europe.[14]

Another advantage of the flat demand rate for small customers is the possibility of exactly and definitely foretelling to the prospective customer what amount he will have to pay every month for the lighting of his home with a given installation. This makes it easier to induce these small customers to try electric service than where they are to be served on a meter basis and where therefore no definite promise can be made as to the cost of the service.[15]

129. Nothing has been said so far about the method of determination of the customer's maximum demand for the residential flat demand rate. Simply using the number of the sockets connected for a basis and leaving it to the discretion of the customer what size of lamps he wishes to use would be too inaccurate for a flat rate; this method is at present nowhere employed for a flat rate in this country as far as the writer is aware. Using the connected load in watts as a basis for charging the residential customers, as in case of display lighting has also certain disadvantages. Whereas in case of display lighting the illicit exchange of lamps by the customer for larger ones or the unauthorized installation of additional lamps would be easily detected by an observer on the street, frequent surprise inspections would be necessary in case of residential consumers to be safe against unauthorized increases of the customer's wattage, whether fraudulent or unintentionally. These inspections would be, to say the least, cumbersome, costly, and inefficient, and would frustrate the object of the flat demand rate, viz., to make the cost of service low.

Special sockets into which the ordinary lamps would not fit have been tried, the lamps for these sockets which are not obtainable on the market being furnished by the electric light company. The disadvantages of this system are so great that to the writer's knowledge this method is no longer in use anywhere. In the first place dealers cannot easily be prevented from eventually selling lamps with bases to fit into these special sockets and in the second place lamp sockets have been standardized during recent years with an expense of work and money much greater than the outsider would suspect, so that every attempt to introduce nonstandard sockets nowadays means a step backwards.

Similar considerations apply to the use of low-voltage lamps (for instance 55 volts) for residential flat-rate customers to prevent the customers from buying higher wattage lamps and inserting them into the sockets. Strenuous and successful co-operative efforts are being made at present by the electrical industry to exclude all but a very few standard voltages (110, 115, and 120 volts) in order to reduce the cost of production.[16]

Monthly measurements of the actual maximum demand would bring accurate results, but they would necessitate just what we want to avoid with the introduction of the flat rate—the installation of expensive measuring instruments for every consumer which necessitate periodic reading, etc.

130. The best method is to prevent the small flat-rate consumer by automatic devices from using a larger wattage than he has contracted for. This is done by the use of an inexpensive instrument called "demand limiter" or "current limiter" or sometimes, though not quite as accurately, "demand indicator." As soon as the customer at any time switches on a larger wattage than he is allowed under his contract, that is, as soon as he uses a current in excess of what he has paid for, this instrument, which is connected in series with his entire installation, will rythmically break and make the circuit until the excess current is turned off again. The current is broken about 20 to 300 times a minute according to the make of the instrument. This causes a very disagreeable flicker of all the lights in the entire installation which warns the customer that he has—intentionally or otherwise—

[13] It is even feasible to require that these payments be made in advance, since their amounts are definitely known in advance. Losses from bad debts and expenses for collecting back payments can thus be restricted. The principle of prompt-payment discounts or delayed-payment penalties, respectively, (Section 110) can as readily be applied to the flat rate as to the meter rate.

[14] See also S. E. Doane: "The Successful Handling of the Small Consumer in Europe," Proceedings of the National Electric Light Association, 1914, also reprinted in Electrical World, May 23, 1914.

[15] As to the good results obtained by flat demand rates for soliciting the small consumer, see Earl A. Whitmore: "The Value of the Poor Man's Business," Electrical World, Jan. 22, 1916.

[16] Only very few examples of flat residence rates on the basis of the connected load could be found by the author. Dallas, Tex., charges per month:

$0.60 per 16-cp. lamp for 3 to 5 lights.
$0.50 per 16-cp. lamp for 6 to 8 lights.
$0.40 per 16-cp. lamp for 9 to 12 lights.
.... etc. ....

All the other instances found (three in number) are close together, in Connecticut, and apply to the use of low-voltage (55-volt) lamps, for instance: Hartford, Conn.: $1 per month for ten 10-cp. low-voltage tungsten lamps, 6 cents for each additional lamp; $1.50 for ten 20-cp. tungsten lamps, 12 cents for each additional lamp.

exceeded his allowance and which most effectively induces him to shut off the excess wattage. This kind of flat demand rate is sometimes called the "controlled flat rate."

This instrument acts on the principle of an ordinary electric bell. It is so adjusted that it does not work unless the current passing through it exceeds a certain amount, namely the equivalent of the wattage for which the customer has contracted. These instruments require no periodic inspection as the meter and they are much simpler in construction and therefore cheaper than the meter.

The customer may now have installed as many and as large lamps as he chooses, but he never can burn a larger wattage at any time than what the current limiter allows to pass, that is, what the customer's contract permits. The greater, however, the ratio is of the installed capacity to the contracted maximum demand the oftener the current limiter will come into action and this, of course, means annoyance and dissatisfaction to the customer. If, for instance, a customer sits downstairs in his home reading and his daughter turns on the light in her own room at a time when the entire contracted demand is being used, all the lights in the entire house will begin to flicker and thereby cause a certain amount of inconvenience. It is but human that the customer does then not blame himself for not having contracted enough wattage to cover his needs but that he curses the electric light in general and the electric light company in particular. Such a thing never had happened to him before he had electric light. To avoid this it seems good policy on the part of the electric light company to make a rule in the flat-rate schedule that a customer must contract for the entire wattage of his installation or at least for a certain stipulated minimum percentage of that wattage.[17] If the lights then begin to flicker it is a warning to the consumer that he has violated his agreement and it is brought home to him forcibly that he is doing something wrong so that he is the one to blame and not the electric light company.

The "controlled flat rate" is especially suited for the man of small means and by turning a large number of individuals into satisfied customers it contributes towards strengthening the good-will of the public towards the electric light company.[18]

D. Rates Based on Both Energy Consumption and Demand.

1. *Introduction.*

131. Since the cost of service to a certain customer depends, as we have seen, about as much on the energy consumption as on the maximum demand, a rate which contains these two elements will in general be more accurate than any rate which contains only one of these two elements; that is, the unintentional deviations of the charges from the cost (plus a fixed percentage of profit) can be avoided more effectively. (This will be explained in Part V, "Accuracy of Rates," Section 171). The charges from the two elements of energy consumption and demand may or may not be combined with a customer charge and in this manner we get either three-charge or two-charge rate systems under this heading.

2. *Determination of the Demand.*

a. Theory and General Remarks.

132. As shown in the theoretical part of this series of articles (Sections 27-29 and Insert VI), the exact evaluation of that portion of the central station's capacity which is determinative for the demand cost of a certain customer is so complicated an undertaking that an attempt to introduce it into general practice without far-reaching approximations would be hopeless.

The first step of approximation towards practical determination of the portion of the central station's capacity just mentioned and with that towards determination of the customer's demand cost and demand charge is the assumption that the demand cost is proportioned to the peak responsibility, that is, to the kilowatt load which the customer draws from the central station at the time of the peak-load of the latter, assuming as peak-load time of the central station not an instant, but a certain short interval of one or several minutes or hours duration. This latter assumption is necessary not only for practical reasons, inasmuch as the top of the central station's load curve is too flat to permit of pointing out one definite second of the year as bringing a heavier load on the central station than any other second of the year, but theoretical considerations prove it to be correct so that we would use it even if our measuring instruments were accurate enough to determine just at what second the absolute maximum of the central station has occurred. It has been shown in Insert VI that, whereas the customer's load at every single moment of time has a certain influence on the customer's demand cost, the influence of the customer's load is practically imperceptible during those moments of time when the central station's load, expressed in percentages of the central station's peak load, is not large. On the other hand, during those elements of time when the central station's load is near 100% of the central station's peak load the influence of the customer's load is paramount, so that these latter moments of time can be exclusively considered. But the decrease in the importance is a steady though rapid one as we go from the 100% limit downwards; in other words, the influence of the moment with the central station's real peak load (100%) is not of a greater *order of magnitude* than that of a moment with 99.9% or 99% load,[19] etc., and there are no *abrupt* changes in the degree of influence as we go down the scale of percentages on a continuous load curve.

We have therefore to take the customer's demand during a certain interval of time when the loads are near 100% and, as the customer's demand will in general vary during that interval, we will have to take

---

[17] The controlled flat rate of Scranton, Pa., specifies that the demand shall not be less than 75% of the total sockets installed at the rate of at least 25 watts per socket (with a few secondary exceptions).

[18] Examples of the controlled flat rate: Worcester, Mass.:

Watts Demand.	Net Charges Per Month.
100	$1.00
125	1.25
150	1.45
175	1.65
200	1.85
225	2.05
250	2.25
275	2.45
300	2.65
325	2.85
350	3.05

It is easily seen that this means a (net) charge of 0.8 cent per watt plus a customer charge of 25 cents (with exception of the 100 watts demand, which is 5 cents lower).

In Allentown, Pa., the charges of the controlled flat rate are diversified between residences and stores and in the latter class they are again diversified according to the time of closing in the following manner:

1 cent (net) per watt per month for residences.
1.5 cents (net) per watt per month for stores, etc., closing at 9 p. m. or earlier.
2.0 cents (net) per watt per month for drug stores, saloons etc.
2.5 cents (net) per watt per month for establishments open all night.

[19] The former (100% load influence) may even be smaller than the latter (99.9% or 99%) although as a rule it will be larger.

the average of all the customer's instantaneous demands during that interval.

We have then to define the "peak responsibility" as the average of the customer's instantaneous demands taken over a given or chosen interval of time. This term "average demand taken over a certain interval of time" is not as definite as it seems at first sight. This question, which is of secondary practical importance, has been dealt with in Section 34-37.

The question now suggests itself how large the interval should be over which the customer's instantaneous demands are to be averaged in order to furnish the most exact result. The solution of this question depends entirely on the shapes of the load curves. In order to solve that problem for a particular case we would first have to find out how large the correct unapproximated value of the demand cost is with the given shape of the customer's and central station's load curve (Insert VI). But the object of the whole approximation is to avoid just that complicated calculation of the true value. We will therefore have to select more or less by guesswork some standard length of interval over which the customer's demand is to be averaged.

Fortunately it does not make much difference generally whether we use those moments of time when the central station's load is above 95%, or when it is above 98%, or 99%, etc. It does make a difference with an individual consumer whose load curve has a freak shape containing large and abrupt rises and falls during the assumed interval of the central station's peak which are symmetrical to the latter, but with the ordinary shape of load curve the duration of this interval is not a matter of great importance.

What would be the effect of using too large or too small values for that interval? If it is chosen too short, this would mean penalizing a customer who once in a while, as an exception, or even as a consequence of an accident has a heavy but short demand. This short demand would as a rule not necessitate the electric light company keeping an additional equipment of the same capacity in readiness as the chances are that these exceptional demands do not occur during the central station's peak-load time. Even if they do, they will affect the central station's size in a much smaller measure than the amount of kilowatts of the maximum demand indicates, because these extremely short demands of a number of customers would not come all at the same moment but generally one after the other; in other words, the diversity-factor between these peaks would be very great on account of their short duration. This penalizing of the very short demands would result in a corresponding unjustified favoring of the customers with demands which are steady during a longer interval of time and thereby do not give the possibility of a large diversity so that they affect the central station's size in a much greater measure than the same number of kilowatts would for a short period. If we go to extremes, the customer might have to pay during the whole month, or even year, for the current occasioned by a short-circuit in his installation.

On the other hand, if the interval is chosen too great, the element called "peak responsibility" loses more and more the character of a real peak responsibility by approaching more and more the element of energy consumption. This is best illustrated by again assuming the extreme case, which now means that the interval within which the "peak responsibility" is to be measured (averaged), is no longer so small as to be measured in minutes or even hours, but extends over the entire 8760 hours of the year. In that case the rated "peak responsibility" would be the average demand of the customer over the whole year and would be proportional to the customer's yearly energy consumption.

133. The next step towards enabling practical application is the replacement of the customer's peak responsibility as basis for the demand cost (or for the demand charge respectively) by the customer's maximum demand, regardless of the time when the latter occurs. With this approximation we arrive at a method of general practical applicability.

The maximum demand of the customer is usually not defined as the instantaneous maximum demand, but the demand as averaged over a certain given interval of time, just as this has been done in the first approximation with the customer's peak responsibility and for the same reasons. That interval of the given length within which the demand averages to a larger amount than during any other interval of the same length is then selected and the average demand during that particular interval is the rated "maximum demand." The maximum instantaneous demand must not necessarily occur during the same interval.

(To be continued.)

ERRATA.

We have had our attention called to two errors in Mr. Eisenmenger's eleventh article, which appeared in the issue of Sept. 20. On page 474 there is an error in Fig. D. The abscissa OA' should equal m_0 and $A'B'$ should equal M_0. The corrected Fig. D is reproduced herewith.

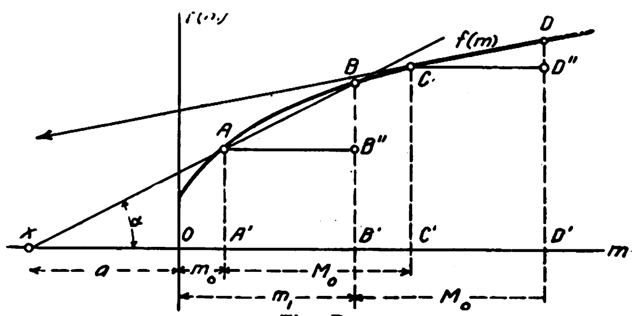


Fig. D.

On the same page a little below Fig. D, there is an error in the sign between the two parts of the modified relation (24). It should read as follows:

Multiplying by (-1) and adding $(b_1 - b_0)$ to both sides (24) becomes

$$(b_1 - b_0) - [f(m_1) - f(m_0)] \leqq$$
$$(b_1 - b_0) - [f(M_0 + m_1) - f(M_0 + m_0)]$$

FRANCE MAY USE POWER OF WAVES TO SAVE ITS COAL.

Practical experiments to determine the possibility of utilization of tidal power to make good for the coal shortage under which France is expected to suffer for a long time will be carried out under government auspices in St. Briac bay, on the north coast of Brittany. A committee has been appointed for the scientific investigation and study of hydroelectric power, and will undertake the experimentation by government orders.

Experiments are also being conducted to determine the possibility of replacing coal partly by gasoline.

Development of Favorable Public Opinion Toward Utilities

The Policy of Decrying Publicity and Information Has Changed to One of Taking Public Into Confidence—Employes and Stockholders Can Help—Paper Before Illinois State Electric Association

By JOHN F. GILCHRIST

Vice-President, Commonwealth Edison Co., Chicago.

A FEW months ago a prominent St. Louis banker spoke before a meeting called to consider the situation of the street railways, and stated that in the language of the street "they were getting just what was coming to them," or in more poetical language, "they were reaping the whirlwind." The well-informed men who listened to him felt that he was probably taking an extreme position to which he himself did not fully subscribe, in order to point a moral, or, if not, he was unreasonably severe, was not up-to-date and posted on the changed conditions which have prevailed during the last 80% of the time since public utilities came into existence, and that he had not analyzed the situation fairly. Furthermore, seriously or for effect, he was taking a view of the situation from the standpoint of an outsider, not appreciating the complicated fabric which linked his business with the one he was denouncing, which, if seriously injured, must injure his own business together with all others. In other words, he was sawing off the limb on which he was sitting—between himself and the tree—and yet this man's views typified the views of thousands of other people of like standing with himself as to intellect and judgment, and of tens of thousands of people not so well equipped to understand such matters, but who constitute the great rank and file of the people, who by their votes govern this great country of ours.

J. F. Gilchrist.

Early Appreciation of Public Utilities.

In the early stages of the public utility business people had not learned to give much thought to the rights of the public. The situation was quite different, and it was very natural that the managements of utilities, who looked upon their business as being private enterprises, should consider that they were conferring more of a favor upon the public than the public was conferring upon them. In the case of many public service corporations, all sorts of inducements in addition to liberal franchises were offered to encourage them to start in various communities. The people at those periods of the inception of the business having never enjoyed service of this kind apparently had the fullest appreciation of the value of utilities. Furthermore, they apparently recognized the fact that the public utility man was not the inventor of the systems newly discovered at that time, and that he not only had to pay more for patented apparatus (the inventors not being willing to forego their fair reward because the service was to be rendered to the public) but the future of the business was not assured and he had to pay high prices for money for investment purposes.

Starting in this way, utility managements have not appreciated the change which has taken place in the view of the people, and have not realized the importance of keeping the people informed. In fact, a well recognized policy, and unfortunately one which generally received the support and approval of the ablest managers, decried publicity and information. It adhered to the plan of sitting tight and saying nothing, regardless of the viciousness of attacks made upon them, apparently believing that this policy would result in such attacks wearing themselves out and charges being forgotten. Even at this date, when almost any body of intelligent men meeting for conference would agree that the best policy was to take the public into confidence, many managers will, as individuals, hesitate to be frank and open with the public, and if they put forth any statements at all, they will not make a full statement.

Now, it is common knowledge that differences between individuals almost invariably grow out of a lack of knowledge of what prompts certain acts. If two men doing business together know each other very intimately and they are both fair and honest, there is rarely any chance for trouble between them, but if they are not acquainted and attribute all kinds of motives to each other's acts, suspicion and distrust is likely to arise, which frequently leads to open rupture. The situation is no different as between a public utility and its customers, and there is much more chance for trouble in such a relationship because customers realize, generally speaking, that they can get the service rendered only from one source, whether they will or no, and they are much more likely to attribute avariciousness and wrong motives to the vendor under such circumstances than they are under any business relation where the purchaser can take his trade elsewhere if he is not satisfied.

Public Opinion All Powerful.

In this discussion we can assume that public opinion is all powerful, especially under a government such as ours, and that the cultivation of favorable public opinion toward any project which would succeed is not only desirable and necessary, but imperative. Public opinion generally builds up slowly. An adverse public opinion may reach serious proportions before pronounced evidence of its existence become particularly apparent, and when it has reached this serious stage it can only be overcome by a similar slow, painstaking process like the one which resulted in its creation; like a disease, it must run its course, and notwithstanding the application of remedies, it will generally go on to its crisis with attending disasters to those who have incurred its displeasure.

In every public utility, as in most undertakings, there are five principal factors—the public, the customers, the owners, the employes, and the management. In the development of favorable public opinion it is by efforts directed at or through these factors that all results will be obtained, and the attitude of these various branches toward each other will have most decided bearing on results. Let us assume that the management is honest and fair towards its customers, its employes, and the public, or at least that it intends to be, because many times the two things are not synonymous. A management may, from its viewpoint, believe itself to be most high-minded and most fair, but it is always dangerous to attempt in your business to administer justice, you being the sole judge of what is just. The wise management will miss no opportunities to see its motives and policies through the eyes of its customers and the public, and if in addition it will adopt the policy of considering in the investigation of all questions from the people that the customer is right and the company is wrong, until the contrary is proved, it will do much to establish fair methods and to set up in the community as a fair and popular institution.

Utilizing Employes to Build Up Favorable Public Opinion.

In the ordinary utility with a large number of employes, there is, in the building up of favorable public opinion, no more effective means than by utilizing the employes in all such activities. A careless, thoughtless, neglectful and surly body of employes can do more to injure the standing of a company than the management can by other means possibly offset, and if such a situation exists it is without question the fault of the management. Continuous work should be done, first, to make the employes realize that they and the management are all partners in an enterprise which, if successful, will be to the personal advantage of every one in the company, and, if not successful, will be to the disadvantage; second, to educate employes to realize what a factor each one of them is in establishing the company in the good graces of the public, and what a bearing their little every-day acts in their intercourse with the company's customers and the public have in developing public opinion. The employe who comes in contact with the public is the company from the standpoint of the customer, and the former's attitude is looked upon as the attitude of the company. If he is fair, courteous, faithful and painstaking he will make friends for the company; if the reverse is true he will make enemies, and, if anything, it is probably a little easier to make enemies than it is to make friends under such circumstances.

Aside from intercourse with the customers and the public in the ordinary course of his duties, the employe can do an incalculable amount of good to the company by talking about it on all occasions, praising its good qualities, explaining its difficulties and its ambitions, showing what it hopes to accomplish, and the ideals of service it believes in and is striving for. Too often in the public utilities this great factor is neglected; employes are not encouraged to support of their own company, and all too frequently are actually aligned against the company in its difficulties and relations with the community. This attitude must certainly grow out of a greatly neglected opportunity on the part of the management, as loyalty and pride in one's own institutions is not at all a rare human quality, and should be properly built up and directed. The mistake too frequently made by managements with regard to gaining the assistance of their employes is that they do not realize how small the opportunity of many employes is to learn the policy of the company and to learn enough about it and its affairs to appreciate what it is and what it is trying to do, and, consequently, how poorly equipped they are to explain these things to others. A management can hardly spend too much time and money in properly educating, cultivating and directing its employes along these lines.

Public Utility Should Have Personality.

A public service institution should have a personality in the same way that an individual or a firm has. We all have had the experience of seeing some popular young men who have joined in partnership develop a business. As long as the owners come directly in touch with their customers or are in daily contact with and supervise the employes who do come in contact with the customers, an atmosphere of service and courtesy is developed which makes for the success of the institution, but when it becomes so large that the management representing the owners and having high ideals as to the kind of service to be rendered to the customers becomes separated from the employes who are actually getting in touch with the customers, there is the gravest danger of a situation arising which may lead to misunderstandings, the lack of proper service, and trouble for the company. In all plans for the cultivation of the good will of your customers and the public the writer urges managements to be thoroughly alive to this danger and ever alert and diligent in seeing that there is no perversion of the company's policies towards customers going on without the knowledge of the management.

The stockholders, too, afford an opportunity for the spreading of information as to the fairness of the company, its desire to render the best service, its importance to the life of commerce and industry in the community, and such other information as may increase the value of a property by favorably advertising it and creating public favor toward it.

But no results from this avenue for favorable publicity can be expected unless it is properly organized, and by a long process of patient education, stockholders are shown that their active co-operation is desired, and furthermore, are shown how they can best be of service to the company. Much of the annoyance and embarrassment of companies, due to the fact that politicians firmly believe that corporation baiting is popular, would be choked off, and if the politicians or newspaper editors from whom they get their cue were, on the issuance of unfair criticism of deserving local enterprise, to receive a shower of communications, or even an occasional word of mouth quietly spoken, there would be established a doubt in their minds as to whether or not the chord on which they were playing was so popular.

Suppose, for instance, that 5% of the 200,000 public utility stockholders in Illinois should write a state representative, mayor or an editor advising him upon the occasion of his making an unfair statement that either he was misinformed or grossly unfair and that he was treading on the toes of a very large number of worthy citizens who were supporting the community by the taxes they pay, would it not have a very prompt effect? Merely to convince the average politician that 80% of the owners of $1,000,000,000 worth of securities of Illinois utility companies live within the state, principally in the communities served, and that most of them were people of small means, employes, savings banks, insurance companies and the like, would probably have the effect of making him very careful how he attacked such properties.

It does not seem impossible to build up and maintain in the minds of the utility stockholders of this state a knowledge of how they may help their own interests, as well as the interests of the community, to such an extent that 5% of them would promptly come to the front when any movement calculated to injure their interests was about to be promulgated.

Increasing the Number of Stockholders.

In this connection, the desirability of increasing the number of owners should not be overlooked. A public utility cannot have too large an ownership among the people of the community it serves. If it were possible that every customer could be a shareholder it would be most desirable. A prominent member of one of the utility commissions has said: "If you want to increase the popularity of private ownership increase the number of private owners." As an investment, what is more logical than the ownership of an interest in the public utility which serves the community in which you live? The tendency of investors, particularly new investors, too frequently is to invest in projects located far away. Distance seems to lend glamour. Too many people are skeptical of enterprises with which they come in daily contact.

Experienced investors are more and more given to the investment of money in places where their own personality and influence will be a factor in the prosperity of the project in which they invest. This thought should be in the minds of the small investor and he should carry out this policy. The public utilities of the country are enterprises which must exist for the good of all. There is not one, however high may be the cost of the service, where, if the utility did not exist, the citizen could render himself the same service and thereby conserve his time, strength, convenience and money except at a cost many times the charge made by the utility. Therefore, what is more logical than that the people joining together with their fellows in a community should own these utilities, than which there is nothing more safe, because the company's income is based on a service which is necessary to the welfare and existence of the people, and in connection with which each stockholder's influence, however small, may be used to the advantage of the property in which his money is invested.

Utility Securities for Small Investors.

Many utilites have made great progress in the wide distribution of their securities among the people of the communities in which they operate, but the possibilities are so great that the surface has hardly been scratched. Any company not vigorously exerting itself in this direction at the present time is neglecting, to the serious hurt of itself, the greatest opportunity which public service utilities have yet had a chance to take advantage of. There is a very wide distribution of wealth in this country—there is a lack of safe and suitable investments. With the letting down of the demand of our government to borrow money, the people who would be thrifty and save must find some other form of investment. The young man or young woman who, as a result of patriotically subscribing for the government loans, has learned to save and the fascination and satisfaction of owning securities will find some other place to put his or her money, and there is no better place than in the securities of a well-managed utility serving the community in which the young man or woman lives. Under the natural order of things the purchase of a share or two of stock by an embryo investor in a certain company will pledge him to this security as his favorite.

In the sale of these securities the services of the employes should be utilized. There is nothing which will equip the employe with information and give him faith in the soundness, integrity and progressiveness of his company like the acquirement of the information which he must have in order to explain to his neighbors and friends the workings of his company, the corporate structure, the property owned and the value of its securities, and what employe can go out and sell the company's securities and not be a booster for the company?

Good Will of the Press Important.

In the activities directed toward the public the approval of the press and such publications as circulate in the community is of great importance. The press is the natural medium to reach the people. As merchandisers of news the press is generally found to be fair and anxious to print information which will be interesting to its readers.

It is to the best interest of a community that the newspapers be unprejudiced, fearless and honest, and it is my belief that fundamentally a very large percentage of those who dictate the policies of the newspapers of this country are honestly trying to be all of the above in serving the best interests of their communities. But naturally they are in the newspaper business to make a living, which they cannot expect to do if they are not very active in taking up all kinds of inquiries which may lead to improvements.

There are very few newspapers in this country with which a broad-minded, fair utility manager can not work, not with any idea of squelching just and fair criticism of his properties but in an honest effort to improve the service which he is rendering to the community, and to keep the public fully informed as to matters of interest concerning the important enterprise in the community which he manages, advising it of his troubles and difficulties and the limitations which prevent the company's meeting any of the public views which from time to time spring up.

And thus you will probably reflect from the fact that so few of the utility managements are taking advantage of their opportunities in using the few mediums here referred to, that in view of the hundreds of other ways in which favorable public opinion may be cultivated, most of us have ourselves to blame if the public does not know as much as it should of our good work, our difficulties and our honest intention to render material service to them. If, lacking this information, they continue to listen to the slanderous statements of those who would advance their personal interests in such ulterior ways, then we have only ourselves to blame.

Electric Versus Hydraulic Drive for Steel-Mill Auxiliaries

Factors Affecting Choice of Equipment — Characteristics of Drives for Different Applications—Relative Costs—Paper Before Iron and Steel Engineers

By R. B. GERHARDT

Sparrows Point Plant, Bethlehem Steel Co.

CLIMATIC conditions as to atmospheric temperature variations affect selection to a very considerable extent. It is very desirable to eliminate all hydraulic power possible where mills are located in very cold climates or where it is not possible to protect a piece of apparatus from severe cold weather. Where a hydraulic system is already installed and hydraulic power is available, it is often more preferable, when considering an additional piece of apparatus which is considerably simplified by driving from a piston and cylinder, to hold to the hydraulic drive. Often good judgment dictates that an electric driven hydraulic plant for taking care of auxiliaries which are considerably simplified with hydraulic rather than with electric drive, is the best installation; as in the case of large bloom or slab shears which would require a flywheel motor-generator set and special driving motor if electric drive were used.

Location and Control.—From the control standpoint the electric drive almost always has an advantage over the hydraulic drive, for the electric controller is usually a more convenient piece of apparatus for an operator to handle than a hydraulic valve, and for adaptability to location it has a decided advantage over the valve.

The distance of the piece of apparatus under consideration from the hydraulic supply mains is quite a factor in making a selection between the two types of drive, as it is very costly to transmit hydraulic power any distance due to expensive piping, loss of power due to friction, and liability to leaks. On the other hand, such distance is no item whatever with electric transmission. The expense of operating a hydraulic system is very high if constant vigilance is not maintained to avoid leaks and to keep dirt and grit out of the water in the system.

Adaptability to Specific Equipment.—The main difference between the two kinds of power under consideration is that one more readily is transferred into a reciprocating motion and the other into a rotary motion. Considering two drives, one hydraulic and the other electric, for operating a certain piece of apparatus having a straight line motion, if the hydraulic engine and the electric motor were built under the same specifications as to capacity and ultimate speed of the apparatus they drive, without the specifications having outlined a complete duty cycle, the probable result would be that the speed of acceleration of the two equipments would be somewhat different for the following reason: with the electric motor drive the torque developed in the motor has considerable work to do in overcoming the inertia of the motor armature and other rotating members of the drive, while the force acting on the piston of a hydraulic drive usually has fewer parts to accelerate and considerable less inertia to overcome. The control of each equipment is a factor in the time of acceleration, since with the electric motor the torque is proportional to the current and the controller regulates the current to the motor; while with the hydraulic equipment the control valve admitting the water regulates the quantity of flow to the cylinder which affects the force acting on the piston. It should be pointed out in the one case the feature limiting the torque which can be developed by the motor is the mechanical and electrical limits of the machine itself, while in the other case the pressure on the hydraulic system limits the force available for doing work.

Efficiency.—With regard to efficiency, the electric drive has an advantage over the hydraulic drive. Pressure engines are very efficient at full load, but their efficiency decreases as the load decreases. With the electric motor the efficiency varies but slightly between wide limits of load.

Considering then each of the particular auxiliaries before mentioned which under present day practice are being installed with either method of drice, we arrive at the following detailed conclusions:

FURNACE DOOR HOISTS.

The operating mechanism for a furnace door is usually quite simple when hydraulic power is used. A cylinder and piston is supported above or behind the furnace for each door, and the door is handled by this piston through chain or cable which passes over a sheave attached to the furnace directly over the door. When electric power is used the cylinder and piston are replaced by electric motor, connected with suitable gearing to a crank which has a throw equal to the maximum lift of the door. Sometimes a special motor-driven drum is used instead of the crank as in the case of the electric door hoist. With the electric drive the door is usually counterweighted. In cases where the control for a great number of furnace doors is grouped in a pulpit, the electric drive has a decided advantage. Sometimes an electric operated valve is used with a hydraulic drive when this pulpit control is desired.

Table I gives a comparison between hydraulic and electric drive for a heating furnace door.

TABLE I—FURNACE DOOR HOISTS.

	Hydraulic.	Electric.
Initial cost	$703.00	$2009.00
Power per year	4.40	5.15
Maintenance and repair (labor)	93.60	10.40
Cost per year (material)	62.40	20.80
Depreciation and interest	70.30	200.90
Total expense per year	230.70	237.25

Furnace Covers.

The apparatus for handling a furnace cover is in a great many respects similar to the furnace door hoist except that in this case a motion of translation is required instead of a raising and lowering motion. The soaking pit furnace cover is usually carried on wheels and made to traverse back and forth over the furnace by means of a hydraulic cylinder anchored to the furnace at one end and connected through piston and a long rod to the cover. When the electric drive is used the cylinder is replaced by a motor and suitable gearing, meshing into a long rack which is attached to the cover. Sometimes the electric motor drives a long rod, attached to the cover, back and forth through a suitable friction, and in this way one motor can be used to handle more than one furnace cover.

The points as to convenience of control hold the same in this case as with the furnace door.

TABLE II—FURNACE COVERS.

	Hydraulic.	Electric.
Initial cost	$4020.00	$8150.00
Power per year	11.75	9.36
Maintenance and repair (labor)	105.00	24.00
Cost per year (material)	83.20	46.80
Depreciation and interest	402.00	815.00
Total expense per year	601.95	895.16

Elevators.

The elevator used in the steel mill very closely resembles the general freight elevator used in commercial work.

Table III gives data on each type of elevator for a particular installation.

TABLE III—ELEVATORS.

	Hydraulic.	Electric.
Initial cost	$41,000.00	$22,000.00
Power per year	1,944.00	691.20
Maintenance and repair (labor)	434.00	425.00
Cost per year (material)	890.00	720.00
Depreciation and interest	4,100.00	2,200.00
Total expense per year	7,368.00	4,036.20

Blooming Mill Manipulator.

The side guard manipulator for handling and turning steel during the rolling process in the blooming mill is at the present time the manipulator most commonly used. Essentially it consists of two long heavy steel plates carried vertically on edge directly over the mill live table rollers, one toward either side of the table. These plates are supported from independent movable beams located underneath the table, by means of arms extending up between the table rollers. The beams, of which there are usually two to each plate or guard, are carried on guide rollers and attached at the ends to hydraulic pistons, or through suitable rack and pinion to electric motors, which actuate the plate or guard back and forth in a direction parallel to the axis of the table roller. A piece of steel on the table can be caught between the two side guards and carried back and forth across the rollers to any desired position. To turn the piece, fingers are provided, which work vertically up and down just inside one of the guards. These fingers are carried with the guard on suitable supports and by means of a separate cylinder and piston; or electric motor and crank mechanism, acting through a lever, shaft, and bell cranks, receive the vertical motion mentioned.

Table IV gives a comparison between two such drives for a particular manipulator:

TABLE IV—SIDE GUARD MANIPULATOR DRIVE.

	Hydraulic.	Electric.
Initial cost	$22,566.00	$23,850.00
Power cost per year	2,308.80	898.56
Maintenance and repair (labor)	220.80	93.60
Cost per year (material)	271.00	145.20
Depreciation and interest	2,256.60	2,385.00
Total expense per year	5,057.20	3,522.36

Lifting Tables and Middle Roll Balance.

These two mechanisms are usually considered together on a three-high plate mill and will be so considered in this comparison. Essentially the hydraulic lifting table mechanism consists of a cylinder located under the table, having a piston and rod connected through a link to a suitable system of bell cranks which actuate the table vertically up and down according as the piston is forced into or out of the cylinder. With the electric driven lifting table the motor drives through reduction gearing to a crankshaft which through a connecting rod actuates the bell cranks above referred to. In each case the tables are usually counterweighed. The hydraulic middle roll balancing mechanism consists of cylinders carried on the mill housings, the pistons of which transmit a vertical motion through the rods to heavy link members connected at the lower ends to centers of beams which are attached through rods at one end to the mill housing in such a way as to give a straight line motion to the other ends which carry the middle roll. With an electric drive the motor is connected through reduction gearing to a crank shaft which imparts a vertical motion to heavy hollow weights open at the bottom, by suitable connection through rod, shaft, and bell cranks. These weights telescope over other weights pinned to one end of walking beams which are supported at their center on trunnions carried on pedestals under the mill housings. To the other ends of these beams are pinned yokes each carrying two vertical rods which support at the tops a shoe carrying the middle roll. Ordinarily the middle roll overbalances the weight on the end of the walking beams and stays in its lower position, but when the telescope weight is lowered on the top of this weight the balance is overcome and the middle roll rises to its top position. To prevent a severe shock when this telescope weight is lifted through the gearing, crank shaft, and levers, it is supported by a heavy spiral spring interposed between a rod carrying the weight and the actuating lever.

Table V gives data on the two methods of drive for a particular mill.

TABLE V—LIFTING TABLE AND MIDDLE ROLL BALANCE.

	Hydraulic.	Electric.
Initial cost	$36,370.00	$41,600.00
Power per year	14,030.64	3,895.00
Maintenance and repair (labor)	588.72	285.60
Cost per year (material)	787.20	518.40
Depreciation and interest	3,637.00	4,160.00
Total expense per year	19,043.56	8,859.00

Shears.

A hydraulic shear is probably the simplest piece of hydraulic machinery in the mill. It usually consists of a heavy frame carrying at one end in a suitable housing a knife blade, and at the other end a cylinder. The piston carries the other knife blade and works in and out of this cylinder producing a shearing action between the blades. Hydraulic shears are usually build up-cut or down-cut. The particular shear selected for this comparison is one of the latest design using a steam intensifier for securing pressure for the cutting stroke. With this arrangement there are two distinct hydraulic systems used, one a closed system directly between the cutting cylinder and the intensifier, and the other the regular mill system connected through suitable valves to cylinder for the return stroke. By using the steam intensifier greater economy is gained, as the expansive power of the steam is utilized also; it is possible to get up to working pressures of 6000 lbs. per sq. in.

The electric driven shear requires a considerably heavier frame casting. The lower shear blade is held stationary in this frame and upper shear blade receives its motion through either a crank, eccentric, or cam action. The driving motor is geared through countershafting to this crank, and a heavy flywheel is mounted on the countershaft. Usually the motor and flywheel are allowed to run continuously, the shear being operated by throwing in a clutch on the countershaft. More recently, on account of trouble encountered with such a clutch, the flywheel has been omitted and the motor geared directly to the shear, the motor being started and stopped in this case with each cut of the shear. Such a design of motor-driven shear is the one considered in the following calculations.

Table VI gives data on the two types of drive for a particular bloom shear application.

TABLE VI—SHEARS.

	Hydraulic.	Electric.
Initial cost	$22,640.00	$39,600.00
Power per year	5,723.47	4,310.70
Maintenance and repair (labor)	328.00	135.60
Cost per year (material)	385.76	334.00
Depreciation and interest	2,264.00	3,960.00
Total expense per year	8,701.23	8,740.30

SUMMARY.

With each of the foregoing comparisons, in the case of the initial cost of the hydraulic drive the proportional cost of an electric driven hydraulic pumping station is included.

The fixed charges are always one of the main items of expense, and this is taken in all cases as being 10% of the initial cost. Except in the case of the furnace door and cover drives the item of power is highest or second highest. The cost of a unit of electrical energy was taken as being 1 cent per kw-hr.

To obtain the cost of power with hydraulic drive a test was conducted on the pumping plant which consists of three 7½-in. by 24-in. horizontal, duplex, end-packed, plunger pumps, each direct-connected through reduction gearing to a 350-hp., a-c. slip-ring motor. An automatic governor is arranged to start and stop the motors one at a time, depending on the demands on the hydraulic system. By means of a large accumulator located outside of the pump house the pressure is maintained constant at approximately 750 lbs. The results of the test mentioned show a power consumption of 8 watt-hours per gallon of water pumped.

Under maintenance and repair costs are considered: with the hydraulic drive, cylinder and rod packing replacements, cup leather and valve renewals, and lubrication; with the electric drive, controller repairs and contact renewals, motor brush and pinion renewals, and lubrication.

It should also be remembered that the prices here shown do not hold good in general, as they are all war prices and cover a particular installation at a certain location. The figures are only given for the purpose of making a comparison.

Reviewing each of the tables the author draws the following conclusions: In the case of the furnace door hoists the expense of operation is about the same with hydraulic or electric drive. The initial cost of the electric drive is almost three times that of the hydraulic drive. With the furnace cover drives the advantage as to expense of operation and initial cost lies with the hydraulic drive. Ease of control has a decided advantage in the case of the electric drive, and the hydraulic furnace covers for a large mill might require more operators than electric covers, in which event the expense of one additional operator would more than offset saving indicated with the hydraulic drive.

The electric driven elevator has an advantage over a hydraulic elevator in both operating expense and initial cost.

For driving the side guard manipulator the electric motor has an advantage over the hydraulic cylinder in operating expense, and the initial cost of either drive is about the same.

The electric drive for lifting table and middle roll balance on a three-high plate mill costs considerably more than hydraulic drive, but has a decided advantage over the hydraulic in operation expense.

There is comparatively no difference in the cost of operation between an electric driven and a hydraulic bloom shear, but the initial cost of the electric drive is considerably higher than that of the hydraulic drive.

There is probably very little difference between the reliability of the hydraulic drive and that of the electric drive in each of the above mentioned applications however.

The hydraulic field covering large power presses and forges has not, up to the present time, ever been invaded by the electric motor, but this does not necessarily mean that the electric drive cannot be adapted to do this work. More than likely it is the prohibitive cost which has kept the electric motor out of consideration. The motor-driven intensifier, before mentioned, is the entering wedge for the electric drive in this field.

NEW HYDROELECTRIC PLANT NEAR WINNIPEG, MAN.

One of the largest hydroelectric plants in America is to be built at Little du Bonnet falls, on the Winnipeg river, near Winnipeg. It is proposed to expend $9,000,000 on the work and the expectation is that 160,000 hp. will be developed. The first step in the project will be the building of a concrete dam 2000 ft. long and of a maximum height of 70 ft. across the Winnipeg river at Little du Bonnet falls. The dam will create a reservoir from 50 to 70 ft. in depth, extending several miles up the river to the second McArthur falls, and, by raising the river's level will drown out Grand du Bonnet falls, where the river drops 35 ft. in four plunges. Eight turbines of 21,000 hp. each, of four-runner, horizontal shaft type, will be installed in pits in the concrete substructure. The water from the reservoir will pass directly into the turbines at 20,000 cu. ft. per sec. The power generated at the plant will be transmitted to Winnipeg by a double-circuit line supported on structural towers 54 ft. high. A second double-circuit line will connect the power house with the power plant at the Winnipeg Electric Railway at Pinawa higher up the river. A double-loop connection will thus be maintained between the city and the source of power.

FIFTIETH ANNIVERSARY OF THE WESTERN ELECTRIC COMPANY.

From Extremely Modest Beginnings in 1869 the Company Has Grown to Be One of the Largest Electrical Manufacturers in the World.

Half a century of continuous existence is no new thing in American business, but the significance of such a life in the electrical industry is indeed great because, properly speaking, the electrical industry belongs to the present generation of men.

In November of this year the Western Electric Co. celebrates the fiftieth anniversary of its birth. It began in 1869 as a small two-man concern, founded by Elisha Gray and Enos M. Barton. The firm was known as Gray & Barton.

As the telegraph was practically the only application of electricity which had been brought into any considerable commercial use in 1869, undertaking to manufacture electrical apparatus required not only vision but indomitable faith and energy together with sound business sense. Mr. Barton had these qualities and sensed the opportunity which was offered when he took over the Cleveland shop which the Western Union Telegraph Co. had decided to abandon. Soon after the new concern moved to Chicago.

Before the day of the telephone the little shop manufactured telegraph apparatus, signal boxes, registers, annunciators, call boxes and fire-alarm apparatus. After the advent of the telephone in 1875 the company was busy making equipment for the exchanges of the Western Union Telegraph Co. In 1879 the retirement of the Western Union from that field gave the control to the American Bell Telephone Co. This company had hitherto purchased its telephones from competitive manufacturers, but, recognizing the superiority of the equipment made for the Western Union, it entered into a contract with the Western Electric Co. which provided that the latter should make all the telephones for the American Bell's use.

The needs of this service quickened the inventive genius of the company's engineers and brought a corresponding and ever increasing expansion of its volume of business.

The common-battery lamp switchboard of today was evolved from the crude switchboard of the early seventies, the attractive desk stand telephone from the cumbersome box type. The paper-insulated lead-covered cable solved the problem of the necessary increase in the number of open wires as telephone service became popular, and the establishment of transcontinental wire communication and transoceanic wireless communication solved the problem of long-distance transmission. In the telegraph field the multiplex printer is an achievement of the Western Electric engineers in co-operation with others.

To meet an ever increasing demand for products which it did not make, the company bought such goods of the makers and resold them to the user. Out of this early relationship of buyer and seller has evolved the largest electrical jobbing organization in the world, operating from 42 distributing houses. These houses perform a two-fold function. By virtue of the supply contracts with the American Telephone & Telegraph Co. and associated companies, they supply all the apparatus and supplies for these companies, thus effecting tremendous economies as a result of being able to purchase greater quantities than each individual company could.

Further than this, each distributing house maintains large stocks of materials and electrical appliances for every possible electrical need. It is prepared to supply materials for building pole lines; for equipping and wiring homes, offices and factories, and for supplying electrical appliances for simplifying housework.

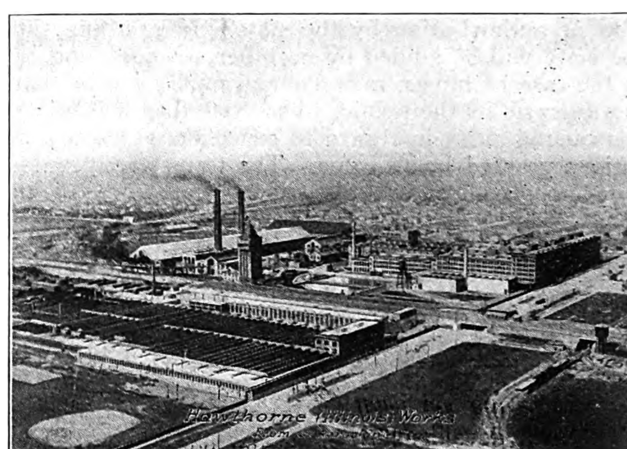
The company also maintains a large manufacturing plant built at Hawthorne, at the city limits of Chicago, Ill., in 1903. This plant is constantly being enlarged to meet the fast increasing needs of the telephone manufacturing end of the business. The employes of this plant, together with those from the 42 branch houses in the United States and the foreign houses, constitute a working force of over 30,000 men and women.

The telephone was an American invention and to the Western Electric Co. belongs the credit for having the foresight in 1879 to lay the foundations for an enduring business in foreign lands.

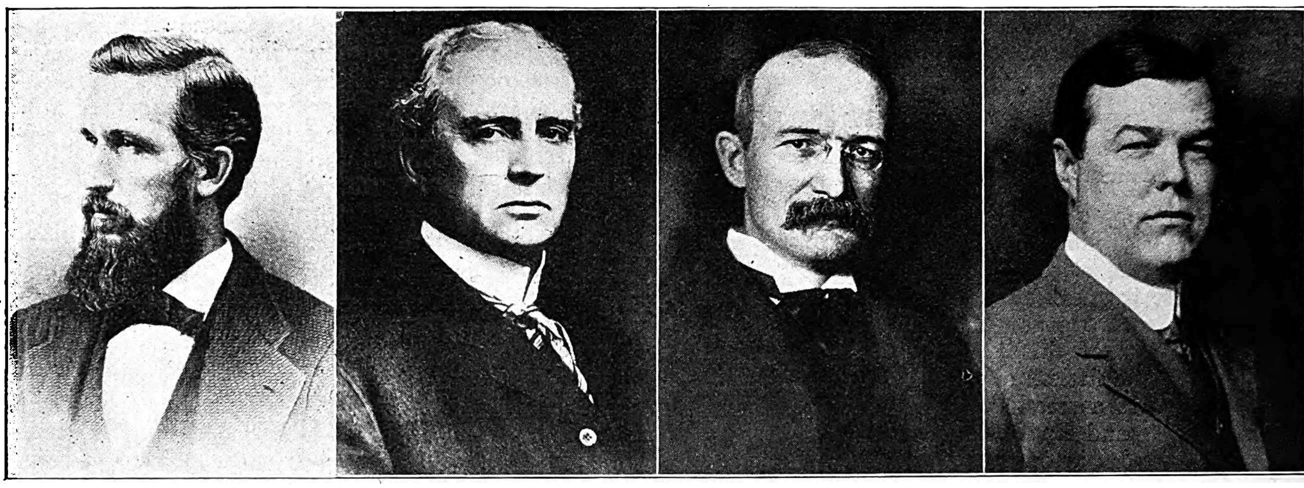
At the present time it has associated companies in Belgium, Switzerland, Argentine, Norway, South Africa, England, Italy, France, Australia, Japan and Holland, and allied companies in China, Russia, Austria and Hungary.

The Western Electric Co. played a prominent part in the World War. It has been said by experts that the American Army could not have functioned without the modern telephone system which was built in

Building on Kinzie Street, Chicago, Where the Company Established Its First Plant, Shortly After Organization of the Business in 1869 by Gray & Barton.



Hawthorne Works of the Western Electric Co.—This is Now the Principal Plant of the Company and One of the Largest Electrical Works in the World.



Successive Executives of the Western Electric Co. During Its 50 Years.

Elisha Gray, President, 1869-1887. Enos M. Barton, President, 1887-1908. H. B. Thayer, President, 1908-Dec., 1918. C. G. Du Bois, Became President in 1919.

France between the front line and the seacoast. The multiplex printing telegraph was put to the test in handling the armies of the Allies. In the air, the company did notable work in the development of radiotelephone equipment, particularly as applied to communication between airplanes and the earth, while on sea, in addition to the great practical utility of the radiotelephone from ships to the land, and from ships to each other, the submarine detecting equipment as developed by engineers both here and abroad undoubtedly was an important factor in defeating the submarine peril.

Apparatus was likewise developed for use in the locating of enemy artillery fire, and equipment for use in the listening posts in advance of the lines.

In addition to its work on telephone apparatus, the company was able to serve the Government in conspicuous fashion by assembling and shipping to the other side large quantities of electrical supplies of every character.

At the same time the foreign allied houses manufactured large quantities of equipment which were used by the allied armies.

NEW FRENCH WATER-POWER LAW.

The new law on water power in France provides that no one may use the power of the tides or of the water courses of whatever category without a concession or authorization by the state. In granting this the state will be guided by no other consideration, as in the case of mines, railways and public works, than the interests of the public. The state that will be the contracting partv in regard to concessions or authorizations granted in its name. The term water course is to include all natural or artificial waters, canals, or rivers, and even the mountain lakes which are frequently sources of energy.

While including within its discretion the use of the tides, the new law recognizes that the utilization of the varying levels of sea water as power generators is far from being efficient; in fact, that it has only been approached theoretically, no practical application thereof having yet been established. It is capable of subsequent development.

It is recognized that the water-power concessions will be made to great and small concerns; and in regard to the latter the new law embodies a novel idea. The factories that furnish current for the illumination of villages are often very small, and use only a few horsepower. In the basin of the Seine, for example, in 1910 there were 149 factories for community lighting, of which 36 possessed the normal power of 2 to 10 hp., 43 of 11 to 20 hp., 23 of 21 to 30 hp., 13 of 31 to 40 hp., and eight of 41 to 50 hp.

It appeared to the framers of the law that the state should not make its intervention too direct in these small concerns where such might become vexatious, and that the state need not in these cases exact certain costly formalities. The state proposes, therefore, to leave the law now in existence, as it is for concerns of which the maximum power does not exceed 50 kw., the effect of which provision would be to enable little factories, not using over 30 to 35 hp., to neglect concession formalities. The second category includes factories of a maximum power of over 500 kw. for whatever purpose.

PROPOSED RAILWAY ELECTRIFICATION IN FOREIGN COUNTRIES.

European and South American countries, with the exception of England alone, lack an adequate supply of fuel, but many of them, including Norway, Sweden, Switzerland, Italy, Spain and Brazil, have large amounts of water power, while France has a moderate amount. These resources, combined with the high cost of fuel, make extensive railroad electrification in these countries inevitable sooner or later. Switzerland has a well established program covering a term of years, while both Norway and Sweden are giving active consideration to definite projects. In England a considerable amount of electrification is in contemplation along with the general plan for the electrification of industry. A French commission, composed of government and railroad engineers, has already visited the United States in order to thoroughly familiarize themselves with American practice. The Italian government will continue its definite program as soon as financial conditions permit. An official Belgian commission is already planning to rehabilitate with electric power at least a portion of the railroads destroyed during the war. In Spain, Brazil and South Africa as well, railroad electrification is under active consideration.

Editorial Comment

The Coal Miners' Strike

AS WE go to press, it seems that no assembly of forces can be marshalled to avert the impending bituminous coal miners' strike. The public will again suffer heavily as the "innocent bystander." And in the individual sense it probably will be more concerned with the inconveniences caused than with the merits of either factor in the controversy.

As customary in public calamities of this character, curative treatment will overshadow the preventative. As we are being drawn into this thing, which should never occur in this great, rich country of ours, government officials are perfecting a program to meet the situation. This program, besides including steps to break the strike, will provide means to revive the Fuel Administration, to prevent hoarding and profiteering, to re-establish maximum prices, and to allocate and distribute coal to homes, railroad and essential industries.

The question that every central station faces is how long will the supplies of coal available suffice? This in turn depends upon how long the strike lasts or how long is required for conditions to settle down to those of one month ago. In circumstances such as these conservation is sound. Coal must be conserved in every way feasible. What is feasible depends upon the strike situation during the days to come. The central station must be prepared for the worst.

The present high price of coal causes operating economies to be quite generally maintained. Little therefore can be done now in this connection to save coal. Every little helps and every little that can be done should be done, should have been done long ago. If the rate of coal consumption is to be lowered appreciably it will be necessary to accomplish this not by only increasing the efficiency a small percentage, but also by curtailing load. Deciding just where load should be curtailed—bearing in mind that such is an emergency measure only—is not an easy matter, because there are so many aspects to the problem—financial, technical, commercial and legal.

If a coal shortage seriously threatens conditions will rapidly assume those existing during the worst period of the war. The revived Fuel Administration or similar agency will doubtless adopt the same effective tactics followed in those days of lightless nights, heatless Mondays and when the absolutely non-essential industries were closed down. The central stations can follow tactics similar to these upon their own initiative and according to the seriousness of their depleted coal supplies.

Dark days may be ahead, literally and figuratively speaking. We do not know. But we do know that once again has been brought home to everyone the wisdom of having coal stored away. Not long ago we said in these columns that the time to store coal was then. The days to come will prove that advice both sound and wise, for if needed the coal is there.

Without coal supply, manufacturing dwindles and transportation stops. Production is one of the crying needs today. Without coal the world shivers, sickens and starves. Coal is a vital, indispensable thing—the foundation of comfort, of industry, of modern civilization. It is a sad weakness of our industrial system that controversies over the remuneration or other details of employment cannot yet be settled amicably and with reason instead of resorting to stoppage of work, often involving violence, and thus depriving the public of one of the most vital necessities of modern life. The collapse of the national industrial conference, upon which everyone looked to help solve this problem, has therefore left the country at the mercy of the contending industrial factions.

The A. I. E. E. Publication Policy

THROUGH its Board of Directors, the American Institute of Electrical Engineers has launched a radical change in its policy respecting the publications it issues. Heretofore the monthly *Proceedings* and the annual *Transactions* have been issued at considerable expense out of the general funds of the Institute and in the last few years this expense has quite materially increased, as has that of all publishers without exception. Consequently the issuance of the publications has become more and more of a burden on the general resources of the Institute. Among the recommendations made a few months ago by the Development Committee, which was charged with making a thorough investigation of Institute affairs to the end that means be found for making the organization more valuable to the membership at large, was that a policy be adopted which would make the Institute's publications, especially its monthly, of much more value to the members than at present and yet make them self-sustaining and no longer a burden on the general resources.

A similar problem was presented to the American Society of Mechanical Engineers a year or so ago and it was solved by greatly expanding its monthly *Journal,* the expense thereby involved being met by taking on a great deal more advertising than before. It is reported that the enlargement of the *Journal* has not only proven very popular with the membership of that society, but that its advertising income has made it entirely self-sustaining.

In view of the evident success of this sister society's changed publication policy, it was but natural that the A. I. E. E. should follow this precedent. This has now been done. The action comes after considerable discussion and after quite a few members raised their protest against a national technical society falling back upon commercial support to relieve the membership from sharing equitably in meeting the increased costs of operation. Similar protest was made in the A. S. M. E. against thus lowering the society's ethics.

However, the majority rules and the only question remaining is to put through the new policy without further lowering of the dignity and standing of the Institute. If the income from advertising is put back entirely into the publication fund, but few will find fault. While the caution may not be needed, it should be emphasized that any attempt to use this income for the general needs of the Institute would immediately open it to the charge that it is no longer conducted "not for profit."

Minimizing Noise and Vibration in Substation Buildings

ECONOMY of investment in conductors and economy in operation because of line losses, as well as good voltage regulation, all favor the location of substations at the center of gravity of the load, present or prospective, as the case may be. As the result many substations are built in residential or commercial districts, where the population is comparatively dense and housings somewhat congested. Apparatus so located, whether for supplying power and lighting or street railways, should operate as noiselessly as is practically feasible.

Litigation has occurred in the past, although it must be said the cases are few and far between, because some property owner or some tenant has claimed damage was being done him on account of vibration or noise, these two either singly or combined being claimed to be giving rise to injurious effects. Apart from this aspect of the matter, which embraces matters of public policy and relations, electrical apparatus that must from necessity or from choice be located in residential districts especially, or anywhere else for that matter, should make a minimum of noise and commotion.

The manufacturers have done quite a lot toward making both static and rotating electrical apparatus operate more or less noiselessly. They have reduced vibration and noise due to loose laminations and the rattling of parts. They have very largely reduced humming at pole tips and air gaps due to high flux density and hysteresis loss. They have minimized whistling and singing due to windage. All these are influenced by design and all are contributing factors that go to make up the elusive but nevertheless very real "stray loss," so whatever is done to reduce noise and vibration is a movement in the direction of higher efficiency.

However, while the onus for making electrical apparatus noiseless may devolve upon the manufacturer, and whether apparatus is relatively noiseless is very largely a matter of unit cost—how much the purchaser is willing to pay for silent operation—the operator of equipment is not altogether lacking in opportunity to decrease noise. By proper installation, noisy apparatus may be so installed that noise and vibration are restricted instead of magnified, concentrated and dissipated instead of distributed. In other words, the method in which noisy apparatus is installed and the type of structure in which it is housed may be factors that decide whether certain apparatus is to make a noise that is objectionable or whether that same noise shall be unobjectionable. The responsibility for this rests with those concerned with the substation building and the installation of the equipment in it.

While the conditions to be met by the designer of the electrical apparatus may be complex, those encountered by the architect and construction engineer are comparatively simple and, in the main. self-evident. Windows, and especially needless windows, should be omitted from the substation walls to reduce the transmission of noise. What windows are used should be located so as not to be in direct path of air currents upon which noise is carried away. Walls should, where possible, be built with air spaces to form a cushion which will impede the passage of direct noise. The foundations for apparatus should be isolated and distinct from the walls of the station, thereby reducing the transmission of both vibration and noise. Where forced ventilation is employed the ventilating system should be so arranged that it does not act as a duct for air-borne noises to the outside of the building. These are all conditions that can be met by the architect once he appreciates the situation.

More specialized are those cases where forced ventilation is employed and where machines are totally inclosed either for purposes of shutting in noise or carrying away thermal losses; pads can be installed underneath transformers and induction regulators; soundproof rooms often are the indicated solution. These are matters for the electrical and construction engineers rather than the architect.

It may be pointed out that whereas the construction engineer can fairly readily adopt measures during and subsequent to the time equipment is installed to reduce existing noise and vibration, the architect must make his plans well in advance, since it is usually too late when a structure is erected to then commence to isolate foundations, build partitioned walls and change the location of windows. The moral from this is, of course, to familiarize the architect thoroughly with the problem of reducing noise and vibration from electrical apparatus and co-operate that the end may be eventually attained by prevention rather than eradication.

Current Events

Steinmetz on Power Supply — Radio Interests Combine — A.I.E.E. Publication Enlarged—Illinois Association Meets

STEINMETZ' CHICAGO LECTURE TELLS OF FUTURE POWER SUPPLY.

Crowded Joint Meeting Listens to Famous Engineer's Discussion of Power Supply and Generation.

On Oct. 29 Dr. C. P. Steinmetz, of Schenectady, N. Y., gave his annual lecture before the Chicago Section, American Institute of Electrical Engineers, and the Electrical Section, Western Society of Engineers when he addressed an overflow meeting at the Art Institute, Chicago, on "Power Supply and Generation of the Future."

In his typical manner Dr. Steinmetz first took up the question of what is the meaning of energy supply. There are two entities essential to the civilization of today. One of these is materials, the other energy. It is the characteristic of the age that these materials come not from the immediate vicinity where we use them, but they come from a distance. Where once a man produced his own leather and made his own shoes, today he purchases them or at best produces only one small part of the whole. This means that transportation by railroads, steamships, etc., is a vital factor in the civilization of today. Transportation is in part responsible for the high state of civilization as it is found now.

Energy is the ability to "do." It is energy in some form that transports the materials, as by trolley, by locomotive and truck. Just as our existence depends upon materials, so it depends also upon energy. It is essential if we are not to cease to see when night comes, it is required to create heat to keep us warm and to aid our limited muscular power. The question is how to obtain energy and how to supply it? It is very largely a matter of systematized transportation of materials.

Dr. Steinmetz then discussed the difference between energy and power, explaining that power is the rate of doing work. Lightning strokes are over in a fraction of a second; their power is enormous, their energy extremely small. Energy, like matter or materials, cannot be destroyed, but only converted or transformed into some other form. In obtaining this essential energy, man has called upon nature's most readily convertible sources of energy—coal (including oil and gas) and water power. The energy in these materials must be transported from where it is found in the raw state or material state to where it is to be used. This brings up the problem of transporting energy and converting that energy from a nonusable form or form not wanted to the form in which it is wanted.

Of the two forms of energy that may be transmitted, chemical and electrical, chemical energy for secondary distribution is excluded. For general distribution only electrical energy is available. It is electricity that makes the widespread supply of energy to civilization possible for any and every purpose. By a network of transmission lines the large industrial plant and the small individual household can alike obtain energy whether it be for operating the huge steel mill, for making steel, aluminum and carborundum or for operating the fractional-horsepower motor in the home.

In the early days electricity was used for light, supplied by local stations. Then came power and trolleys, with power plants farther separated. Today light, heat and power utilize electrical energy as the working medium generated in large stations. Where once each man produced himself his major necessities of life, today a man specializes in some one thing. Every industry is a combination of two industries—the production of goods and the production of power. But in this age of specialization power production and distribution has become a specialized industry. The first to realize the need for and possibilities of specialized power production was Samuel Insull, of Chicago, whose power generating system is the largest in the world.

This industry of power supply is covering the country with transmission and distributing lines. Primary distribution is in large bulk at high voltage to substations. Secondary distribution is in smaller bulk at lower voltages. Systems are being interconnected, as are also stations. Much chemical energy is transported by boat and rail and is then converted to mechanical energy and then into electrical energy, then transmitted. There are some generating stations at the coal mines and these eliminate the transportation of chemical energy. There might well be more.

In this country 800,000,000 tons of coal (including the equivalent in gas and oil) are consumed annually. If a wall were built of the size of the famous Chinese wall, only using one year's coal consumption as the building material, it would encircle the entire boundaries and coasts of the United States. The energy of all this coal would be sufficient to raise such a wall 200 miles into space.

Consideration of water power as an alternative source of energy shows that even if every drop of rain were utilized the water power would amount to only about one-quarter that already obtained from coal. The potential water power due to our annual rainfall is nearly 1,000,000,000 kw-yrs. Much of this is impossible of utilization for power purposes, however, because agriculture needs much water. Allowing for the requirements of agriculture, for losses by seepage, evaporation, etc., there would be left for power production through the use of lakes, dams, etc., sufficient water to produce a maximum of about 200,000,000 kw-yrs., or about 260,000,000 hp-yrs. On the basis that one ton of coal is equivalent to one kilowatt-year, and remembering that 800,000,000 tons of coal are already consumed each year with gradual increased yearly consumption, it can be seen that there is not enough water power to replace our coal and that the idea of doing so is an idle dream.

But water power should replace coal where possible. Water power is scattered widely; often sources of power are but small. These water powers should be harnessed and their energy collected, combined and distributed. Small powers, low heads and intermittent flow mean that these stations must operate without attendants, must be automatic so as to run when and according to the water available. Induction generators that come in upon the system when water permits and function without manual supervision offer the solution to economical utilization of the small water-power plants. In the New England states alone many old power sites of 100 hp. and thereabout could be put to use through linking up to a common system.

Turning to other sources of energy, Dr. Steinmetz next spoke of energy derived from wind, one of the first sources of power to be used by man. Wind is erratic and the energy available is relatively small. But so is the flow of water sometimes, although water is less irregular than wind. Wind could be utilized by installing wind mills upon transmission-line structures. Each structure would have also its transformer which would connect the generator to the transmission line. Wind-driven generating stations might prove more economical in the desert than a coal-burning plant.

Turning then to the utilization of tides and waves, Dr. Steinmetz pointed out that the amplitude of tides varies. Using tide would be like using a piston with a stroke every six hours. Tidal energy would have to be changed to ordinary hydraulic energy, equivalent to a low-head waterfall with a changing head.

Solar energy, obtained as radiant heat from the sun, is another method of making energy available to man, a method of vast possibilities for the future, but not feasible today. While from all available water power 200,000,000 kw-yrs. might be obtained annually, and from coal at existing rates of consumption 800,-000,000 kw-yrs., from solar energy 100,000,000,000 kw-yrs. could, theoretically, be obtained, or 100 times more than from coal and water combined. How this could be done economically, said Dr. Steinmetz, he would leave to the engineers of the future to say, since we must leave some problems for them to occupy their attention.

After the lecture Dr. Steinmetz for nearly an hour answered a large number of questions, embracing such matters as obtaining volcanic heat from the planet by shafts sunk into the earth, radioactivity and the energy of atoms, and divers other complex and academic aspects of the power production of the future.

RADIO CORPORATION OF AMERICA TO ABSORB AMERICAN MARCONI CO.

New Company, with Backing of General Electric, to Develop Active Competition with Cable Lines in Overseas Communication.

Plans for the establishment of a transatlantic wireless system that will compete with and not give merely a supplementary service to that of the cable companies have been announced in New York City. The Radio Corporation of America has been formed with the backing of the General Electric Co. to absorb the American Marconi Co. The plan is dependent upon the approval of the stockholders of the company.

The war, which led to a high degree of reliability in the workings of the long-distance wireless, put a pressure on means of communication which in the case of the cable lines in the Atlantic threatens to result in a permanent congestion of messages and involved temporary hindrances to the private wireless enterprise. An aftermath of war has been a demand from commercial interests that wireless facilities shall be developed on a scale commensurate with the need for means of rapid communication.

The plan of organization of the Radio Corporation of America is for an alliance of the American Marconi Co. with the General Electric Co. A substantial block of shares in the American Marconi Co. that are now held by the British Marconi Co. will be acquired by the General Electric Co. and will be part of its contribution to the capital of the Radio Corporation of America.

It is said that the new company will be exclusively American. An agreement is in negotiation with the British company by which the Radio Corporation will obtain enlarged wireless facilities abroad and new rights in the countries of South America. Because of patent agreements the operations of the American Marconi Co. have been limited to the United States and to Cuba.

The directors of the American Marconi Co. have approved the plan and appealed to stockholders to vote it into operation. A stockholders' meeting will be held Nov. 20.

It is planned to sell all the assets of the American Marconi Co. except its manufacturing plant at Aldene, N. J., and certain claims, including some against the United States Government arising from alleged illegal use of Marconi patents, to the Radio Corporation for 2,000,000 shares of common stock and preferred stock of a par value of $10,000,000. The proposal involves a 25-cent dividend on Marconi shares, payable on or about Jan. 2, 1920, and the leasing of the Aldene factory to the General Electric Co.

The plan does not involve the complete liquidation of the American Marconi Co. but does radically change the scope of its operations and relieves it of the conduct of wireless communication and the sale of wireless devices.

The capital provided by the proposed financing is believed to be ample for the fullest development of the company within its sphere. No offer of stock on the market is contemplated.

Research laboratories and the engineering force of the General Electric Co. have been at work for a number of years on radio matters. Apparatus of great value was developed and turned over to the Government during the war. The new company will have the technical assistance of the General Electric Co. and will retain the highly specialized staff of the American Marconi Co.

Edward J. Nally, who has been vice-president and general manager of the American Marconi Co., will be the first president of the Radio Corporation.

A. I. E. E. TO ENLARGE ITS MONTHLY PUBLICATION.

Board of Directors Approves Report of Special Committee on Publications—Scope of Monthly Proceedings to Be Increased.

At the last annual convention of the American Institute of Electrical Engineers the chief topic of discussion was the report of the Development Committee, one of the important suggestions of which dealt with making the Institute's publications more valuable to the membership without additional expense to the members. To further consider this matter a special committee was appointed and this reported to the Board of Directors, at the meeting held in Philadelphia on Oct. 10, as follows:

In accordance with the resolutions adopted by the Board of Directors on August 12 relating to the report of the Committee on Development, this committee has carefully considered the Development Committee's report and the communications relating to the publications of the Institute that have been received by the president, the secretary, the Development Committee, and this committee, up to the present time.

In general, the views expressed by the membership are overwhelmingly in accord with the suggestions in the Development Committee's report, including the publication of additional matter in the *Proceedings.*

In order to best meet the needs of the membership and to promote the objects of the Institute as expressed in our constitution, namely, the advancement of the theory and practice of electrical engineering and of the allied arts and sciences and the maintenance of a high professional standing among its members, this committee recommends the following as the policy to be carried out when and as the necessary funds become available:

1. *Transactions.*—That the annual *Transactions* be continued in accordance with the long established policy, *i. e.,* with no change in size or character of contents.

2. *Proceedings.*—That the publication of a monthly periodical, heretofore designated *"Proceedings,"* be continued.

3. *Contents of Proceedings.*—(a) That high-grade engineering and theoretical papers, in full or in abstract, shall continue to constitute the major portion of the monthly periodical and that the space devoted to such papers shall be limited only by the amount of material available and the permissible expense.

(b) That the substance of discussions at Institute meetings be published.

(c) That the papers and discussions, in full or in abstract, as presented before sections and branches, be published as may be selected by the committee in charge.

(d) That a portion of the monthly publication shall be devoted to material relating to the engineering art, other than that which is presented in Institute papers and discussions, such as descriptions of new developments characterized by notable advances.

(e) That the publication of items relating to activities of the Institute and other organizations be continued and expanded.

(f) That some form of descriptive index of electrical engineering literature be published, with due regard to the various indexes now published elsewhere and the avoidance of undesirable duplication.

4. *Title of the Monthly.*—That the name of the publication be changed from *"Proceedings of the A. I. E. E."* to a title that will better indicate the broader scope of the proposed contents.

5. *Size of Monthly Publication.*—That the size of the monthly publication be increased to 9 in. by 12 in., the generally adopted standard for technical periodicals, as soon as it is found commercially practicable.

6. *Advertising.*—That the Institute's practice of the past 25 years of carrying advertisements in the monthly publication be continued and that, as heretofore, the editorial and advertising policies be entirely independent of each other.

7. *Supervision.*—That the general supervision of the monthly and annual publications, including decisions regarding the publication of articles, papers, discussions and all other matter available for publication be assigned to a standing Publication Committee, and that the carrying out of the policies that may be determined from time to time by the Board of Directors be delegated to this standing committee.

The Board of Directors approved the report and authorized the president to appoint a standing Publication Committee to formulate and carry out plans in accordance with the recommendations embodied in the report.

AUGUST ELECTRICAL EXPORTS ABOUT AVERAGE.

Substantial Recovery Shown from Preceding Month and Big Gain Over Last Year.

Electrical export figures as shown in the monthly summary of the foreign commerce of the United States for last August issued by the Bureau of Foreign and Domestic Commerce, Washington, D. C., show that a healthy recovery took place in August as compared with the relatively low total of July. The August total was also nearly 50% greater than in the corresponding month of last year. It ran just about the average of the eight months ended August 31; for that period the electrical total is reported as $62,319,616, compared with $38,611,639 for the corresponding eight months of 1918.

The following table gives the classified figures for last August and the comparative figures of August of last year.

Articles.	August 1919.	August 1918.
Batteries	$ 587,951	$ 252,529
Carbons	106,823	123,926
Dynamos or generators	586.211	258,589
Fans	53,099	29,296
Heating and cooking apparatus	124,668	79,954
Insulated wire and cables	741,443	677,485
Interior wiring supplies, including fixtures	166,499	108,386
Lamps—		
Arc	3,373	2,135
Carbon-filament	10,135	5,474
Metal-filament	350,284	203,046
Magnetos, spark plugs, etc	230,403	181,347
Meters and measuring instruments	268,448	189,393
Motors	729,603	573,547
Rheostats and controllers	45,833	17,408
Switches and accessories	356,676	159,811
Telegraph appartus, including wireless	115,645	36,858
Telephones	324,755	259,185
Transformers	441,733	554,576
All other	2,472,641	1,627,980
Total	$7,716,228	$5,340,925

Not included in the above are electric locomotives, of which there were exported during last August a total of 29, valued at $27,215.

MEETINGS HELD BY ILLINOIS ELECTRICAL CONTRACTORS' ASSOCIATION.

Two meetings of the Illinois State Association of Electrical Contractors and Dealers were held Oct. 16-17 at the Coliseum, Chicago, when the Electrical Show was in progress. The first meeting was addressed by W. R. Leeper, representing the U. S. Chamber of Commerce, who outlined conditions existing in trade as a result of labor troubles, and who emphasized the necessity of co-operation in the business world in order to readjust matters satisfactorily. A round-table discussion, led by R. W. Poelma, chairman, and J. W. Collins, secretary of the association, followed. Conditions affecting the electrical industry, especially contractors and dealers, were considered.

The Friday meeting also was in the form of a round-table meeting, at which two definite policies were adopted. It was proposed that steps be taken to influence the contractor members of the association to become dealers as well in order to strengthen the merchandising power of the organization as a whole. The other policy related to improving the credit of contractors and dealers, in order that their buying powers be increased.

The meetings were attended by a large number of down-state members as well as a good representation from the Chicago district.

NEW YORK ELECTRICAL SOCIETY MEETS.

A joint meeting of the New York Electrical Society and the Metropolitan Section Society of Automotive Engineers was held at the Engineering Societies Building, New York, Oct. 29. Kingsley G. Martin, late lieutenant-colonel, Motor Transport Corps, A. E. F., addressed the meeting on "Motorization of the World's Traffic," reviewing the accomplishments of American vehicles during the war.

Illinois State Electric Association Has Profitable Meeting

Central-Station Representatives at Chicago Convention Hear and Discuss Papers on Many Subjects Vital to Industry—B. J. Denman Re-elected President

MARKED by an abundance of excellent papers and spirited discussions covering practically every subject of interest to the central-station man—from merchandising to operating—the first post-war convention of the Illinois State Electric Association, held at the La Salle Hotel, Chicago, Oct. 23-24, proved very profitable to the 150 delegates in attendance. Eleven papers were presented at the three sessions, and with the attendant discussions made an exceedingly busy and business-like meeting, from which the members gleaned a great deal of information. All papers were printed in advance of the meeting and leaders appointed for the discussion on each side. This arrangement succeeded in bringing out lively comment and amplification of the subject matter of the papers themselves.

President's Address.

In his presidential address B. J. Denman, Peoples Power Co., Moline, outlined conditions affecting the central-station industry throughout the state since the last meeting of the association. Emphasis was laid on the necessity of obtaining adequate rates to justify investment in public utilities. Central stations generally are too conservative in their attitude toward raising rates. The notion of the public that rates cannot go any other way but downward must be corrected because increased costs wrongly deemed temporary by central stations necessitate advances in rates. Maintenance of records and statistics are necessary to properly present rate cases before the Public Utilities Commission. Lack of fuel this winter will probably result in taking over numerous isolated plants by central stations, bringing up the question of extensions calling for investment which must be justified by adequate rates. In closing, President Denman said the most important work of the association had been in connection with state legislation, and he asked the co-operation of public utility interests at the coming Illinois constitutional convention.

The report of Secretary-Treasurer R. V. Prather, Springfield, indicated the extent of the work accomplished in legislative and Public Utilities Commission matters.

Presenting a Case to the Utility Commission.

Bert H. Peck, St. Louis, Mo., formerly electrical engineer, Illinois Public Utilities Commission, read a paper on "How to Present a Case to the Utilities Commission" which applied particularly to central-station companies of moderate size. Procedure in Illinois was given, and then the following advice as to fundamentals. The utility must be convinced that it has a just case or it cannot hope to convince the commission of that fact. The same arguments should be used to convince the commission as one would use in convincing himself, were he in the commission's place. It must be remembered the commission is human and may at times have difficulty overcoming prejudices incurred through neglect or abuse. Facts should be presented which the commission has by previous orders indicated worthy of consideration. All facts deemed pertinent, even including those which may be to some extent unfavorable, should be presented. Untrue statements should not be allowed to go into the record without contradiction by credible evidence to disprove them.

The discussion on this paper was led by F. A. Warfield, Illinois Traction System, Peoria, who said the advice regarding a just case was axiomatic, and that he had never heard of a utility presenting other than a just case or of a case that was not bitterly opposed on the theory that all petitions for increased rates were wrong. He advised that in presenting a case provision should be made for appeal. He thought rates should not depend on plant valuation, but if the valuation was necessary it should be based on replacement rather than on original cost or possible selling price. Variation from paths of procedure in presenting a case cause trouble and delay. It should not be taken for granted the commission is always right, but the central-station company should give all the evidence and express its own ideas as to the right and wrong of the case.

Lightning Protection.

A paper on "Lightning Protection for High-Tension Lines" was presented by A. Herz, Public Service Co. of Northern Illinois, Chicago, which gave an outline of over-voltage line conditions due to static electricity caused by lightning; it also included an outline of other causes for over-voltage. A history of the development of protective devices followed, special reference being made to the construction and operation of the horn-gap, multigap, aluminum cell and oxide film arresters, and to the practice of overbuilding the transmission line with a ground wire to afford lightning protection.

Discussing the paper, J. L. Buchanan, General Electric Co., said the growing complexity of distribution networks adds to the difficulty of affording protection against over-voltage, especially in design of an arrester which is not self-destroying. The oxide film arrester, which was brought out nearly three years ago, and in commercial use the past six months, may solve the latter problem. In his opinion the use of an overhead ground wire is good practice.

J. H. Sears, Mississippi River Power Co., Keokuk, Ia., thought the installation of an overhead ground wire a waste of money. His company operates a line that has no ground wire and also a 90-mile, 110,000-volt line that has an overhead ground wire the entire distance. There has been no perceptible difference in operation, and on the latter line the lightning discharges do not seem to prefer the ground wire to the uppermost conductor.

Harry Caldwell, Public Service Co. of Northern Illinois, Chicago, said about one-third of his company's system was built without ground wire and on this section one or two poles are shattered during a severe storm, while on other two-thirds, with ground wire, no shattering of poles is experienced.

E. H. Negley, Canton (Ill.) Gas & Electric Co., said his company had installed a bayonet on every pole on one of its lines and had more trouble with it than before the bayonets were put up. F. P. Bowen, Peoples Gas & Electric Co., Savanna, said he had the same experience, while John Leisenring, Illinois Traction System, Peoria, stated he had found bayonet installation afforded good protection against lightning.

Closing the discussion on this subject, Mr. Buchanan said the arrester could not be deemed a cure-all for lightning troubles and that the difference of opinion as to the use of a ground wire meant that the problem was different for different classes of line. Mr. Herz said it was a good plan to build a line without ground wire and later install one over sections of line on which trouble from lightning discharges developed.

Central-Station Statistics.

The uses and methods of obtaining statistics were brought out in a paper on "Value of Statistics in Central-Station Operation," presented by E. F. Fowler, Commonwealth Edison Co., Chicago. Statistics should connect up the engineering with the accounting and financial sides of the business and should deal not only with what has happened but with probable demands and tendencies. The manifold value of statistics indicates that central stations, even of moderate size, should have a department devoted to gathering them and pointing out their uses.

In the discussion, H. E. Weeks, Peoples Power Co., Rock Island, said it was regrettable smaller companies did not keep statistics because they are needed in controversies to obtain higher rates. Statistics effect economies and are necessary in arriving at operating costs.

President Denman emphasized the need of impressing a company's own employes as to their value.

S. B. Cushing, Public Service Co. of Northern Illinois, said that since so much had been done to make generation and distribution of electrical energy of high efficiency, the accounting department was a place to look to for future economies. Thus, it costs some companies 14 cts. per meter per month for billing, while others have brought this figure down to 7 cts. G. H. Lukes of the same company emphasized the value of submitting operating cost statistics to operators promptly.

Selling Goods and Service.

As a part of a symposium on the above subject, prepared by the Commonwealth Edison Co., O. R. Hogue, head lighting agent, read a paper on "Improving the Lighting Load." Obtaining new customers and educating present customers to new uses of electricity will produce increases in the lighting load. Promoting good industrial lighting, electrical signs and house-wiring are the big fields in which the central station can operate to advantage.

"Timely Power Loads" was the title of a paper by George H. Jones, power engineer. Central stations should specialize in building up load-factor by cultivating loads off-peak in character. Electric vehicles and trucks offer a big opportunity for such loads. Electric ice-making machines, steel and brass furnaces and electrochemical processes also offer excellent opportunities. Another class of off-peak service often overlooked is summer service for existing isolated plants.

Points regarding the routine of handling orders were brought out in a paper on "Modern Methods of Handling Customers' Orders," by Harold Wright, chief clerk. These were concerned with indexing of customers, receiving and entering orders, preparing and distributing copies of orders, and keeping progress reports on installations being made.

E. A. Edkins, manager of Commonwealth Edison electric shops, in his paper on "Merchandising Electrical Appliances," gave the basic principles of merchandising and then commented on such subjects as the sale of related lines of electrical accessories (like flashlights and batteries), deferred payment plans, and on specific methods of handling sales of the different kinds of appliances.

The completeness of the symposium left little room for discussion, but C. W. Johnson, Hodenpyl-Hardy Co., added a point when he said lack of building operations has been responsible for the increase in merchandising activities on the part of central stations.

John F. Gilchrist, Commonwealth Edison Co., said added impetus must be given to the commercial side of the central-station business. In the early development stage the most effort was put to the purely engineering side, but since that branch of the industry had become so efficient more effort is being made along financial, operating and merchandising lines. The answer to large merchandising sales is the deferred payment plan, which is particularly applicable to central stations selling electrical appliances because payments can be added to the monthly light bill. Low first payments will help develop a habit in customers of purchasing their electrical needs in this manner, and will stimulate many sales which would never be made otherwise.

Outdoor Substations.

"Modern High-Tension Outdoor Substations" was the title of a paper presented by H. W. Young, Chicago. He called attention to the standardization of outdoor substation equipment on the unit type basis, rendering capacity changes and repairs comparatively easy. Such equipment is simple in design and has no concealed parts carrying high voltage. The use of remote control affords protection to operators and material savings in aisle space. Comparing the performance of fused disconnecting switches with automatic oil circuit-breakers, it was stated, since the damage done to transformers during short-circuit condition is directly proportional to the energy flowing into the circuit before the transformers are disconnected, that high-tension fuses of good design will clear short-circuits in approximately 0.013 sec., or from 10 to 12 times as rapidly as an automatic oil switch, thereby affording greater protection against surges. The latter, however, can be used for switching as well as for overload protection. Also it can be closed, if in good condition, immediately after circuit interruption, while replacing fuses generally means somewhat lengthy service interruptions. Mr. Young's paper was illustrated with lantern slides showing various kinds of outdoor substations designed to meet practically any kind of service required.

The discussion was led by John Leisenring, Illinois Traction System, Peoria, and Harry Caldwell, Public Service Co. of Northern Illinois. The former called attention to the rapid development of outdoor substations, but said, from an operating standpoint, improvements were desirable, especially those allowing for easy renewals of equipment when damaged. Former practice was to place transformers 5 or 6 ft. above ground (to keep them out of reach) necessitating heavy structures; there was no reason why transformers could not be placed at ground level on a concrete slab, and make more sightly installations. For small substations, say 500 kw. or smaller, lightning protection is important, but perhaps the oxide film arrester will solve this difficulty. Fuse protection in small stations, he said, of, say 10 kw., was not entirely satisfactory.

Mr. Caldwell said that comparing proportionate costs of wood and steel construction of outdoor substations, excluding transformers and arresters, showed the wood to cost about one-half that of steel construction, but the latter probably made up the difference in permanency and sightliness. It was his opinion that the expense of arresters is not warranted on small installations; at 15 of his company's substations only two transformers had been burned out, due to lightning, over a period of years, though a number of bushings had been burned off. He considered it good practice to have insulators on switches have 25% more capacity than line insulators.

G. H. Lukes, Public Service Co. of Northern Illinois, expressed the need of an inexpensive outdoor automatic oil switch as well as a lightning arrester.

In closing the discussion on Mr. Young's paper, Alfred Alsaker, of the same company, brought out some additional points. Wood structures should be provided for operators to stand on when opening air-break switches. Electrolytic arresters are satisfactory but too expensive for small substations. The trouble with the resistance type is that it is usually set wrong; twice line voltage is about right.

Testing of Meters.

Data tending to show installation tests could be eliminated on some types of meters and the time between periodic tests could be materially increased was presented in a paper by R. A. Keller, Central Illinois Light Co., Peoria, on "Installation and Periodic Meter Tests." Tests made by this company during the first eight months of this year on 2500 meters (of several different makes and sizes) showed 81.3% were within 2% correct and 95% within 4%. Cost of making these installation tests was 48 cts. per meter. It was recommended that installation tests on single-phase meters up to 25 amperes capacity could be eliminated. The requirements of a number of states as to periodic tests were tabulated and showed considerable variance. Test figures indicate the accuracy of the small capacity induction type meters and it was Mr. Keller's opinion that the period of tests could be made as long as five years on this type without appreciable inaccuracies.

Commenting on the paper, R. B. MacDonald, Peoples Power Co., Rock Island, said the factors of vibration, shock and temperature were more important than making installation test 30 or 60 days after laboratory test. It is difficult to conduct field testing because it is hard to get competent help. Periodic tests should be based on character of load in each instance. One period for all is not consistent.

After some discussion, the convention passed a resolution to place a petition before the Illinois Public Utilities Commission asking for an extension of the 30-day limit for test after meters are installed.

W. R. Leeper, representing the United States Chamber of Commerce, addressed the convention and requested the co-operation of the association in destroying radicalism against business, harmonizing relations between employers and employes, equalizing foreign trade conditions, and creating the viewpoint of every citizen as to the national aspect of each individual business.

Rural Electric Service.

A paper on "Extensions of Electric Service to Rural Customers" by D. W. Snyder, Bloomington & Normal Railway & Light Co., Bloomington, contained some pertinent information regarding the necessity of providing rural service, the adoption of standard plans of rendering service and the correction of present systems of rate making. Most farmers do not use sufficient energy to make the business remunerative unless they pay for maintenance cost and core losses. The widespread use of farm-lighting systems show farmers want electric service and are willing to pay for it, so that the demand for central-station service appears to be on the rise, and managers should prepare for it.

E. H. Negley said group farmer business should be compared to that of a small village, say of 400 inhabitants, where a great deal of expense is involved per kilowatt-hour sold, and that the remedy as to income was proper apportionment of charges.

B. H. Peck urged the appointment of a committee to study the question, prepare service standards and rates and submit same for the approval of the Public Utilities Commission.

Development of Favorable Public Opinion Toward Utilities.

Under this title John F. Gilchrist, Commonwealth Edison Co., presented a paper, read by B. J. Mullaney, which discusses methods of influencing the public's attitude in favor of utility companies. It is published on other pages of this issue. Mr. Mullaney, who is secretary of the Committee on Public Information, N. E. L. A., outlined the publicity work that had been accomplished throughout the state in connection with newspapers.

The election of officers resulted as follows: B. J. Denman, Moline, was re-elected president; Adam Gschwindt, Rockford, vice-president; R. V. Prather, Springfield, re-elected secretary-treasurer. The executive committee will consist of B. J. Denman; H. E. Chubbuck, Peoria; D. E. Parsons, East St. Louis; R. S. Wallace, Peoria; Frank J. Baker, Chicago; H. V. Channon, Quincy; W. A. Baehr, Chicago, and M. E. Sampsell, Mattoon.

KANSAS CITY JOVIANS ELECT OFFICERS.

The Jovian Electric League of Kansas City held its annual meeting Oct. 17, with the election of officers resulting as follows: President, J. E. Launder; first vice-president, W. B. Satterlee; second vice-president, F. F. Rossman; third vice-president, H. C. Blackwell; fourth vice-president, Sam Furst; secretary, P. L. Lewis. New members of the executive committee are J. D. Todd, W. M. Hand, R. W. Hodge, H. P. Wright, and holdover members are Sam Furst, A. P. Denton, P. J. Kealy and F. M. Bernardin.

WASHING-MACHINE MANUFACTURERS DENOUNCE PREMIUM PLAN.

American Washing Machine Manufacturers' Association Prepares Arguments Against Practice of Giving Premiums to Encourage Sales.

In considering the premium plan of selling electrical appliances, especially washing machines, at present employed to some extent in the industry, the American Washing Machine Manufacturers' Association, under recent date, adopted the following resolution: "The association condemns as unfair and not good business the practice of giving 13 machines for the so-called price of 12; or the practice of giving a premium or premiums of any kind or description with or for the sale of washing machines."

This resolution expresses the attitude of washing-machine manufacturers on the subject of the premium merchandising plan of selling washing machines. Every effort is being used to have the premium practice discontinued and the following summary of arguments has been drawn up by the association to urge the discontinuance of the so-called premium plan of merchandising of household electrical devices.

Electrical household appliances and electrical household labor-saving devices, properly merchandised, offer to public utility corporations a channel or a means of developing a decent relation between themselves and their customers. Electric ironing machines, washers, toasters and ranges offer a means of satisfaction, comfort and happiness to their users which may and should be used by the public utility corporations to develop the right sort of confidence in them.

At present there is a question in the minds of the executives of the public utility corporations and of their national associations as to the future of the public utility corporations as merchandisers of electrical devices. In the early days electrical devices were sold at any old price in order to obtain the revenue from the sale of current to operate them. No effort was made to really sell electrical devices on their own merit and on a legitimate merchandising basis or plane. The idea was to get the devices in use, no matter how, so that additional current would be used and paid for by the public. The results of such a so-called sales policy have been two-fold. Electrical dealers were hampered in their sales of electrical devices because they could not do business without a profit. This class of dealers—many of them real merchandisers—resented the sales policies of the public utility corporations. Manufacturers producing electrical devices sought channels of distribution other than the public utility corporations because their products were not sold on a legitimate basis.

Information now comes to hand that many of the public utility corporations have decided on a new policy as to sales of household electrical appliances. Some of them are employing real merchandisers to sell these devices on the right sort of basis. Such public utility corporations will probably develop into real distributors of washing machines, the sales records of which will equal those of some of the best specialty dealers in the country. Other public utility corporations are still, practically, giving away electrical devices or premiums with them. Their argument for this policy is about as follows: "The giving away of a premium with the device or the sale of the device below current market price reduces our profit per unit but it whips up our volume of sales so that the bulk profit—including revenue from increase of sales of current—is greater. We are in business to make money. We are making it and more of it. Therefore, our policy justifies itself from the money point of view."

Some years ago the premium plan of selling goods was quite the fashion. Every housewife and every tobacco user was saving stamps or coupons under the belief that they were going to get something for nothing. Then the savers of stamps and coupons began to wonder where the fortunes came from which the owners of stamp and coupon corporations were displaying; it dawned upon them that they were paying for the stamps they saved, and in addition some one was making a profit out of their stamp-saving proclivities. The reaction came and is here.

In the second place, many have lost sight of the fact of the extremely rapid development of the whole household electrical devices industry. How can any one prove that the increase in the volume of their sales of household electrical devices is due to the premium plan of merchandising? As a matter of fact, the increase in their volume of sales of household electrical appliances is probably due to the enormous increase in the demand all over the country for household labor-saving devices, electrically driven or otherwise. Washing-machine manufacturers need not be again informed on this point. They know how great the demand is for their product and they know that this demand has been created by conditions in this country which are far removed from any premium—lamps, stamps or anything else—plan of merchandising.

Executives of all public utility corporations should be fully informed that they should not use the sales records of corporations using the premium plan of merchandising electrical devices as a basis for judgment on the question as to whether or not they should use the premium plan. The sales records and increase in revenue from increased sales of current of a public utility corporation using the premium plan now do not prove or mean anything as to the merits of the premium plan. Such sales records only show whether or not the public utility corporation has followed the tide in increases of sales of household electric devices by all classes of dealers. All of the manufacturers are behind on orders.

The dealer who gives trading stamps, vacuum cleaners, or anything else with the sale of a washing machine is only creating trouble for himself which is sure to react and for the whole electrical industry. Now is the time, if there ever was a time, when the public should be thoroughly educated to the view that when a household electrical device is purchased no premium goes with it; but that the purchaser does get one hundred cents worth of device for every dollar it costs.

STUDENT BRANCH OF A. I. E. E. ORGANIZED IN MILWAUKEE.

At a meeting of faculty and students of the School of Engineering of Milwaukee, Wis., held on Oct. 21, a branch of the American Institute of Electrical Engineers was organized with a membership of about 200. At the meeting Dean John D. Ball presided and Arthur Simon, Harrison P. Reed and Prof. F. A. Kartak spoke. The following officers were elected: J. D. Ball, chairman; Henry Lowcock, vice-chairman; John L. Gordon, secretary; W. H. McCoy, treasurer; B. A. Bovee, director at large. Meetings will be held on the third Friday of each month.

Commercial Practice

Low First Payment Policy—Relations of Central-Stations to Contractors and Dealers—Electric Pumping for Sluicing

CENTRAL STATION ADOPTS PART-PAYMENT POLICY OF $1 DOWN.

As a special inducement for the purchase of electrical appliances the Commonwealth Edison Co., Chicago, has, during the current week, been selling such devices as washing machines, ironing machines, flatirons, vacuum cleaners, electric talking machines and the like on a basis of an initial payment of $1. Subsequent payments may vary from $1 to $5, depending on the total cost of the article in question.

The offer, which held for the one week only, is the result of observation as to customers' attitude toward the amount of the initial payment in connection with the part-payment plan. According to a statement by E. A. Edkins, manager of the Commonwealth Edison Co.'s electric shops, it has been found that a low initial payment policy has been productive of increased sales in comparison to one calling for high first payment, and this in spite of the fact that no change is made in the amount of the regular monthly payments. For instance, the number of prospective customers who will pay $5 down on an appliance is considerably less than those who will pay $2.50, and a surprisingly larger number will purchase at $1 or $1.50 than at $2.50.

The explanation seems to be a matter of valuations; as a general rule, the individual does not consider $1 as beyond his or her means, while $2.50 or $5 is an outlay of money. The future will take care of the monthly payments in either case. As far as the credit risk is concerned, the purchaser is as good a risk at a $1 as at a $5 initial payment.

THE RELATION BETWEEN CENTRAL STATIONS AND CONTRACTOR-DEALERS

Some Policies and Theories of Pacific Power & Light Co. That Have Proved Effective.

In a very illuminating manner, John V. Strange, Pacific Power & Light Co., Portland, Ore., discussed before the recent convention in Seattle of the Northwest Electric Light and Power Association the important matter of relations between the central station and the local contractor-dealer from the three aspects of prices, merchandising and campaigns.

Mr. Strange approaches his subject in the light of the experience of the Pacific Power & Light Co. which company is engaged in supplying electrical energy for the most part in the smaller communities. Fifty per cent of its total residential customers live in communities of less than 5000 population and 10% of the total live along rural lines radiating out from small population centers. It is absolutely essential in a few of the towns that the company handle appliances in order that its customers may have the opportunity to secure these devices. In other communities the need is catered to by contractors and in some of the larger centers the situation would be completely met were the utility to refrain entirely from selling appliances. Regardless of local conditions, however, the company is actively engaged in pushing the sale of electrical appliances in all its territory.

Mr. Strange expressed sympathy for the man who attempts to make his livelihood through the sale of electrical appliances and electric wiring contracting, especially in the smaller communities. As a rule he is a man with limited capital and in many ways he seems to be under a handicap. As a class he certainly has improved wonderfully in the past few years but still he needs encouragement and at least some moral assistance. The Pacific Power & Light Co. feels that he is absolutely necessary because it is not disposed to go into the electrical contracting work except where it cannot be avoided. This being true, endeavor is being made to conduct appliance selling efforts on a plane where the dealer-contractor can compete and be successful.

In years past the sale of current-consuming devices has been looked upon by the central stations as a necessary side line, the central-station manager realizing that he must carry a line of appliances so that a customer might have an opportunity to purchase if he so desired. In most places there was no dealer with the inclination to pioneer in the industry, consequently the central station became the exclusive appliance dealer. This fact has had a tendency to discourage the sale of appliances. The average customer said, "You handle appliances because you want to increase my lighting bill." After years of hard educational effort on the part of the central station, the public has been awakened to the economy, convenience and service afforded through the use of the electrical appliance and the patron of the central station has awakened to the fact that electrical appliances are offered for sale because of their real serviceable value and the current consumed in the operation of such appliances is merely a nominal and incidental operating expenditure.

This, Mr. Strange felt, is a great victory for the persistent educational campaign that has been waged during all these years by the central stations, dealers and appliance manufacturers. The electrical appliance dealers and manufacturers have played an important part in this campaign and it has occurred to him that the logic of the position of these men who have expended their money in the manufacture of a household article entirely dependent upon the use of electricity for its operation and who have had no financial connection with the central station industry, has done more to remove the prejudice that existed in the minds of current-consuming customers against the free use of appliances than any other influence. A few years ago the prospective purchaser wanted to know, "How much current will this article consume?" while today the question is, "Will this article give me the best service?" It is the great educational work of recent years that has been done through the national advertising of our manufacturers and jobbers and the persistent efforts of the local dealer have brought about this change.

We all know now that we have arrived. The day of selling electrical appliances is here. The least of our troubles is to sell—everybody wants to do it electrically. The important thing today, it seems, is to try to elevate the standard of the appliance selling business so as to make it a really profitable adjunct of our central-station industry. If prices cannot be maintained and merchandising made a self-sustaining department, it should be abandoned entirely. A study of the industry shows that the list price established by the manufacturer is a fair price for the customer to pay and is not more than enough to enable the central station to pay the expenses incidental to this department with the overhead profit remaining to which it is entitled. In analyzing the business from this standpoint it will be found that the utility is confronted with the same elements of expense that the exclusive appliance dealer encounters. In bringing the margin of profit up to a point where these elements of expense are covered and are not swallowed up by the main industry, that of manufacturing and distributing electric energy, the appliance business is placed upon a plane where the dealer can successfully compete and he is thereby encouraged to extend his efforts in merchandising.

The automobile is sold today as a labor-saving and pleasure-affording vehicle of transportation. The electrical appliance is now firmly entrenched as a part of the essential equipment of the modern home and business because of equal importance. The automobile has from the start been pushed by dealers and at no time was it ever sold by gasoline manufacturers as a gas-consuming device. The electrical appliance was, in the early stages, handled almost exclusively by the central station but not until the public became convinced of its value and the idea that it was being sold solely because of its ability to consume electrical enenergy was dispelled, did it come into almost universal use.

Now that the electrical appliance has been introduced, the pioneering work is over and it is accepted universally that no home equipment is complete without an assortment of electrical labor-saving and comfort-affording devices. As central-station appliance dealers, the utilities should take stock of the opportunities. If they are to continue to sell appliances, and there seems to be no reason why they should not do so, they should elevate the standard of the business, thereby encouraging the dealer to compete. Full list price should be maintained; an additional price for time payment sales sufficient to pay the cost of carrying installments plus interest on the capital engaged is justified; stocks should be standardized so that it is possible to keep investment to the minimum and afford a creditable percentage of turnover and, as a further result, the element of obsolescence will be minimized. The utility will be in a position to take on the improved types of appliances promptly and should carefully select all appliances on which they standardize with the idea of service as the predominating factor.

All washing machines wash clothes cleanly. One may do the job a little quicker than the other and with less wear on the garments but the essential thing is, will the appliance be in operation Monday morning or will the central station have to send a service man to the house to make repairs or adjustments before the housewife can continue the operation? This is the big consideration. After selecting the appliance that gives the maximum of satisfaction and the minimum of operating trouble, standardize on it and handle it exclusively. Attempt to handle an appliance to meet every whim of the purchaser, which removes the strongest argument, which is, "We handle this appliance because we have found it to be the best."

Mr. Strange believes in campaigns. Enthusiasm is the life of any business and it takes some kind of a revival to keep up this spirit of enthusiasm. His company has found campaigns in which the several branch offices compete to see which can make the best record as productive of excellent results. Reduced price campaigns are of doubtful value although they are, at times, necessary in order to move merchandise that has accumulated through mistakes in buying and because of obsolescence.

RAISING GROUND LEVEL BY MEANS OF ELECTRIC PUMPING.

Five Hundred Horsepower Taken from Lines of Public Service Co. of Northern Illinois for Use in Construction Work.

At the new plant of the H. W. Johns-Manville Co. being built just north of Waukegan, Ill., a novel application of electric current is being made in conjunction with raising the ground level about 4 ft. by pumping sand and gravel from one portion of the property on to another portion.

A steam shovel has dug a 4-ft. ditch from Lake Michigan parallel and closely adjacent to the electric line. About 1000 ft. from the lake a pond about 40 ft. square and 14 ft. deep has been dug. In this pond a large scow has been built, on which are installed the following items of equipment: Three 200 kv-a. 2300-volt to 440-volt power transformers, 5 kv-a. lighting transformer, 400-hp., 440-volt, slip-ring motor, driving a large centrifugal pump; 75-hp. motor driving a smaller centrifugal pump; 50-hp. motor on a hoisting engine; 10-hp. motor driving a small reciprocating pump.

The pump on this scow will pick up sand and gravel from the bottom of the pond and pump it through an 18-in. pipe line about 2000 ft. long to a point where factory buildings are to be erected, the grade at this point being raised from four to seven feet. As the sand and gravel are pumped to a depth beyond which the contractor does not wish to go, the scow will move along so that when the job is done a channel 200 ft. wide by about 14 ft. deep will have been dug from Lake Michigan across the customer's property, a distance of nearly a mile. At some future date this channel will probably be used for harbor facilities for this customer. The centrifugal pump driven by the 75-hp. motor is used to loosen up sand and gravel on the bottom of the pond, pumping water out of the pond and forcing it against the bottom through a nozzle which will give a high velocity jet.

Public Service Co. current at 2300/4000 volts is carried on to the customer's property, and a line is then run a distance of about 4000 ft. to Lake Michigan.

Current is carried from the pole line along the channel to the barge by means of a No. 4 submarine cable supported on pontoons.

This plant will operate day and night until extremely cold weather sets in, as it is desired to complete the fill as early as possible.

Operating Practice

Locating Defective Pin-Type Insulators—Handling Underground Cables—Bare Wires—Oil Switch Safety Feature

TOOL FOR LOCATING DEFECTIVE PIN-TYPE INSULATORS ON WOODEN POLES.

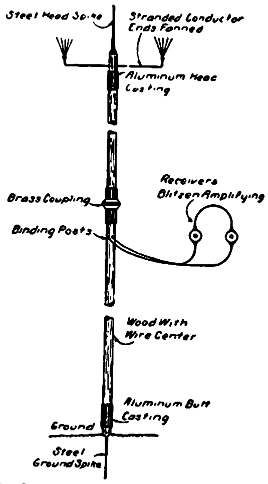
Abstract of Paper Before Southeastern Section, N.E.L.A. Valuable Experiences on Insulator Testing.

The tool shown in the accompanying illustration is designed by T. F. Johnson, Georgia Railway & Power Co., for locating defective pin-type insulators located on wooden structures. Its usefulness is almost entirely limited to those lines upon which the supporting structures are wood, such as wooden poles or built up wooden structures. The most satisfactory results are obtained on those lines on which crossarms and pins are both wood; however, it works well on those lines upon which the crossarms are steel with steel pins and not grounded, or upon which the crossarms are wood with steel pins, but no results can be obtained on lines such as steel tower lines or lines on which the cross arms and pins are steel and grounded. It will not under any condition locate a leaking or defective suspension type insulator, its usefulness being entirely limited to types of construction as explained above and pin-type insulators.

The instrument does not locate all defective pin-type insulators existing upon a line at any one time. It locates only those defective insulators which are so defective that they have started to leak. Pin-type insulators as it is well known, are defective for a considerable time before any appreciable leakage starts. However, by covering the line, as a general proposition, about four times a year with one of these instruments, all line outages due to insulator failures can be eliminated if the leaky insulators located by this instrument are removed as soon as possible after they have been located.

This instrument may be considered in a way as a small wireless antenna, and perhaps works partly on wireless principles and partly by induction. Anyhow, long experience has established that it does work, and will without fail, in the hands of an experienced patrolman, locate definitely a pole on which there is a leaky insulator. Note, in the above statement nothing is said about locating any particular leaky insulator on a pole on which there is a leaky insulator. The instrument shown in Fig. 1 is a wooden pole, joined in the middle so that it may be taken apart for transportation, with an aluminum head casting carrying a steel head spike and also a stranded conductor antenna; the ends of the conductor being turned vertically and fanned out. The head casting is connected with one binding post by means of a wire inside the stick; the lower half of the fault finder is of the same construction, the aluminum butt casting being connected to the other binding post. Across these two binding posts is connected a pair of amplifying telephone receivers. The telephone receivers are worn by the patrolman carrying the insulator fault finder.

To locate a pole on which there is a leaky insulator, the fault finder is put together as indicated in the sketch, with the receivers connected across the binding posts and the stranded conductor antenna arranged as shown. By sticking the steel ground spike in the ground as near the base of the pole as possible, and with the fault finder in a vertical position, with the antenna preferably parallel with the line conductor, the steady inductive hum of the line can be heard in the receivers; this hum is always heard when the fault finder is erected in the vicinity of a working line.



Tool for Locating Defective Pin-Type Insulators Supported Upon Nonmetallic Structures.

A leaking insulator makes itself known by a more or less intermittent scratching sound superimposed upon the inductive hum of the line. After a little experience, leaks are easily located, and a man soon learns about how long to listen at a pole for a leak before moving to the next pole. The worst leaks can be heard by simply sticking the fault finder vertically in the ground as described above, but in cases of very slight leaks it is often necessary to stick the steel head spike in the pole as far up as can conveniently be reached, holding the aluminum butt casting in one hand.

The fault finder when used in connection with the amplifying telephone receivers, is a very sensitive instrument, and it takes some experience to tell the difference between a leaking insulator and the corona which some times occur on small tie wires. Leaking insulators can be heard for a considerable distance by simply carrying the fault finder on the shoulder (rifle fashion), and holding the aluminum butt with one hand.

As pointed out, the fault finder locates the pole on which there is a leaking insulator, but does not locate the particular insulator which is leaking. To locate this particular insulator use is made of a set of amplifying receivers similar to the set used with the fault finder, by touching one end of the receiver cord to the through-bolt on the pole, and the other end of the receiver cord a short distance out on the cross arm; preferably the ends of the receiver cord should have sharp pointed instruments attached to them so that they can be buried in the wood. The end of the crossarm on which there is no defective insulator, will give no indication as the receiver cord is moved out along the bottom side of the crossarm. However, by repeating this operation on the other end of the crossarm, the defect will show up as the end of the receiver cord is moved along the crossarm on the end of which carries the defective insulator, the sound in the receivers will get louder until the point bearing the defective insulator has been passed. The sound then remains constant, or diminishes a little.

In a great many instances upon climbing a pole as described above to locate insulators, the crossarm braces will be found hot, or the insulator so noisy, or various other indications so clear that the application of the receivers will be obviously unnecessary.

METHOD OF HANDLING IMPORTANT FACTOR IN BEHAVIOR OF UNDERGROUND CABLES.

Failure of High-Voltage Lines Frequently Traceable to Careless Installation.

Every company operating high-voltage underground conductors knows that considerable damage can be done to these cables at the time they are being installed. The most frequent causes of damage are bends of small radius, too frequent bending, impact that causes cracks in the lead sheath and voids between sheath and insulation.

Speaking of the effect of careless handling upon conductor behavior of high-voltage underground conductors before the eleventh annual convention of the New England Section, N. E. L. A., held Sept. 22 to 24, inclusive, Wallace S. Clark cited a number of instances where it had been proved that bends of small radius are injurious to the conductor and lower very materially the dielectric strength.

In one investigation on a single-conductor lead-covered cable having an insulation of 5/32-in. thickness of saturated paper, a test voltage was applied, starting at 15,000 volts and increasing it at the rate of 2000 volts per minute until breakdown occurred. The lowest breakdown potential in 32 tests was 32,000 volts and the highest 48,000 volts; or expressed in volts per mil, 200 and 310 volts per mil, respectively. Duplicate samples were bent at an angle of 180° around a 11-in. mandrel, then straightened, and reversed through three cycles. Test voltage then showed that the lowest breakdown pressure was 15,000 and the highest 30,000. All samples were 10 ft. in length. This test showed that before bending the highest breakdown potential was 50% above the lowest, while after bending it was 100% above the lowest, proving that bending does materially lower the dielectric strength of underground conductors.

USE OF BARE WIRE ON LOW-VOLTAGE CIRCUITS.

Pertinent Reasons Advanced for Adhering to Use of Insulated Wires for Outdoor Transmission.

In reply to a circular sent to central stations in Canada, A. A. Dion, of Ottawa, chairman of the Canadian Electrical Association's committee on overhead lines, received the following letter from one of the companies:

"Regarding bare wire for line use under 2200 volts, it has never been the practice of this company to use bare wire for city distribution and although it is generally understood that the insulation on the wire, especially after it has been baked out, is no adequate protection for 2200 volts, insulated wire is useful in the erection of the lines because the insulation protects the wire from mechanical injury and prevents linemen coming in contact with live lines already installed.

"Our company's rules provide that all lines are normally considered alive by our men and work done accordingly. Lines are only treated as dead when known to have been killed properly and the proper clearances given. In order to show differentiation between primary and secondary lines, lines of 2000 and 4000 volts are erected on porcelain insulators, while low-voltage lines are on glass insulators.

"Use of both bare and weatherproof wire would necessitate carrying two classes of wire in stock as well as on repair and construction wagons. In city work the primary is only a small part of the distribution system and it would be still necessary to supply insulated weatherproof wire for all service work.

"In outlying districts where primary runs are long and service connections few, it would likely be considerably more feasible to use the bare wire."

Mr. Dion states as his own opinion that while ordinary weatherproof triple-braided insulation is not altogether effective, and linemen should treat all wires as alive, still the insulation is some measure of protection in dry weather and he favors its use on city streets.

SPECIAL SAFETY FEATURES FOR INDICATING OPENED CIRCUIT-BREAKERS.

Safety Indicating Lights Feature of Philadelphia Electric Co.'s Operating Procedure.

When a circuit-breaker is opened for repairs or any similar reason, the Philadelphia Electric Co. not only employs a tag or card stating why the circuit-breaker is open, by whom opened and on whose authority, and mechanical blocks for preventing accidental closing, but a special illuminating system for showing when a circuit-breaker is open is also employed. At the load dispatcher's office miniature electric lamps fed from a source of supply through "jacks" indicate upon the system dispatch board when a circuit-breaker has been reported opened anywhere on the system.

In the stations, not only is a circuit-breaker cell locked when the switch had been opened for special purpose, but inside each cell is installed an incandescent lamp which can be clearly seen through the wire glass panel at the front. These lamps are controlled by the mechanism of the circuit-breaker and are so located that they cannot fail to be seen when anyone looks at the disconnect switches between the circuit-breaker and the bus. These indicating lamps, in addition to those located on the switchboards and benchboards, are colored green and are in circuit only when the circuit-breaker is open. They serve the additional purpose of indicating when it is safe to pull the disconnect switches controlling the circuit-breaker which is shown to be open by the fact that the lamp burns.

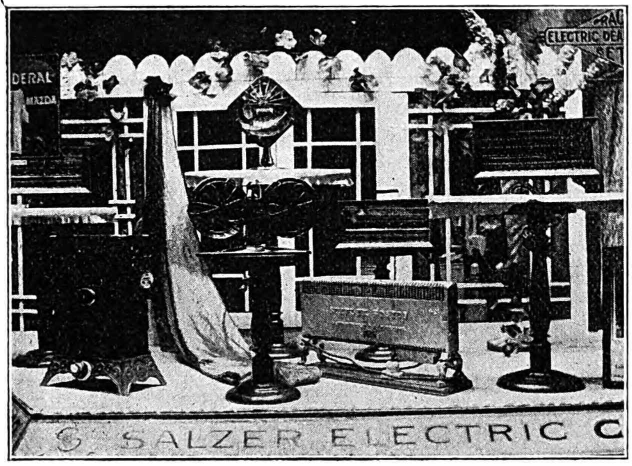
Contractor-Dealer

Week End Specials Part of Merchandising Plan—Collecting Bad Accounts—Contractors Organize Bureau of Education

PLAN OF SELLING WEEK-END SPECIALS USED BY CLEVELAND DEALER.

The Salzer Electric Co., Cleveland, Ohio, makes a practice of advertising a week-end special, an attractive price being made on a single electric appliance for Thursday, Friday and Saturday of each week.

Newspapers advertisements are linked with window displays to make its sales plans more effective.



This Window Display Was Used in Connection with Newspaper Advertisements Announcing Special Terms on Electric Radiators and Helped to Introduce Them to Many People Who Did Not Know the Convenience and Utility of This Electric Heating Device.

In connection with a recent sale of electric radiators the company inserted this announcement in the local papers:

ELECTRIC RADIATOR

Regular price, $12—Thursday, Friday and Saturday, only $9.

Just the heat for cool mornings and evenings, for bathroom or bedroom. At this price we can accept no telephone orders, C. O. D.s, charges or deliveries.

The window display space was carpeted with lavender cloth and a tall white vase in the rear was filled with branches of autumn leaves and wreathed with vines. In the center were the radiators mentioned in the newspaper advertisements, while the balance of the window space was given over to electric heaters and radiators of different types and prices.

SUCCESSFUL METHODS OF COLLECTING BAD ACCOUNTS.

Effective Collection Letters and a Series of Collection Media for Electrical Contractor-Dealers.

By Chester A. Gauss.

The most common way to collect overdue accounts is through the medium of collection letters which, if properly written, are not only cheap, but extremely effective. In writing these letters the appeal should be based upon plain human nature, for human nature is fundamentally the same the world over. Many people pay their bills just because they are honest. Others are too proud to have outstanding accounts, while still others will only pay bills through fear of action.

Most people are honest, so the first appeal to be made in a series of collection letters is one based on honesty. If a person is not honest, he generally has some pride, so the second appeal should be based on pride. There are still other people, but not a very large percentage, who deliberately try to avoid paying their bills. Such people can only be reached through fear of a lawsuit or other public method of collection. This gives us the third appeal that should be used, namely, one based on fear.

All three appeals should not be used in one letter, but only one in a letter. The first letter of a series of collection letters should be a strong appeal to the customer's honesty. Such a letter will bring returns from those who have lapsed in payment because of oversight or temporary inability to pay. This first letter should therefore be short and straightforward in the statement that the bill has evidently not been paid through oversight. The next few letters should be based upon the same appeal but more emphasis should be put on the fact that the debtor is expected to pay because he is truthworthy and honest. If three or four letters with the honesty appeal fail to bring a response. several letters based on the second appeal, that of pride, should be sent.

Failing to collect by appealing to both honesty and pride, there is only one other appeal that can be made in a letter, namely that based on fear. Whether or not this appeal should be used on any particular customer, depends upon whether or not it is worth while to let the account drag in the hope of future business. This fear appeal should not be used, as a rule, until relations have practically reached the breaking point. Before using the fear appeal it would be well to try some of the usual methods of collection mentioned later in this article.

The object in appealing first to honesty, then to pride, and finally to fear in collection letters is, of course, to eliminate outstanding accounts until only the hardest to collect remain. It must be remembered that many people who are honest but who have failed to pay, may have neglected to do so because they forgot or because they are low in funds and would welcome an extension of time. In the first letters, therefore, the dealer should give the debtor a chance to explain why the account has not been paid. Granting a short extension of credit to a man who has been ill or who has suffered a temporary business reverse will cement him to a store as a customer, but if he receives letters with a fear appeal there is great danger of eliminating him entirely as a customer.

Below are given sample letters with the honesty, pride and fear appeals. It must be remembered, however, that several letters with the same basic appeal should be sent a customer before changing the appeal. Each letter should attempt to eliminate those customers that have failed to pay for some particular reason. Always give the debtor a chance to explain his failure to pay, but don't create the impression that the debt can be dragged along, for it will decrease the effectiveness of all future letters.

Based on Debtor's Honesty.

Dear Mr. Jones:

I am hoping you enjoyed the coffee made in your new electric percolator. We know you feel that it is worth all it cost—$18—and more.

Upon referring to our books we find, however, that you have forgotten to pay your bill for it last month.

May we not be favored with payment before the end of this month?

Sincerely yours,

Based on Debtor's Pride.

Dear Mr. Jones:

Do you remember how everything that Midas of antiquity touched turned to gold? If we were Midas we would not be writing this letter and insisting upon the payment of your account of $18 with us.

Why have you treated us as you have? We certainly expected, at least, a reply to our previous four letters.

We know that you take pride in paying your bills promptly—in having a good credit standing in this town rather than to be rated as slow-pay by the local merchants.

We inclose a check on your bank made out for the correct amount—$18. Just sign your name to it and mail it in the inclosed stamped envelope. Like Midas, you will have converted your account into gold for us.

Sign it now before you forget. Thank you.

Sincerely yours,

Based on Debtor's Fear.

Dear Mr. Jones:

Your standing in this community is too valuable to you to permit it to be jeopardized over harmful publicity in a suit in court for a mere $18 which you owe us. It will mean attorney fees, loss of time at work and a lowering of the esteem by which you are held by your employers.

This is our seventh and last letter regarding this long overdue account of yours.

You owe it to yourself to permit no further delay and to avoid any unpleasant step you force us to take in this matter.

Isn't it worth sending us a check immediately to avoid action?

Sincerely yours,

It will be noticed that in the second letter reference is made to an inclosed unsigned check. This, of course, assumes that the name of the bank with which the customer does business is known. Collection letters with a personal touch like this pull best, for they serve to notify the debtor that the dealer is familiar enough with his business connections to cause trouble if his account is not promptly paid.

No collection letter can be effective if it lacks dignity and force and should not indicate a doubt about getting returns. The debtor owes the creditor money and the creditor expects it as a matter of course, not as a personal favor, because he has bills to meet, or for any other reason. In all cases the amount owed should be specifically mentioned and the request for payment should be made as definitely as possible.

Tracing the Skipping Debtor.

There is one kind of bad account which is too often given up as hopeless, but which still presents possibilities of collection—namely, that of a debtor who has removed to another section of the town or who has moved out of town, failing to leave his change in address. Letters sent through the mails will, of course, be forwarded to him but, secure in the knowledge that the postoffice is not at liberty to reveal his former address, he is likely to think that he is safe in believing that his creditors cannot learn his whereabouts.

The new address, however, can very often be secured from his employers, or if he has removed to another town, from his last employer with whom he is likely to have left a forwarding address either with the firm or with an individual in it. Then, too, the debtor's neighbors can often supply the information or refer to a friend who is likely to know the changed address. The superintendent or janitor of an apartment house also often knows of a friend or relative of the debtor's. In a small town the chief of police or a justice of the peace can often furnish the desired information themselves or secure it promptly. These individuals, however, have to be approached diplomatically so as to prevent a refusal or the creating of antagonism on the part of the debtor through his learning of any ill advised statements made to these individuals. In addition, in almost every town there is some kind of a retailers' credit association which traces debtors' movements within a town and, through the aid of other local bodies, learns a creditor's new address if he removes to another town.

Faulty Checks.

Checks are often received in payment of long due accounts which are intentionally or unintentionally left in such a way as to cause one at first sight to believe that he cannot collect them and that the check will have to be returned to the debtor with the request that it be made out properly and with the possibility of another long delay in obtaining the money. Faulty checks, drafts, etc., can, as a general rule, be collected through a bank if the dealer has evidence in writing of the remitter's intention to pay and will guarantee the bank against loss.

If the remitter sends a check on one bank and his letter states that it is on another bank, the creditor, if refused payment by the bank whose name appears on the check on the grounds that it has no such account, can guarantee its amount, make a note on the check that the remitter has no account at the bank named on the check, change the name of the bank on the check and deposit the check and letter of remittance with his banker again for collection. When a check is not signed it is easy to collect it by guaranteeing its amount and depositing it with a banker together with the letter that accompanied it. If the amount of the check is incorrectly given, or if it appears in the two places on the check as different amounts, the creditor can note on the back of the check the correct amount and guarantee it above his signature, attaching to the check the letter of remittance or a copy of his bill. If a check or a draft is made out to the debtor's order but is not endorsed by him and is remitted in payment of a bill, the creditor can supply the necessary indorsement himself as agent for his debtor, attaching the latter's letter as evidence of his authority to do so.

One of the most common tricks played by a debtor of little moral stamina is to write a letter saying that he is inclosing a check or draft, which he neglects to do, feeling that he is secure in claiming that the check must have reached the creditor and that he is not responsible for what happens after it gets into his place of business. Although such an explanation for refusing to send another check is of no value as a point of law, as the drawee could easily notify his bank to refuse payment on the first check and send a new one to his creditor, one often does not care to subject himself to further delay in collecting his bill or to subject himself to a lot of wrangling as to what became of the check. An easy way out of the matter is to draw a draft on the debtor for the amount named in his letter as being remitted and to deposit the draft with the letter of remittance attached, for collection through the bank, notifying the debtor that he failed to enclose a check and that you have made a draft out on him for the amount specified in his letter to save him from "further trouble" in regard to his account.

Unusual But Effective Means of Collecting Accounts.

Although a series of collection letters is one of the most commonly used, inexpensive and effective means of collecting bad accounts, especially for the electrical contractor-dealer, there are times when it is advisable to employ other means, many of which, although affective, are not so widely known.

One method which is as good in most cases as employing a personal collector at considerable expense is to put the matter in the hands of the American Railway Express Co. for collection. The express company will provide the merchant with an envelope in which he can insert the letter asking for the remittance or giving the choice to the customer of remitting in full or returning the goods in as good a condition as received. A charge of 25 cents is made by the express company whether or not it is successful in obtaining the money or the return of the goods.

The telephone is also another effective collection medium. Although it is not very effective in the case of those who will attempt to avoid payment at any cost, it enables the creditor to secure all the advantages of a personal call with a considerable saving in time and expense. That is, the creditor can discuss the matter as freely over the telephone as in a personal interview, employing appeals to honesty, pride and even using threats of action which he would perhaps hesitate to put in a letter while the account was in its present stage of collection for fear that the printed word is longer remembered than the spoken word. In fact, before sending a fear letter it would be well for the electrical contractor-dealer to try collecting over the telephone to avoid creating the ill effects that such a letter may create.

Another method which is effective, especially when an account is long overdue, is to send a strong letter which either directly or indirectly suggests the probability of stronger action being taken, by registered mail for which a receipt is requested. Such a letter serves to inform the debtor that his account is so long overdue that the credit is likely to take more serious steps and possibly wants the registry receipt for legal purposes. An example of such a letter, carrying a threat of action and designed to be sent by registered mail, is given below:

Dear Sir:

Not having received an answer to any of our eight letters regarding your account, we have registered this letter to make certain of delivery, so that if suit is filed against you, we have proof that you were properly notified:

Certainly you are aware of the fact that all retailers in this town are organized and that the debtor who does not pay his debts cannot obtain credit from any of them. Even doctors—the very ones you must call at critical times when every minute is precious—will blacklist anyone who is rated as poor pay. Surely you do not care to ruin your reputation for honesty and to reduce your standing in this community by refusing to pay a just debt.

If this matter is taken to court, it simply means a lot of unnecessary harmful publicity for you as well as a lot of unnecessary expense. You know when judgment is entered against a debtor, he must pay not only the debt, but all the legal costs and court costs for both sides.

We have always been willing to do the right thing by you and hesitate to cause you any trouble. If it is impossible to see us immediately, write us, inclosing a check for $25, the amount of your bill.

Act now, for in fifteen days we shall be forced to take this matter to court, thereby putting you to great expense.

Very truly yours,

A less drastic letter intended to be sent by registered mail and to create the impression that more forceful and unpleasant steps are likely to be taken if a remittance is not sent, could be worded about as follows:

Dear Sir:

This is the sixth time we have written you about your unpaid balance of $50 which has been standing against you for half a year.

To be frank, you have taxed our patience to the utmost and we do not intend to write you again in regard to this matter. We have, therefore, sent you this, our last letter, by registered mail so that we shall have proof of its receipt in case you cause us to take any unpleasant steps.

You are on the level. I know it.

You have as little use as I for the man who fails to live up to his written word. You trusted me and I proved worthy of your trust, sending your goods and not merely pocketing the small initial payment. I trusted you with much more, but you have repeatedly ignored your obligations to me. I hope you merely forgot to pay your bill. I know how easily it is to put off such things—also what a lot of trouble such a neglect may cause.

Don't force me to take other steps to collect this long standing amount. I should hate to do so as I value your patronage and good will.

Just send me a check today. It will be too late if you put it off a few days.

Thank you. Insistently yours.

BUREAU OF EDUCATION AND RESEARCH ORGANIZED.

National Association of Electrical Contractors and Dealers Completes Plans for Field Educational Work.

At the Milwaukee convention of the National Association of Electrical Contractors and Dealers representatives of that organization, the Associated Manufacturers of Electrical Supplies, the National Electric Light Association, the Electrical Supply Jobbers' Association and the electrical press made up a committee to consider the establishment of a bureau of education and research. The plan was given favor and each representative made the recommendation to his respective association to support it.

It is announced by the National Association of Electrical Contractors and Dealers that organization of the plans and work of this bureau is now well under way. A number of field men will be employed who are prepared to give dealers advice as to improvement of their stores and business methods, how to install and carry on proper cost, accounting and bookkeeping systems; in fact, give any assistance they can.

At present there are not many localities throughout the country where the co-operation between the manufacturers, central stations and retailers is all that it should be, but the bureau will in time bring these interests together to the end that it will greatly increase the retail distribution of electrical material. The field men, by means of personal work in the various localities, will also be instrumental in bringing together the three branches of the industry and by getting together the interested parties and directing their efforts towards the results desired will ultimately have all sections of the country working to accomplish the same end, namely, better electrical retail shops. The work of the field men will be supplemented by a series of lectures on such subjects as management, accounting and estimating.

New Appliances

Self-Regulated Range—Electric Rivet Heater—Utility Iron Set—Rough Service Battery Jar—Linemen's Safety Staging

New Hughes Automatic Electric Range.

Two distinctive features are combined in a new automatic electric range recently developed and placed on the market by Hughes Division of the Edison Electric Appliance Co., 5660 West Taylor street, Chicago. These features are an automatic time-controlling device and an automatic temperature regulator.

The time-controlling element is a simple device which can be set to automatically switch the current on and off at any hour or over any period of time desired. It requires no winding and is always ready for immediate use.

New Hughes Automatic Range.

The automatic temperature regulator consists of a device with a thermostat which automatically maintains the heat of the oven at any desired cooking temperature indefinitely. The proper oven temperature at which to cook the food is determined first; then the regulator is set by means of a lever as shown on the instruction card which is permanently secured to the side splasher.

As the oven is heated, an indicating pointer moves up the thermometer scale until it is opposite an adjustable pointer which designates the temperature at which the oven is to be heated. The current is then switched off by means of the thermostat; if the heat in the oven should reduce the indicating pointer will drop, and as soon as the indicating pointer drops below the adjustable pointer the current is again automatically switched on. This procedure is continued until the time set for the current to be switched off, so that an even temperature is maintained during the entire cooking operation. In other words, a curve plotted in terms of heat against time would show a sharply rising curve while the oven was being brought up to the cooking temperature, then a flat curve during the cooking period, and finally a slowly descending curve starting at the point where the current was switched off. The thermometer responds quickly to fluctuations in the heat of the oven and shows actual temperature in degrees whether the oven is being heated or cooled.

The manufacturer claims that the automatic regulator prevents extravagance in the use of energy by supplying just enough heat to keep the oven at the desired temperature. It saves food because it prevents scorching or burning, and at the same time provides the particular temperature best adapted for yielding the most nutrition and flavor for any kind of cooked food.

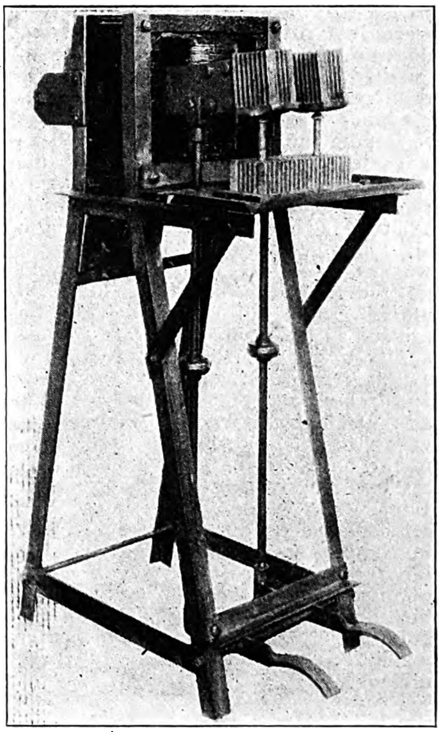
The range can be operated in three different ways: (1) The automatic time control and temperature regulator are both set, giving full automatic control. (2) The temperature regulator only is used, the current being switched on and off by hand at the oven switches. In other words, the temperature regulator is set, the switches operated by hand, and the indicating pointer moves up the scale and operates in the same manner as described above. This continues until the operator turns the current off by hand at the switches. (3) The temperature regulator is used as a safety device only, both the current and temperature being controlled by hand. That is, the temperature regulator is set at the top of the scale, so that there is no possibility of overheating.

The automatic feature for the time being will be confined to the Hughes type No. 50—right-hand oven only—and will be furnished in plain or nickel finish.

Electric Rivet Heater Possesses Many Advantages Over Old Methods.

In an effort to overcome the many difficulties involved in heating rivets previous to their being driven and riveted, the General Electric Co., Schenectady, N. Y., has designed an electric rivet heater which embodies low first cost with simplicity of operation, foolproofness of construction and maximum efficiency. This is accomplished by the following design.

A transformer rated at 15-kw. is mounted on angle-iron legs, which may be fitted with wheels. At the front of the transformer, two copper bars are fitted with heavy air-cooled electrode blocks of cast copper, and under these is another copper block which acts as a support and electrical connection for two rivets in series. When the rivets are stood up on the block and the electrodes are allowed to drop on the head of the rivet, the



Electric Rivet Heater, Which Does Its Work Reliably, Economically and Without Objectionable Features.

circuit is completed and heating begins. The two electrodes may be raised independently by two pedals, gravity being sufficient to lower the electrodes when the foot is removed. A primary tap switch mounted on the back legs of the machine gives all the variation needed for different lengths and diameters of rivets and rates of heating desired.

The advantages of this electric rivet heater are said to be the following:

(1) The higher efficiency of localizing the heat energy in the rivet resulting in less heat radiation.

(2) Better heat regulation in proportion to quantity of rivets used and

energy is used only when heating rivets, giving high economy.

(3) Production of heated rivets is 5 lbs. per kw-hr.

(4) Cleanliness—no smoke or gases are formed.

(5) No time is wasted in starting production.

(6) Quality of heat is better and minimum of scale forms. Rivet heats from inside out, giving more uniformity of heat and better upsetting conditions in shank.

(7) Wastage of rivets is reduced to a minimum.

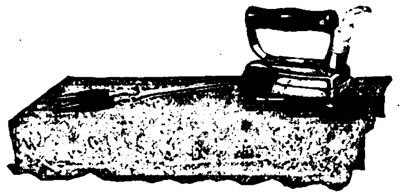
(8) Heater is portable, takes any rivet up to ⅞ by 5 ins. without adjustment, and but two power lines are required to each heater, eliminating piping for oil, air or gas.

The sizes of heaters so far developed are a 5-kw., two-jaw type for rivets up to ½ in., and a 15-kw., two-jaw type for rivets up to ⅞-in. diameter. The two-jaw heaters are intended for one-gang use; however, in actual test the 15-kw. machine heated 500 ½-in. by 1¼-in. rivets in one hour, which is ordinarily enough for two gangs of gun riveters.

During a careful survey of present methods of heating rivets, it was found that large quantities of rivets were lost after having been driven, due to uneven heating and consequently failure to upset in the hole thus causing a leaky rivet hole. Attendance was large, requiring a man to handle the forge blower as well as a passer; auxiliary equipment of the oil-burning rivet heater was expensive, requiring in many cases as high as 10 hp. per oil burner to supply the air blast necessary. The equipment was not flexible; the burners could not be moved easily from place to place. Small forges could not be utilized in many places due to the inability to get fuel to the forge as well as the trouble of handling the ashes and rebuilding the fire daily. This was particularly true in shipbuilding yards where the forge was used down in the holds of the ships to heat rivets used in riveting bulkheads, partitions, floor plates, etc. Here the atmospheric conditions were bad and in some cases it was found that the laborers have instituted severe complaints against the old methods of heating rivets. All of this led to the adoption of the electric rivet heater which has overcome many of these difficulties.

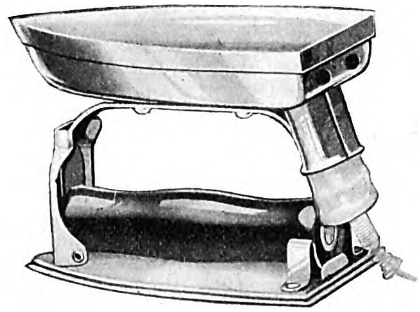
Hotpoint Utility Ironing Set.

A new electric appliance which is particularly appropriate for gift-giving purposes has been placed on the market by the Hotpoint Division of the Edison Electric Appliance Co., Chicago. It consists of a 3-lb. flat-iron, folding curling iron, and collapsible stand for inverting the iron when heating the curling iron or when used as a small cooking stove. The iron differs from the standard Hotpoint iron only in the following respects: It has no attached stand; has two holes in the rear for inserting of curling irons—thus two irons may be heated at the same time. When the stand supplied for inverting the iron is not used for that purpose it serves as an ordinary iron stand. The set fits into a very cleverly constructed folding box consisting of four wooden sides, hinged with cloth, so constructed that it will fold up in such a way as to provide closed ends. When folded in the box form it presents a very compact, neat appearance. The end of the decoratively printed cloth cover may be tied with a silk cord. The size when folded is approximately 8 by 4 ins.



Hotpoint Utility Set Consisting of Flat-Iron, Curling Iron, Ironing Board and Collapsible Stand for Using Set as Cooking Stove.

The big feature about this folding box is that when unfolded flat it provides a very handy ironing board, with a surface of 16 by 8 ins., on which any little pressing job may be accomplished by the user. Thus the inconvenience usually experienced by travelers not having suitable ironing surface will be done away with.



Collapsible Stand for Using Hotpoint Utility Set as Small Cooking Stove.

New Battery Jar for Rough Service.

In certain classes of service the storage battery is subjected to extremely rough usage in different ways. For example, mining locomotives, industrial tractors and even automobiles, are subject to jolts and vibration, while the shocks that accompany collisions and derailments of locomotives and similar incidents place heavy stress upon the storage battery jars.

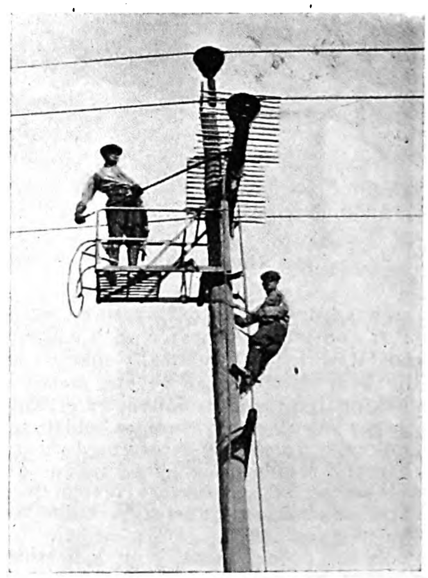
To meet this condition of rough usage, the Electric Storage Battery Co., Philadelphia, Pa., has developed a battery jar, known as the "Giant" jar. This battery jar is made of exceptionally tough material, having great strength under compression and tenacity to withstand impact. The result is that the jar is practically unbreakable; and, upon the basis of all reasonable working conditions may be claimed to be unbreakable. Exhaustive tests made by the manufacturer have proved that the "Giant" jar will stand a pressure of 2000 lbs. at its weakest cross section, while the old-style jar failed at less than 1000 lbs. The "Giant" jar has high dielectric strength, withstanding a potential test of 30,000 volts and has low unit weight. The Electric Storage Battery Co. states that the ability of this jar to withstand the severest service is causing it to be extensively used in mine-haulage service, for industrial tractors and similar work where a strong jar is needed to protect the storage battery.

Safety Staging and Guards for Linemen.

Even when using linemen's belts, working upon poles is not free from danger because of the possibility of the belt breaking or the likelihood of the lineman's spurs slipping out of the pole. In any case the fact that one's position is more or less restricted by the range of the belt and the fact that the feet are more or less rigidly fastened to the pole movement is limited and the speed at which work can be accomplished is affected. Then there are the safety aspects also.

The accompanying illustration shows a lineman's platform and guard developed by the Bush Electric Co., Cleveland, O., the purpose of which is to enable linemen to work with greater freedom and greater safety. The chief use of the Bush staging is on high-tension lines.

The staging is designed for the purpose of changing insulators, pulling up slack, grounding pins, testing insulators, etc., on high-voltage energized lines. It forms a solid platform on which the men can work and which is adjustable to any position, in or out, or around the pole. The wood from which these stagings are made is selected with utmost care and submitted to a special impregnating and drying process known as the Bush treatment. This treatment enables the wood to withstand a voltage of 5000 volts per inch so that if a workman should accidentally touch a 75,000-volt line while standing on the staging, he would not be injured. The safety guards are also made of wood similarly treated. When placed as shown in the illustration they serve as a reminder to the man to keep within certain bounds when working on the crossarm. Many otherwise impossible jobs can be done when these guards are used.



Bush Linemen's Stage and Guard in Use on High-Voltage Line.

Trade Activities

St. Paul Electric Appointed Westinghouse Agency—Matthews Light Plant Purchased by King of Siam

Citizens Electric Co., Hot Springs. Ark., will hold an electrical show in that city on Nov. 13, 14, and 15. Various manufacturers and jobbers have been invited to participate in the display of electrical devices.

James McEwan & Co., 488 Broad street, Newark, N. J., has been organized to engage in the production of electric and gas appliances and kindred specialties. Malcolm Thomas, Hackensack, and James McEwan, Montclair, head the company.

British Westinghouse Electric & Manufacturing Co. has changed its corporate name to Metropolitan Vickers Electrical Co. Through the recent amalgamation of Vickers, Ltd., with the Metropolitan Carriage, Wagon & Finance Co., the former became the controlling factor in the affairs of the British Westinghouse company.

L. V. Estes, Inc., industrial engineer, 202 South State street, Chicago, has prepared a booklet entitled "Human Relations in Industry," which in view of present conditions and the labor problem is particularly timely and of special interest. It presents a clarification of the principles and factors of industry and sets forth the underlying principles of personal relations and industrial management that are essential to industrial harmony and maximum production. It outlines in a general way the requirements of the work and the procedure necessary for putting into effect plans tending toward a betterment of human relations in industry.

Electric Furnace Sales.—Considerable activity in the sales of electric furnaces has recently been experienced by the Electric Furnace Co., Alliance, Ohio, the company having received the following orders for its product: Drew Electric & Manufacturing Co., Cleveland, Ohio, a 105-kw. furnace for melting yellow brass; Nolte Brass Co., Springfield, Ohio, a 105-kw. furnace of 1500-lb. capacity for melting yellow brass; Kennedy Valve Co., Elmira, N. Y., a 105-kw. electric furnace for red brass; American Bronze Corp., two 1500-lb. electric furnaces for melting bronze; Dominion Steel Products Co., Brantford, Ontario. Can., 50-kw. furnace of 500-lb. capacity for yellow brass; Deming Co., Salem, Ohio, a furnace of 500-lb. capacity for melting yellow and red brass; Miller Pasteurizing Machine Co., Canton, Ohio, a Baily 50-kw. furnace for yellow brass; Landers, Frary & Clark, New Britain, Conn., a 50-kw. furnace with capacity for melting 200 lb. aluminum per hour, and the installation of nine Baily electric furnaces for melting a wide range of non-ferrous metal and alloys.

The Electric Furnace Construction Co., Finance building, Philadelphia, advises orders received for "Greaves-Etchells" electric furnaces from Lacheze et Fils, Dijon, and C. Markham & Co., Ltd., Chesterfield.

The Triumph Electric Co., Cincinnati, Ohio, has appointed W. H. Thompson as works manager. Mr. Thompson was recently works manager of the Fairmont Mining Machinery Co., Fairmont, W. Va., and previously had spent 12 years with the Westinghouse Electric & Manufacturing Co., East Pittsburgh, Pa.

Pelouze Manufacturing Co., 232-242 East Ohio street, Chicago, is sending out a new 25-page catalog on scales and electrical appliances. The first half of this publication is devoted to illustrated descriptions of Pelouze scales of various types and sizes. The remainder of the booklet deals with electrical devices manufactured by the company, among which are included electric irons, toasters, electric radiators, heating pads, etc.

The Roller-Smith Co., with main office and export department at 233 Broadway, New York City, manufacturer of electrical protective and measuring apparatus, announces that it is now represented in Cuba by Martinez Cartaya & Bueno, located at Muralla 40, Havana, Cuba. Martinez Cartaya & Bueno will handle the Roller-Smith products of electrical measuring instruments, watthour meters and circuit-breakers on an exclusive agency basis for the entire island of Cuba.

The Goulds Manufacturing Co., Seneca Falls, N. Y., is sending out a new bulletin entitled "Centrifugal Pump Sales Service Data." The data contained in this bulletin were first issued as a series of sales letters for the use of its selling organization, but because of the enormous demand for authentic information on the centrifugal pump, they have been reprinted by the company, placing at the disposal of its customers a vast amount of information on the theory, design, testing, practical application, etc., of these pumping units. The concluding chapters of this publication are devoted to detailed descriptions of the Gould line of pumps. The text is accompanied by numerous illustrations of typical installations and pumping units. and charts, showing head curves, efficiency curves and horsepower curves. The Goulds company is now in its seventy-first year as a successful producer of centrifugal pumps, which rank among the very best in this country in completeness, as well as in construction and design.

Western Electric Co., 195 Broadway, New York City, is making distribution of a new booklet entitled "The Eight-Hour Day in the Home," which treats in a unique way the housekeeping problem under the present servant shortage. The treatment of the subject matter marks a new epoch in electrical appliance advertising and the book carries the endorsement of a celebrated household efficiency expert, who is in hearty accord with the suggested solution of this problem, namely, the use of electrical labor-saving devices for the home. This booklet has been issued in connection with an advertisement that appeared in the Oct. 18 issue of the Saturday Evening Post. The advertisement also treats of the servant problem and how it may be mitigated, if not entirely solved, by the use of electrical appliances in the household.

The Pittsburgh Reflector & Illuminating Co., Pittsburgh, Pa., has prepared a very convenient calculator for quickly showing which of its show window reflectors should be used for the proper illumination of show windows of various dimensions. This calculator consists of a cardboard pocket holder with two slots near the top. At the left are shown different heights and depths of windows and at the right various heights of the background in feet. The window heights range from 7 to 14 ft. and the depths from 3 to 10 ft., while the window trim of background ranges up to 10 ft. A card placed in the holder has stamped on it in suitable rows the figures for height and depth of window and, at the right, the catalog numbers for the five different types of show window reflectors made by the company. By pulling out the card to any desired window dimensions, it is possible to instantly determine the type of reflector to be used for different heights of trim. On the outside of the holder are shown illustrations of the reflectors made by the company together with data relative each.

Westinghouse Electric & Manufacturing Co., East Pittsburgh, Pa., has issued motor application circular No. 7179 entitled "The New Farm Help." This is an attractively illustrated booklet with a three-color art cover and pleasing two-color pages, setting forth more than seventy uses to which electric motor power can be applied as an efficiency builder and labor saver on the farm. It explains not only how electric power can be utilized for doing a large amount of work on the farm, but how it provides the best, safest and most convenient form of light and how it takes the drudgery out of many of the hardest household tasks of the farmer's wife. By citing various instances where electrical installations are in actual operation on farms, it proves that electricity is beginning to revolutionize agricultural life not only by making it more profitable, but by providing it with many of the comforts and conveniences heretofore found only in the city. It explains how central-station power may be secured where no service lines exist at present and gives instructions as to how to connect and distribute power about the farm. The booklet will be sent free on request to central station officials who are interested. The following information should be included with the request: Length of proposed line, number of possible consumers, number of original consumers and general plan of organization.

St. Paul Electric Co., jobber of electric supplies and appliances, 145-147 East Fifth street, St. Paul, Minn., has been appointed agent-distributor for the northwest territory by the Westinghouse Electric & Manufacturing Co. A complete and varied stock of Westinghouse products will be carried for which purpose an entire floor has been set aside. The company aspires to carry the largest stock of motors, meters, transformers and other power apparatus in the Northwest and to render to the trade service on apparatus such as no other distributor in this territory has heretofore been able to give. Facilities are provided for handling engineering work in connection with the proper installation of Westinghouse apparatus, and this department will be in charge of M. R. White. The Westinghouse agency will, in addition to the other manufacturers that it represents in this territory, enable the St. Paul company to handle a very extensive and varied stock of electrical apparatus either for the generation or use of electricity and supply everything from a socket bushing to a steam-driven turbogenerator.

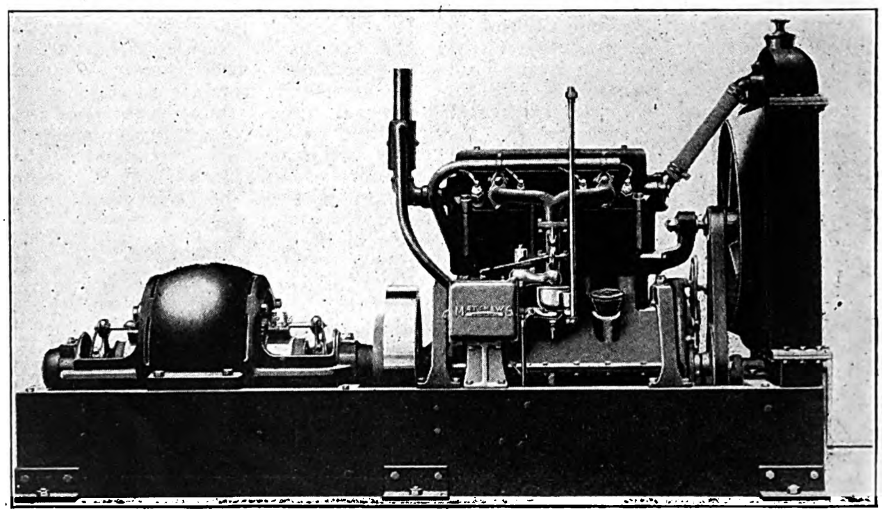
The Cutler-Hammer Manufacturing Co., Milwaukee and New York, has prepared a number of standard descriptive booklets which illustrate and describe various types of C-H apparatus. A recent addition to this list of publications is known as Booklet J and is illustrative and descriptive of C-H rectangular magnets, which are particularly adapted for efficient handling of regular shapes in steel and iron. The advantages of using a rectangular magnet over any other type of magnet for handling such material as sheets, bars, billets, ingots, pipes, etc., is maximum lifting capacity for a given weight of magnet, resulting in economy in the price of the magnet, crane equipment, and current consumption, and besides, greater speed in handling the material. The booklet makes mention of a few typical applications where C-H rectangular magnets are handling ship plates, pipe, cold-rolled steel in coil and other material. In one instance, one of the magnets had a record of unloading 50 tons of plates in 50 min. from a railroad car to stock pile. Numerous illustrations show the magnets in use in several prominent plants. Occasionally magnets are used in pairs. The booklet describes the magnet construction, gives dimensions and other engineering data and tables of lifting capacities for various classes of material.

The Esterline Co., Indianapolis, Ind., has issued a well illustrated book entitled "Typical Graphic Records." This shows 36 graphic records taken on Esterline recording instruments, these giving a very effective idea of the change in power consumption of various machines, changes in speed, variations in power-factor, fluctuation of gas production, transformer load record, etc. Through analysis of some of these power records extremely valuable results have been obtained in eliminating errors and losses in operation and production. In other cases, valuable data have been obtained for aiding in scientific rate making by power companies. The value of these records and the many possibilities of securing improvement in operation through a study thereof are pointed out in the publication. It also includes a number of views of essential elements of the Esterline graphic instruments and gives a brief description thereof. This publication should prove of great value to those somewhat familiar with the use of recording instruments but who have not fully realized the many possibilities of usefulness that they possess.

Zobell Electric Motor Corp., Garwood, N. J., has entered the field to manufacture alternating and direct current motors, ranging in size from 1 to 7½ hp. It is also intended to make a very high-grade motor with many new refinements. The design of the first line of motors has been completed in which the shafts may be removed without disturbing either the core or the commutator, and the commutator may likewise be removed without disturbing the shaft or core, a method which it is claimed has not heretofore been used on small motors. All refinements used on large motors are to be adapted to these small machines. A line of standard commercial motors is being brought out, but at present the company is principally devoting itself to building motors designed especially for machines on which they are to be employed. The equipment is designed to produce from 200 to 300 motors monthly. The company, which was recently incorporated with a capitalization of $250,000, has for its officers the following: Fred G. Bell, president; A. T. Zoebisch, treasurer, and F. E. B. Bucker, secretary.

Consolidated Utilities Corp., Chicago, factory distributor for Matthews full automatic electric light and power plants, recently sold to the King of Siam a 5-kw. electric plant to furnish light and power for the luxurious royal palace. The special representative sent by His Majesty spent considerable time investigating many factories and in studying the features of the various plants on the market, and because of its full automatic features, and its long proven reliability, as well as its wide use by the United States government, the Matthews full automatic plant was selected. On this same American trip a gold-plated typewriter was purchased. A 10-kw. Matthews electric light and power plant left the factory last week and was shipped to Rene Berndes, who is the ex-Hungarian consul for Cuba. Senor Berndes has recently gone into the sugar business and has an immense, modern plantation which requires an ample installation for both light and power, and the absolute dependability of this plant is of first importance.

The presidential train of the Republic of Mexico, renowned as perhaps the most elaborate train in the world, presented by the Pullman Co. to the Mexican government, has just been equipped throughout with electric lights and a Matthews full automatic plant was installed. This train was presented during the regime of Diaz and has been in constant service ever since. It is most lavishly decorated and finished without regard to expense, several of the interiors being trimmed in gold-leaf, with intricate and classic hand carvings, and inlaid with ivory. With its present Matthews equipment this train now possesses every possible modern convenience. These plants are the same as are used throughout America on thousands of farms, but are of larger models. The patented full automatic features of the Matthews make it a most popular plant where reliable service is expected. It gives the battery full protection at all times against over-charging or excessive discharge. It starts and stops itself automatically. These plants are built in seven sizes from ⅓ kw. to 25 kw.



Matthews Power Plant Used in Royal Palace of King of Siam.

Current News

Weekly Record of Construction Activities—Conventions

EASTERN STATES.

Lewiston, Me.—Arrangements are being made by the Androscoggin Electric Co. for the construction of an extensive addition to its power at Deer Rips, on the Androscoggin river, near Lewiston, Me., for increased capacity. The project including machinery and equipment will cost about $200,000.

Ludlow, Vt.—Council has recently completed work on the extension of its power lines from the municipal electric plant to Smithville.

Springfield, Vt.—Colonial Power & Light Co. has completed arrangements with the Fellows Gear Shaper Co. for furnishing additional electric power for the operation of a new addition to its plant now nearing completion. The company has recently commenced the construction of a 3-phase line extension to the plant of B. Steinfield & Sons, for additional service.

Rutland, Vt.—Vermont Hydro-Electric Co. will build hydraulic plant and a dam to cost $450,000.

Boston, Mass.—Boston Insulated Wire & Cable Co. contemplates the erection of an addition to its plant.

Lowell, Mass.—Massachusetts Cotton Mills has awarded contract for the erection of a power house to cost $100,000.

Pittsfield, Mass.—Plans have been prepared for an addition to the plant of the General Electric Co., to cost $200,000.

Albany, N. Y.—Plans are under consideration by the board of managers of the Homeopathic Hospital, 161 North Pearl street, for the erection of a new heating plant, laundry building and solarium at the institution, estimated to cost $134,415. Considerable electrical and mechanical equipment will be required in connection with the proposed work.

Brooklyn, N. Y.—In connection with the construction of the proposed plant of the Gehnrich Indirect Heat Oven Co., 60 Franklin avenue, to be located at Buckley and Skillman streets, Long Island City, estimated to cost $100,000, considerable electrical and mechanical equipment for operation will be required. The new works will be a two-story structure, about 125x200 ft.

Brooklyn, N. Y.—Fahnestock Electric Co., Meadow street, manufacturer of electrical equipment, has completed negotiations for the purchase of property, about 50x100 ft., on East avenue, Long Island City, to be used as a site for the construction of a new machine shop.

New York, N. Y.—Announcement has been made by the Marconi Wireless Telegraph Co. of America, Woolworth building, that a contract has been entered into with the United States Shipping Board, Emergency Fleet Corp., for the maintenance of its wireless service on the 400 ships of the board. The agreement provides that the company furnish the necessary operators, and includes the maintenance and repair of the wireless apparatus.

New York, N. Y.—Considerable electrical and mechanical equipment will be required by the United Cork Co., 50 Church street, in connection with the construction of a new plant at Lyndhurst, N. J. The works will comprise a group of one-story structures, including main manufacturing building, and are estimated to cost $100,000.

Bloomingdale, N. J.—Plans are under consideration by the Borough council for increasing the electric lighting facilities in the Bloomingdale Flats district.

Dover, N. J.—Board of Water Commissioners is considering plans for the installation of new electrically driven pumping units at the municipal pumping station to replace the present gas engine equipment. Service is furnished by the New Jersey Gas & Electric Co.

Hoboken, N. J.—Fire recently damaged a large quantity of stock at the plant of the Cooper Hewitt Electric Co., 722-32 Grand street.

Hoboken, N. J.—Button Machinery Co., 1023 Clinton street, has awarded a contract to the Industrial Engineering Co., 30 Church street, New York, for the erection of a new boiler plant in connection with its proposed works to be located on 11th street, extending from Grand to Adams streets. The project is estimated to cost $170,000.

Newark, N. J.—Essex and Hudson county commissioners jointly have ordered the county engineers to prepare specifications for a new contract covering the lighting of bridges over the Hackensack and Passaic rivers in the respective counties for a period of five years. The present contract expires on Nov. 15.

Verona, N. J.—In connection with the construction of the proposed group of hospital buildings at the Mountain Sanatorium by the Essex county officials, work has been practically completed on the erection of the boiler plant at the site. It is understood that light and power service, as well as water, will be furnished from the Overbrook Hospital, Overbrook, and work has been completed on a new booster installation to be used for this purpose. A large laundry building is also included in the plans, and in this connection, considerable electrical and mechanical equipment will be required.

Washington, N. J.—In connection with the establishment of the proposed plant of the Merritt-Grieler Silk Throwing Co., on East Washington avenue, plans have been prepared for the installation of a new engine plant for general factory operation.

Allentown, Pa.—Peters & Jacoby Co., 627-29 Hamilton street, has recently completed extensive improvements at its plant, including a change in motive power to individual motor drive. It is said that the company is considering the erection of a new plant for the manufacture of ice cream, and in this connection considerable electrical equipment and refrigerating apparatus will be required.

Glen Mills, Pa.—Glen Mills Electric Co. has filed application with the Public Service Commission for permission to furnish electric energy for light, heat and power purposes to Thornbury township.

North Catasauqua, Pa.—Borough council has approved plans for the installation of the proposed electric street lighting system. It is understood that power for operation will be furnished by the Lehigh Valley Light & Power Co. for a period of about ten years.

Philadelphia, Pa.—Sears, Roebuck & Co. have awarded contracts for a large reinforced concrete building, 780x440 ft., and will represent an investment of approximately $7,500,000. George C. Nimmons & Co., Chicago, are the architects.

Philadelphia, Pa.—Announcement has been made by the Keystone Telephone Co. that plans are being arranged for the installation of automatic telephones, to replace the system now in use by the company throughout the Philadelphia district. Edward M. Cooke is vice-president and general manager.

Philadelphia, Pa.—In connection with the construction of the proposed building of the American Ice Co., to be located in Frankford district, contract for which was recently awarded to Cramp & Co., Philadelphia, considerable electrical equipment and refrigerating apparatus will be required. The structure will be of reinforced concrete construction, and will cost approximately $150,000.

Pittsburgh, Pa.—The department of public service will advertise for bids for furnishing and installing motor generator set in connection with the plant at the Department of Public Safety building. Address E. V. Babcock, mayor.

Pittsburgh, Pa. — Follansbee

Brothers Co., manufacturer of tin plate automobile and electrical black sheets, etc., has completed arrangements for a bond issue of $1,500,000, the proceeds to be used to cover the cost of the construction of a new manufacturing plant of like size as its present works at Follansbee, W. Va. The plant comprises four 35-ton open-hearth furnaces, six tin and seven sheet mills, and has an annual capacity of about 65,000 tons of finished material. William U. Follansbee is president.

Yardley, Pa.—Yardley Water Co. has recently completed the installation of a large new pumping unit at the local waterworks plant. Other improvements to facilitate service have also been made in the system.

Baltimore, Md.—Service Terminal Co. is understood to be considering plans for the erection of a large new local cold storage plant. Considerable electrical equipment, refrigerating apparatus, etc., will be required in connection with the proposed work.

Baltimore, Md.—Samuel T. Williams, 223 North Calvert street, is in the market for a motor-driven single-drum hoister, suitable for tub rig hoist, 50-hp. motor, a. c., 220 volts, 3-phase, 25-cycle; drum 30-in. diammeter, 24 ins. long with or without motor.

Welch, W. Va.—Welch Armature Co. will erect a three-story and basement building, 63x63 ft. John Doss, architect.

Wadesboro, N. C.—Extensive improvement will be made to the light system. Address mayor.

Denmark, S. C.—Edisto Public Service Co. is arranging plans for the erection of a new local plant, including the construction of a 10-mile transmission system to Stalo. The work is estimated to cost $40,000. R. A. Easterling is manager.

Gaffney, S. C.—City council is considering plans for extensive improvements and extensions in the municipal light and water system.

Orangeburg, S. C.—City is planning for a bond issue of $45,000, the proceeds to be used to cover the cost of proposed extensions in the municipal electric light system. W. A. Livingston is mayor.

Bainbridge, Ga.—Bainbridge Power Co. has organized with a capital of $100,000 to build dam and power house, to cost $75,000. The power house will be erected at Spring Creek. Bids will be asked for the machinery. J. M. Simmons, president.

Cochran, Ga.—City has approved the issuance of bonds for $15,000 to cover the cost of improvements in the municipal electric light and water systems. H. D. Sturdivant is engineer.

Spring Creek, Ga.—Bainbridge Power Co., recently organized with a capital of $100,000, is arranging plans for the construction of a local hydro-electric power plant with dam, estimated to cost $80,000. Included in the proposed work is the construction of a transmission system, which with machinery will cost about $55,000. J. M. Simmons is president; D. T. Sutherland, vice-president; and E. J. Perry, secretary-treasurer; all of Bainbridge, Ga. B. M. Hall & Sons, Peters building, Atlanta, are architects and engineers for the company.

Eau Gallie, Fla.—Eau Gallie Electric Co. will erect an ice and electric plant to cost $40,000.

Vero, Fla.—Vero Utilities Co. is arranging plans for extensions and improvements in its local power plant, to provide increased service, including the installation of new generating and engine equipment. It is also proposed to extend its lines to Vero Beach.

DATES AHEAD.

Jovian Order. Annual convention, Chicago, Nov. 5 and 6. Headquarters, Hotel Sherman. Acting Mercury, Eli C. Bennett, St. Louis, Mo.

Electrical Supply Jobbers' Association. Semi-annual meeting, Cleveland, Ohio, Nov. 18-20. Headquarters, Hotel Cleveland. Secretary, Franklin Overbaugh, 400 South Clinton street, Chicago.

American Society of Mechanical Engineers. Annual meeting, New York City, Dec. 2-5. Secretary, Calvin W. Rice, 29 West 39th street, New York City.

American Institute of Chemical Engineers. Annual meeting, Savannah, Ga., Dec. 3-6. Secretary, J. C. Olsen, Brooklyn, N. Y.

Electric Power Club. Meeting, Hot Springs, Va., Dec. 11, 12 and 13. Headquarters, Homestead Hotel. Secretary, C. H. Roth, 1410 West Adams street, Chicago.

National Council of Lighting Fixture Manufacturers. Annual convention, Detroit, Mich., February, 1920. Secretary-treasurer, Charles H. Hofrichter, Cleveland, Ohio.

National Electric Light Association. Annual convention, Pasadena, Cal., May 18-21, 1920. Headquarters, Hotel Huntington. Acting secretary, S. A. Sewall, 29 West 39th street, New York City.

NORTH CENTRAL STATES.

Indianapolis, Ind.—Delaware Realty Co. will erect an 18-apartment building, to cost $100,000.

Indianapolis, Ind.—Gladstone Realty Co. has begun the erection of a 48-apartment building, to cost $200,000.

Indianapolis, Ind.—Holcomb & Hoke Manufacturing Co. will erect two new buildings, one to be a three-story brick building and the other a one-story frame structure.

Wabash, Ind.—Service Motor Truck Co. will erect a new building, 75x775 ft., to cost $150,000.

Wabash, Ind.—T. F. Vaughn, president of the Wabash Cabinet Co., announces that additions to cost $100,000 will be erected at once.

Chicago, Ill.—Edison Electric Appliance Co., Inc., has under consideration an addition to its plant. The structure is to be 342x355 ft. and will cost $270,000.

Chicago, Ill.—George W. Pyott Co., manufacturer of power transmission machinery, has purchased from the Pyott Foundry Co. a tract of land, 575x318 ft. at Lake street and Kilpatrick avenue.

Chicago, Ill.—Ed. V. Price Clothing Co. will build a 12-story building, 250x120x178x250 ft., corner South Throop street and West Jackson boulevard.

Chicago, Ill.—Stromberg Motor Devices Co. has begun work on the erection of a seven-story building on a 75-ft. tract, and will involve an expenditure of $280,000. It will be used as addition to the plant of the Stromberg company on 25th street.

Chicago, Ill.—A four-story factory building, to cost $50,000, is to be erected by Ludwig Pottasch, 32 South Wabash avenue, at 113-115 West Austin avenue.

Chicago, Ill.—C. Reynolds Bronson will erect a one-story factory building, 100x100 ft., at 4435-45 West Kinzie street. This building has been leased to the Handy Manufacturing Co., manufacturer of steel clamping devices, for a period of 10 years.

East St. Louis, Ill.—Through the construction of a second line from the Keokuk dam to the distributing station of the East St. Louis Light & Power Co., it is hoped to relieve the interruptions in light and power to which the city is now subjected. Work on a dual high-tension line is being pushed rapidly and will soon be completed. With this line in operation the company will always have one line in reserve in case of interruption to the other.

Elgin, Ill.—An ordinance is before the council providing for an issue of $200,000 in bonds for establishing a local lighting plant. Address A. E. Price, mayor.

Galena, Ill.—Interstate Light & Power Co. has received requests from two large mining companies for extension of electric transmission lines to furnish power for sinking shafts to new ore bodies.

Monmouth, Ill.—On Nov. 18 an election will be held to vote on the question of issuing municipal light bonds. Address city clerk.

Ottawa, Ill.—Peltier Art Glass factory has been destroyed by fire, with loss of $150,000. The plant will be rebuilt.

Peoria, Ill.—Cappel-Garrard Co. will erect steel addition, 60x40 ft., to cost $15,000.

Peoria, Ill.—National Warehouse Co. has awarded the contract for new buildings to W. M. Allen & Sons, for $175,000. The new building will be 140x80 ft., seven stories in height.

Waukegan, Ill.—Board of education plans the erection of a $200,000 high school building.

Kalamazoo, Mich.—Eddy Paper Co. has commenced work on its power plant at Three Rivers, Mich., 57x191 ft.

Monroe, Wis.—Monroe Electric Co. has under consideration the extension of its service to Juda. The proposed route of the transmission wires is now being surveyed and it is expected to have the work under way in a short time. The company has also installed an additional boiler at its plant, increasing its capacity by one-third.

Oshkosh, Wis.—Oshkosh Washing

Machine Co. contemplates a plant addition, one-story, 80x200 ft.

Wood, Wis.—Local business men will organize a company and will incorporate the Wood Electric Light & Power Co. for the purpose of providing the town with electricity for lighting and power. It is planned to install a plant at once and have it completed within 60 days.

Faribault, Minn.—One hundred hp. in motors has been added to the connected load of the Colburn Brick & Tile Co., served by the Northern States Power Co. This is for the operation of electrically driven hoists for stripping.

Montevideo, Minn.—Southwestern division of Northern States Power Co. will supply electric energy amounting to 75 hp. in motors for the requirements of the new $300,000 high school at Pipestone. The company is also furnishing 30 hp. for the operation of a new creamery at Montevideo. Among new buildings in prospect for Pipestone is a $50,000 hospital, foundation for which will be started this fall. Electric light and power requirements will be supplied by the Northern States Co.

Dubuque, Iowa—Cadillac Motor Co. will erect a $20,000 garage building for storage and display rooms.

West Liberty, Iowa—Bonds will be issued for the purpose of installing additional equipment in the local power plant.

Clark, Mo.—A transmission line is to be built to connect with Sturgeon's 24-hour electric service.

Doniphan, Mo.—Election to vote bonds for new equipment for the power house carried.

Greer Springs, Mo.—As a future development the Missouri Iron & Steel Corp., St. Louis, will build a hydroelectric plant at Greer Springs. Surveyors are now assembling hydraulic, topographic, and geologic information from which development will be designed.

Independence, Mo.—The city council has awarded contracts for machinery for an addition to the electric light plant to cost $60,000. The contract for an engine, generator and condenser was awarded to the Hamilton Corliss Engine Co., for $40,940. The O'Brien Boiler Co. of St. Louis, was awarded the contract for a boiler which will cost $8851.

Liberty, Mo.—Missouri Gas & Electric Service Co., which owns the Liberty electric light plant, will construct a transmission line to Missouri City to furnish electric light and power to the coal mines there. The line will also be extended to Lexington and Richmond.

Mexico, Mo.—Contract to furnish electric current for light and power to the city of Auxvasse, was closed Oct. 15 with the Mexico Light & Power Co. The line will be 11 miles in length and construction will begin immediately.

Osborn, Mo.—L. C. Lambard has purchased the electric light plant at Osborn from Ed. Bauer.

St. Louis, Mo.—Board of public service is having plans prepared for the complete electrification of the street lighting system, to cost approximately $193,000. Ralph Toensfeldt is engineer.

St. Louis, Mo.—Union Electric Light & Power Co. is said to be planning for the construction of a large new addition to its generating station for greatly increased capacity. It is planned to have a daily generating capacity of approximately 60,000 kw. It is said that the project will involve an expenditure in excess of $5,000,000.

St. Louis, Mo.—Mississippi Valley Iron Co., 6500 South Broadway, plans the erection of a one-story engine house, 29x82 ft., and a one-story plant, 36x93 ft.

Peabody, Kans. — Peabody Light, Power & Ice Co. has been granted a 24-year franchise. The plant is to be doubled or trebled in capacity at once.

St. Francis, Kans.—Election will be held Nov. 4 to vote $15,000 in bonds for the purchase of a site and constructing a power, light and heat plant. F. L. Shields, city clerk.

Lincoln, Neb.—Plans for a new $85,000 power house and equipment in connection with the proposed extension of the municipal water and lighting departments, were submitted to the city council by C. F. Lampert, representing Burns & McDonnell, Kansas City, consulting engineers.

Armour, S. D.—The towns of Ethan and Dimock have raised $25,000 for installing electric lights here.

Clark, S. D.—F. W. Boyle purchased property on which he will erect an electric light plant soon.

Ipswich, S. D.—The city has granted Ipswich Electric Light & Power Co. the right to erect, construct, install and maintain an electric light, power and heating plant. E. R. Perrin, city auditor.

Ree Heights, S. D.—The proposition of granting a franchise to E. L. Eague, for installing and operating an electric light system, was approved at a recent election. It is expected the construction of the plant will be commenced soon.

Montpelier, N. D.—Albert Sitel will erect an electric plant and feed mill.

SOUTH CENTRAL STATES.

Louisville, Ky.—Commercial department of Louisville Gas & Electric Co. during the week ended Oct. 10, secured 66 new electric light and power customers with 42 kw. of lighting and 71 hp. in motors, and accepted contracts for wiring 39 already built houses. New business connected to the company's lines shows an increase of 62 customers. Output of electric energy was 15.7% greater than during the corresponding period last year.

Mayking, Ky.—Mayking Coal Co. has completed arrangements for the installation of new electrical operating equipment at its local plant, to increase the present output. Lee Stone, Lexington, Ky., is general manager.

Maysville, Ky.—Maysville Power Co. is arranging for the installation of new power plant equipment to increase the present capacity. The installation will include a new steam turbogenerator unit with exciter and other operating equipment. J. E. Sirrine, Greenville, S. C., is architect and engineer for the company.

Birmingham, Ala. — Henry Lengfelder, head of the Orbon Stove Co., Belleville, Ill., is organizing a new stove manufacturing company in Birmingham. He has purchased a site for a future location of the plant.

Starkville, Miss.—Bonds to the amount of $55,000 have been voted by the city for an electric light, water and sewer system. Address the mayor.

Monroe, La.—City has called a special election on Nov. 18 for voting on the issuance of bonds for $450,000 to provide for the construction of a new electric light and power plant and waterworks system, to be used for municipal service. Arnold Bernstein is mayor.

Monroe, La.—R. A. Smith Co. is in the market for electrical equipment.

Texarkana, Ark.—Southwestern Gas & Electric Co. will double the capacity of its power plant at a cost of $75,000, including a 300-hp. turbine engine.

Enid, Okla.—Announcement has been made of the Oklahoma Flour Mills Co.'s intention to erect a $100,000 mill in Enid.

Hobart City, Okla.—V. V. Long & Co., engineers, 1300 Colcord building, Omaha, have prepared plans for the proposed light plant to be erected at a cost of $130,000.

Ochelta, Okla.—Election will be held Nov. 4 to vote $13,000 in bonds for a waterworks system and $7000 to extend and improve the electric light plant.

Oklahoma City, Okla.—Oklahoma Gas & Electric Co. has had plans prepared for an electric generating plant to cost $3,000,000.

Sulphur, Okla.—Sulphur Ice, Light & Power Co. contemplates the expenditure of $30,000 for new machinery.

Dallas, Tex.—The city commission has approved the requisition of the Dallas Electric Light & Power Co. for the purchase of the heat, power and distributing plant owned by Smith & Whitney. The cost will be $50,000, and it has been purchased for the improvement of service.

Devine, Tex.—Devine Electric & Ice Co., recently incorporated, is considering plans for the construction of a new local plant, estimated to cost $25,000. B. Morrison is manager.

Fort Worth, Tex.—Texas Power & Light Co. has arranged plans for improvements and extensions at its plant, including the erection of a new boiler house. The work is estimated to cost $135,000.

Fort Worth, Tex.—Ballard-Martin Electric Co. will erect a factory which will involve the expenditure of $100,000.

Port Arthur, Tex.—Eastern Texas Electric Co. is considering plans for the construction of a new unit at its

Port Arthur electric generating station. The work is estimated to cost $600,000.

WESTERN STATES.

Cheyenne, Wyo.—The lighting system will be rearranged by the Cheyenne Light, Fuel & Power Co.

Chehalis, Wash.—The city commission has passed a resolution calling for the installation of new standard street lights, about 90 concrete poles with 400-cp. lights on the business streets.

Everett, Wash.—On Nov. 15 an election will be held to decide whether or not a municipal power plant is desired and to ask for sufficient bond issue to cover the proposal.

Everett, Wash.—The Commercial Club is discussing a better lighting system for the city. It is planned to create an improvement district in the down-town section for installing a cluster light system.

Seattle, Wash.—Seattle Lighting Co., Stuart building, is to erect a fireproof gas holder at a cost of $50,000, at 2000 Northlake avenue. The Stacy Manufacturing Co., Stuart building, has the construction contract.

Seattle, Wash.—Rothert Process Steel Co., 622 Harriman street, Seattle, is installing a two-ton alloy furnace to make its own alloys. This will be operated by electricity as are its other furnaces. The company is now turning out from two to three tons per day of high-speed steel and the output is to be steadily increased. Installation of a small rolling mill is under consideration.

Seattle, Wash.—H. Bittman, structural engineer, Securities building, has been authorized to prepare plans for construction of a one-story building with concrete floors and basement for the Everready Electric Service Co., at East Pine street and Nagle place, estimated cost about $30,000.

Astoria, Ore.—McCartney Electric Co. received the contract for electric wiring of sections 1, 5 and 6 of the port warehouse at $3344.

Astoria, Ore.—Announcement has been made of proposed developments by the Crown-Willamette Paper Co. of its holdings in the Youngs river district, a few miles above Astoria. The plans include erection of a 60-ft. dam to electrically harness Youngs river falls. Power will be furnished for an electric plant which will be the center of a number of industries to be located in that vicinity. The company announces a proposal to erect a grinding and pulp mill with a capacity of 100 tons of paper pulp daily. Work of clearing the site for the dam has been completed.

Bend, Ore.—T. H. Foley, president of the Bend Commercial Club and manager of the Bend Light & Power Co., was in Salem recently to enter into a contract with the state for the appropriation of water from Tumalo creek for power purposes at this place.

Bishop, Calif.—Southern Sierras Power Co. is making rapid progress on the preliminary work in connection with the construction of its new local plant located on Bishop creek. Active work has been inaugurated on the grading for a 51-in. flow line to be about 14,000 ft. long, extending from Sabrina to the proposed power plant site, while plans have been arranged for the building of another flow line six miles in length, to extend from South Lake.

Modesto, Calif.—Plans are under consideration by the city officials for the issuance of bonds for $20,000, to cover the cost of the installation of the proposed ornamental street lighting system.

Porterville, Calif.—Plans are being arranged by the Mt. Whitney Power & Electric Co. for the rebuilding of approximately 80 miles of its transmission system. It is understood that the present 30,000-volt line will be replaced with an aluminum system of 60,000-volt capacity.

Sacramento, Calif.—It is reported that the Pacific Gas & Electric Co. will build a large hydroelectric plant in Shasta county.

San Bernardino, Calif.—City is having plans prepared for the installation of a new ornamental street lighting system on Third street. It is understood that Marbelite standards will be utilized.

San Bernardino, Calif.—Announcement has been made that plans have been arranged by the Pacific Electric Co. for the removal of the general offices of the entire eastern division to Riverside.

San Francisco, Calif.—Great Western Power Co. has completed arrangements for the construction of the proposed steel tower transmission line from Caribou, Plumas county, to extend to Oakland, a distance of about 195 miles. The new line will parallel the present system of the company from the Big Bend power site in the vicinity of Oroville to Brighton, and will be of 150,000 volts capacity. The company is planning to complete the new power plant at Caribou and the proposed power line within 12 months' time. The project is estimated to cost $2,500,000.

Santa Ana, Calif.—City council has taken bids for the construction of the proposed ornamental street lighting system to be installed on Glassel street, extending from Sycamore to Culver avenues, and on Chapman avenue, between Cambridge street and the Santa Fe railroad.

FOREIGN TRADE

[Addresses of firms referred to in these trade opportunities may be obtained by writing to the Bureau of Foreign and Domestic Commerce, Washington, D. C., or its branch and local co-operative offices. Request for each opportunity should be on a separate sheet and the file number given.]

Electrical Goods (31,062).—A firm in Brazil desires to secure an agency for the sale of agricultural machinery, factory supplies, and electrical goods. Reference.

Electrical Materials (31,023).—An agency is desired by a man in Italy for the sale of electrical materials of all kinds, especially those for illuminating purposes, agricultural implements, machines, tools, rolling stock for railroads, locomotives, and electric locomotives. In all cases where possible samples and catalogs are desired. Quotations should be given c. i. f. Italian port. Payment, cash against documents. Correspondence should be in Italian. References.

PROPOSALS

Light Station.—Until 2 p. m., Dec. 17, bids will be received by the Commissioner of Lighthouses, Washington, D. C., for all materials and labor for the construction of Point Borinquen light station at Porto Rico.

Electrical Equipment for Bridge.—Bids will be received at Room 406, City Hall, Chicago, for furnishing, constructing, delivering and installing the entire electrical equipment for a double-deck bascule bridge over the Chicago river at North Wells street, according to plans and specifications on file in the office of the Department of Public Works. Charles R. Francis, commissioner of public works.

Electrical Equipment.—Until 12 o'clock, Nov. 14, the Philadelphia District Salvage Board, Committee on Sale of Buildings and Equipment, Ordnance Department, 1713 Market street, will receive bids for electrical equipment at the Eddystone rifle storage plant at Eddystone, Pa. It is understood that the equipment includes approximately 300 motors, ranging from 1 to 75 hp., as well as 50-hp. motors with starting compensators for each motor of 5 hp. and above, and other apparatus.

Electrical Equipment.—Bids will be received by J. P. Henican, vice-president of the board of administrators, Charity Hospital, New Orleans, until Nov. 10, for the following: electric wiring for the buildings, Diesel engines, direct-current generators, steam engine, switchboards and underground cables, underground ducts and manholes, direct-current X-ray apparatus, and second-hand alternating-current apparatus. A. Wyndham Lewin, consulting engineer, 804 Union street.

Electric Work.—Bids will be opened in the office of the supervising architect, Treasury Department, Washington, D. C., at 3 p. m., Nov. 20, for furnishing materials for the construction of the United States post office at Lewiston, Pa., including materials for concrete, reinforced concrete, stone, granite, brick, structural terra cotta, structural steel, miscellaneous iron and steel work, composition roofing, slate roofing, sheet metal work, skylights, plastering, interior marble, heating, electric work, etc., in accordance with drawings, specifications and bills of quantities attached thereto. Copies may be obtained from the custodian of the site at Lewiston, Pa., or at this office, in the discretion of the supervising architect. James A. Wetmore, acting supervising architect.

INCORPORATIONS

New York, N. Y.—Geyser Electric Washing Machine Co. Capital, $20,000. To manufacture electrically operated washing machines, etc. Incorporators: E. S. Hawley, F. H. Butehorn, and R. S. Baker, 37 Wall street.

New York, N. Y.—Utility Products Corp. Capital, $100,000. To manufacture electrical machinery and supplies for railway power and lighting service. Incorporators: G. Tiernan, G. H. and J. B. Purcell, 64 Wall street.

New York, N. Y.—Hadges & McLain Co., Inc. Capital, $100,000. To manufacture electrical devices, etc. Incorporators: E. Hadges, H. E. McLain, and W. Loomer, 652 Amsterdam avenue, New York.

Brooklyn, N. Y.—Agenda Novelty Manufacturing Co., Inc. Capital, $25,000. To manufacture electrical mechanical novelties, etc. Incorporators: H. J. Lauman, F. E. Bloch, and D. Goldfoile, 57 East 89th street, New York.

New York, N. Y.—Ranwood Manufacturing Co. Capital, $200,000. To engage in a general electrical and mechanical engineering capacity. Incorporators: C. A. Wolf, Brooklyn; L. B. Morehouse, and J. B. Greene, 2 Rector street, New York.

Louisville, N. Y.—Louisville Power Corp. Capital, $20,000. To operate an electric plant at Louisville. Incorporators: G. P. Matthews, V. A. Warren, and W. F. Wilson, Louisville.

Portville, N. Y.—Portville Utility Co. Capital, $50,000. To operate a plant at Portville, Cattaraugus county, for the generation and distribution of electric power. Incorporators: M. J. McCary, C. L. Vergason, and E. C. Nagel, Portville.

Atlantic City, N. J.—Pleasantville & Shore Electric Co. Capital, $100,000. To engage in the distribution of electric energy for heating, lighting and power purposes. Incorporators: G. M. Gest, Edmund Wishewski, and Howard C. Blackwill.

Plainfield, N. J.—Edoscope Manufacturing Co. Capital, $200,000. To engage in a general electrical engineering capacity. Incorporators: Charles A. Rice, Frank A. Weeks, and Walter F. Manning.

Philadelphia, Pa.—Aerex Manufacturing Co. Incorporated under Delaware laws with a capital of $100,000. To engage in an electrical engineering capacity, manufacture electrical goods, etc. Incorporators: J. Vernon Pimm, E. M. MacFarland, and F. R. Hansell, Philadelphia.

Chicago, Ill—Automotive Power Co. Incorporated under Delaware laws with a capital of $1,500,000. To manufacture engines, tractors, etc. Incorporators: J. A. Massen, L. P. Barrett, and R. W. Plummer, Chicago.

Beatrice, Neb.—Consolidated Electric Co. has been organized with capital of $10,000, to supply the towns of Virginia, Rockford and Holmesville. Adress J. S. Dell, president, Beatrice, Neb.

Goshen, Ind.—Goshen Auto & Electric Co., of Goshen, has been incorporated with a capital of $25,000, with U. D. Straw, Claude E. Cornell and Benjamin Hartzog as the incorporators.

Chilli, Wis.—Lynn-Chilli Electric Co. has been organized with an authorized capitalization of $15,000 to manufacture, purchase and sell electric current. Incorporators: W. C. Portz, William Wagner, Oscar F. Franke, August Lindow, Ernest Neinas.

Albany, Ore.—W. F. Burman, E. C. Cline and C. E. Bryant have incorporated the Electric Store of Albany with a capital stock of $10,000 to handle and deal in everything electrical.

Arkansas City, Kans. — Broror-Willys Light & Power Co. has been chartered with $25,000 capital stock by F. R. Brown, Ann Brown, Foss Farrar and J. F. Hunt, all of Arkansas City.

Warsaw, Ind.—Hurgo Manufacturing Co. has been incorporated with capital of $1,500,000 to manufacture vacuum cleaners and accessories.

East Orange, N. J.—Electric Signal Manufacturing Co., Inc. Capital, $100,000. To manufacture electric signalling apparatus, etc. Incorporators: Charles O. Geyer, Harry H. Picking, and S. L. Gedney, Jr.

Huntington, W. Va.—Electric Unit Corp. Capital, $50,000. To manufacture electrical goods. Incorporators: E. F. Kincaid, C. C. Hatzell, E. L. Smith, H. T. Lovett, and H. Blaisdell, all of Huntington.

New York, N. Y.—American Keith Co., Inc. Capital, $100,000. To manufacture power fans, blowers, and other power equipment. Incorporators: W. R. Young, S. K. Greene, and W. C. Wallace, 30 Church street.

Wurtsboro, N. Y.—Mamakating Light & Power Co., Inc. Capital, $25,000. To operate a local plant for furnishing electric service, etc. Incorporators: Fletcher Rhodes, Joseph E. Holmes, and Samuel Goldstein, Wurtsboro.

Paducah, Ky.—Paducah Electric Co. Capital, $1,200,000. To operate a local electric plant. Incorporators: Charles K. Wheeler, Alfred S. Nichols, and R. N. Kirkland.

Lee, Ill.—Lee Power & Light has incorporated with a capital stock of $10,000. Incorporators: David L. Hedberg, James Johnson and Emanuel Anderson.

NEW PUBLICATIONS

"Bibliography of Scientific Literature Relating to Helium" has been issued by the Bureau of Standards, Washington, D. C. This bibliography was first prepared at the beginning of the development of helium for balloon-gas purposes and was intended as an aid in that enterprise. It has since been brought up to date, and is believed to contain practically everything published up to Jan. 1, 1919, except reviews and other articles containing no original work which were published in inaccessible foreign journals and contained no material which was not available in English or American publications. The arrangement of material under each subhead has, in general, been such that closely related articles occur together in their chronological order. The bibliography is thus in effect a brief outline history of the subject. Copies may be obtained by addressing a request to the Bureau.

Reflecting Power of Stellite and Lacquered Silver is the title of Scientific Paper No. 342, by W. W. Coblentz and H. Kahler, published by the Bureau of Standards, Washington, D. C. This paper presents data on the reflecting power of the latest production of stellite and also of lacquered silver mirrors. It is shown that the reflectivity of stellite varies somewhat in the visible spectrum depending upon the homogeneity and no doubt upon the exact composition of the alloy. Data are given on the reflecting power of lacquered silver mirrors, before and after exposure to ultra-violet light. It is shown that owing to photochemical action in the lacquer the silver is turned brown in color, thus reducing its reflecting power. The price of this paper is 5 cts. and anyone interested may obtain a copy by addressing a request to the Bureau.

Electrolysis in Concrete.—The Bureau of Standards, Department of Commerce, Washington, D. C., is making distribution of the revised edition of technologic paper No. 18 entitled "Electrolysis in Concrete," issued March 19. It contains the results of a series of long-time tests which show that with reinforcing iron anode at very low current densities, rusting of the iron and cracking of the concrete eventually occur. In the specimens under test, damage became apparent in from four to eight years. The cathode effects noted in former tests had not progressed much beyond the point reached at the end of the first two or three years. Any one interested may obtain a copy by addressing a request to this Bureau.

Leakage Resistance of Street Railway Roadbeds and Its Relation to Electrolysis of Underground Structures is the title of technologic paper No. 127 issued by the Bureau of Standards, Department of Commerce, Washington, D. C. This bulletin was prepared by E. R. Shepard, electrical engineer of the Bureau, in collaboration with the U. S. Forest Products Laboratory. Several methods of making electrical resistance measurements on street railway roadbeds, and on experimental roadbeds are described and the results of such measurements are given in tabular and graphical form. Certain conclusions are reached regarding the best type of roadbeds and the best methods of treating ties where the reduction of stray currents is important. This paper is now ready for distribution and those interested may obtain a copy by addressing a request to the Bureau.

Personals

Leonard Morey to Study Trade Conditions in Far East— F. A. Moreland Joins Carrick Engineering—Other Changes

WALTER J. HOWELL, for some time radio inspector for the Sperry Gyroscope Co., has been appointed instructor in the Marconi Telegraph Co.'s school at 25 Elm street, New York.

WILLIAM H. FETTER, for the past five years manager of the Harrisburg, (Pa.) branch of the Bell Telephone Co., of Pennsylvania, has been appointed district manager, to succeed S. S. Eberts, recently deceased.

E. E. YENSEL, vice-president and general manager of the New Jersey Power & Light Co., Dover, N. J., has resigned to become connected with the American Auto Supplies Co. Mr. Yensel will be succeeded by E. L. White.

G. O. HOUSE, manager of the St. Paul division of Northern States Power Co., was manager of the St. Paul Association of Public and Business Affairs which has carried on a campaign for the inauguration of a "Better St. Paul." E. E. Sanford, manager of the securities department, is also taking an active part in the campaign.

J. M. BRAMLETTE, manager of the Lincoln Traction Co., Lincoln, Neb., has resigned to take a long needed rest. Mr. Bramlette has been connected with public utility companies for more than 30 years, starting as an electrician with the Union Depot Co. in St. Louis in 1889. He has been vice-president as well as manager of the Lincoln company.

F. H. VAN GORDER, who has been connected with the Western Electric Co. for the past 12 years, has been appointed manager of the Newark store. Mr. Van Gorder joined the Western Electric Co. in 1907 as salesman with the Chicago branch. In the spring of 1914 he was made sales manager of the Detroit store and in June, 1918, became power apparatus specialist at New York.

F. A. MORELAND has recently become connected with the Carrick Engineering Co., Chicago, as manager of sales. Mr. Moreland is very well known in the power plant field throughout the Middle West. For 10 years he was connected with the Vulcan Fuel Economy Co. and the Vulcan Soot Cleaner Co., in their Chicago office. He was treasurer of the Vulcan Fuel Economy Co. for a number of years, during which time he was responsible for the development of a number of the company's products, the most important work of his being perhaps the development of the Vulcan-Orsat instrument for analysis of flue gases. As manager of sales for the Carrick Engineering Co., Mr. Moreland is using his wide and thorough knowledge of power plants and methods necessary for coal conservation toward making the control of combustion an automatic process by the use of the Carrick automatic regulator.

FRANK HEDLEY, vice-president and general manager of the Interborough Rapid Transit Co., 165 Broadway, New York, has been elected president of the company, succeeding the late Theodore P. Shonts.

PROF. R. C. DISQUE of the electrical engineering department has severed his connections with the University of Wisconsin to become head of the electrical department of Drexel Institute, Philadelphia.

LEONARD MOREY, vice-president and sales manager of the Electric Products Co., Cleveland, Ohio, left that city on Oct. 1 on an extended business trip, which will include the Pacific coast and western Canada. On Nov. 11 Mr. Morey will sail from San Francisco for Sydney, Australia, to visit his old home. Although his trip is primarily for personal reasons, he will take advantage of the opportunity to study trade conditions in Australia and the Far East, which under present conditions is of utmost importance. Mr. Morey expects to return to the States by April 1, coming back either by way of Italy, France and England or by the southern route to San Francisco and from there east.

Leonard Morey.

MAJ-GEN. JOHN BIDDLE, U. S. A., recently visited the Chicago offices of H. M. Byllesby & Co., and inspected the various departments. General Biddle until recently was commander of all of the American forces in Great Britain. Colonel Byllesby served under him as purchasing agent for the A. E. F. in Great Britain during the period of greatest activity in the acquisition and handling of munitions and military supplies.

R. H. BALLARD, Los Angeles, president of the National Electric Light Association, stopped at Seattle, Oct. 19, enroute from the East and Middle West, through which he recently made a tour to confer with other leading members of the association.

FRANK GILL has been appointed chief engineer of the Western Electric Co. for Europe, adding to the staff of this company one of the best known and highly respected telephone engineers outside the United States. Mr. Gill is a telephone expert of varied experience and began his career in 1882 with the United Telephone Co. of London. In 1896 be became responsible for the management of the whole Irish system and in 1902 was selected engineer-in-chief of the National Telephone. Ten years later, with his assistant engineer, Mr. Cook, he established the firm of Gill & Cook, consulting telephone engineers, in which capacity he was jointly responsible for work in Argentine, Brazil, China, Egypt, India, Malay States, Portugal, Turkey and other localities. With the outbreak of war, he offered his services and was called upon at an early date to organize a department of the ministry of munitions which he undertook in a voluntary capacity. At the completion of this work he resumed his consulting practice. The exigencies of war called for his further service in this direction and he was asked to establish and take charge of another department which occupied his time from 1917 until he relinquished the office of controller of stores in the ministry of munitions last June to enter the services of the Western Electric Co. Mr. Gill is well known in the United States. He visited this country in 1903, 1905, and 1913 and has studied telephone practice in Canada, France, Belgium, Holland, Denmark, Sweden and Switzerland.

Obituary.

W. P. SPARKS, who for the past year has represented the Cleveland Milling Machine Co., Cleveland, at Indianapolis, passed away on Oct. 10. Mr. Sparks was held in high esteem by members of his firm and his many friends in the industry.

PAUL H. STENZ, junior partner of the Stenz Electric Co., Milwaukee, Wis., died at his home on Oct. 17, after an illness of three months. He was a native of Fond du Lac, and is survived by his widow, father, mother and seven brothers.

FRED A. LARKIN, connected with the New York office Allis-Chalmers Manufacturing Co., Milwaukee, manufacturer of motors, generators, turbines, etc., in the capacity of mechanical engineer, and formerly New York representative of the company, died on Oct. 18 at his home in Brooklyn.

Electrical Review

Vol. 75. No. 19. CHICAGO, NOVEMBER, 8, 1919 Three Dollars a Year

The New G-E Specialties Catalog

This handy pocket reference book on G-E wiring devices should be in every electrical man's hands.

It can be secured from the wiring device distributors listed below.

Address the one nearest you.

Albany, N. Y.
Havens Elec. Co., Inc.
Atlanta, Ga.
Carter Electric Co.
Savannah, Ga.
Carter Electric Co.
Baltimore, Md.
The Southern Elec. Co.
Birmingham, Ala.
Matthews Elec. Supply Co.
Boston, Mass.
Pettingell Andrews Co.
Buffalo, N. Y.
Robertson-Cataract Elec. Co.
Butte, Mont.
Butte Elec. Supply Co.
Charlotte, N. C.
Elec. Supply and Equip. Co.
Chattanooga, Tenn.
James Supply Co.

Chicago, Ill.
Commonwealth Edison Co.
Central Electric Co.
Cincinnati, Ohio
F. D. Lawrence Elec. Co.
Cleveland, Ohio
Republic Electric Co.
Columbus, Ohio
Erner-Hopkins Co.
Columbia, S. C.
Perry-Mann Electric Co.
Dallas, Texas
Southwest General Elec. Co.
Dayton, Ohio
Wm. Hall Electric Co.
Denver, Colo.
Hendrie & Bolthoff, Mfg. & Supply Co.
Des Moines, Iowa
Mid-West Electric Co.

Detroit, Mich.
Frank C. Teal Co.
Duluth, Minn.
Northwestern Elec. Equip. Co.
El Paso, Texas
Southwest General Elec. Co.
Houston, Texas
Southwest General Elec. Co.
Indianapolis, Ind.
Indianapolis Elec. Supply Co.
Jacksonville, Fla.
Florida Electric Supply Co.
Kansas City, Mo.
B-R Electric Co.
Los Angeles, Calif
Pacific States Electric Co
Louisville, Ky.
Belknap Hdwr. & Mfg. Co.
Memphis, Tenn.
Electric Supply Co.
Minneapolis, Minn.
Peerless Electric Co.

Newark, N. J.
Tri-City Electric Co., Inc.
New Orleans, La.
Woodward-Wight & Co., Ltd.
New York City
E. B. Latham & Co.
Royal East'n Elec'l Supply Co.
Sibley-Pitman Elec. Corp.
Oakland, Calif.
Pacific States Electric Co.
Oklahoma City, Okla.
Southwest General Elec. Co.
Omaha, Nebr.
Mid-West Electric Co.
Philadelphia, Pa.
Philadelphia Electric Company Supply Dept.
Pittsburgh, Pa.
Union Electric Co.
Portland, Ore.
Pacific States Electric Co.

Rochester, N. Y.
Wheeler-Green Elec'l Supply Co.
St. Louis, Mo.
Wesco Supply Co.
St. Paul, Minn.
Northwestern Elec. Equip. Co.
Salt Lake City, Utah
Capital Elec. Co.
San Francisco, Calif.
Pacific States Electric Co.
Seattle, Wash.
Pacific States Electric Co.
Syracuse, N. Y.
Mohawk Elec'l Supply Co.
Tampa, Fla.
Florida Electric Supply Co.
Washington, D. C.
National Elec'l Supply Co.
Waterbury, Conn.
The New England Eng. Co.

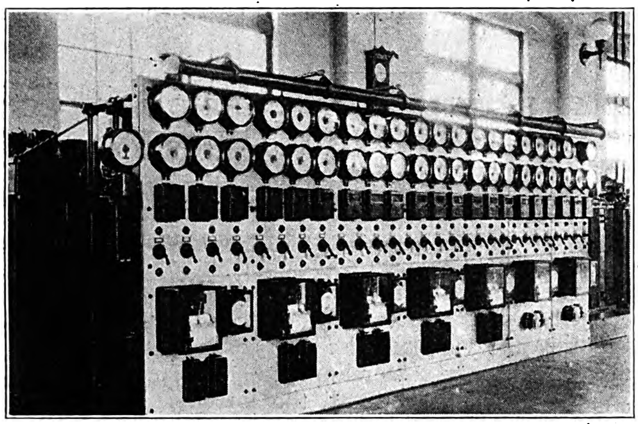
General Electric Company

General Office
Schenectady, N.Y.

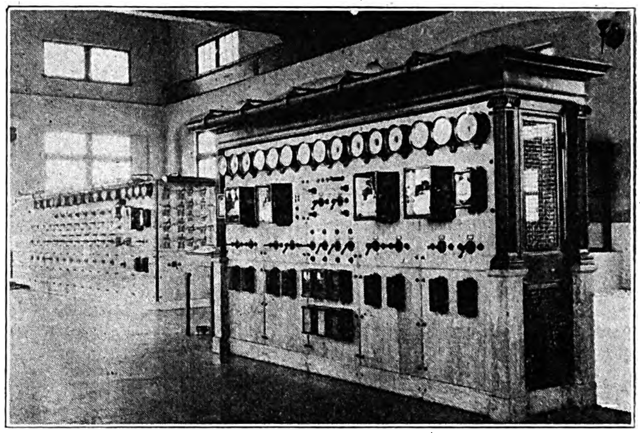
Sales Offices in all large cities

Electrical Review
WITH WHICH IS CONSOLIDATED WESTERN ELECTRICIAN AND ELECTROCRAFT

VOL. 75—No. 19. CHICAGO, SATURDAY, NOVEMBER 8, 1919. PAGE 769.



Seven-Panel Feeder Switchboard Installed in Nisqually Substation, Tacoma, Wash.



Five-Panel Switchboard Controlling High-Tension Lines and Transformers—14-Panel Board in Background.

Some Features of the Nisqually Substation at Tacoma, Wash.

Switchboard and Control Equipment—Interesting Method of Regulating the Standby Battery for Operating Circuit-Breakers and Pilot Lamps

THE supply of electrical energy for the city of Tacoma, Wash., is well provided for by the Nisqually substation of the Department of Light and Water of that municipality. The station was designed to transform and distribute electrical energy up to a capacity of 20,000 kw. Three-phase, 60-cycle power is received at 50,000 volts over two transmission lines from the city's hydroelectric station at La Grande, 36 miles distant.

A tap is taken off the high-tension line to supply Camp Lewis and also the pumping station for the city water supply. Current is distributed at 4000-2300 volts, over a Y-connected primary distribution system throughout the city for light and power. By agreement with the city, the private central-station company operating in Tacoma does not furnish any light or any power in units under 25 hp. within the city limits.

Though the substation was originally designed for a capacity of 20,000 kw., it usually carries a load of 24,000 kw. or over. The substation is under the direction of F. S. Morrison, chief operator, who has under him one operator and an assistant for each of the three 8-hour shifts.

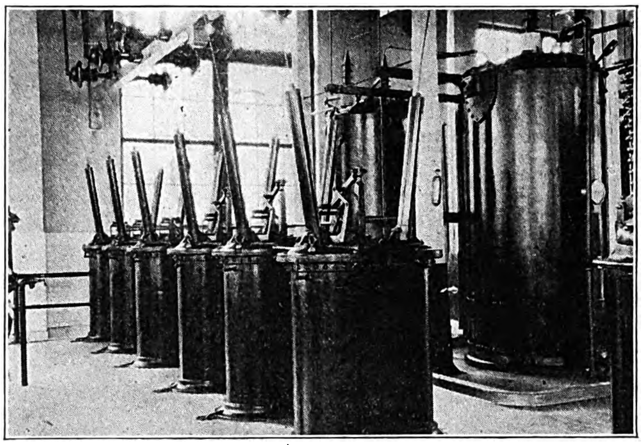
For regulating the voltage of the light and power feeders, there are installed 21 69-kv-a., 10 to 20%, single-phase automatic feeder regulators.

The switchboards for the control of the incoming lines, outgoing feeders, series arc street-lighting circuits and auxilaries in the substation are built in sections and mounted separately, as shown in the accompanying illustrations. The boards are of blue Vermont marble surmounted by cornice work and are equipped with the usual complement of switching and measuring devices, making altogether a most attractive looking installation. Each outgoing feeder circuit is equipped with a graphic recording meter. The switchboards, together with the lightning arresters and oil circuit-breakers on the high-tension lines, transformer banks and feeder circuits, and the feeder regulators were furnished by the Westinghouse Electric & Manufacturing Co., East Pittsburgh, Pa.

Standby current for the operation of the remote-controlled circuit-breakers and the pilot lamps is furnished by a storage battery which floats on the line continuously. It contains 65 cells and is of the E-11 type supplied by the Electric Storage Battery Co., Philadelphia, Pa.

Current for normal operation of the circuit-breakers and pilot lamps and for charging the battery is supplied by a motor-generator installed in the basement. The battery is kept floating on the line continuously, that is, it is never discharged except in an emergency and during tests, and it is charged just enough to equalize the cells once every two weeks; at other times the motor-generator carries the load and the battery floats.

The floating voltage of the battery is from 2.10 to 2.14 volts per cell, and in order to protect the graphic meters and pilot lamps it was necessary to insert a resistance. The resistance originally used was a grid with a standard rheostat head which protected the

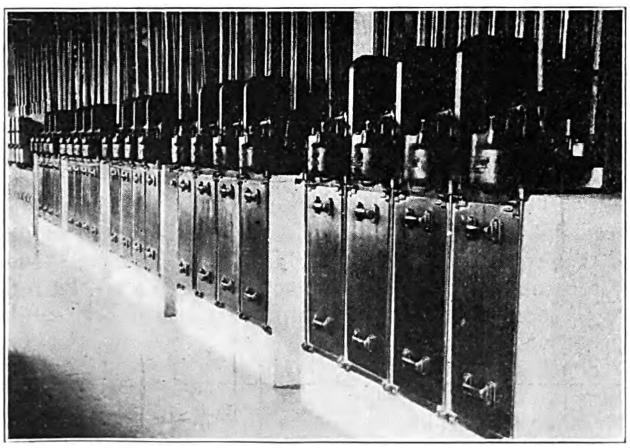


Two Three-Pole 60,000-Volt, 300-Ampere Oil Circuit-Breakers on Incoming Lines—Transformers in Background.

devices but did not allow enough current to pass to operate the oil circuit-breakers. In order to overcome this difficulty, counter cells were installed, some of which were built up out of old battery elements. These cells reduce the voltage, but at the same time permit a sufficient flow of current to operate the breakers. There are 12 counter cells divided into three groups of four each, with taps taken off so as to permit the cutting in or out of one or more groups as may be desired, and they are so connected that the current passes through them from positive to negative, thus continually charging them.

The operation of the graphic meters and pilot lamps requires a continuous flow of about seven amperes through the counter cells which causes a rapid evaporation of the water as well as the deterioration of positive plates. To overcome this, Mr. Morrison has adopted the following scheme which has worked out most successfully. A 6.6-ampere series burning incandescent lamp is connected across each group of four cells. This shunts six amperes away from the cells, reducing the current flowing therein to from one-half to three-fourths of an ampere and at the same time affords the benefit of the illumination given by the lamps which are located at certain points about the premises where it is needed. These locations are vital points and in the event of the power going off at night the illumination is of the greatest assistance to the station operator.

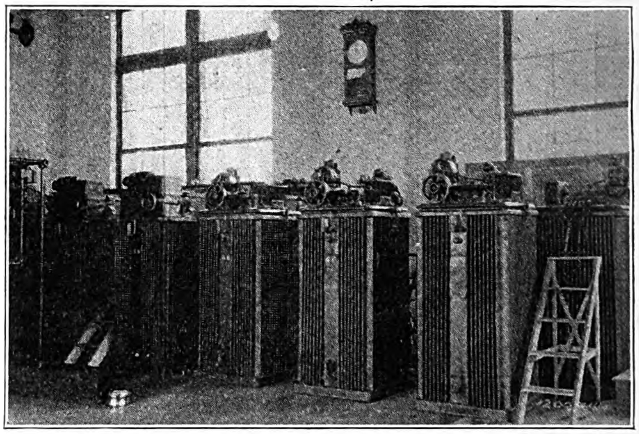
In operating one of the circuit-breakers, the current momentarily reaches a value of seven amperes, thus subjecting the lamps to an excess rush of current. In order to correct this Mr. Morrison expects to add three more cells, making a total of 15; he will divide them into three groups of five each and install a short piece of resistance wire in series with each lamp so as to hold down the current to six amperes. A snap switch is installed on each lamp so that when the battery is getting its equalizing charge the lamp can be cut out, causing the counter cells to build up to their highest voltage at the time when it is most needed.



Five 4000-Volt, 600-Ampere, Four-Pole Oil Switches on Light and Power Lines.

FERTILE FIELD FOR AMERICAN ELECTRICAL GOODS IN LATIN AMERICA.

A most promising future for American electrical goods exists in Argentina, Brazil and Uruguay, according to a report made to the Bureau of Foreign and Domestic Commerce, Department of Commerce, by Trade Commissioner Philip S. Smith. The use of electricity is widespread in all three countries. In Argentina and Uruguay the high cost of imported fuel and lack of water power limit the use of electricity to some extent, but in Brazil the immense amount of water power available makes the electrical field a peculiarly attractive one to manufacturers of electrical equipment. As this water power is found for the most part in the coastal section of the country, it will be available for industrial enterprises and for general lighting, heating and power purposes in the numerous cities of this section, which includes the greater part of the population of the country.



Part of the Bank of 21 Single-Phase, 2300-Volt Regulators on Light and Power Feeders.

American materials were not a very important factor in Argentina before the war but have become decidedly so since hostilities began, and the problem there is to maintain this advantage when the old competition returns. In Brazil, American electrical supplies have always been favored above all others, owing principally to the fact that the power plants in the large cities use American materials almost exclusively. Germany's share in the trade, however, was increasing steadily up to the time the war started, and since that time Japanese materials have appeared on the market, although not in large quantities.

The trade commissioner's report is a detailed guide published for the benefit of the American manufacturer who wants to make the most of his opportunities in Latin America. It is entitled "Electrical Goods in Argentina, Uruguay and Brazil," Special Agents Series No. 184.

Central-Station Rates in Theory and Practice

Eighteenth Article — Rates Based on Both Energy and Demand—Time Interval of Maximum Demand, How Demand Is Determined and Other Details—Power-Factor—Demand Measuring Instruments

By H. E. EISENMENGER

This is the eighteenth article of this series that began in the issue of July 12. The first part of the series consisted of seven articles on the cost of central-station service. In Part II there were six articles on the policies relative to choice of a rate system. Part III, of which this is the fifth article, deals with the different rate systems in more or less common use; next week's article will conclude this part. In Parts IV to VI will be discussed rate analysis, accuracy of rates and rate regulation by commissions. The remaining articles will appear weekly until the end of the current volume, Dec. 27.

PART III—SYSTEMS OF CHARGING—Continued.

II. The Various Types of Rates—(Continued).

D. Rates Based on Both Energy Consumption and Demand.

2b. Details of the Determination of the Measured Demand in Practice.

1. Interval of Time Over Which the Customer's Demand Is to Be Averaged.

SECTION 134. As has just been shown, it is impossible to determine by exact theory how long the interval should be over which the customer's demand is to be averaged for the determination of his rated maximum demand. Consequently this interval in practice varies within very wide limits[1] and it is impossible to say that the time interval chosen by one company is more correct than that of another company as they all remain within reasonable limits. Here again is an instance where a wide field is left to the judgment of the designer of the rate. Where we have reason to assume that the customers of a certain class all have a peak of about the same duration it may be well to choose the duration of that peak as the interval over which the maximum demand is to be averaged.

Sometimes several intervals are quoted in the schedule as alternatives, so that smaller percentages are to be taken of the short-interval demands than of the long-interval ones.[2] Or shorter intervals are chosen for such loads as are subject to violent fluctuations, such as hoists, elevators, welding machines, etc.[3]

The instantaneous demand may also be made the basis for the rated demand, but then it is generally reduced by a certain large percentage to arrive at the rated maximum demand and special provisions may be made in that case to exclude the effects of short-circuits and accidents on the rated demand.[4]

2. Period Over Which a Certain Amount of Demand, Once Determined, Remains the Basis of the Charges.

135. As the capacity of the central station is determined by the yearly peak and the monthly peaks have nothing to do with it, it seems logical to take the customer's yearly maximum demand as the basis for all his demand during the whole year and not to change it until his peak load for the following year has been determined.[5]

In most cases it is felt, however, that a single high demand would penalize a customer for the whole year and thus might work hardship and injustice. The maxima are, therefore, taken usually for shorter periods than one year; most commonly the monthly maximum is chosen. As the bills are almost universally rendered monthly, the demand-meter reading can be easily taken together with the watt-hour-meter reading every month. We are trying in this manner to get a value which is proportional to the *probable* value of the customer's maximum demand as given by the character of his load and to eliminate the accidentals of a single maximum demand. Since the maximum demand is nothing but a substitute for the peak responsibility, it seems that the average of the 12 months' maximum demands is a good substitute for, or even a better one than, the amount which the demand happens to reach only once a year. If customer *A* reaches 50 kw. in one month and 25 kw. only during each one of the remaining 11 months, and if customer *B* reaches 40 kw. of maximum demand month after month, the 50-kw. maximum of *A* may

[1] 1 minute: Duluth, General Power, see footnote 2 below.
2 minutes: Buffalo, Wholesale Lighting and Power (optional schedule).
3 minutes: Binghamton, N. Y., Wholesale Power.
5 minutes: East St. Louis, Ill., Retail Power.
10 minutes: Waterbury, Conn., General Power.
15 minutes: City Electric Co., San Francisco, Wholesale Lighting and Power.
30 minutes: Chicago, General Lighting and Power.
1 hour: Detroit, Standard Power, where lighting amounts to more than 10% of total load.
3 hours: Detroit, Standard Power, where lighting amounts to less than 10% of total load.

[2] One of the two optional General Power Schedules of the Great Northern Power Co., Duluth, rates the demand at the option of the company as the highest of the following: 40% of the instantaneous peak, or half the maximum 1-minute peak, or two-thirds of the maximum 3-minute peak, or the maximum 5-minute peak.

[3] Primary Power, Cincinnati: 5 minutes instead of 20 minutes.

[4] The Duluth schedule mentioned in footnote 2 provides that peaks due to short-circuits and accidents shall not be counted.

[5] This would mean that the highest recorded demand of the previous 12 months is to be chosen, as in the Wholesale Light and Power schedule of Washington, D. C. A little different interpretation is made in the Standard Lighting schedule of Detroit, where the demand indicator is reset June 30 each year so that the customer has to pay for the maximum demand since the preceding June 30 only. In the first case the rated demand will never be smaller than the maximum of a full 12-month period, whereas in the second case the demand to be paid for will generally steadily increase from June until December and then remain stationary until June, when a sudden decrease to the June monthly maximum takes place.

be the result of some casual contingency (neglecting in this example, for the sake of simplicity, the seasonal regular variations of load) and B is then liable to have a larger peak responsibility than A; yet under a system which takes into account the yearly maximum demand A would have to pay more for demand charges than B.

The demand charges are mostly based simply on the monthly readings, but other plans for calculating the rated maximum demand are also found.[6]

3. *Sundry Details of the Determination of the Measured Demand.*

a. Influence of the Demands of Previous Billing Periods.

136. Various rate schedules provide that the rated demand depends on the previous demands of the same customer in such a manner that during the term of contract it may not decrease substantially below the highest demand established at a previous period[7], or that it cannot decrease below a certain percentage of the highest previous demand[8], or that the previous demand retains such a restricting influence at least for a certain length of time[9] (usually one year). In the latter case we get either the equivalent of a yearly demand, or if the maximum monthly demand may not exceed a certain percentage of the highest reading of the last 12 months, we arrive at a hybrid between the monthly and the yearly establishment of the demand.

b. Influence of the Power-Factor.[10]

137. A small number of electric supply companies make provision for a modification of the rated demand in case of the power-factor being below certain limits. Thus in some cases the demand is increased over the measured demand if the power-factor is smaller than a certain minimum percentage.[11] In other cases the regular demand charge of the schedule is not based on a 100% power-factor but on a smaller one; consequently the demand charge is not only increased for smaller power-factors but also decreased if the power-factor is large.[12]

Naturally provisions for an influence of the power-factor on the charges are found only in power rates for large consumers (wholesale power rates and general power as distinguished from retail power, etc.).

c. Methods Used for Measuring the Maximum Demand.

138. There are two methods in practical use for finding the maximum which the average demand over a certain interval (for instance 30 minutes) reaches within a given period (for instance, one year).

1. Determining the Demand by the Service Watt-Hour Meter.

139. The first method is the calculation of the average maximum demand from the number of kilowatt-hours consumed during the interval. The service watt-hour meter of the installation can be very conveniently used for that purpose in combination with a stop watch. If, for instance, the readings on the watt-hour meter show that during one certain hour 500 kw-hr. have been consumed, the average hourly demand during that particular hour is evidently 500 kw. If we now obtain a number of such readings at different hours when the maximum demand may be expected to take place, the maximum of these readings will be the nearer to the maximum average hourly demand the larger the number of readings has been. If we desire to know the average demand over a shorter (or longer) interval than an hour, we have to divide the kilowatt-hour reading of that interval by the length of that interval in hours.[13]

This method can, of course, be applied for large customers only and is not suitable for general use. It is not as reliable as the other method, to be described hereafter (special demand-indicating instruments) because it is left to chance whether the watt-hour-meter readings are made actually at that interval which shows the highest average demand. The test method is, therefore, not frequently used and where it is used

---

[6] Standard Power schedule, Detroit, Mich.: The maximum demand is determined by load tests every 60 days.

Long-Hour Lighting schedule of Boston: The highest reading between Nov. 1 and Feb. 1 is taken to be in force for 12 months. That means a yearly maximum, but only that part of the yearly maximum demand is counted for which there is a possibility of its coinciding with the central station's peak.

The Retail Power schedule of the same city bases the demand charge on the average of the November-December-January-February peaks, whereas the demand charges of the Wholesale Power schedule are based on the average of the 150 highest half-hour peaks that have occurred in the 12 months previous to the bill.

The Primary Industrial Power and Railway Generating Power schedule of Baltimore requires that the demand be based on the highest readings (not less than ½ hour) between 4 and 8 p. m. any week-day during the months of November, December and January and not less than two-thirds of the actual demand at any other time.

The Wholesale Power schedule of the Sioux City Gas & Electric Co. rates the demand as the measured average over 15 consecutive minutes during the month, provided that the instantaneous demand is not more than twice the annual maximum demand. In the latter case the demand for the month shall be rated as 50% of the instantaneous demand.

The Large Lighting and Power schedule of Chicago provides that the demand be determined either monthly or yearly. When on the monthly basis, the average number of kilowatts in the highest 30-minute interval in the month is to be taken. When on the yearly basis the average number of kilowatts in the three highest 30-minute intervals in the month is selected from three different days, the first month's maximum to prevail for 12 months, unless a higher maximum takes its place, in which case a new 12-month period begins.

[7] Industrial Lighting and Power schedule of Baltimore, where the demand is not substantially to be decreased during the term of the contract. The minimum term of contract under this schedule is three years.

[8] Wholesale Power schedule of Macon, Ga., where the demand shall in no case be less than 75% of the highest previous recorded demand. Under the Primary Power schedule of Minneapolis the demand must never be under 50% of the highest previous peak occurring throughout the 10-year term.

[9] General Lighting and Power, Portland, Me.: Once determined, the demand may not be decreased during the year. Primary Lighting and Power schedule of Des Moines, Iowa: The demand shall not be less than 75% of the demand occurring in any of the preceding 12 months. Wholesale Power schedule of Pawtucket, R. I.: The demand shall never be under 50% of the highest in the preceding 12 months.

[10] The nontechnical central-station man will find an explanation of the term "power-factor" and allied terms in Insert XV.

[11] Primary Large Lighting and Power schedule, Chicago: If the power-factor is less than 70%, the maximum demand is increased for billing purposes. In other cities the limit of the power-factor is 80%, thus in Philadelphia (Wholesale Power Lighting), Harrisburg, Pa. (Primary Power), and Little Rock, Ark. (Wholesale Lighting and Power). In Pittsburgh (Off-Peak Service) the limit is 90%.

Another way of expressing the same thought is that of the Wholesale Power Schedules of Boston, which specify that either the average kilowatts, or 80% of the kilovolt-amperes, are used for the demand, whichever is higher.

The Wholesale Power schedule of the Sioux City Gas & Electric Co. specifies that the monthly demand charge will be increased by 1% for each 1% the lagging power-factor on the consumer's load is below the following:

75% at the time of the demand.
70% at 75% of demand.
65% at all other loads.

In Cambridge, Mass., the average demand during the peak-load period is determined from the kilowatt-hour consumption as indicated by a watt-hour meter in case of noninductive load and from the kilovolt-ampere-hours as determined by a voltmeter and amperemeter in case of inductive load. (See Section 139, "Determining the Demand by the Service Watt-hour Meter" and second footnote of that Section.)

[12] The General Power schedules in the following New England cities: Waterbury, Conn., New Britain, Conn., and Salem, Mass., provide that the maximum demand be adjusted accordingly if the power-factor is below 75% or above 80%.

An extra discount of 10 cents per kilowatt per month is granted on the demand charge of the Sioux City rate (referred to in the preceding footnote) if the power factor is 95% or better.

[13] For instance, if in the 2 hours between 3 and 5 o'clock 100 kw-hr. have been used, the average demand during that interval has been $100/2 = 50$ kw. Or if in some 10-minute interval 8 kw-hr. have been used, the average demand during that interval has been $8 \div 1/6 = 48$ kw. (because 10 minutes equals 1/6 hour).

it is generally either as an alternative to some other method[14] or for secondary purposes.[15]

This method may also be carried out in a more accurate way by means of the so-called "printometer," that is an attachment to the customer's watt-hour meter which prints on a strip of paper in regular intervals—for instance, 5 minutes or half hours, etc.—the number of kilowatt-hours used.

2. Demand Metering Instruments.

140. The second method of determining the maximum demand makes use of special instruments for that purpose. This method is much more frequently employed than the calculation from watt-hour-meter readings and in all cases where the actual amount of the maximum demand in kilowatts or watts must be known the use of these instruments is the rule.

A description of the principles on which these instruments act is given in Insert XVI.

In a few cases the readings of the demand meter are modified by a stipulation in the schedule that the demand must never be taken lower than a certain percentage of the connected load.[16]

In some isolated cases the demand charge is based not on the measured demand, but on a certain fixed percentage of the demand.[17] This is, of course, merely a matter of changing the form; the total demand charge in dollars is the same as if the total measured demand had been chosen with a correspondingly reduced unit charge per kilowatt. But certain conditions, for instance the historical development of the rates of a company, may make this way of expressing the charges preferable.

The demand limiters (see Section 130) and similar devices, like fuses, automatic cutouts, etc.,[18] do not strictly belong in this class of instruments as they give no lasting record of the amount of the maximum demand, but they simply disturb the customer's supply as long as he tries to draw a larger demand than he has subscribed for. They have a very small time interval, which means that they act practically on the instantaneous demand.

d. Substitutes to Approximate the Measured Maximum Demand.

1. General Remarks.

141. Measurements of the maximum demand as described in the preceding Sections require either special labor, or special instruments, or both. Moreover, as has been pointed out several times in this series of articles, the element of the customer's demand as a basis for the demand charges has been derived from the theoretically correct basis by a series of approximations and therefore is not the accurate basis anyway. For these two reasons many electric utility companies avoid in all or in a part of their schedules the complication occasioned by the measuring of the maximum demand and use substitutes for the measured maximum demand which are more easily determined, even though by the additional approximation a further element of inaccuracy is introduced.

The possibility of substituting other values for the measured maximum has already been proviously mentioned, in Section 129. It has been stated there that these substitutes, such as connected load and number of sockets, are not popular among central-station managers for the flat rates other than display lighting. It is different in case of the rates which are based on both the maximum demand and the energy consumption. Here the inaccuracy introduced by the employment of a substitute for the real maximum demand of the customer affects a portion only of the total charges, so that the inaccuracy is, so to speak, diluted. A customer who increases the wattage of his lamps or the number of his sockets will in general also increase his energy consumption and therefore he will not get for nothing the additional, and possibly fraudulently obtained, service, as he would in case of a flat rate.

Insert XV—Appendix to Sections 53 and 137.

EXPLANATION OF THE TERM POWER-FACTOR AND ALLIED TERMS.

(For the nontechnical reader.)

In case of purely heating and incandescent lighting loads the power in watts consumed by the customer is given by the product volts × amperes. The number of the kilowatts is of course only 1/1000 of this value, as the unit of kilowatt is 1000 times as great as the unit watt. The power in kilowatts with such loads is therefore $\frac{\text{volts} \times \text{amperes.}}{1000}$.[1] With certain other loads, the so-called inductive or reactive loads, notably with most motor loads, the physical conditions in alternating-current circuits are such that the power which is produced by a certain current at a given voltage is smaller than the term $\frac{\text{volts} \times \text{amperes}}{1000}$ indicates. A larger current is therefore necessary with these loads to produce a certain power in a given system (that is at a given voltage).

Now the "capacity" or "size" of generators and transformers is determined by the product of volts × amperes and since in a given electric system of the most common type the voltage is constant, a generator or transformer of a given size can supply less power with inductive load than with noninductive load.[2] Also the copper sections of transmission and distribution lines depend on the current they have to carry and a given line will therefore not be able to carry as much inductive load as noninductive load. We see from this that it is cheaper to supply noninductive load because the electrical supply equipment is smaller and therefore cheaper. Moreover, the maintenance of proper voltage is more difficult with inductive load.

The term $\frac{\text{volts} \times \text{amperes}}{1000}$ is called the "apparent kilowatts" or the "apparent power." The apparent power is equal to the real power only in case of non-inductive (nonreactive) load, otherwise it is always larger. The unit of apparent power is the "kilovolt-ampere," which is 1000 times the apparent power delivered by one ampere at one volt, with single-phase current, just as the kilowatt is 1000 times the real power delivered by one ampere at one volt on noninduc-

[14] Wholesale Power and Lighting schedule, Birmingham, Ala.: If no demand indicator is used, the demand in kilowatts is assumed to be four times the highest recorded consumption in kilowatt-hours for any 15-minute period.

Primary Power Service, Buffalo: The demand is determined by the kilowatt-hour meter for 2 minutes, or by an indicating or graphic recording wattmeter.

[15] For instance, Cambridge, Mass., has pure block meter rates, but the knowledge of the customer's demand is necessary for writing out the bill in one of the schedules, because the minimum monthly charge is based on it and another one of the schedules applies only for the customers whose load-factor exceeds a specified minimum. The demand in these cases is determined as the average of three 5-minute readings of the watt-hour meter (or, in case of low power-factor load, of a voltmeter and ammeter), the readings to be made with the use of a stop watch.

[16] General Power schedule in South Bend, Ind.: 50%; Optional Commercial Lighting schedule of the Universal Electric & Gas Co., San Francisco: 60%.

[17] General Power schedule of Fitchburg, Mass., and Haverhill, Mass.; 75% of the measured demand.

[18] Auxiliary Lighting and Power schedule, Buffalo: Demand limited by fuses or other device. Auxiliary Power, Cleveland: The customer shall install an automatic circuit-opening device which the company will set and seal for an amount slightly above the demand contracted for.

[1] This applies to direct-current and single-phase alternating-current circuits. In case of three-phase circuits this product must be multiplied by 1.732 here and in the following.

[2] This does not mean that power is lost (except in a secondary way). The generator is simply unable to deliver as much power without undue heating and it can, therefore, not receive as many horsepower from the prime mover. It is designed and built as a larger "generator" with corresponding cost but can operate only as a smaller one if the load is inductive. Transformers are affected in the same way.

tive load with single-phase current. A kilovolt-ampere furnishes one kilowatt in case of noninductive load, otherwise less.

The ratio of the real power to the apparent power is called the power-factor. In central-station practice the power-factor is expressed in per cent; "80% power-factor" means that the real power is 80% of the apparent power. The power-factor can never be larger than 100%. In case of noninductive load it is equal to 100%, while for inductive load it is smaller. The power-factor of small motors is smaller than that of larger motors, and for a given individual motor it decreases as the load on the motor decreases. This refers to asynchronous (induction) motors. In synchronous motors the power-factor can be regulated by the exciting current.

All our readers will probably be familiar with the fact that in alternating-current circuits the direction in which the current is flowing is continually reversing and at a very rapid rate too, in most of our central-station systems 120 times a second. It increases from zero to its maximum value in 1/240 second, then decreases in the next 1/240 second again to zero, reverses its direction, reaches its maximum in the opposite direction after the third 1/240 second (negative maximum), again becomes zero and thus after 4/240 or 1/60 second begins the same cycle as described. The same applies to the voltage. The speed with which the voltage varies is exactly the same as that of the variations of the current (namely 120 reversals of the direction every second), but the current does not in every case reach its maximum (or its zero value) at the same instant as the voltage. It may be, for instance, always 1/500 second ahead of the voltage, or it may be a little behind the voltage. In the former case we say the current is "leading," in the latter it is "lagging." If the current and the voltage both reach their maximum at exactly the same instant, that is, if the current is neither leading nor lagging, we say current and voltage are "in phase."

The machinery in the central station determines the number of reversals per second, the character of the load determines whether the current is leading, lagging, or in phase.

Now noninductive load means nothing else than that current and voltage are exactly in phase. Then the power-factor is 100%. If they are out of phase we have a power-factor of less than 100%. We see from the above that if the power-factor is smaller than 100% this may be due either to a leading or to a lagging current.

As may be expected, the lag of the current of one customer may be balanced partly or wholly by the lead of the current of another customer, so that the supply of the two together may combine into a current in phase or at least less out of phase. The generators, transformers, etc., will then have to supply current which is less out of phase, the power-factor will be raised and the undesirable effect of a low power-factor on the central station and lines will be reduced.

Now the ordinary asynchronous or induction motor has such characteristics that it can only draw a lagging current from the system. Conditions of the customer's load which make the current lead the voltage are practically found only in the so-called synchronous motors under certain methods of operation (overexcitation.) These synchronous motors are practicable in exceptional cases only for large sizes and under certain other conditions. This explains why in Sioux City (see footnote 11, Section 137) the increase of the demand charges in case of small power-factors is restricted to lagging currents.

Insert XVI—Appendix to Section 140.

Instruments for Measuring the Maximum Demand.

One type of demand-measuring instruments is working in connection with the ordinary service watt-hour meter of the consumer. A contact mounted on the wormwheel of the watt-hour meter makes and breaks a circuit at a rate proportional to the speed at which the meter disk revolves, that is, proportional to the power which passes through the meter. Every time the contact is made, a member in the demand-indicating instrument is pushed forward a small fixed amount by means of an electromagnet and a ratchet. This member may be either a stylus (if a graphic record is desired) or a driving dog which pushes a friction pointer forward on a dial. After a prearranged interval over which the demand is to be averaged has elapsed (5, 10 or 30 minutes, one hour, etc.) the above mentioned stylus or driving dog is disengaged by the action of a clock and drawn back to zero position by spring action. The stylus in the recording type of instrument then begins a new mark on the sheet or disk of paper which is creeping or revolving underneath the stylus. The driving dog in the other type of instrument on its withdrawal leaves the friction pointer lying in the position to which it had been pushed previously, so that the pointer always indicates the highest position which the dog has ever reached since the pointer was reset the last time by hand. From the chart of the recording instrument (called "demand indicator" by the manufacturers in contradistinction to the dial instrument, which is called "demand meter") we have then to select the highest mark as indicating how large the highest demand was and when it occurred, whereas in the dial instrument we can read directly from the position of the pointer how large the maximum demand has been since the last resetting of the instrument, but not when it occurred.

Another type of instrument for measuring the demand is the "Wright maximum-demand meter." It consists of a U-shaped glass tube partly filled with liquid and sealed at both ends. At each end (both of which in the normal position point vertically upwards) the tube is widened into a bulb. Just below one of these two bulbs the vessel communicates with the upper end of a graduated vertical overflow glass tube, which is sealed at its lower end. (The whole arrangement is therefore hermetically sealed on all sides.) The bulb on the other leg is surrounded by a coil of resistance wire connected in series with the consumer's installation. The heat generated in the coil by the current expands the air in that bulb and forces a portion of the liquid out of that leg, making the liquid overflow at the other leg into the vertical overflow pipe. The liquid will remain in the latter even after the coil cools off and thus the amount of liquid contained in the graduated tube is a measure of the maximum current, which has been passing through the coil since the last resetting of the instrument. This resetting is made by tilting the instrument so that the liquid can run back into the U-shaped tube. The whole instrument is enclosed in a cast-iron casing and hinged, so that the electric light company's inspector can easily tilt the instrument for resetting after he has made his periodic reading.

As this instrument acts on the heating capacity of the current it will at fluctuating loads register differently from the electromagnetic instruments previously described, which base their registry on the energy delivered. The Wright demand meter is rated to record as follows (from Foster, "Electrical Engineer's Pocket Book"):

If the maximum load lasts 5 minutes 80% will register.
If the maximum load lasts 10 minutes 95% will register.
If the maximum load lasts 30 minutes 100% will register.

If we have, for instance, a load of 1 kw. (1000 watts) for 5 minutes and no load for the following hour this combination of loads will register on a Wright demand meter as 800 watts, whereas an electromagnetic instrument will record the following maximum demands:[1]

If the instrument is set for 5 minutes or less: 1000 watts.

If the instrument is set for 10 minutes: $1000 \times 5/10 = 500$ watts.

If the instrument is set for 30 minutes: $1000 \times 5/30 = 167$ watts.

As the Wright instrument records 100% of the demand after 30 minutes duration of the full demand, the comparison might be made with an electromagnetic instrument set for a 30-minute interval. Supposing now the full load of 1000 watts to be turned on for a number of minutes, as shown in the first column of the following table, and no load for the rest of the time, the registries will be:

Duration of 1000-watts Load	Electromagnetic Instrument Set for 30 minutes	Wright Demand Meter
5 minutes.....	167 watts	800 watts
10 minutes.....	333 watts	950 watts
30 minutes.....	1,000 watts	1,000 watts

We see from these comparisons that the Wright demand meter is more sensitive to high demands of short duration than the electromagnetic devices. This will not surprise the engineers among our readers as they know that the heating effect increases with the square of the current.

It seems reasonable to assume that the heating effect of various percentages of load acting for various periods of time on the air in the bulb of the Wright instrument is more or less similar to the heating effects on electric machinery and equipment; the way in which the Wright instrument responds to various loads may therefore to a certain degree express the effect of an overload on the necessary size of the capacity of the power-house machinery, etc., and with that on a certain part of the capital invested and the corresponding demand charges.

We cannot, however, by any means say that the way in which the Wright demand meter responds to various dura-

[1] Provided that this 5-minute interval of 1000 watts starts at the same moment when the electromagnetic instrument starts its own interval of readjustment, that is, at the moment of the disengagement by the clockwork.

tions of overload is preferable to that of the electromagnetic instruments. (Compare also Sections 36 and 37). In the first place a certain part of the electric light company's equipment, notably the distribution lines, have no time element in the way they respond to overloads; this means a short overload on the distribution lines will at once show its full effect on the quality of the service (by an excessive voltage drop). In the second place the heating and cooling curves of the various parts are different from one another and different from that of the Wright instrument. In the third place we have moved so far away from the exact theoretical requirements by the various successive approximations made[2] that these nice distinctions lose their importance alongside these approximations.

(To be continued.)

CONDITIONS FAVORING AND FACTORS INFLUENCING ELECTRICAL UTILIZATION OF BLAST-FURNACE GASES.

British Fuel Economy Committee's Report Advocates Cleaning Gases and Efficient Use.

In the course of a report on fuel economy and consumptions in the manufacture of iron and steel, which came before the autumn meeting of the Iron and Steel Institute in London, England, recently, Prof. W. A. Bone, Sir Robert Hadfield, and Alfred Hutchinson in the course of a review of their conclusions said that the result of their investigations proved beyond all question that much remained to be done before British iron and steel works would have attained to anything like the practical ideal of fuel economy which at least three leading iron and steel makers had declared to be even now attainable. Among other directions in which economies could be effected was the utilization of waste gases from boilers, stoves, furnaces and soaking pits. Such satisfactory progress was now being made with the electrostatic cleaning of blast-furnace gases, that the day might be confidently anticipated when all gas, whether required by stoves or engines, would be so cleaned. This would undoubtedly increase the thermal efficiency of the hot-blast stoves, and make a larger surplus of gas available for the steel works. Speaking of the utilization of the surplus gas for power purposes, it seemed a barbarous practice, said the authors, to burn uncleaned blast-furnace gas in Lancashire boilers, whose efficiency probably did not exceed 55%, when (if cleaned) its potential energy could be transferred into electric power via the gas-engine and the dynamo. The day was fast approaching when, in steel works adjacent to blast furnaces, all stationary machines (including blowing engines, cranes, and rolling mills) would be electrically driven by current generated from the explosion of blast-furnace gas in internal-combustion engines. Even now, steam-driven reciprocating blowing engines should be superseded by electrically driven turboblowers. When such reforms had been carried out in connection with the blast-furnace plants they might look for the abolition of the "gas producer" in the adjacent steel works, a step much to be desired.

In the course of their reference to the problem of isolated blast-furnace plants, the authors said it would, as a rule, undoubtedly pay any firm to make coke in its own regenerative by-product ovens on a site adjacent to the blast furnaces. In the case of a Cleveland furnace making 1000 tons of pig iron per week, and using no more than 22.5 cwt. of coke per ton (which means working under the best possible conditions) it could be shown that the total gas made per hour at the furnaces would be about 1,115,000 cu. ft. at 60° F. and 30 in. barometer. If this were electrostatically cleaned and used to the best advantage on the plant, half of it should suffice to generate and heat the blast. The potential energy of the other half, if converted into electric power with an overall efficiency of 20% would be capable of developing 3350 kw. continuously at the switchboard. The available surplus coke-oven gas would amount to a further 48,000 cu. ft. per hr., or sufficient to generate about 1150 kw. continuously. Hence the total available power from the combined gases would attain about 5000 kw. continuously. This did not take any account of power derivable either from the stove waste heat or gas-engine exhaust, or yet of the heat carried away in the molten slag and iron, all of which might be turned to profitable use. The best way of disposing of such surplus gas and waste heat would be to sell them to an electric power company for conversion into electricity; but, if there was no power company near at hand to buy the energy then it might be used to generate electricity for some electrochemical process, such, for instance as (1) the manufacture of nitric acid from the air, or (2) some electrometallurgical or electrolytic operation. "What ought to be realized is that the combined by-product coke-oven and blast-furnace plant is not only an efficient producer of iron, but that it simultaneously, and of necessity, generates a most valuable power gas, of which the utmost use must be made in the interests of national economy."

The same subject was covered further in a report prepared by Cosmo Johns and Lawrence Ennis for the Iron and Steel Institute "On the Present State of Fuel Economy in the German Iron and Steel Industry of the Occupied Territory on the Left Bank of the Rhine." They stated: (1) The blast-furnace gas should be cleaned, without loss of sensible heat, if the conditions render it possible, until the dust content is at least as low as 0.1 gram per cu. in. It is only when this has been done that the gas can be used economically for any purpose in iron and steel works practice. It is only thus that any useful surplus can be obtained for use in the steel works. Gas intended for use as fuel in internal-combustion engines should, of course, be still further cooled and cleaned. (2) All power, whether compressed air for blast furnaces or converters, or electric energy, should be generated in gas-driven prime movers, with only such steam turbines as are found necessary to deal with fluctuating loads. As much steam as possible should be furnished by waste-heat boilers attached to the large gas engines. These waste-heat boilers should be of the fire-tube type, not water tubes. (3) If the linking up of the power stations of neighboring works is possible, then the whole of the steel works should be electrically driven.

CITY SAVES $15,000 THROUGH CENTRAL-STATION SERVICE.

Two years ago the city council of Grand Forks, N. D., signed a contract with the Red River Power Co. for electric energy for operation of its water pumping supply system and street-lighting system. At the Oct. 6, 1919, meeting of the city council the report of expenditures for electric power showed that in the 23 months of the contract the city had saved $14,846, compared with the cost of operating its own plant.

[2] Compare Insert V and the additional assumption that the consumer's maximum demand is proportional to his peak responsibility, and that the latter is the correct portion of the central station's capacity for which the customer should be charged; see Insert VI.

Military Searchlights and Their Scientific Testing

Review of War's Very Striking Developments in This Field of Light Projection — Power, Mobility and Utility Greatly Improved—Important Developments in Searchlight Testing

AMONG the most important engineering developments of the World War was the big stride in improvement of big searchlights. Doubtless the most complete general review of these achievements was presented in a paper by Capt. Chester Lichtenberg, U. S. Army, read before the recent Chicago convention of the Illuminating Engineering Society. Extracts from this paper are given herewith, followed by extracts from an article on searchlight testing by F. A. Benford, of the Illuminating Engineering Laboratory, General Electric Co., which article appeared in a recent issue of the General Electric Review. The rapidity and success of these searchlight developments was due in large measure to the splendid co-operation of the research scientists and engineers of progressive manufacturers with the engineers of the Army. Each step in the development of powerful and mobile searchlights was verified by painstaking tests calling for new methods and apparatus, the principal ones of which are described herewith.

SEARCHLIGHTS have been used for military purposes for over fifty years. They are essentially war materiel, although in recent years they are being used for special illumination work. Their military application has been varied according to the strategy employed and the tactics involved. Their development has been spasmodic, resulting from immediate needs in war times with practically no peace-time demands. Their testing has been difficult owing to the many independent variables and the large parameters involved.

The startling events of the past four years have caused marked changes in military affairs and required fundamental and radical alterations in many lines of equipment. Searchlights are included in that class of materiel which experienced undreamed modification. They received a design and application impetus during the past two years which has more than counterbalanced the relative inactivity of the preceding fifteen years.

Service.—Searchlights are used by military organizations for detecting and illuminating distant targets. The visible area, color contrast, shape and relative speed of the targets varies through wide limits. They may be grouped in classes as follows:

1. Buildings, intrenchments, bodies of troops, and similar large stationary or essentially stationary targets on land.
2. Automobiles, motorcycles, bicycles, horsemen, small bodies of troops, and similar agile and fast-moving targets on land.
3. Battleships, troop ships, and similar slow-moving targets on water.
4. Destroyers, motorboats, rowboats and similar small, agile or fast-moving targets on water.
5. Bombers, and similar cargo-carrying and sluggish targets in air.
6. Scouts and similar fast agile targets in air.

The service requirements determine in a large measure the desirable characteristics of the most suitable searchlight. Distant targets require beams of great penetrating power, hence a beam of minimum divergence is sought. Near targets require beams of relatively great area-covering power, hence a beam of maximum divergence is preferred. Fast-moving targets demand an agile control of great responsivity. They require a beam of relatively wide divergence for their continued illumination. Slow-moving targets may use a beam of relatively small divergence if the beam fully covers them at the nearest range to which they will be permitted to approach. So for each kind of target there is a beam which will best detect and illuminate it.

The year 1917 found the nations of the world confronted with at least one new problem. The science of aeronautics had developed with astonishing rapidity. High-speed airplanes of huge carrying capacity were sent hundreds of miles under cover of darkness distributing terrifying and death-dealing missiles throughout wide areas. The destruction of life was serious. The undermining of the morale of the civil and military population threatened defeat.

The tactics were new. No counter efforts were known. Means for detecting the raiders were demanded. Searchlights were suggested, tried and found effective. The available materiel was, however, ill adapted for aerial service. It had been designed for detecting and illuminating land and water targets. The elevation range was limited to about 30°. The designs were heavy and immobile, being intended for installation in fixed fortifications. The control was sluggish, being intended for following relatively large and slow-moving targets on the earth's surface.

A survey of the situation was ordered by Maj. Gen. Wm. M. Black, the chief of Engineers, United States Army, in the early fall of 1917. It was inaugurated by Col. R. S. A. Dougherty, Engineers. The investigation covered existing European practice and the probable trend of the art.

It was found that the targets were new. They moved above the earth's surface at altitudes up to 25,000 ft. They were remarkably fast and agile. They were colored so as to blend with the backgrounds that they used. They moved singly or in formations. They were accompanied at times by screen or decoy units. They presented relatively small visible areas making detection at a distance difficult, even by day.

Problems.—The problems disclosed were many and difficult. Searchlights to meet the situation seemed to require new characteristics. They must have a relatively wide field to rapidly search a given area of sky. They should have a beam of good and well distributed illumination effective at ranges from 5000 to 25,000 ft. Their design must be simple yet rugged since only inexperienced operating personnel would be available. They must be relatively light in weight to permit rapid movement from point to point. They must be relatively small in size to permit convenient intrenching. They must have reliable, silent and mobile power units which must not only carry the searchlights and personnel, but must furnish the power to operate the searchlights. The control must be simple, capable of operating the searchlights very fast for changing direction of search and relatively slowly for searching. It must permit searching through 240° in elevation and indefinitely in azimuth.

The requirements were new. Existing facilities were limited to a few standard barrel searchlights each week. Thousands of units were needed immediately. Increasing production of developed designs was difficult because of the acute labor shortage. It was, therefore, imperative that new design and manufacturing facilities be sought and developed.

Mobilization.—Mobilization of existing resources was started in the spring of 1918. The principal manufacturers of searchlights and searchlight equipment were approached. The problems were presented to them. They were induced to assign new groups of engineers, designers and mechanics to the task. The aid of prominent scientists was enlisted and fundamental problems presented to them for solution. Close liaison was established with the American Expeditionary Forces in France. Advantage was taken of the facilities of the National Research Council to maintain contact with established scientific organizations of the Allied nations. Every source of information or assistance was probed and advantage taken of each bit of data obtained.

Determinations.—The determination of the characteristics of existing searchlights and searchlight equipment was the next step taken. Existing methods were investigated. They were found to be antiquated and inaccurate. Expert assistance was sought. Dr. C. G. Abbott of the Smithsonian Institute, I. G. Priest, E. C. Crittenden and A. H. Taylor of the Bureau of Standards, Physicist Enoch Karrer of the Army Engineers, W. D'A. Ryan and F. A. Benford of the General Electric Co., and Preston R. Bassett of the Sperry Gyroscope Co. were consulted. In co-operation with the officer in charge, searchlight investigations, United States Army, they surveyed the field, analyzed the problems involved, and developed and applied new and novel methods of determining the characteristics of searchlights for land, water and air service.

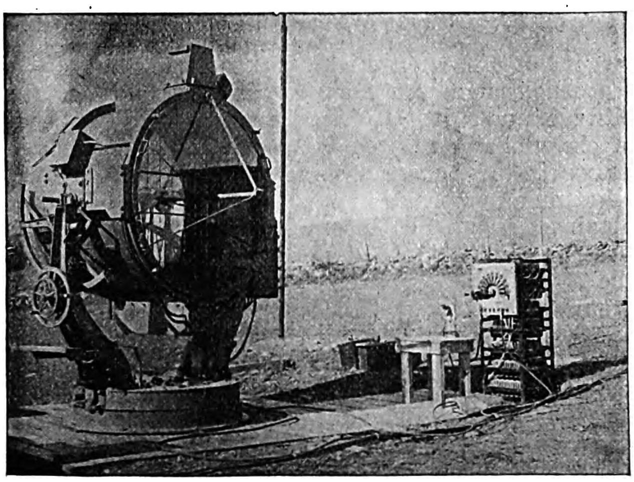


Fig. 1.—Full Automatic High-Intensity Searchlight in Coast Fortification Type Drum—On Account of Bulk and Weight This Outfit Was Not Suitable for Mobile Service.

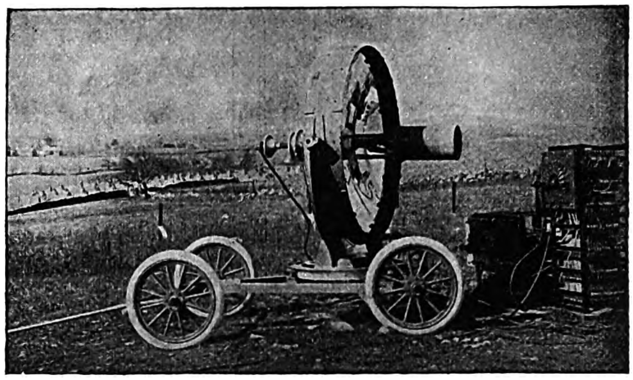


Fig. 2.—An Early Model of the 60-In. Open Type Medium-Intensity Searchlight Adopted for Army Use—This and Later Types Were Much Lighter, More Portable and More Powerful Than the Type Shown in Fig. 1.

Arc illumination is the basis for all searchlight calculations. The amount of light energy available, and its distribution are vital factors in projecting beams. Methods for determining the characteristics of arcs and other similar sources of light used in searchlights were developed by Messrs. Crittenden, Karrer and Benford.

Messrs. Crittenden and Karrer determined arc illumination by the use of mirrors and a photometer. The arc and photometer were held fixed in position. The mirrors were rotated around the arc step by step in three great circles. Photometric observations were made at each step. The observations were plotted and a characteristic curve obtained. The curves gave direct means for comparing the various arcs and other light sources used or considered for searchlights.

Mr. Benford used a hollow hemisphere with its concave side receiving and collecting the light. A reflecting surface at the focus and a photometer located outside the hemisphere complete the equipment. The observations give the total light from the arc or the beam when a mirror is placed behind the arc.

The determination of the most suitable color of searchlight beams was a problem of absorbing interest. This characteristic was found dependent principally on the temperature of the source. At relatively low temperatures, that is, with low-intensity arcs having a current density of about 0.1 ampere per square mm., the color is reddish-yellow. Ingredients in the cores of the carbons can be used to modify the color slightly. At intermediate temperatures, such as produced by medium intensity arcs having a current density of about 0.4 ampere per sq. mm., the color of the beam is greenish-yellow. Ingredients in the cores of the carbons have little modifying effect on the color. At high temperatures, such as produced by high-intensity arcs with a current density of about 1.0 ampere per sq. mm., the beam color is bluish-white and is uninfluenced by ingredients in the cores of the carbons.

The colors of searchlight beams can be accurately controlled by the use of filters. These reduce the amount of light in the beam from 20 to 50 or more per cent. Their use has been abandoned for military purposes, where the amount of light is of paramount importance.

Absorption.—The absorption of searchlight beams under various atmospheric conditions has been studied. The investigations have not been completed. They are still in progress. Initial results indicate that the amount of light returned to an observer near the searchlight varies inversely as the sixth or seventh power of the range. It has also been found that the shorter wave lengths of light energy are absorbed more rapidly by the earth's atmosphere than the longer wave lengths. Experiments with a blue-white 150-ampere high-intensity arc in a 60-in. parabolic glass mirror showed the beam to appear distinctly yellow at 20 miles. Radiometer tests show that 75% of the light energy in the yellow part of the spectrum is dissipated in 7.2 miles of clean dry air near the earth's surface.

Front Glass.—The front glass or door or lens of a searchlight was first given attention by Dr. Abbott. While observing a searchlight beam he remarked the large diffusion caused by the front glass. Later investigation revealed that the glass used was relatively poor optically and that it diffracted some of the light of the beam. It was also found that dust and dirt on the front glass further reduced the light in the beam.

Tests were made to determine the ordinary light losses caused by the front glass. Three organizations co-operated. They made an exhaustive series of measurements at ranges from 1000 to 3000 ft. It was found that the front glass cut off an average of 25% of the beam light.

Searchlights were next operated without front doors. Trials were made with 24-in. barrels containing 75-ampere high-intensity arcs, and 36-in. and 60-in. barrels with 150-ampere high-intensity arcs in all kinds of wind and weather. Their operation was found successful in all but rare combinations of wind and angular position of the searchlight barrel. In these cases it was found that the walls of the barrel caused eddies of air which disturbed the arc stream. The successful operation of barrel searchlights without front doors was a leading factor in suggesting the development of open type searchlights.

Target Finding.—Target-finding determinations proved a most interesting and valuable contribution to the art. Previous investigators had contented themselves with separate photometry or other measurement of searchlight arcs and beams. The lack of suitable standards, the intensity and unsteadiness of the source and the important effects of atmospheric absorption were neglected. The results were neither absolute nor comparative.

The limits of the older forms of testing were soon realized. It was seen that more reliable methods were necessary. The field was carefully surveyed and the problem studied. A return was made to first principles. One or more sources of light comparable with the source to be examined were arbitrarily made standards. These were chosen from sources which had been or were being used under service conditions and concerning whose performance some data were obtainable. The visibility of distant targets illuminated alternately by the standard sources and the unknown source was determined when viewed by a number of observers at service distances from the source and the targets.

Fixed-area targets were the first form used. They were 18 in number. They were rectangular in shape. Their sides were in the proportion of 5 : 1. They were painted dull black. The largest had an area of 500 sq. in. The smallest had an area of 2.5 sq. in. They were located on a sky line about 3000 ft. from the searchlight under test. The number visible when illuminated by any beam gave an indication of the finding power of that beam. The inverse relation of the least mean areas observable when illuminated by the several searchlights gave a comparison of their relative finding powers.

Variable-area sky-line targets followed. They consisted essentially of a long canvas roll mounted on a cylinder in the same fashion as a window curtain. The surface turned toward the searchlight was painted dull black or in a series of combinations of dull white and dull black. They are used in the same manner as the fixed-area targets. Their principal advantage is that the observations with them are less likely to be biased since the observers have no gauge of the least area visible.

Airplanes and ships are being used extensively as comparison targets. They are the preferred kind. Their use is relatively simple. They are caused to pass successively through the standard and unknown beams at 6 to 10 ranges on 3 or 5 or more nights. The number of times they pass through each beam is noted by observers on them. The number of times they are seen to pass through the beams is noted by observers located at service positions. A ratio of the mean number of times the targets are observed to pass through the beams and the actual number of times they pass through gives an indication of the finding power of the beams. A comparison of the ratios of standard and unknown beams gives a direct comparison of their finding powers.

Comparison target-finding tests are based on the assumption that lights of known finding power under service conditions are used as standards. These tests then form a simple, accurate and rapid method for the determination of the service utility of a new or modified searchlight. The tests were used with marked success in comparing mirror sizes, mirror colors, mirror shapes, front-glass losses, medium and high-intensity arcs, color screens and over 20 designs of searchlights.

Observer's Position.—Observer's positions have always been known to influence the finding power of a searchlight. Many observations were made from time to time, but no co-ordinated results obtained. The problem was given special attention in the spring of 1918. A series of tests was made with airplane targets at Ellington Field, Texas. A 36-in. barrel searchlight with a 150-ampere high-intensity arc, 40 observers on a 6000-ft. base line and an airplane flying at elevations from 3000 ft. to 6000 ft. and ranges of 10,000 ft. to 20,000 ft. were used. Observations were taken on a number of nights. Over 800 readings were obtained. The collated results indicate that the best observing position is in the axis of the trunnion of the searchlight and from 300 ft. to 1000 ft. distant from it.

Designs.—The design of searchlights and searchlight equipment to meet the new warfare conditions required radical changes in the fundamental ideas previously held. The service needs were collected and analyzed. The views of collaborators and liaison officers were obtained. Future operations and tendencies were considered. Problems were formulated and assigned to selected groups of engineers. Their queries were invited and answered. Their products were examined during the progress of development. The final samples were given rigid and exhaustive tests.

Five designing engineers with their assistants cooperated with the War Department. Each formed a group of keen, skilled enthusiasts whose knowledge, interest and efforts resulted in the successful development of a number of new, novel and epoch-making designs.

Barrel Searchlights.—The barrel searchlights available at the beginning of hostilities were intended for fixed installations. A portable type was needed. The problem was submitted to the Sperry Gyroscope Co. and the General Electric Co. They assigned Preston R. Bassett, John L. Hall and E. J. Murphy to consider the requirements. The first result of their study was a standard 36-in. barrel searchlight with a four-wheeled carriage instead of the remote-control base. This reduced the weight from 4000 to 1600 lbs. Next they modified the design and produced a 60-in. light barrel weighing 1800 lbs. complete with carriage. The mechanisms of these searchlights are noteworthy. They are automatic yet very simple. The number of parts in them is less than one-fifth of the number in the previous standard designs. They weigh only one-fourth as much as the standard designs, yet are more rugged and function better.

Open Searchlights.—The open type searchlight was conceived by Maj. Richard Wheatley Lewis, Engineers, in May, 1918. He was deeply impressed with the need for a lighter-weight searchlight than any available. He saw the desirability of having one which would combine lightness with ruggedness, simplicity and ease of operation. He studied the results of experiments made in the United States and sketched a design which eliminated all but the basic essentials of a searchlight.

The problems of design were submitted to a group of army engineers, the General Electric Co. and the Sperry Gyroscope Co. Capt. L. C. Josephs, Jr., and C. A. B. Halvorson and P. R. Bassett were assigned to crystallize Major Lewis's conception. They developed and within two months placed in production a 60-in. searchlight of remarkable properties. It weighed only one-fifth as much as the previous standard. It had one-twentieth of the bulk and cost only half as much. It was infinitely simpler and could be produced in less than one-fourth the time required to produce the old standard. It used the same mirrors and carbons as the old designs. It was uniquely adapted for the service conditions encountered.

Improved open type searchlights followed the successful initial designs. The carriage was made stronger and lighter. The mechanism was made simpler. A tripod mounting was made for a 30-in. size. A litter carrier was made for the 60-in. size. The finder was simplified and improved, the controls bettered. The result is a searchlight design which will accommodate the wide variety of arc light sources and mirrors to meet the many service conditions encountered.

Power Units.—Mobile power units were as essential as mobile searchlights. They were required to be dependable and quiet in their operation. Their design was submitted to Maj. Lorimer D. Miller and Capt. L. C. Josephs, Jr., Engineers, and Harry S. Baldwin of the General Electric Co. Two schemes were developed. Both used an automotive engine as prime mover. One is the so-called Mack design. It had the generator located in front of the engine and supported beyond the automobile chassis. The other is the so-called G. E. Cadillac design. It had the generator located on a quill between the automobile transmission and the differential and supported inside the automobile chassis.

The Mack design was an adaptation of French practice developed during the war period. It eliminated the belts, chains and other links of the French systems and placed the generator on an extension of the engine crankshaft. This design permitted standard truck units to be modified and used as mobile searchlight power units. It also permitted a limited operation of the searchlight and truck motive power simultaneously. The design was projected in December, 1917. One hundred and eighty units using 5½-ton Mack trucks were built. They were equipped with extra radiator and extra water supply and carried a 115-volt, 15-kw. generator, a 36-in. wheeled barrel searchlight, 500 ft. of cable, rheostats, etc. About 30 units reached the American Expeditionary Forces in France where they were successful on hard roads.

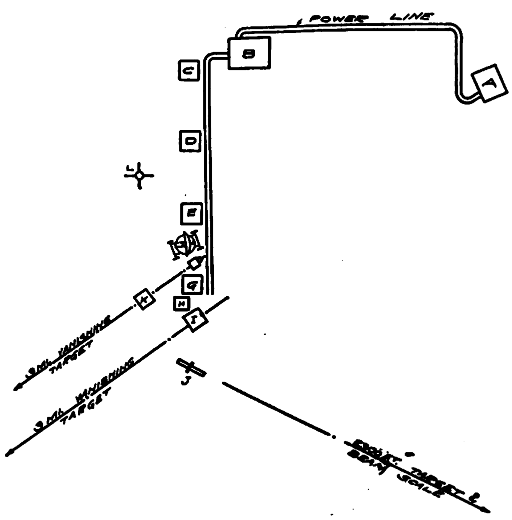


Fig. 3.—General Ground Plan of Searchlight Station.

(A) Power house; (B) general test house; (C) 60-in. high-intensity drum type projector; (D) 60-in. low-intensity drum type projector; (E) 60-in. high-intensity drum type projector; (F) 60-in. medium-intensity army open type projector; (G) incandescent projector; (H) wireless telephone station; (I) sectored disk for visibility test; (J) 6-in. telephotometer; (K) 15-in. telephotometer; (L) antenna of wireless telephone.

The G. E. Cadillac design was a distinct departure in power unit construction. Similar to the Mack, it uses a standard automobile engine and chassis. In addition, however, it uses the standard water reservoir and cooling equipment. The generator is placed concentric with the propeller shaft and connected to it through a quill. A standard Cadillac clutch and gear-shift lever enable the engine to be connected to either the generator or the automobile propellor shaft.

The Cadillac idea was suggested in June, 1918. A sample was ordered in July, 1918. Delivery was made in September. A short but thorough test was made in the United States. The sample was then shipped to France where it was received and placed with the Second American Army early in October. It carried a 105-volt, 20-kw. generator, 600 ft. of cable, and a 60-in. open type searchlight. Ninety additional units were authorized soon after the sample was started.

Extensions of the Cadillac idea have been made. A 50-kw. unit has been completed. A 7-kw. unit is being constructed. The three models form a unique line of portable power units employing automobile designs which have been standardized for the general service in the Army.

The future of military searchlights is assured. The remarkable advances in aeronautics alone provides a wide field for their employment as detectors, beacons, landing lights and signals. Their development has but just started. They will undoubtedly be wonderfully improved in the next decade.

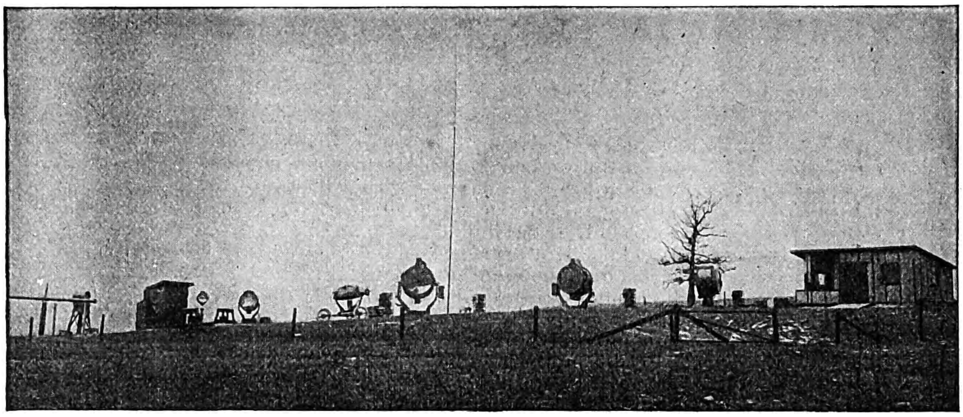
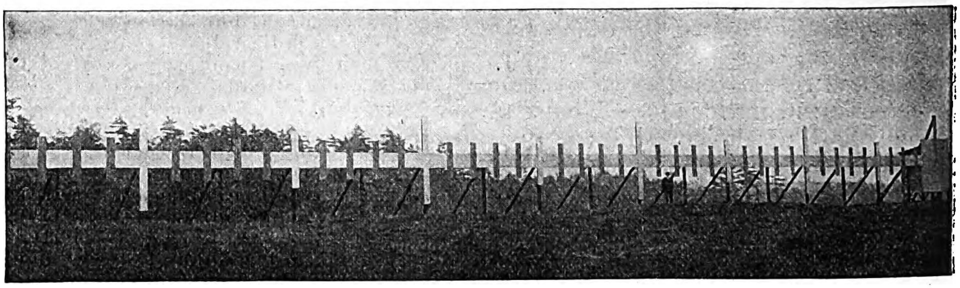


Fig. 4.—General View of Searchlight Station—Test House at Extreme Right.

Searchlight Testing.

The characteristics required of an anti-aircraft searchlight are: Mobility, durability under rough usage, reliability under all circumstances, ability to operate at any elevation of axis or even upside down, good luminous efficiency, and quietness of operation. When to this list is added the fact that the positive electrode is often at a blazing white heat for its entire length and many parts of the lamp are red hot during a protracted run, it is seen that the design of an operating projector is not a simple matter. Several of these requirements were entirely new, and some idea of the radical changes in the new projector may be gained by a glance at the illustration of the old fortification-type searchlight, Fig. 1, and the army open-type searchlight, Fig. 2. During the tests that accompanied the development of the new type searchlight, every part of the projector had to be kept under constant observation and the interested engineers kept posted. The scheme and scope of the testing was laid out by W. D'A. Ryan, and all actual test work was done by members of the Illuminating Engineering Laboratory of the General Electric Co. Following each test, technical reports were made to the General Engineer Depot, U. S. Army, covering first, fairly complete original test data and notes on operation; second, a summary and comparison of the data; and third, a judgment on the thing tested.

Fig. 5.—Close-up View of the Beam Scale and Photometer House—Note Size as Compared with the Man Standing Near Middle.



The principal source of information was the outdoor searchlight range on the Schenectady-Duanesburg road. Here was equipment for operating and testing the numerous types of searchlight, singly or in groups. The test work fell into three classes: first, a mechanical or operation test of the searchlight or carbons; second, a test of the relative revealing power of the searchlights; and third, a photometric analysis of the beams of light. The last class of testing took up the greater part of the time, but the three classes were always more or less interwoven and proceeded simultaneously. To the uninitiated, the amount and

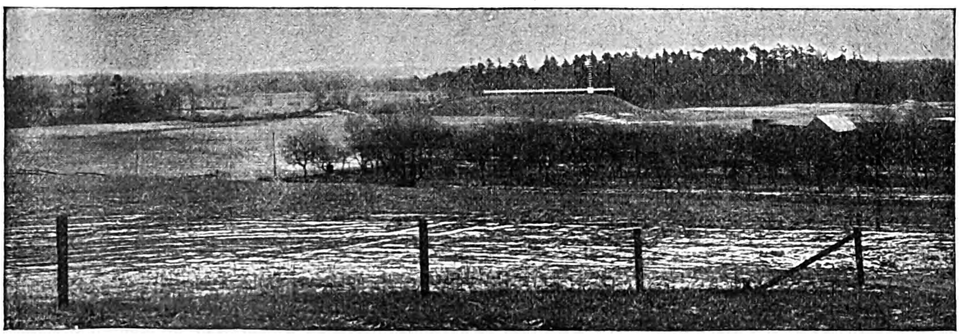


Fig. 6.—The 2300-ft. Target and Beam Scale as Viewed from Searchlight Station — Horizontal Scale Is 5° 30′ Long, and Vertical Scale Is 1° 30′ High.

scale of testing apparatus is amazing, and the labor involved in choosing between two identical appearing carbons seems beyond all reason. The explanation is simple enough for sheer difficulty—searchlight photometry stands in a class by itself. There are several factors, such as current and voltage, that are under control; several others, such as crater formation and steadiness of burning, that can be observed but only slightly controlled; and finally, there is the action of the atmosphere, which cannot be controlled, and until this station was built was probably never before measured as a regular part of the photometric testing of a searchlight.

The country around Schenectady was thoroughly examined before a suitable location was found on the Schenectady-Duanesburg road about five miles from Schenectady. This location is entirely free from smoke and river fog. The power station and searchlight are located on a hillside having a free view across a wide shallow valley. A high point of ground 2300 ft. away was selected for the station at which photometric readings were to be taken. A mile and a half away an airplane silhouette was erected, and three

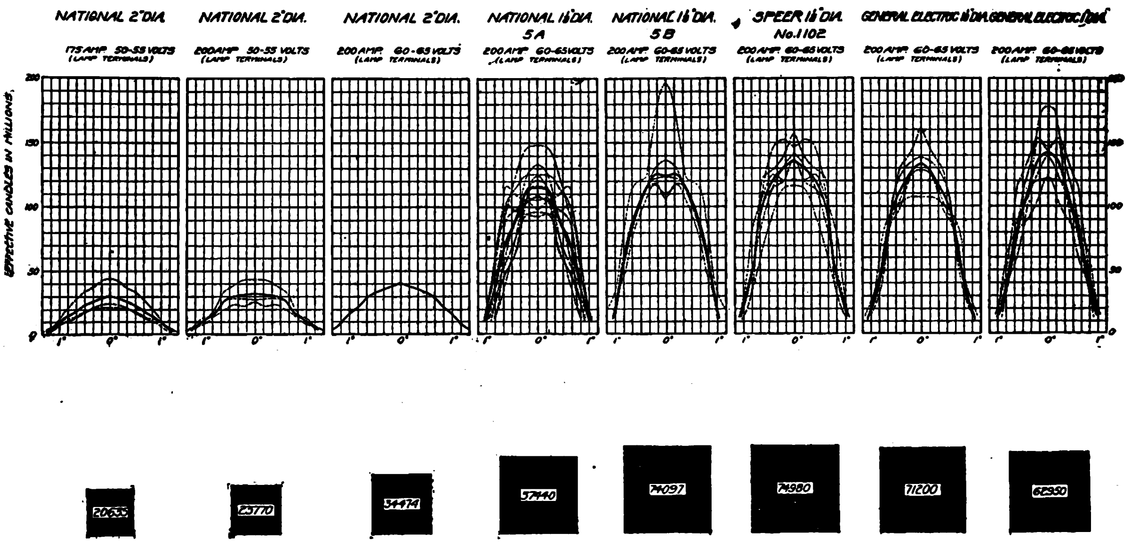


Fig. 7.—Three Curves at Left Show Pre-War Intensities from a 60-In. Searchlight—Five Curves at Right Show Preliminary Results with Five of the Most Promising Electrodes Developed During the War—Later Tests Were Restricted to the Three Best Out of These Five.

miles across the valley was located the big "vanishing" target mounted on the brow of a hill so that the sky formed the background. The searchlight station, power house, and photometric station were connected by a telephone line, while communication between the searchlights and vanishing target depended on a wireless telephone outfit similar to those used by the airplanes spotting for the artillery.

The beam of light reflected from a parabolic mirror has several peculiar features, the most important being the great distance to the point where the light in the beam has assumed an approximately final distribution. The light that strikes the center of the mirror has the greatest spread and forms the outside of the beam, and the light that strikes the rim of the mirror is most abundant in the center of the beam. Theoretically this crossing over process never ceases, but practically the light is in its final position at from 100 to 400 times the diameter of the mirror, depending upon the type of arc. These distances allow considerable atmospheric interference and also necessitate some means of constant communication between the two parts of the testing squad which is composed of five active members, as follows:

(1) Lamp operator, who also records arc voltage and current at half-minute intervals.

(2) Beam trainer, who sees that the arc is properly focused and who directs the beam on the target and, by watching the arc, helps the operator in maintaining a normal crater.

(3) Communication man at searchlight, who in addition to keeping up communications, records the degree of flicker in the beam, the kind and time of hissing arc, and the outages.

(4) Photometer reader and communication man.

(5) Data recorder for photometer only.

In addition to the above, there is the engineer of the power station and from one to six observers, depending on the type of the test.

The electrodes of the open-type searchlight are kept in the correct burning position by occasionally rotating both positive and negative. Any slight movement of the crater on the positive carbon is accompanied by a movement of the beam and there is no provision on the searchlight itself for keeping the arc as sharply in focus as is required in test work. For this reason, the beam scale shown in Figs. 5 and 6 was used as both a guide for the beam and as a means for observing and checking the beam width. The photometer was placed with its head at a hole in the center of the large white square near the right end of the scale. This zero mark on the scale was really a 6-ft. square hut with full equipment and accommodations for the photometer reader and the data man. The trainer would direct the beam so that the part in which measurements were required would come at the zero mark. The points of measurement were usually 0.2 of a degree apart, or two small divisions on the scale. The trainer watched one edge of the beam as he moved it across the target. The edges of the beam are more clearly defined than the center and as only one edge can be seen plainly at a time, the target was placed near the extreme right end of the scale. The left edge of the beam could then be moved over 4° 30′, if the beam were that wide. In general.

the testing was done across the horizontal center line of the beam, but a vertical scale was built so that occasional special tests in a vertical plane could be carried out.

The photometers were of the Weber portable type with a working range of 100,000 to 1, which is more than sufficient to cover the variations in intensity encountered. Thus, the ratio of the greatest intensity of the high-intensity arc to the lowest measured intensities of some of the smaller arcs was about 1000 to 1. The readings were in foot-candles at the face of the target, normal illumination, and the apparent intensity of the searchlight in candles was found by multiplying the illumination by the square of the distance, or 5,290,000.

It was realized from the first that the handicap of not knowing the atmospheric transmission would be fatal to much of the testing originally planned. Consequently, two instruments were designed and assembled at the laboratory for the measurement of this transmission. The smaller one, 6-in. diameter and 18-ft. focal length, was used during photometric work on the 2300-ft. target; and the larger one, 15-in. diameter and 30-ft. focal length, was used during the visibility tests on the three-mile target. These telephotometers each consisted of a simple double convex lens which formed an image of the target in the center of the Lummer-Brodhun cube of a portable photometer.

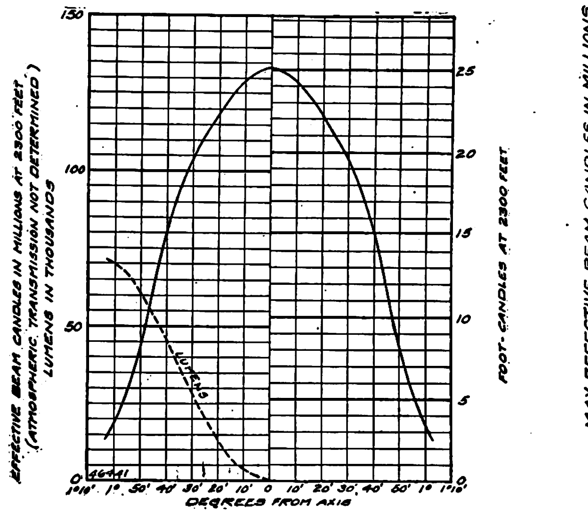


Fig. 8.—Curves Showing Beam Intensities and Flux Values Obtained With a Certain Group of Similar Electrodes.

The instruments were first set up in the laboratory and directed against a block of magnesium of such size as to give an image similar in size to that of the target on the outdoor range. The brightness of the magnesium was then measured through the telescope and compared with measurements made directly at a few feet distance. This ratio gave a figure for the relative brightness of the image in the photometer field. When used on the range, the zero section of the beam scale was illuminated by an incandescent searchlight that was carefully adjusted and maintained constant during the test. At a given signal, the man at the telephotometer would take readings and the men at the target, who had an extra photometer for the purpose, would take brightness readings on the same surface. A comparison of the two figures for brightness so obtained would give the loss of light in the atmosphere from the target back to the telephotometer, and the photometric data of the searchlight on test could be corrected accordingly.

Telephotometer readings were usually taken at the beginning of each night's work, at 11 o'clock, and at 2 a. m. just before quitting. A curve of time against transmission was drawn for each night, and the various tests were then located on this curve and given the proper correction.

The selection of electrodes for the open-type searchlight involved testing a large number of makes and mixtures before the final choice could be made. Three companies, the Speer Carbon Co., the National Carbon Co., and the General Electric Co., were actively engaged in making experimental mixtures that were tested out and reported on so that the chemists of the three companies were kept posted on both their own electrodes and those of the other two. Frequent meetings of the three chemists were held at the laboratory, where the test data and carbon stubs were inspected and these led to an extremely rapid development in the art of making better electrodes. It was this part of the work with which Mr. Ryan identified himself most closely, and it was his original specifications for sizes and currents that gave the development of carbons its flying start toward success.

Fig. 7 gives the total data of the tests on eight

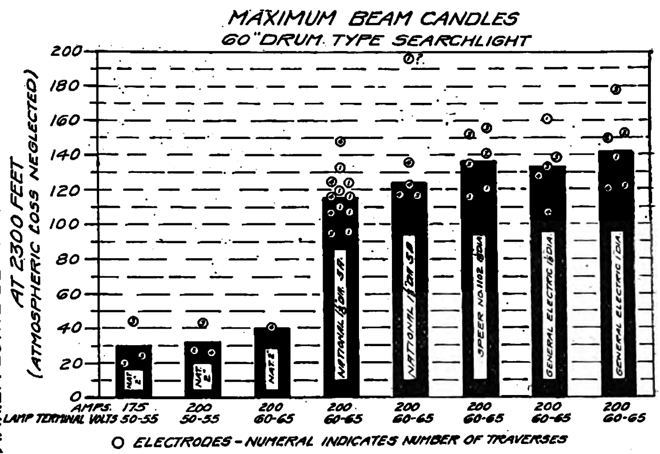


Fig. 9.—Graphical Study of Maximum Intensities Given by Different Electrodes—Scattering of the Spots Indicates the Variations Encountered Between Individual Electrodes of the Same Mix.

carbons of the same mixture, including curves of the beam characteristics as determined by 17 separate traverses of the beam.

There are three prime requirements to be met by carbons for anti-aircraft searchlights. These are: High luminous efficiency, steadiness and uniformity of burning, and quietness. The first is the easiest to meet and the last is the hardest. Luminous efficiency and quietness (that is, freedom from hissing) seem to be opposite characteristics, and to obtain one without sacrificing the other is often difficult. The electrodes now made surpass the best pre-war carbons in all three features; and the development of carbons for greatly increased currents is still under way and holds great promise for the future.

The so-called disappearing target consisted of a strip of canvas 13 ft. wide and 300 ft. long. This was wound on two spools leaving exposed a section 13 ft. long. This 13-ft. section constituted the target on which visibility tests were made. The canvas was held high in the air so that the sky formed its background, and to this extent at least it resembled an airplane, and its distance from the searchlight, three miles, represents a common "pick up" distance for airplanes. One end section of the canvas was painted with a good white diffusing paint having a reflection coefficient of 0.670. The second section was white with a number of fine black stripes, reducing the average coefficient to 0.532. The third section had wider black stripes and a coefficient of 0.423. The fourth had a coefficient of 0.335 or just one-half that of the first section. This geometric series, which reduces the coefficient by half every three steps, was continued until the last target was entirely black. The black and white markings were not visible at three miles, and to the observer the target grew dimmer and dimmer as it was moved toward the black end.

This target was used both as a disappearing and as a reappearing object. Starting with a white target, the canvas was rolled toward the black end. To the observers the target became gradually dimmer and dimmer until it finally disappeared. The disappearing point is not sharply defined, principally on account of the normal variations in the intensity of the beam. While the target was still fairly bright and distinct it would momentarily disappear during a period of low crater brilliancy. These periods of invisibility became longer as the target became a darker gray, until finally the target could be seen only during short periods of high crater brilliancy, and then came total invisibility.

The observers, who occupied various positions about the searchlight and whose watches had previously been set to agree with that of the target operator, recorded

(a) Time of first momentary disappearance,
(b) Time of disappearance half the time,
(c) Time of final disappearance.

The curtain was then wound in the opposite direction and the observers recorded

(d) Time of first appearance,
(e) Time of visibility half the time,
(f) Time of permanent visibility.

These records were then compared with the log of the target and the various sections identified. This test repeated with different searchlights gives a means of comparing their revealing power. It is worthy of notice that the revealing power, or working range under fixed conditions, increases much less rapidly than the beam intensity.

It is one of the unfortunate peculiarities of a searchlight that the beam itself often forms a most effective concealment for the target. The beam appears as a bright blue-tinted shaft of light, and this illuminated space forms a curtain in front of the objects under observation. In the vanishing-target tests the beam maintained its brightness and the target grew dimmer. At the vanishing point it may have had a fair degree of brightness, but not enough to make it visible in the body of the beam. This condition made it highly desirable to have another means of controlling the disappearing point of the target. An obvious way of doing this would be to decrease the intensity of the searchlight until the target was lost. It is not practicable to alter the intensity of a searchlight without altering its color or beam width. The same result may be obtained by cutting down the light from target and beam as it enters the observer's eye. This was done at the range by having the observer look through the blades of a rapidly rotating sectored disk. The eye slit slid along a scale that told the degree to which the light was diminished. Thus, if the target was found to be just visible at 0.20 on the transmission scale of the disk, it indicated that a projector of one-fifth the intensity would show the target under the given conditions of test.

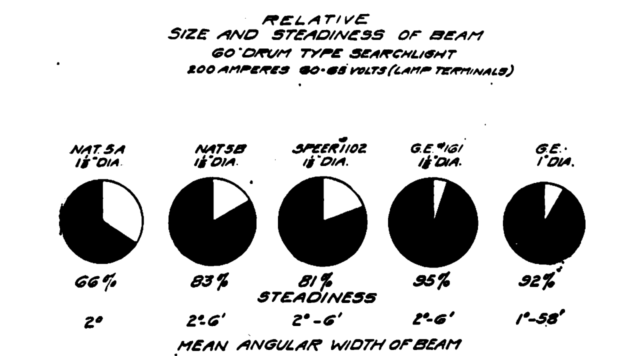


Fig. 10.—Holding a Searchlight Beam on a Swiftly Maneuvering Plane Requires Alertness and Quick Action for Which a Wide, Steady Beam Is a Great Help—The Above Shaded Areas Are a Measure of the Beam's Holding Power.

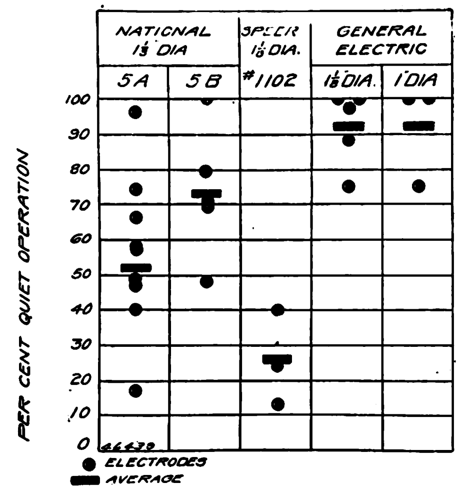


Fig. 11.—Quietness of Operation Is Essential When the Operator Has to Listen for Shouted Orders—Many Electrodes of Good Efficiency Were Discarded Because of Hissing—Such Noises Also Interfered Greatly with the Listening Devices Auxiliary to the Searchlight Equipment.

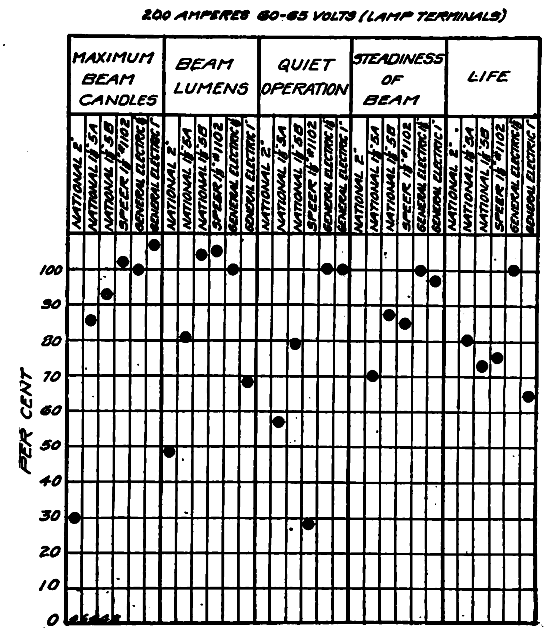


Fig. 12.—General Graphic Summary of Tests—This Form of Final Record Is a Great Help in Getting a Properly Balanced View of All Factors.

Editorial Comment

Improving the Load-Factor in Coal Mining

As a general rule the public has only a very vague notion of all the conditions prevailing in any industry, and it is not until something develops to focus attention upon some particular industry that the actual facts regarding it bcome generally known. This truth is being borne out in the intensified study now directed on the coal-mining industry as the result of the widespread strike of bituminous coal miners.

One of the main contentions of the miners is that in the summer, when conditions for work in the mines are most favorable, they actually are called on to work but two or three days a week, whereas in winter they must work seven days a week. They insist on an evening up of their work to five days a week throughout the year. The mine owners, on the other hand, reply that they would gladly bring this about if the public would spread out its coal purchases more evenly during the year. Storage of coal on a large scale at the mines is said to be out of the question. Much money has been spent in trying to educate the public to order its winter supply of coal during the spring or summer months, but little has yet been accomplished in this direction.

The electrical central-station industry was the first to recognize that a spreading out of the demand brought about important economies and electrical men have for a great many years been working for improvement of the load-factor in electrical supply. In other lines of business, while the desirability of steady orders has frequently been appreciated, little has actually been done to make a systematic study of it and adopt such measures as will improve the load-factor in the respective business. In the coal-mining industry the conditions just cited evidently call for an improvement in the load-factor. This would involve a change in the habits of the people and many are afraid that human nature is against this, because people as a rule do not want something until they actually need it and then they want it very badly. Thoughts of coal during the summer offend the ordinary perspiring individual at that time and he puts off purchase of his winter's coal until he actually must start up his heating plant.

In central-station electrical supply a great deal has been done in improving the daily and annual load-factors by introducing demand rates to keep down the peaks, by making off-peak business desirable through slightly more favorable rates, by stimulating summer loads and by attracting other loads that fill the valleys of the daily and yearly load curves. In the coal business reductions in price per ton are offered during the spring and summer months, but evidently they are not large enough to attract purchases on a large scale at those times. It is now proposed to make a strong effort to secure lower freight rates on coal during the summer months. Whether this would suffice in stimulating purchases during the summer it is not easy to say, but the matter deserves serious study and earnest co-operative effort on the part of every one concerned in improving the annual load-factor in coal mining. We believe that much good will come from this not only to the miners, to the mine operators, to coal dealers, the railroads and all others concerned with the coal business, but also to the public generally because the more stabilized condition in every branch of the coal business should reduce the necessary margins now necessary and possibly lead to reduction in price or at least prevent or restrict further increases in price.

Electricity Helps the Worker to Increase Production

For many months past writers and public speakers have been urging upon industrial workers the importance of settling down to work and ensuring, with the aid of the more efficent means now at their disposal, a larger output. The needs of the world are very large, and the need of greater financial and economic stability on the part of some great nations is even more pressing than are the requirements of peoples that cannot manufacture for themselves.

It has been stated over and over again that a special kind of propaganda movement suited to the prevailing spirit and conditions must be promoted in order to expedite the return to full industrial activity through the better understanding of the situation on the part of the people. It is said that it has always been one of the serious questions after there has been a war, how to get the people back to the ways of peace and every-day occupation without delay. After the late great war in which half the world has been compelled to change its ways, the problem is necessarily a more serious one than ever before. It is one thing to change over from war production to commercial industry in a factory; it is quite another, and a more difficult one, to change the mind and disposition or intention of millions of men and women. It is proving to be of little service for public men, however exalted, in England to urge British workmen to work harder and produce more in order that the nation may keep off the Road to Ruin. What is likely to be more successful is to show them that by the better means that have been placed at their disposal during the war, by the use of modern and efficient equipment, and by the fullest possible use of electric power, they will be able to increase their output of work and manufactures without greater strain than in the past. References to Road to Ruin do not move them in many cases, but the other line of argument makes an appeal to the imagination and will produce quicker results.

The situation has created an excellent opportunity for electrical propaganda, but unfortunately public men and those who have the ear of the people are not quite so well qualified as they might be to handle the great national and personal aspects of electrical questions. In England such subjects have never seemed to appeal to legislators as suitable themes wherewith to interest their audiences, but there is a change in progress at last. The nationalization of electric power supply, by being a plank in the platform of the government now in office, has done something to induce the change. Mr. Lloyd George has referred to the subject once or twice recently, and others are now following suit. One of the best speeches of the kind was delivered recently by Mr. C. A. McCurdy, parliamentary secretary to the food controller. We quote some extracts from this address elsewhere in this issue. It would seem opportune for our public men in America to take a similarly progressive view of the potentialities as to production increase through greater use of electric power. No time should be lost in bringing the matter to their attention.

Air Supply to the Boiler Room

IN THE production of steam in power plants, air, fuel and water are the raw materials employed. Air is the bulkiest raw material handled by the power plant, and a greater weight of air is handled than any other raw material that goes into the conversion of the latent chemical energy of coal into the thermal energy of steam.

The evaporation of water per pound of coal varies from, perhaps, 4 to somewhat above 10 lbs. in the large modern plant. The amount of air required for the combustion of coal, likewise, varies quite widely. Theoretically, about 12 lbs. of air per pound of coal are required for complete combustion. In practice, the excess air may and often does attain 300 per cent, so that in practice the air per pound of coal may vary from 18 to 48 lbs. per pound of coal. Upon this basis it can be readily seen that the weight of air handled always exceeds from 12 to 48 times the weight of coal consumed, and even at the highest evaporation of water per pound of coal exceeds the weight of water evaporated.

In the utilization of the steam, however, in contradistinction to the production of steam, a greater weight of water is handled for condensing purposes than of air for combustion. And, incidentally, this water carries away to waste about 60 per cent of the heat obtained from the coal. The amount of circulating water used depends, of course, upon the vacuum obtained, the temperature difference of the cooling water and condensate. For low vacuua and cold water, the weight of cooling water handled may be less than that of the air required for combustion. But for vacuua above 29 ins., referred to a 30-in. barometer, and temperature of cooling water above 40 deg., the weight of the condensing water will be equal to and will usually exceed the weight of air needed for combustion.

That a greater weight and volume of air than coal or water is handled in producing steam is a fact that should be borne in mind in laying out a power plant and in operating it. At this time of year especially it is well to remember the large amount of air required for combustion, for sometime and somehow this air must come from outdoors. With cold days and colder nights, windows and doors are closed for the comfort of the men, and absence of a definite entrance for the air may result in operating difficulties and lowered efficiencies.

It might seem that so long as air gets under the grate and thence through the fuel bed, it matters little how it gets there. But not so. With windows and doors closed and the free entry of air hindered, a partial vacuum may be created in the station, reducing the effective draft, which in turn affects the combustion rate and efficiency, ability to maintain steaming rates, tending to create smoke and taxing stack or blowers. And then the temperature of the ingoing air to the fuel bed is a factor in furnace temperatures. Cold air only lowers the furnace temperature while air taken into the boiler room through the roof or warmed by the boiler room or losses of turbogenerators not only adds to the comfort of the men but may be transferred from the debit to the credit side of the ledger by lowering combustion losses.

Comfort of the men in the boiler room is almost as important a factor as the air furnished the fire. Both can be best served when the air supply is given as much attention as the coal and water-handling systems. Too many power plants suffer from insufficient air; too many stacks are taxed because of closed doors and windows during the cold weather. The fires in too many boiler rooms are partly asphyxiated because no proper provision for incoming air has been made. And the reason for these things is not because it has been overlooked that air is one of the three raw materials required in steam making by fuel, but because the vast volume and heavy weight involved are not fully appreciated.

The air-supply system, like the coal and water-handling systems, needs deliberate consideration and wise provision unless the performance of the furnaces is to be influenced in the interests of the comfort of the boiler-room force when the cold weather comes. Plant layout cannot now very well be changed, obviously, but the effect upon plant performance of closing all doors and windows and other sources of influx for air can be borne in mind.

Current Events

Jovian Order to Be Revived—Power Economy Conference to Promote Fuel Conservation — Drafting of Safety Codes

N. E. L. A. COMMITTEE TO AID UTILITIES GET COAL.

National Committee on Electric Service Revived to Co-operate With Government as to Coal Needs of Central-Station Companies.

John W. Lieb and George Elliott, chairman and scretary, respectively, of a special committee representing the electric light and power companies affiliated with the National Electric Light Association, have gone to Washington to co-operate with Director-general Hines and Fuel Adminstrator Garfield regarding the maintenance of fuel supply to public utility and related companies during the strike.

M. H. Aylesworth, operating manager of the association, said the committee's functions would be similar to those which were exercised by the National Committee on Gas and Electric Service during the war, in helping to conserve coal and to allocate the supply. A number of light and power companies, Mr. Aylesworth said, had advised him that they were already facing a fuel shortage and, in some instances, higher prices were being demanded for coal.

The committee will endeavor to keep every plant in operation by obtaining for it the required amount of fuel.

JOVIAN ORDER REJUVENATED AT CHICAGO CONVENTION.

Measures Adopted That Will Revive Interest and Bring Back Old Members—A. J. Binz Elected Jupiter.

Voting unanimously to reduce annual dues to $2, to eliminate all existing commercial features and to function solely as a fraternal and social body, the Jovian Order in annual convention at the Hotel Sherman, Chicago, Nov. 5, took steps that practically assures it of renewed interest and activity. Preceding this action, Arthur J. Binz and Ell C. Bennett generously agreed to underwrite the present indebtedness of the Order, so that the money received during the current Jovian year may be used to pay operating expenses. Any surplus after all expenses are paid will be used to apply against the past indebtedness, but even if there is no surplus at the end of the year the Order will be clear of debt.

Another measure adopted unanimously that will be of considerable importance in reviving interest provides that any man heretofore affiliated with the Jovian Order can by the payment of $2 for the current year's dues be placed in good standing regardless of his past indebtedness or his having previously resigned. It was the consensus of opinion that this action would insure the return of a great many Jovians who dropped out or failed to pay dues during the war.

The convention was scheduled for two days, but the work arranged was carried out so harmoniously that it was found possible to complete the program at the end of the first day. Jupiter L. O. Ripley presided at the two sessions, assisted by Mercury Bennett. The report of Jupiter's cabinet, which held a meeting on Nov. 4, was presented and embodied the recommendations already mentioned, which were unanimously passed with the exception of a recommendation to remove the central office from St. Louis to Texas. This recommendation was not pressed because of the action of Messrs. Binz and Bennett agreeing to underwrite the indebtedness of the Order providing the central office remained in St. Louis.

The election of officers resulted in Arthur J. Binz, Dallas, Tex., being elected Jupiter; Ell C. Bennett, St. Louis, Mercury; J. H. Betz, New York, W. R. Herstein, Memphis, and William Hand, Kansas City, members of Jupiter's cabinet. Upon motion of Mr. Bennett it was voted that Mercury serve without compensation.

In connection with the reduction of dues to $2, it was provided that such dues be payable directly to the central office. It was also voted to retain the insurance feature, which permits Jovians to obtain insurance at reduced rates.

NEW YORK ELECTRICAL SOCIETY AND AUTOMOTIVE ENGINEERS MEET.

Army Officers Describe the Remarkable Work of the Motor Transport Corps with the American Expeditionary Forces in France.

A joint meeting of the New York Electrical Society and the Metropolitan Section of the Society of Automotive Engineers was held in New York City on Oct. 30. The program consisted of a lecture by Lieut.-Col. Kingsley G. Martin, chief transport officer of Base Section 1, A. E. F., and a discussion by Lieut.-Col. Arthur J. Slade, of the Motor Transport Corps, on the motorization of the world's traffic. Colonel Martin revealed the experiences of the Transport Corps during the war, the accomplishments of the motor truck in the war emergency, and, finally, the impressions created by the American car in the minds of foreigners. He alluded to the relation between electrical development and the development of the motor car and showed that the successful operation of a motor car like that of so many other mechanical devices, depends upon the successful functioning of electrical apparatus.

Nearly all motor vehicles used by the expeditionary forces were shipped abroad in a knocked-down condition and were assembled at bases established in various parts of France. The amount of assembly work required per vehicle increased as the duration of the war increased, because of the tendency to ship abroad the separate parts of the cars collected in crates. Even the bodies were shipped knocked down, the metal covering being merely stamped in shape, the wood parts fashioned, and the upholstering material in bolts. Some disorganization was caused at one time because a shipment of parts failed to contain tacks for the upholsterers.

The Motor Transport Corps was sent to France without equipment and instructed to assemble and repair the army's cars and trucks. The officers negotiated for land at the bases and began work when the right to use the land was acquired. Plans of assembly buildings were drawn so that the work could be prosecuted exactly as it is prosecuted in the most successful automobile plants in the United States. A chassis started down an inclined track at one end of a building and arrived a complete car at the other end.

Buildings for barracks and other purposes could not be erected until shipments arrived on account of the fact that the men had no building material. The crates in which the cars arrived, however, solved the building material program. From these crates the men constructed the only buildings in the bases. They built their own hoists, derricks, and shops, and made many of their own tools. They set up their own electric light plants and installed their own lighting equipment. They improvised prime movers by driving their dynamos by means of engines salvaged from disabled cars.

The wholesale production of cars was the marvel of the French people. Before 1917, European cars generally were made to order to suit the fancy of the purchaser, who was willing to wait several months for delivery. One of the principal influences that this country exerted on the actions of the Europeans was to change their method of producing manufactured goods. The hand-made system in French industry was replaced in many places by the system of quantity production which was introduced by the Motor Transport Corps. The largest French cities never had traffic control before the American army trucks arrived. The size of the army trains can be judged by the fact that, to fuel a single train, two five-gallon gasoline pumps operated continuously during a 43-hour interval.

WESTERN SOCIETY OF ENGINEERS TO BROADEN ITS ACTIVITIES.

Plans for More Intensive and Numerous Meetings, More Frequent Inspection Trips, New Sections, More Committees and Greater Service to Members.

As the result of the recent fiftieth anniversary membership campaign of the Western Society of Engineers, during which an effort was made to increase the membership to about 2000, a total of 2096 applications were received, thus increasing the membership to almost three times what it was before the campaign. The success of this campaign led to a general meeting of the society, held in its rooms in Chicago on Nov. 3, at which plans for the future of the society were freely discussed.

Amendments to the present constitution were submitted, changing the fiscal year to begin hereafter on June 1, instead of corresponding with the calendar year. The idea of this was to bring the change of administration during the summer dull season and cause less interference with the year's business program thereby. These changes were approved by the meeting and will be submitted to letter ballot of the members.

E. T. Howson, chairman of the Development Committee, presented a general report of the work done by this committee so far in discussing plans for expanding the work of the society and increasing its value to the membership. Much study has been given to this matter, especially in view of the very large increase in membership as the result of the campaign referred to. The committee submitted various suggestions for discussion and wished to get the sentiment of the meeting thereon.

As regards the time of holding the meetings, it was urged that the meetings convene earlier in the evening so as to permit members living in the suburbs and cities near Chicago to reach home in good time; the general sentiment was that the meetings should begin promptly at 7 p. m., and terminate not later than 9:30.

It was proposed to have, aside from the regular weekly or semi-weekly evening meetings, occasional luncheon meetings, these to be devoted largely to civic and nontechnical subjects, but which engineers should keep closely posted on. This suggestion was indorsed by many speakers who thought that one such a meeting a month would be very valuable, not only in broadening the knowledge of engineers, but in enabling them to meet socially more frequently.

Secretary E. S. Nethercut spoke about the library service of the society, which it is hoped to extend. Classification and indexing of the books has been carried on and this cataloging should be completed in the near future. There is considerable call on the librarian for furnishing special bibliographies on a considerable range of technical subjects and the librarian is co-operating with other libraries in Chicago on this matter. It was suggested that if enough members would desire it the rooms of the society would be kept open in the evenings. On motion of C. W. PenDell, this will be tried out for some 90 days and each notice of a meeting will carry mention of the fact that the reading rooms and library are open in the evenings.

Conducting more frequent inspection trips and excursions was suggested and this met with hearty approval. It was pointed out by a number of speakers that such inspections, given about once a month, should include not only the most important engineering works in and near Chicago, but also interesting industrial plants, public buildings, etc.

The society now has five sections devoted to electrical engineering, mechanical engineering, bridge and structural engineering, sanitary, hydraulic and municipal engineering and gas engineering. Three new sections have been authorized as follows: Electrical communication, industrial engineering and railroad engineering. Several speakers advocated the formation of still other sections, devoted to chemical engineering, power-plant engineering and public affairs.

An extension of the committee work was also discussed and among the suggestions made was that a committee be organized to gather data from construction projects involving deep foundations to secure definite information as to the depth of rock in different sections of the city. Another committee suggested was one to keep posted on proposed city ordinances involving engineering matters; another one that may be organized should investigate accidents in engineering structures; still another may draft standard contract forms for construction work.

The Committee on Program and Publications reported that programs for the remainder of the year have been practically completed and the prospects are very satisfactory for having a very interesting series of meetings throughout the coming season.

Fuel Conservation Comes Nearer as Permanent Bureau Is Formed

International Power Economy Conference Establishes Bureau to Collect and Circulate Information of Plant Performance at Chicago Convention

WITH the bituminous miners' coal strike looming as a certainty, the second International Power Economy Conference assembled in Chicago at the rooms of the Western Society of Engineers, October 30 and 31. The purpose of this meeting was to discuss the fuel situation present and prospective, to review progress made since the previous meeting and to formulate plans for promoting a permanent organization after listening to the reports of the Executive Committee and other committees.

Vice-chairman A. A. Gray in calling the meeting to order reviewed the past work of the conference, the need for carrying on and perpetuating the accomplishments of the Fuel Administration, and dwelt upon the threatened coal strike that would start before the conference terminated. Mr. Gray then stated what the Conference had done in connection with the Bureau of Mines toward assisting in perpetuating the work of the Fuel Administration, telling of interviews at Washington with Dr. Van H. Manning, director of that Bureau. Dr. Manning strongly endorses an organization that aims to co-operate with the Bureau of Mines and improve fuel economy and transportation facilities by inspection and supervision of coal at the mines. The prominent part taken by David Moffat Myers toward fuel conservation, by his work in the Fuel Administration and as a consulting engineer was dwelt upon by Mr. Gray, who then told of Mr. Myers' suggested program for carrying on and enlarging upon the work of the Fuel Administration. Unfortunately this program, while very thorough and desirable, was so comprehensive that there seemed little hope of having it acted upon by Congress at this session, due to its chaotic conditions and frenzied attempt to economize and cut expenditures.

C. A. Tupper, chairman, who then assumed charge of the meeting, said he was convinced that the present time offered a real opportunity for the manufacturers of power-plant apparatus to render a patriotic service. The looming coal strike and the possibility of similar conditions to those existing during the war strongly emphasized the need for such a body as was gathered together in the cause of making fuel economy permanent. Everyone should stand solidly behind the Government, regardless of politics and affiliations, during whatever complications lay ahead. The conference must decide for itself whether it should be a permanent organization or not, and this can be done only when everyone does his bit instead of "letting George do it." Mr. Tupper then explained the vast opportunity to serve the public and conserve fuel by education and development of public opinion.

The report of F. A. Moreland, chairman, Committee to Co-operate with the Fuel Administration, was thereupon presented.

Mr. Moreland told of the manner in which the Bureau of Mines had taken over the work of the Fuel Administration and gave in more detail the suggested program drawn up by David Moffat Myers, advisory engineer, Fuel Administration, and of the proposed inspection of coal at the mine by the Bureau of Mines, including the method by which coal would be sold upon a heat-unit basis and coal operators required to rate their coal accordingly to a definite set of standards under supervision at coal-sampling stations maintained by the Bureau throughout the country in proximity to the coal mines. As Mr. Myers' program would require not less than $1,000,000 appropriation, the first year, there would be little immediate chance to obtain any such amount from Congress. Meanwhile the Fuel Administration has been inactive, while the Bureau of Mines is not able to carry on the work for lack of authority to do so and from the fact that the Fuel Administration is still in existence. The big fuel saving brought about by the Fuel Administration in a short time and before it got working steadily augurs well for some similar body to encourage and carry on the work.

Urgency of Coal Conservation.

Joseph Harrington, former administrative engineer for Illinois, Fuel Administration, then said the fuel situation was really critical. The demand for fuel and labor-saving equipment today was greater than ever before. Practically every manufacturer of such equipment has never been busier and never was the opportunity and possibilities of co-operation for the interests of fuel saving more promising than now. With a coal strike virtually under way, whatever the result, higher coal costs seem inevitable, so that coal already deserves to be classed as an expensive commodity. Coal saving is not a matter of choice, but one of necessity today, and the public, as the ultimate consumer, is realizing that fact. The sum total is that more efficient use of coal is compulsory and wasteful methods will not be tolerated indefinitely.

The public is awakening to the situation through force of circumstances. It is being educated, and now is the time for such a body as represented at the conference to serve the country as a whole, and themselves also, by spreading the gospel of fuel saving. So long as a manufacturer produces equipment that serves a good purpose—and saving coal is prima facie an excellent object—it is to the interests of the public and nation as a whole that such equipment be used, and the fact that the manufacturer profits by its use is merely incidental. If all the manufacturers of power-plant equipment get together and boost the game by educating the public through publicity as to the need for saving coal and how best to save it by consuming it economically, all will be the gainers.

Mr. Myers' Program for Continued Fuel Conservation.

David Moffat Myers then outlined the program he had submitted for the continuation and extended scope of the work formerly carried on by the

Fuel Administration, if taken up by the Bureau of Mines. He said while it may be a crime to waste coal, Congress will only take cognizance of the matter in times of peace when public opinion is roused. The men represented by the present conference can accomplish most by educating the public, so that through it Congress can be reached and influenced in the cause of fuel saving. The high cost of fuel has given the movement of fuel saving great incentive. It is quite possible to save as much as 100,000,000 tons of coal per year without curtailing manufactured products. Over 25,000,000 tons were actually saved by the Fuel Administration in the short time it was active, and this is only a beginning. Valued at $6 per ton, $600,000,000 saving in coal bills annually is a factor neither the public nor the Government can afford to ignore. It is a factor vitally affecting the cost of living. While shortage of apparatus and inability to obtain it made it necessary for the Fuel Administration to devote its energies to saving coal by improving operating knowledge and education, conditions are now such that apparatus can be obtained. The efficiency of any process is the product of machinery and men. Today fuel saving may be brought about to an even greater extent than during the war, since both men and machinery are obtainable. From this reasoning it is apparent that machinery or equipment must be considered by the Government in any national program for coal saving.

Mr. Myers told of mistakes in the use of equipment and the installation of the wrong equipment in the wrong place, pointing out that these things must be stopped if coal saving is to obtain upon a national scale. He looks forward to the time when state engineers or district engineers will be appointed by some body successor to the Fuel Administration for checking up plant designs and seeing that they conform to thermodynamic principles. He said that the time must come when ability to operate power plants will not merely involve a state or city license to indicate sufficient knowledge to keep wheels turning and prevent a boiler from blowing up, but will mean that the engineer possesses some knowledge of combustion and ability to save coal and money for his employer. An organization of manufacturers of power-plant equipment has a magnificent opportunity for serving the country, and if this service is rendered unselfishly such an organization should have immense success.

Mr. Tupper then enlarged upon certain phases of Mr. Myers' remarks, pointing out that the scientific knowledge of the manufacturers and engineers could be utilized to educate the public in the proper way, and he hoped the movement now started would increase in momentum and accomplish its good purpose. The movement had also to have moral support of the central-station industry and many other industries. The problem before the assembly was how best to carry out the work of educating plant operators in the ways of saving fuel.

A. L. Rice, managing editor, *Power Plant Engineering,* opened the discussion by telling of the need and possibilities of coal saving, as based upon his close contact with the power plant field. The quality and cost of coal is becoming an increasingly serious problem. The power-plant-equipment manufacturers can accomplish a noble work by acting in an advisory capacity, and by being more altruistic in teaching the public. Where the coal consumption of a large consumer is reduced as little as one per cent, tremendous good accrues to the public. Such savings to a small number of large consumers are equivalent to the coal used to warm many a town. The task undertaken should be to do altruistic work in educating the public, and not merely trying to build up business.

A. W. Patterson, of The Engineer Co., said the man who manufactures coal-saving equipment is doing a good thing, and that such men are best able to tell the general public how to save coal by the coordination of apparatus. In this he was joined by Mr. Moreland, who pointed out that the public as a whole goes to the manufacturers for practical and technical information and uses them much as consulting engineers. An organization of power-plant-equipment manufacturers can thus be of immense value to the coal-consuming public by the correlation of data and the dissemination of knowledge.

R. J. Stewart, of H. W. Johns-Manville Co., spoke of educating the chief engineers and consulting engineers, telling of his experiences of equipment and materials misapplied and the readiness usually shown for correction and information. Just such a purpose would be served by the organization of manufacturers of power-plant equipment who would educate and co-operate. Other speakers presented similar views.

Coal Zoning and Washing.

Opening the afternoon session, Mr. Tupper introduced Hans J. Meyer, former advisory engineer for Minnesota for the Fuel Administration, and a consulting engineer, who spoke on "Solid Fuels." He said waste occurs in mining, in transportation, in distribution and in utilization. Wastes of transportation offer a big field for the organization to work upon, and the zone system of coal distribution and utilization is one of the most important things accomplished by the Fuel Administration. There is no need for importing eastern coals in the West, for the vast deposits of Illinois and Iowa coals and western lignites can be used when the public is educated in their use. Use of lignites in Minnesota and contiguous territory alone would save more than 500,000 tons of coal a year and release 50,000 freight cars and thousands of locomotives. The movement of coal is an enormous tax upon the transportation system of the country, and only the zoning of coal will solve it. The supervision of fuels mined and used was advocated.

B. J. Roberts, chairman, Committee on Washing and Pulverizing Coal, then presented a report on the "Purification of Coal" in which it was shown that by washing much foreign matter could be eliminated. If done at the mine this would reduce freight and coal bills, conserve freight cars and in any case would eliminate many operating troubles due to clinker, fluxing of refractories, etc. By washing, many coals now considered worthless could be used, and the culm banks now seen around mines could be put to good use. The various methods of washing coals were covered, and the financial gain of so doing brought out. This paper was discussed by David Moffat Myers, Mr. Harrington, and Mr. Meyer, who all agreed that the large amount of foreign matter in coal worked hardship upon the consumer and taxed the railroads needlessly. It was emphasized that cleaning coals by washing and pulverizing offer solutions to the use of low-grade fuels, and thus extend the use of fuels within easy reach.

M. F. Newman, chairman of Committee on Water Purification, then presented his very able and concise report. This covered the choice and operation of the various appurtenances, and the influence of scale upon absorption efficiency of boilers and condensers, the transformation of energy in the turbine, etc. He told of the effect of scale formation in pipe lines, economizers and boilers and the various causes and forms of incrustation, etc. The inertia of the average plant operator was deprecated and the importance of water purification emphasized as a factor in fuel economy. In his remarks Mr. Newman was supported by C. Kennicott who dwelt upon various phases of water purification.

Albert Goetz, chairman, Committee on Boiler Settings, then presented his report, in the discussion of which A. W. Knight elucidated upon the various losses through the brickwork and segregated them. He pointed out that, while comparatively small, the loss through the setting, about 4 to 6% of the total heat loss, can be reduced from 1 to 2% by simple methods.

The report of W. G. Williams, chairman, Committee on Oil Fuels, was then presented. This report covered the consumption of fuel oil and the situation as regards its increasing use and decreasing sources of supply. Statistics were presented that visualized the situation as it exists today. The various methods of producing gasoline and distillation and refining of oils were discussed briefly and a plea made for conservation by reducing needless wastes in producing and drilling and by more efficient methods of utilization. Two lines of action were suggested, the one the more rapid development and utilization of cracking distillation for which the automotive industry must be looked to for assistance; and to the central stations for the use of the fuel oil more efficiently. The report of the Committee on Lubricants was then presented by A. A. Gray.

General Discussion on Organization.

As time was late, discussion of these reports was passed over. Mr. Tupper asked for a general discussion upon the scope of the proposed organization and the best methods of going about their program for the guidance of the Committee on Organization. Mr. Harrington said the matter on hand was to decide what was to be done, what needed to be done and how it should be done. There was the matter of co-operation with the Fuel Administration and Bureau of Mines, there was the matter of educating the public, of the zoning of coal mined and used, and of supervising engineers, etc. J. M. Spitzglass said it was partly a matter of educating engineers of what to do to save coal and what is available in the way of machines and equipment for saving coal, but it was also a matter of telling the public about coal saving and how to accomplish. He promised his unqualified support of such a good movement and offered to do all in his power to further the work of the organization.

E. G. Bailey spoke out for a broad-gauged viewpoint and a concentrated effort as both necessary for success. He advocated that the Fuel Administration be revived rather than that its work be continued by a different body. He said four principal aspects of the situation must be considered. These concern the procedure, the consumer, the general public and posterity. The subject may be divided into two parts, the coal producer and the coal consumer, and between these two groups the Government and the engineering professions must step in if coal is to be saved to posterity. Once the public understanding is obtained, and its opinion aroused, it will back up such an organization as proposed. A. A. Gray and H. J. Gebhardt both spoke of the weight carried by the manufacturers of power-plant equipment and that this weight must be added to that of public opinion for co-operative effort. The engineers are the go-between and it is they to whom the public must look to tell them how to save coal. Mr. Gray said 85% of those present were manufacturers and they represented the opinion of the industry. J. D. Cunningham pointed out the strength in numbers, advocating that the Association of Commerce and the various enginering societies be asked to help the cause.

Mr. Myers spoke at length on the responsibility of the engineering profession to the public and also to themselves. The four national engineering societies can be of assistance as they extend their influence into industry as a whole. The proposed organization should co-operate and seek the assistance of these national engineering societies.

Others prominent in the proceedings were Joseph W. Hays, Joseph W. Hays Corp.; G. B. Burke, Sarco Co., Inc.; E. E. Lee, Vulcan Soot Cleaner Co.; F. R Wheeler, C. H. Wheeler Mfg. Co.; A. H. C. Dalley, consulting engineer, Locomotive Superheater, vice-president, Pulverized Fuel Equipment Corp.; A. W. Knight, Celite Products Co.; G. P. Dravo, Dravo Co.; G. W. Heald, Diamond Power Specialty Co.; W. A. Darrah, consulting engineer; O. R. McBride, Northern Equipment and Coppus Engineering Cos.; J. J. McNulta, Vacuum Ash & Soot Conveyor Co.; M. B. Skinner, M. B. Skinner Co.; C. C. Phelps, Uehling Instrument Co.; W. D. Dreiske; L. L. Shailer, Ehret Magnesia Mfg. Co.; W. D. Hess, Builders' Iron Foundry; C. E. Brainard, Brainard-Fairchild Engineering Co.; C. V. Frailey, Barber-Greene Co.; M. O. Haeger, Abell-Howe Co.

During the first day's meeting Mr. Tupper appointed the following as members of the Resolutions Committee to draw up a preamble as to the aims and organization of a permanent body: Joseph Harrington, James A. Brady Foundry Co., chairman; Hans J. Meyer, Chas. L. Pillsbury Co., consulting engineer; A. L. Rice, managing editor, *Power Plant Engineering;* A. W. Patterson, vice-president, The Engineer Co.; T. Wilson, western editor *Power;* M. F. Newman, manager, water purifying department, W. B. Scaife & Sons Co.; R. J. Stewart, H. W. Johns-Manville Co.; A. A. Gray, of A. A. Gray & Co.; Howard Ehrlich, managing editor, Electrical Review.

Friday Morning Session.

The Friday morning session was opened by C. A. Tupper in the chair. The first speaker was Francis W. Carrett, chairman, Committee on Recording Instruments, who in presenting his report stated that accurate recording instruments are proving immensely valuable in every industry by showing conditions and thereby enabling them to be improved and corrected and results to be sustained. He discussed in particular the instruments of the boiler room, pointing out that without them the combustion of coal must be a hit and miss process, since it is not possible to know what is being done or how it is being done. He spoke of co-operation between the instrument manufacturer and other manufacturers and also between them and the plant operators. Instruments can only tell what is going on and they must be interpreted and their interpretation properly applied if the highest return upon the investment is to accrue. Instruments are of vital importance in the boiler room, and are one of the most powerful factors in power-plant efficiency. By preaching the value of instruments, by applying them correctly and educating the users in their workings and meanings much can be done to save coal and make instruments more useful and more widely used than they are at present.

Following this report, R. J. Stewart, chairman, then presented the report of the Committee on Insulation and Pipe Coverings, in which he dealt with insulating materials and their application, emphasizing the need for a better understanding of the requisites and economies of pipe coverings on the part of the operating and consulting engineers. He advocated closer understanding with plant operators and consulting engineers. The magnitude of the losses was then dwelt upon and instances given where costly pipe coverings had more than paid for themselves in 9½ months. The possibilities of an organization as proposed for educational purposes and as a clearing house of information and data appeared almost limitless. Both the reports by Mr. Carret and Mr. Stewart received considerable discussion.

L. A. Griffin, chairman, presented the report of the Committee on Ash Handling. In this report he took up the evolution of ash-conveying systems going on to point out that the labor situation existing makes mechanical handling practically compulsory. Various methods of handling non-combustible were given and the economies of the ash conveyor pointed out. One specific example of economy was given where a steam ash conveyor functioning for three 15-minute periods during the twenty-four hours was doing the work previously done by eight to twelve men. The future will necessitate mechanical ash-handling methods even more than is the case today. Mr. Griffin spoke forcibly in favor of a permanent organization to further the cause of fuel conservation, offering everything in his power toward making the organization an accomplished fact.

G. S. Carrick, Carrick Engineering Co., chairman, Committee on Combustion, spoke of combustion and the importance of educating firemen. Combustion requires not only men skilled in methods of combustion, but also apparatus and instruments for performing it and telling how it is being accomplished. The labor situation has created the need for automatic apparatus for maintaining high sustained and uniform performance, but these must be supplemented by man power of the right sort, and it is to help produce the right kind of man power by edcuation that the organization proposed can accomplish much. Both these papers received considerable discussion, mostly of a practical nature in the form of personal experiences in the boiler room.

After the presentation of the report of the Committee on Cooling and Condensing Systems, a general discussion ensued. Mr. Patterson emphasized the importance of co-ordinating the various apparatus and the relation existing between them. A better knowledge of individual pieces of equipment would enable a better and less expensive plant to be designed frequently. Each individual manufacturer should be called upon to furnish data and information on his speciality, and then the Educational Committee could analyze this and put it into proper form and sequence for general digestion and utilization. He went on further to give instances of saving due to the use of feed-water regulators, control equipment, instruments, etc. By instilling common sense into the boiler-room crews, between 50 and 75% of the operating troubles occurring today could be obviated. Many men spoke in the same strain, all agreeing upon the need for education and circulation of information.

Hans J. Meyer then presented the report of the Committee on Organization which had prepared the following statement:

Resolutions Adopted.

"The object of this conference is disinterested public service in the subject of conservation of fuel resources.

"We are initiating this movement because of our direct understanding of conditions and desire to convert to the public good our specialized knowledge of this subject.

"We having had direct and intimate acquaintance with the work and results of the Fuel Administration during the war, believe that the results accomplished were substantial and in the interest of the public at large and we, the International Power Economy Conference, advocate the continuance of the work of the administration through the Bureau of Mines, or suitable government agency.

"We are convinced that the losses are so widespread and ingrained that only governmental action will result in securing effective improvement.

"Serious waste occurs in mining, preparation, transportation and utilization of fuel, much of which is preventable. If prevented, a saving to the public will be made of $600,000,000 annually.

"We therefore unite for the purpose of bringing about the results stated in the preamble by means of the dissemination of information of this subject, which should lead to an awakening of public interest and create a demand by the public for governmental action. In furtherance of this object, we solicit the co-operation of the public as well as all civic and engineering bodies—and pledge ourselves to collect and distribute data on this subject as to the best means of accomplishing the economies sought.

"Resolved, That this Conference shall become an incorporated association with the usual officers and directors as soon as 100 representative firms shall become contributing members.

"There shall be appointed by the chairman an executive committee of ten which shall conduct the campaign for membership and draw up a constitution and by-laws for presentation to the next conference.

"Upon the election of the permanent officers, the executive committee shall be dissolved.

"The permanent officers and directors shall thereafter direct the affairs of the association as is usual in accordance with the constitution and by-laws adopted by the Conference."

Hans Meyer made a motion that the report of the Organization Committee be adopted and that the chairman appoint a new executive committee to undertake the work suggested. The resolution was passed unanimously. A. A. Gray offered a vote of thanks for those manufacturers who had devoted so much time to the cause of the movement and those that had come many hundreds of miles for the same purpose. Mr. Stewart offered a rising vote of thanks to Mr. Tupper and his associates for the time and effort they had expended to bring the formation of an organization to such a promising stage. Both of these motions were unanimously adopted and the second annual session of the International Power Economy Conference adjourned.

REPORT OF BALLOTING ON INDUSTRIAL SAFETY CODES.

Bureau of Standards Issues Statement Showing That Interested Organizations Favor Preparation of Safety Codes Under Auspices of American Engineering Standards Committee.

A conference on Industrial Safety Codes was held at the Bureau of Standards on January 15, 1919, at which the best method of procedure in formulating such codes was considered and plans made for the co-operation of all organizations concerned therewith. A committee appointed at this conference and consisting of C. A. Adams, H. W. Forster and E. B. Rosa made a report on April 15, which was printed and distributed to all those attending the conference. This report gave a summary of the proceedings of the conference and submitted two plans, designated as Plan A and Plan B, for future procedure in the formulation of the industrial safety codes.

Plan A provided for the preparation of safety codes under the leadership of the Bureau of Standards with the co-operative effort of all interested organizations and under the general supervision of a large and representative conference committee.

Plan B provided for the preparation of the safety codes and other standards by appropriate sponsor bodies, but under the auspices and procedure of the American Engineering Standards Committee as enlarged under a revised constitution. Since then, the American Engineering Standards Committee has approved a revised constitution, and has submitted it to the five parent engineering societies and the three government department members for ratification as provided in the old constitution. Although the American Engineering Standards Committee will continue to be called a committee, and not an association as was first proposed, the revised constitution provides for the enlargement of its membership and sets forth the procedure by which other national organizations may join it. It is understood that a number of such associations will apply for membership at an early date. Further information concerning the conditions under which national associations may join and the annual dues which are paid by member bodies may be obtained by addressing the acting secretary, C. B. LePage, 29 West Thirty-Ninth street, New York City. It is confidently expected that favorable action will be taken by all members within a short time.

In conformity with the report of the committee above referred to, ballots were sent out for voting on Plan A or Plan B. Such ballots were sent to a designated list of federal bureaus, state commissions, municipal departments, technical associations, manufacturers' associations, utility associations, associations of government representatives, associations of insurance interests, safety and labor organizations.

The result of this ballot is as follows, the voting being by organizations rather than by individual delegates: For Plan A, 25 votes were cast. For Plan B, 60 votes. Of those voting for Plan A, less than one-half indicated a likelihood of joining the Standards Committee in case its reorganization is completed. Of those voting for Plan B, three-fourths looked forward to joining the committee. In other words, approximately 70% of the ballots cast favor Plan B and about 66% of the organizations voting would expect to join the enlarged and reorganized Standards Committee.

The distribution of the votes is shown in the following table:

BALLOTING ON INDUSTRIAL SAFETY CODES.

	For Plan A	For A and probably join	For Plan B	For B and probably join
Federal Bureaus	4	2	5	2
State Industrial Commissions	3	3	5	4
State Utility Commissions	6	2	6	4
State Inspection and Rating Boards	0	0	4	3
Municipal Departments	0	0	2	2
Technical Associations	3	2	10	7
Manufacturers' Associations	3	0	12	10
Utility Associations	1	1	4	2
Associations of Government Representatives	2	1	2	1
Associations of Insurance Interests	0	0	6	6
Labor and Similar Organizations	3	0	0	0
Safety Organizations	0	0	4	4
Total	25	11	60	45
Total Vote	85			
Join A. E. S. C.	56			

It will be noted that the governmental bodies give a slight majority in favor of Plan B; that the engineering, utility and manufacturers' associations give a large majority on the same side, and that the insurance organizations are unanimously in favor of this plan. The two labor organizations voting favored Plan A. Most of the safety organizations favored Plan B. It is consequently evident that Plan B will secure the most general support and should be followed if the necessary conditions are fulfilled.

To further consider this matter and in order to make progress in the co-operative work necessary to formulate industrial safety codes, the Bureau of Standards is calling another conference to be held in Washington, D. C., probably on Dec. 5, 1919. It is intended at that time to consider the procedure which should be followed in further work on safety codes and the co-operation that can be secured among the engineering societies, government departments and other agencies that are actively concerned with safety work.

Formal invitations to attend this conference will be sent out in the near future together with a program of the subjects to be considered.

MILWAUKEE STREET-CAR CASE SETTLED BY COMMISSION.

Fares Raised, More Cars Ordered, Service to Be Improved and Accounting Revised As Result of Important Decision of Commission.

The Railroad Commission rendered a decision on Oct. 30 in the long drawn-out Milwaukee street-railway case. It grants the Milwaukee Electric Railway & Light Co. an increased fare, orders extensions of double transfer privileges, orders it to put into effect the wages, hours of service and working conditions as embodied in the decision of the State Board of Conciliation, orders the puting into service of 100 additional cars, establishes a single fare between certain suburban districts and orders sweeping changes in the company's methods in order to more properly reflect the actual operating costs. In the single-fare zone the cash fare will be 7 cents, 6 tickets for 35 cents or

18 tickets for $1. Children's fares are not changed. The Commission reserves jurisdiction in the matter of tickets in the hope that the revenue produced under this scheme will be such that within a short time it will be able to order an increase in the number of tickets sold for $1. In the suburban area a cash fare of 3 cents for each zone within a minimum of 6 cents is established. Suburban ticket rates are not changed. The company is ordered to submit within 15 days a scheme for the issuance of commutation tickets between South Milwaukee and the single-fare areas.

This decision involves four cases—the report of the Board of Conciliation establishing fair wages to employes which was rendered Sept. 17, 1919, the application by the company for revision of rates which was filed in July, 1919, investigation by the Railroad Commission of the necessity for double transfers which was started in January, 1919, and the original application of the company for increased fares which was started in 1915, and in which case several temporary decisions have already been rendered.

Auditing the company's monthly operating reports and estimating the amount of revenue required for operating expenses for the coming year, the Commission finds that the amounts charged by the company for certain operating expenses exceeds the reasonable allowance for these expenses by several hundred thousand dollars, and it finds that the company had not separated its expenditures and charged the proper amount to reserves and capital accounts. But even with this adjustment after making allowance for this deduction and adding the estimated cost of the increased wages ordered into effect, the Commission finds that additional revenue of between $850,000 and $900,000 would be needed for the coming year. The estimated increase in wages for the single fare and suburban area amounts to about $710,000.

In estimating the return on the investment the value of the Milwaukee company's system, exclusive of power-plant property, was found to be $16,145,534 on July 31, 1919. The Commission finds that there have been no excess earnings during the period beginning Aug. 23, 1912, under the rates of fare established by the Railroad Commission. The excess amounts which it is claimed should be applied to make up the operating deficits at the present time the Commission finds were earnings prior to Aug. 23, 1912, under rates provided by franchises which were lawful rates at that time; that these excessive earnings, if any, were legal earnings and are the property of the company to do with as it sees fit and that it can not be deprived of them without violation of the constitution of the United States; furthermore, to deprive the company of this surplus would be establishing a principle against public policy and against the interests of the riding public of the city of Milwaukee. It could only result in crippling the company financially, making it impossible to carry out the provisions of this order, including additional equipment for giving adequate service, and would interfere with other improvements which might be found necessary for serving the public in the future.

The Commission finds that the working men living in the Bay View district and employed in the manufacturing plants at Cudahy have been discriminated against by the zone system when the fares in this district are compared with those applicable to West Allis and some other suburban territories, and believes that this situation can be remedied by establishing a special rate to and from Cudahy depot from and into that territory south of Mitchell street known as the Bay View district which shall be applicable on special cars and trains during rush hours and has therefore ordered into effect for this special service the same rate of fare as applies to the single-fare area.

The company is also directed to make a study of economies that can be brought about through short routing and a development of traffic during the non-rush period with the idea of improving service conditions in the city. The Commission has repeatedly called attention to the necessity for more equipment on the city railway system. It felt it was not justified during the war period in ordering the company to enter into any activities which might interfere with war activities. However, under the present changed situation, new equipment to meet the present needs should be secured at the earliest possible time. The Commission's investigation shows a considerable shortage of cars on practically all lines in the city. The company is therefore ordered to provide at least 100 additional cars with a total seating capacity of 5000 to be placed in service from time to time, the complete equipment to be in service before Nov. 1, 1920.

In a memorandum attached to the decision the Commission discusses the advisability of establishing an automatic cost basis of fares within the single-fare and suburban areas of Milwaukee, by the operation of which fares would automatically decrease as operating expenses decreased. The Commission is of the opinion that in this way many of the problems connected with street-railway operation would be solved more easily and the regulation of fares put on an automatic basis.

IMPORTANCE OF ACOUSTICAL ENGINEERING IN INDUSTRIAL PLANTS.

Time and money saving are the two all important considerations upon which acoustical engineering will establish itself as one of the important sciences of industrial construction in future, Prof. Vladimir Karapetoff, head of the electrical engineering department of Cornell University, told members of the Cleveland Engineering Society and the Electrical League of Cleveland, in their joint meeting at Hotel Statler, Cleveland, Ohio, on Oct. 30.

Declaring that American industry must speed up production to the highest possible degree if we are to compete successfully with Europe for the world trade, Professor Karapetoff emphasized the necessity of making provisions in every factory for instant communication between responsible departmental heads. This is peculiarly the day of the expert; when infallible knowledge is imperative, quick decisions necessary, and every source of counsel must be ready to respond instantly. Delays in decision were never so costly. And with the possibility of a shortening of working hours in many lines the problem becomes all the more acute.

For the last year the professor has been engaged in research work in many different kinds of industrial plants with widely varying conditions. He has experimented with half a dozen systems of factory code calls, audible and visible. The possibilities of such a system were interestingly demonstrated as a feature of his talk, through the use of the klaxocator, an electrical code calling mechanism of the audible type. The appliance is entirely automatic, and when set for a certain code sounds the call simultaneously in every part of the plant, however large, and summoning the person wanted to the nearest telephone.

Commercial Practice

Increasing Production—Comparison of the Cost of Electric Service With Other Commodities—House-Wiring Activities

MAN, MACHINERY AND POWER TO INCREASE PRODUCTION.

British Parliamentary Official Urges Much More Extensive Use of Electricity to Stimulate Production.

Electric power engineers and specialists are recognizing that they have at hand a means for helping to satisfy one of the most urgent demands of the time—increased production. Through the more general use of electric power the limited outputs per workman due to sticking to manual methods can be greatly increased, efficiencies of plants and of departments can be improved, and present production capacities of existing plant facilities can be increased without expensive extensions or new construction. While these truths are being applied by all progressive American power companies, interesting corroboration of them comes to us from across the water through the following condensed report of an important address, for which we are indebted to our British correspondent.

C. A. McCurdy, parliamentary secretary to the British food controller, recently delivered an excellent appeal to British workmen to settle down to industry and produce more wealth as a means of securing the maintenance of the higher wages brought by the war.

"There are three things used in making wealth: men, machinery and motive power," said Mr. McCurdy. "If you want more wealth you have got to speed up either the men or the machinery, or supply more motive power. There is no other way. Don't expect impossibilities from the men. How about the machinery and the motive power? There you touch the heart of the problem. Machinery and motive power are the tools you give the worker for his business. Before the war the American worker was far better equipped in this respect than the British working man. He had in his factories on the average newer and better machinery, and he had 50% more motive power (steam power or electrical power) to help him in his task. We might double the efficiency and the output of British workmen by giving British industry cheap and abundant motive power.

"Every year we use in England 80,000,000 tons of coal as motive power to drive machinery to help the workers to produce the things we want. Man for man we use in industry half as much coal again as they do in America, but we do it so badly, so wastefully, that one ton of coal used to assist the worker in the United States gives him 50% more help, 50% more motive power, than 1½ tons used to assist the British worker. That ought to be put right. The Coal Conservation Committee during the war reported that our present consumption of coal for industrial purposes might be made to give at least three times the amount of power. That is one way of increasing production. Treble your motive power. More power means more output, and more output means higher wages.

"The motive power of the future will be electricity. What are we doing about that? We have 600 separate authorities at present generating electricity for public purposes, apart from all the private companies and firms that supply themselves. It is a wasteful, petty, parochial method of supply. Experts advise us that this country is losing $500,000,000 a year through failure to take advantage of electrical progress. . . . We know exactly what we want—centralized supply, abundant and cheap distribution of electricity in the interests of British trade. . . . We want cheap power brought to every town and village.

"Cheap power and efficient transport would revolutionize our agricultural industry. Science has achieved many marvels. It has opened for us in the depths of ocean and in the trackless mazes of the air new highways for the commerce of mankind. If the same genius and effort were applied to the soil of England there is an inexhaustible mine of wealth for our people. It cannot be worked out like coal. The more it is worked the better it becomes. In France, Italy, Germany and Sweden, electricity is being harnessed to the service of agriculture. From extensive power stations light overhead lines carry electricity to the farm. A trailing cable carries electricity to the plow. By electricity the chaff is cut, the corn is kibbled, the apples pressed for cider, the sheep are shorn, and the cows milked. The application of science to agriculture is only in its infancy, but to increase greatly our production of food it is only necessary to apply the knowledge we have already got."

MAP SHOWS ADVANTAGES OF TIEING CALIFORNIA SYSTEMS TOGETHER.

The Mt. Whitney Power & Electric Co., Visalia, Calif., has prepared a large relief map of central and southern California showing in distinctive colors the principal lines of the Mt. Whitney Power & Electric Co. and the Southern California Edison Co. as well as the location and capacities of all generating stations and the location of the principal substations of both companies.

This map is to be used in a demonstration of one of the many advantages accruing to each, but more especially to the Mt. Whitney Power & Electric Co., through the unified management of both companies, this advantage coming from the interconnection of the generating systems of the two companies and which permits of the Edison company using the surplus power of the Mt. Whitney company which in former years has gone to waste. It will be shown that, in the absence of any appreciable storage above the hydroelectric generating stations of the Mt. Whitney system, and the existence of Huntington Lake reservoir, with a capacity of 88,834 acre-feet above Big Creek power houses No. 1 and No. 2 of the Southern California Edison Co., all surplus power generated in the Mt. Whitney plants can be and is sold to the Southern California Edison Co., thus enabling the latter company to reduce the quantity of water withdrawn from Huntington lake during such period. It will also be pointed out that with the lines of the two companies tied together and the generating stations of both companies operated as a single system, a continuous and ample supply of electric power to meet the growing demands in the Mt. Whitney territory is made possible.

DEMAND FOR HOUSE WIRING SHOWS IMPROVEMENT.

For the period from Jan. 1 to Sept. 30, this year, the total number of houses wired by the Public Service Co. of Northern Illinois and by contractors in its territory was 2247, a number much in excess of the figures for the same months of 1918 and 25% greater than the total reached during the corresponding period of 1917.

During the war the company found a marked disposition on the part of property owners to restrain all expenditures, but this year there has been a hearty desire to modernize their houses by the installation of electric service. It is noteworthy that in nearly half of the houses wired by the company this year the improvement was paid for in cash.

DECREASING COST OF ELECTRIC SERVICE SHOWN IN STRIKING MANNER.

Curves Circulated by Commonwealth Edison Co. Emphasize Low Relative Cost of Its Service.

That the cost of central-station service has shown a steady decrease year by year until the conditions created by the war brought the decrease to a standstill is quite generally appreciated by the electrical industry and a large number of the people. Likewise, everyone knows that practically all other costs of living have increased, they not even having stood still—as

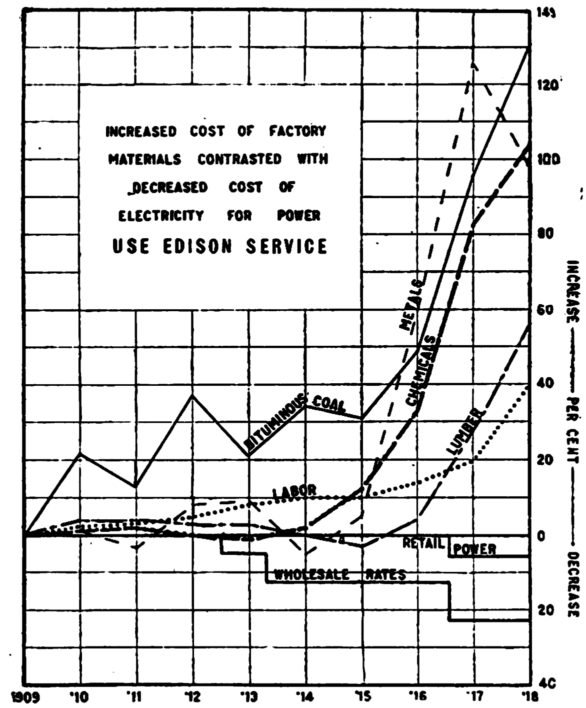


Fig. 2.

the cost of central-station service has done with many of the larger utilities.

During the electrical show in Chicago, the Commonwealth Edison Co. adopted a novel and striking method of bringing home to the local public and all those others who patronized the show the extent to which many of the items in the cost of living have increased in cost while the cost of "Edison" service has gone down steadily until the middle of the year 1916, since which time it has remained constant at the low level reached. The curves distributed among the visitors to the Chicago Electrical Show, typified central-station service to the hundreds visiting the exhibition, and to this extent benefited other utilities.

The accompanying curves, developed by the Commonwealth Edison Co., bring out in a striking manner the relative cost increases—decreases in the cost of central-station service only—that have come about since 1909.

In Fig. 1 are shown curves illustrating the increases in cost of clothing, food, coal and taxes during the last twenty-three years, and the decreases in the cost of electricity during the same period. In Fig. 2, the curves show respectively, the increases in cost of factory materials—coal, metals, lumber, chemicals and labor—during the last ten years and the decreased cost of electricity from Edison service for the corresponding period.

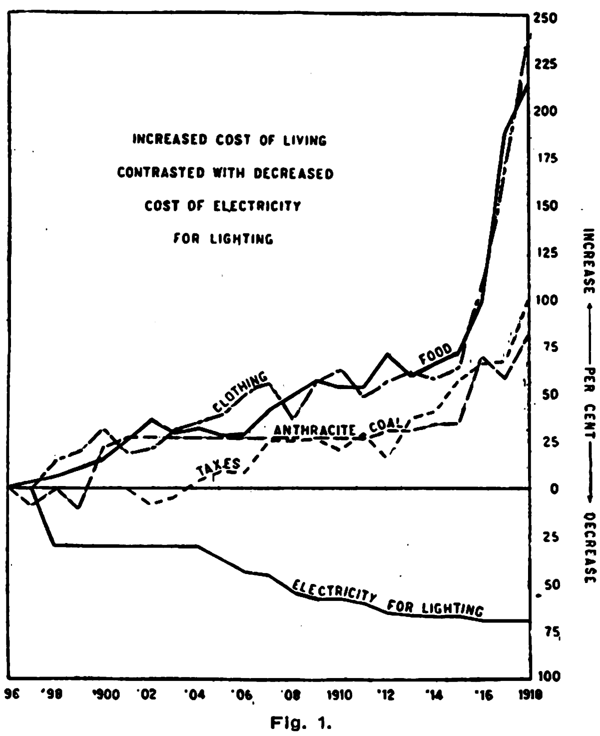


Fig. 1.

NEW HOUSE-WIRING RECORD ESTABLISHED IN MINNEAPOLIS.

Indicating the current prosperity of the people in Minneapolis comes an item from the Northern States Power Co. to the effect that during the month of September one already-built house was wired for electricity every 45 minutes during working hours. The average number of old houses wired per day during September was 23, the total for the month being 597, an increase of 9% over the largest house-wiring month in the experience of the company. As compared with 1918, nearly double the number of houses are being wired this fall.

Operating Practice

Maintaining Boiler-Room Instruments—Advantages of Air and Oil-Break Switches—Special Transformer Mountings

MAINTENANCE OF BOILER-ROOM INSTRUMENTS AND PLANT PERFORMANCE.

Experience of One Power Plant Proves Value of Instrument Maintenance and of Routine Coal Analysis in Improved Operation and Fuel Economy.

Many power plants install boiler-room instruments as a means of reducing their fuel bills by enabling higher operating economies to be obtained, and then, after the novelty of these appliances has worn off, ignore them. The result is that the expected economies do not accrue, and the savings that should occur do not materialize.

Speaking before the International Power Economy Conference held in Chicago October 30 and 31. A. W. Patterson, the Engineer Co., stated he was frequently discovering almost unbelievable things going on in power plants, sometimes through ignorance and sometimes through inaccuracy of instruments.

In one instance especially, of a plant consuming several hundred thousand dollars worth of coal annually, Mr. Patterson said a very simple remedy for inaccurate instruments had been adopted. And this policy had been found to be one of the best dividend producers of all. The plant in question had a full installation of steam-flow meters, stack thermometers, feed-water meters, CO_2 recorders and instruments for indicating feed-water temperature, steam temperature, draft gages and everything else that should enable the boiler-room attendants to maintain plant efficiency. Unfortunately, and of necessity, these instruments did not remain accurate indefinitely, as no instrument can. Stack thermometers became sooted up, dirt and dust, friction and leaks caused inaccuracies to occur, wrong indications resulted and the instruments came into disrepute and disuse.

The superintendent of this plant then had a work shop, consisting of a small room and work bench fitted up, and one or two men assigned to it, according to the demand, to calibrate all instruments and maintain them in proper working condition. This entailed not sporadic work but continuous work since cleaning, calibrating and checking in a station of its size offered steady work for one man all the time and two for a large part of the time.

The result of this workroom and bench, to which has been since added a coal-testing division, has been to place all instruments back on the job and to enable them to function accurately at all times. The aim is to keep instruments in service rather than to repair and re-calibrate them after they are out of service. Coal analysis enables the grade of coal furnished to be checked and too great a variation from the contract grades to be prevented or paid for according to variation. Predetermination of results, uniform results and efficient methods now obtain, followed, of course, by higher evaporation per pound of coal and improved over-all economy generally.

The simple expedient of installing a work shop for the maintenance of boiler-room instruments, and thereby obtaining to the full the return upon the investment, has been found one of the best investments of all.

AIR AND OIL-BREAK SWITCHES FOR OUTDOOR SERVICE.

Review of Situation Shows When Either Piece of Equipment Is Indicated as More Desirable for Installation.

The two major advantages of the air-break switch as compared with the oil-break switch are first cost of the switch itself and the lower installation cost resulting from the facts that the air-break switch occupies less space and may be mounted in the air while the oil-break switch must usually be mounted near the ground. Oil-break switches are more expensive than air-break switches, of course. But the one way in which the low cost of the air-break high-voltage switch can be obtained with but little loss in flexibility existing with the high-voltage oil-break switch, is to install fused air-break switches on the high-voltage side and an oil-break switch on the low-voltage side. The amperage of the fuse on the high-voltage should be such that the low-voltage automatic switch should open in all except the most severe cases of short circuit.

Under short-circuiting conditions, a fuse will open a short circuit much more rapidly than an automatic circuit-breaker. High-tension fuses of good design will clear short circuits in approximately 0.013 sec., which is from ten to twelve times as rapidly as an automatic circuit-breaker. The exceptionally rapid action of fuses will therefore permit over-fusing the transformers theoretically twelve times the normal current and still secure protection equal to that of an automatic oil switch. In actual practice over-fusing from three to ten times normal should be used, depending upon local conditions. For power circuits subject to wide fluctuations, the high-tension circuit opening devices should be so rated that they will not operate except in case of actual trouble, such as transformer failure, and such cases are rare with modern transformer designs.

Such overload protection as is desired can be secured easily and cheaply by means of a low-tension automatic oil switch installed on the secondary side of the transformer bank. In substation practice this combination of heavy high-tension fuses on the primary side which will open only in case of transformer failure and properly adjusted oil circuit breaker on the secondary side of the transformer bank is an excellent protective system often taken advantage of.

The high-tension automatic oil switch has the advantage that it can be used for switching in addition to the overload feature. When fuses are used it is necessary to install an air-break switch to disconnect the transformers from the line. In actual practice, however, it is often advisable and is considered good engineering practice to install disconnecting switches between the oil switch and the line. The reason for this is that the oil-switch contacts are necessarily concealed in the tanks and to be absolutely sure that a line is clear the disconnecting switches should be opened, thus giving the operator ocular evidence of disconnection.

Should the oil switch open frequently or under severe load conditions, it is advisable to inspect the contacts, oil levels and condition of the mechanism. To enable inspection adjustments or repairs, it is often advisable to install auxiliary disconnecting switches so connected that the oil switches can be shunted and entirely disconnected from the circuit, power being temporarily delivered through the auxiliary switches.

Another point in favor of the oil switch is that after interruption it can, if in good condition, be immediately closed, thus reducing the time of service interruption. It will naturally require more time to open an air-break switch and replace fuses than it will to close the oil switch. The saving of a moment's time may in some instances warrant the additional expense of the oil switch. However, the average high tension substation attendant, especially if not "hardened" by long experience, will after an interruption be inclined to go slow in closing the switch until he can actually view every possible part of the switch mechanism, assuring himself that it is in condition to resume service.

The fuse and air-break switch combination has, therefore, a certain advantage in that every part of the units, including contacts and the condition of fuses are in plain view of the attendant.

The above are excerpts from a paper by H. W. Young entitled "Modern High-Tension Outdoor Substations" presented before the Illinois State Electric Association's convention in Chicago October 23 and 24.

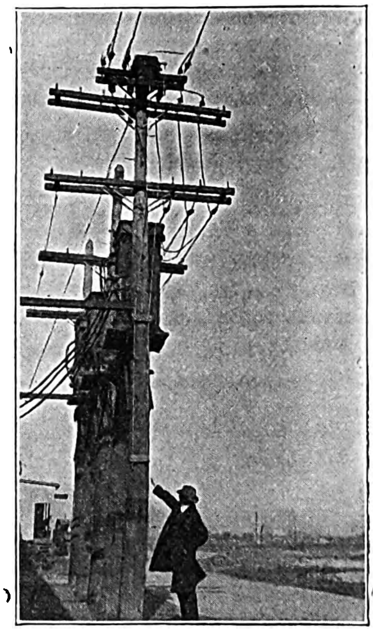
FORM OF OUTDOOR SUBSTATION FOR HEAVY LOADS IN CITY LIMITS.

Salient Features of Structure Used for Some of Cleveland's Heavy Industrial Loads.

Every transformer mounted upon a pole is, in a sense, an outdoor substation. And yet when speaking of outdoor substations something different is implied and understood. When serving heavy loads, as some large industrial plant, within city limits, apparatus must often be mounted upon poles out of ready reach of pedestrians, and yet the nearer the transformers are located to the service connection, the less the voltage drop and line loss on the secondary, likewise, the less work required to hoist the transformers up the pole.

In the accompanying illustrations is shown a type of transformer mounting used by the Cleveland Electric Illuminating Co. for serving some of its heavy loads from overhead lines. These transformer banks are located directly at the load and often on the customer's right-of-way, and vary from 100 up to several hundred kilovolt-amperes in transformer capacity.

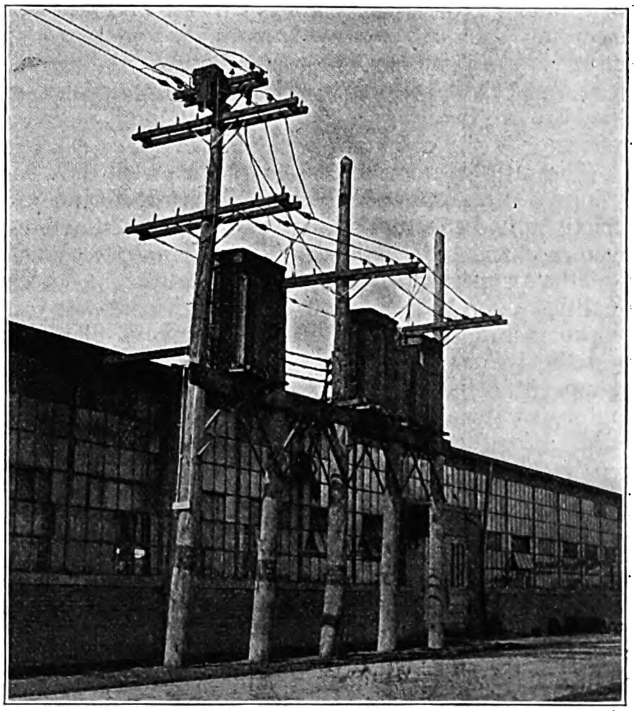
The installation shown consists of three 200-kv-a. single-phase transformers stepping down from 4160 to 460 volts. Space exists upon the transformer platform for a fourth unit. The supporting structure consists of three 35-ft. and two 25-ft. cedar poles. The transformers are mounted 14 ft. from the ground. The secondary leads are of No. 4/0 copper, there being



End View Showing Oil-Switch Control Ropes, Lightning Arresters and Conductor Arrangement.

three leads per phase, an arrangement that not only simplifies handling, but lowers resistance and also inductive drop. It may be noticed that the secondaries are fairly short, a further factor contributing to good voltage regulation.

The transformer bank is controlled by a 4500-volt automatic oil-switch mounted upon the top arm. This switch may be operated from the ground by means of ropes that pass down the side of the pole. Between the oil-switch and the transformer bank are installed compression type lightning arresters, one per phase.



Three 200-kv-a. Transformers Mounted Upon Platform with Automatic Oil Switch and Control Ropes.

Contracting-Construction

St. Louis Contractor Comments on Repair Business—Dallas Jovians Co-operate With Architects—Mine Feeder Wires

POINTS ON CONDUCTING AN ELECTRICAL REPAIR BUSINESS.

Suggestions Brought Out in a Paper Read Before the Missouri State Association of Electrical Contractors and Dealers by C. J. Briner, St. Louis.

Because electrical equipment will deteriorate and wear out, even with the best care and attention. and because abuse, neglect, misuse, defective materials and causes beyond human control must be taken to task, the electrical repair shop has a perfectly legitimate standing in the electrical industry. It may safely be said that 20% of all material such as insulation and copper products is used for replacements.

For one to be successful in the repair business the first requisite is 75% knowledge, gained by experience and study, and 25% in surrounding yourself with capable help and equipment. These figures refer to motor and generator repairs, omitting such repairs as those of household appliances, vacuum cleaners, fan motors, heating devices, telephones, etc.

Knowledge of Electrical Equipment.

Any one engaged in the repairs of electrical apparatus should certainly have knowledge of the various types of motors and generators, both old and modern, their principles and functions, the various types of windings, the temperature guarantees, and, above all, an idea of costs. There are no miracles or guesswork in the repair business; what the engineers in laboratories and factories have laid down must be repeated, excepting such as improved methods and materials only; very seldom can a motor or generator which has been a so-called hot one be made to operate cooler, or, likewise, can heat be put into a cool-running motor or generator if the original principles are adhered to.

The ratio of turns and sizes of wire with the revolutions per minute have been predetermined and it is strictly up to the repair man to reproduce the same; even in changes of the revolutions per minute or voltage the proper ratio must be maintained. Running qualities may be improved by better insulation and workmanship, but the original fundamental principles must be followed. Changing the turns or number or groups of coils affects the speed and horsepower of motors or generators, and changing the sizes of the wires affects carrying capacities. When a motor is repaired properly its test should verify the nameplate unless the latter has been tampered with. With the limited spaces for wires in the slots of armatures or stators or rotors, it is almost impossible to make a mistake unless wantonly so.

Motors and generators built today have the same fundamental principles they had 25 years ago, excepting that they have been mechanically refined and higher values obtained with relation to copper, iron and temperature.

The repair shop does not only attempt to restore to a sound or good state worn and defective apparatus, but should afford prompt and efficient service when catering to the public. Therefore, about the first requirement to consider in a large or a small shop is a good system. When apparatus is received for repairs there should be attached a tag on which full information, such as the owner of the apparatus, date received, maker, horsepower, kilowatts, voltage, amperage, revolutions, type, direct or alternating current, phase, whether with base, pulley, starter or rheostat, etc. This identification tag can be used for any form of apparatus and also for further identification in carrying the repairs through the shop.

Good Shop Systems.

In many instances it becomes necessary to determine the extent of repairs necessary and to confer with the owner as to cost before proceeding with repairs, or an exchange may be affected, all of which means that considerable detail work must be done before final disposition is made.

Motors or generators entered for repair should carry a shop working order and a data card, the latter giving a full description as to repairs, type of winding, number of coils, sizes of wire, etc. A complete time and material record must be kept along with the data for the purpose of rendering a proper bill as well as for comparing costs with the estimated price so the self-preservation of the bank account may be maintained.

It is quite a problem to secure competent help, but having a good simple system will help matters wonderfully. The employe should feel that full knowledge and instructions, especially useful prints and bulletins, can be had and that he can consult superiors without hesitancy or timidity. Most repair men have limited experience. Armature winders can be easily trained because most armatures and stators are coil wound and in many cases hand-wound armatures can be changed to form-wound. Field and coil winding is entirely given over to apprentices. In making repairs outside of the shop it is safest to send good, capable men with instructions to reserve their opinions and communicate with superiors when in doubt. It should be remembered that the customer is usually somewhat excited or exceedingly anxious to resume operations and the repairman must be 100% efficient or the customer will find fault.

Repairs Outside the Shop.

It is a safe policy to have outside workmen get their time as well as the acceptance of job O. K.'d by the customer and so avoid any disputes as well as assuring everyone connected with the transaction that it was performed satisfactorily.

When doing emergency or temporary repairs the client should be advised accordingly, for he may recall a bill of several months' standing when another breakdown occurs and ask for an allowance or refuse to pay, being under the impression that repairs last forever.

In my long experience I have found it does not pay to attempt any patch work. It will only be a short time until permanent repairs become necessary and, although inconveniencing your customer for the time being, a good job takes a little longer and saves time, aggravation and money in the end.

When complete, apparatus should be given a good free running test and a voltage at least three times normal voltage for ground and short-circuit should be applied. All terminals for armature, shunt or compound fields or phase connections should be plainly marked whether for motors, generators, compensators or starters, and the direction of rotation should be indicated by arrows.

Referring to materials and insulating varnish, the best motto is, "Let quality be uppermost; buy the best." Insulation is the cheapest part of electrical apparatus but the most expensive if not handled properly; therefore, for the small difference in price, quality should not be sacrificed. Copper products cost in direct proportion to the market base price. Anticipate stockroom needs, for nothing is worse than to be without materials, especially for emergency repairs. Ninety per cent of the motor and generator users have not learned to carry spare parts and depend upon stock. They will insure their factories against fire and water damage, but neglect operating insurance by buying extra armatures, etc.

When rendering an invoice it should read as plain as possible, giving the identification numbers and the specified character of repairs. When crating or shipping apparatus is used, it must be properly and securely constructed in order to lessen freight damage claims, secure prompt deliveries, relieve the worry of retracing shipments and avoid missing parts.

DALLAS JOVIAN LEAGUE TO EDUCATE ARCHITECTS AND CONTRACTORS.

The Dallas Jovian League, which includes in its active membership over two hundred of the men in every branch of the electrical business in Dallas, Texas, has recently by amendment of its constitution opened its membership to architects and also to building contractors. This action was taken with the idea, as expressed in its constitution, of "inducing the architects and contractors to provide full modern facilities for the use of all forms of all electrical apparatus and devices and also to induce such to specify and use approved, modern materials, appliances and apparatus and to have these installed in a safe and convenient manner."

In order to give full expression to this matter the league invited to its regular luncheon on Oct. 20, the architects and contractors of the city. The idea of the meeting was opened to them in an address by a member of the league which was replied to by addresses from prominent architects and contractors and committees were formed to carry forward this plan of co-operation into actual practice.

The idea of the league is to make itself, through its secretary and committees, a free bureau of information to the architects and contractors not only with reference to the proper wiring of all buildings but also to advise them as to the best apparatus and appliances to be used in each particular case and the proper and most convenient method of installation. In fact, it is hoped to make of the league a free bureau of advice and assistance to every one directly or indirectly connected with the electrical business in Dallas.

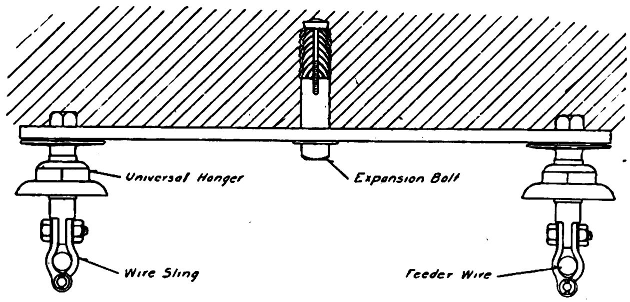
It is further the intention of the Dallas Jovian League, if this idea proves a success in Dallas, to endeavor to extend the idea to other large and medium-sized cities of the state and in this way standardize the electrical business throughout Texas.

This plan does not include any idea of merchandising electrical supplies or apparatus, as it is believed that this latter can best be accomplished through the medium of the National Association of Electrical Contractors and Dealers, the organization of local branches of which is to be undertaken in Texas.

SUPPORTING FEEDER WIRES IN MINES.

A method of supporting machine and feeder cables which is a considerable improvement over the common method of supporting such wires on porcelain spool insulators, has been worked out by John Oniones, Indiana Creek Coal Co., Bicknell, Ind.

The arrangement is shown in the accompanying illustration in which a single expansion bolt supports



Feeder Support for Mines.

both wires. The cross member is a structural steel bar upon each end of which is mounted a universal mine hanger. A cable-sling supports a feeder wire from each of these hangers.

The cable is held more securely by the sling than it could be by a tie wire on the usual type of porcelain spool.

STANDARDIZATION IN CONSTRUCTION.

The National Association of Construction Industries, with offices in the Drexel Building, Philadelphia, has taken up the matter of the need for further standardization in construction activities, and is sending to associations, business firms and individuals a questionnaire asking for the following information:

1. Is there need for further standardization in your branch of construction activity?
2. If there is, what are the needs and what are your suggestions for meeting them?
3. Are you or your association in a position to co-operate in a program of standardization designed to embrace every field of activity concerned?
4. What suggestions have you or your association to make in connection with such a program?

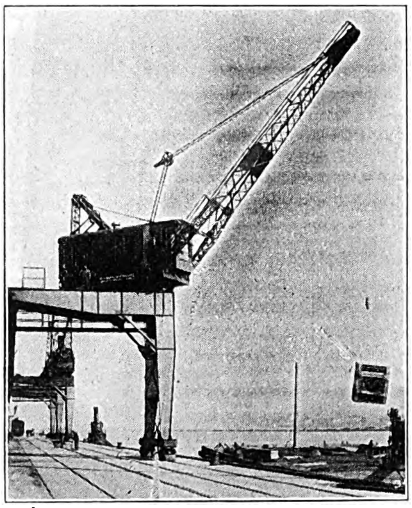
The cost of labor has advanced to a point where the welfare of the construction interests and the general public will be conserved by adopting methods through standardization which will reduce the percentage of labor cost in construction. It is apparent that through the associated effort of all construction interests valuable results can be accomplished which would not be obtained by any single branch of the industry working alone, and it is for this reason that the association has taken up the matter.

New Appliances

Interesting Installation of Dock Cranes at Boston Army Supply Base — Electric Furnace Equipment for Norway

Government Acceptance Test of Dock Cranes at Boston Army Supply Base.

The Wellman-Seaver-Morgan Co., Cleveland, Ohio, recently installed four semi-portal bridge-type hoist cranes at the U. S. Army Supply Base, Boston, to handle freight to and from ships. The Boston terminal includes a long eight-story warehouse separated by a wide street from the marginal two-story wharf house alongside the wharf where the ships dock. Between the wharf house and the water is a space 35 ft. wide with two standard-gauge tracks on which freight cars are run in from main-line tracks to deliver or receive freight from the boats. The W-S-M cranes span these tracks, as will be seen in the illustration herewith. These cranes were described in our issue of Sept. 13, 1919.



View of Dock Cranes From Wharf Deck.

The Government acceptance test of the cranes was made Sept. 17, at which time all four cranes were operated under full load. The speed of the different motions and cycle of operation exceeded in every instance those called for in the specification. The test load consisted of a steel bucket filled with cement sacks, the total weight being 5,000 lbs.

In unloading wool from barges on the same day, one of the cranes made 73 trips an hour, taking on each trip three bales weighing from 500 to 800 lbs. each. It was required to unload the barges evenly, making it necessary to take a load alternately from each end and the middle and landing the loads all in the same place. This method of handling meant a considerable time spent in bringing or traveling along the dock.

The operation included picking up of the wool from a lighter at the wharf side about on the level of the wharf, making a vertical lift on the hoist line of about 40 ft., rotating the boom through an angle of about 120°, traveling of the bridge about 30 ft. along the wharf, and delivering the load on the upper deck platform along the wharf shed. The crane made the complete cycle in about 45 seconds, which would mean 80 trips per hour, but due to unavoidable delays in the hour the number of trips made was 73. The number of men employed in connection with operating the crane was as follows: 1 superintendent, 1 crane man, 1 foreman on the shed platform, 1 foreman on the lighter, 1 tally man, 3 gangs of 5 men each on the lighter, 3 men to receive the load on the upper bench level and to assist in loading the material on the trucks, 11 truckers, and 4 men storing the material, making a total of 38 men. Naturally the number of truckers and those required for storing the material is determined by the method of storing and the distance the truckers must travel to deliver the material inside the shed.

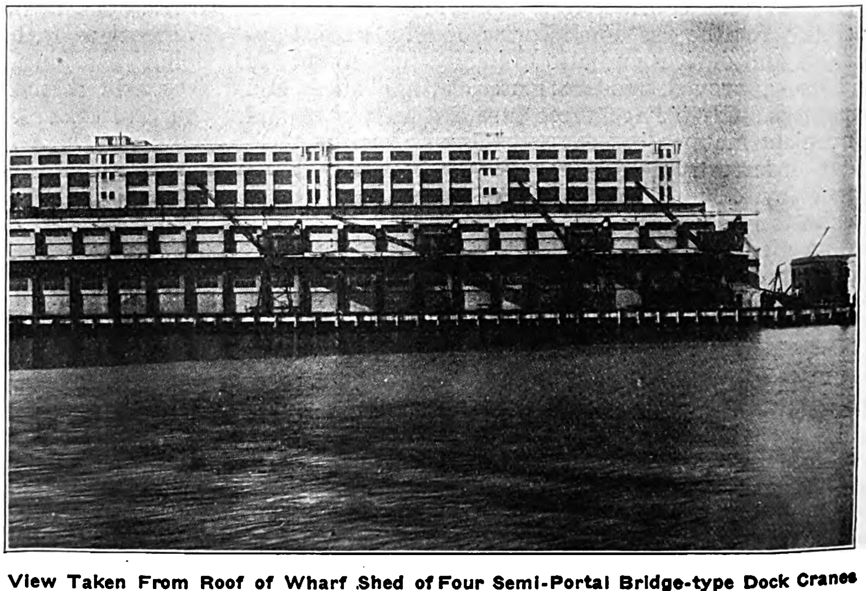
The alinement of the hoisting units and the reduction of friction by the use of Hyatt bearings is well illustrated by the following performance: The weight of 375 lbs., consisting of the lifting hook, 2 ft. of crane chain, the fall weight and 10 ft. of hoisting line, is sufficient to allow the hook to lower at a fair rate of speed and pull the hoisting rope over two sheaves while unwinding the rope from the hoisting drum, rotating the drum, drum gear and drum gear pinion. This takes effect when the jaw clutch is in its neutral position, freeing the drum from the motor and the hold brake on the drum is released.

Notable Export Shipment of Electric Furnace Equipments with Unique Voltage Control.

Electrical equipment for twenty electric furnaces which, when placed in operation, will comprise the largest electric furnace installation ever made, is now being shipped from the United States to the Glomfjord Smeltverk Co. of Glomfjord, Norway.

The apparatus was made by the Westinghouse Electric & Manufacturing Co., East Pittsburgh, Pa., and is divided into units, each unit comprising the equipment for one furnace. Each of the twenty units includes a 1300-kv-a. single-phase main power transformer, a 26.2-kv-a. series transformer, a 26.2-kv-a. induction regulator, an automatic selector switch, a transformer switch and a two-panel separately mounted switchboard for the control of the electrical apparatus. A total of 16,200 gallons of oil for insulating and cooling the transformers and regulators is part of the shipment.

The general scheme of connection is such that the voltage variation necessary to the heat regulation of the furnace is accomplished by changing taps on the high-voltage winding of the main power transformer. A portion of the winding, which is proportional to the amount of voltage control desired, is provided with taps in a number of equal steps. Switches and induction regulator operate together to automatically change connections on the high-tension winding and to provide voltage control on each step. In this scheme, the capacity of the regulator need be sufficient to control only the voltage of one step on the tap winding, thus maintaining a high power-factor.



View Taken From Roof of Wharf Shed of Four Semi-Portal Bridge-type Dock Cranes

Trade Activities

Block & Company Engage New Quarters—Exhibit of Electric Service Construction—Valuable Literature Distributed

Page & Hill Co., Minneapolis, is building a new yard office and laboratory at its Minnesota transfer plant. It is to be modern in every respect. It will contain in addition to the main work room, private offices for the superintendent and private offices and laboratory for the inspection engineer and chemist. Lavatory and shower baths are provided.

McGill Manufacturing Co., Valparaiso, Ind., is sending out a new folder, illustrating and describing various types of Loxon lamp guards. It is a double-duty device eliminating the needless waste of saving incandescent lamps, preventing loss by theft and reducing fire danger from hot or broken lamps. One of the lamp guards listed is of vaporproof construction and is designed to meet the requirements of the garage or wherever gases or inflammable materials may be used.

Lynton T. Block & Co., operators of the Utilities Indemnity and Fire Exchanges and Employers' Indemnity Corp., announce their removal to permanent quarters, consisting of the entire second floor of the new Chamber of Commerce building, Broadway and Locust street, St. Louis. The business of the Utilities Indemnity and Fire Exchanges and the Employers' Indemnity Corp. has grown so rapidly that the acquisition of these new and spacious quarters has been necessitated. After Nov. 8 all correspondence should be addressed to the Chamber of Commerce building, Broadway and Locust street.

Beardslee Chandelier Manufacturing Co., 216 South Jefferson street, Chicago, is sending out a new folder to department stores all over the United States, showing how effectively the Denzar unit may be used in department store illumination. It is one of the most efficient, durable and economical units for store lighting, properly diffusing and distributing the light rays and eliminating the objectionable glare. A detailed description of the Denzar is given and a cross-sectional view included, showing the various parts of this lighting unit. It is made in many different types and sizes to fit every lighting requirement.

Belden Manufacturing Co., Chicago, has issued its Bulletin 1208, descriptive of "Beldenmold" synthetic molded insulation. It is a 20-page booklet which includes descriptions of the properties of "Beldenmold" and the uses and manufacture of molded pieces. Terms and conditions governing quotations, orders and production of "Beldenmold" parts are given in detail, affording the prospective buyer much information as to the advantages and the pitfalls to be avoided in purchasing molded parts. The booklet is profusely illustrated, showing the large variety of purposes for which molded products can be used.

George Cutter Co., South Bend, Ind., has issued bulletin No. 3386, which is a 48-page catalog of its extended line of streethoods, brackets, mast-arms, pulleys, insulators, and other pole-line and street lighting equipment. In the introductory pages is set forth a review of the modern street lighting system and the applicability of Cutter streethoods and Regent film sockets thereto. Construction of these streethoods is described and illustrated and their distribution curves shown. In the strictly catalog pages are shown several hundred views and detail diagrams of the various types of streethood fixtures, brackets, center suspensions, sockets, mast-arms, pole fixtures, pulleys, crossarms, insulators and pole-line hardware. Three pages of indexes complete this book which will be found valuable by all engineers and contractors of street lighting systems of this type.

Cutler-Hammer Manufacturing Co., Milwaukee, Wis., has issued a new four-page, two-color pamphlet No. 479 entitled "Miscellaneous Applications of Electrical Heat," illustrating and describing C-H space heaters. It emphasizes numerous applications of electrical heat by means of flat standardized heaters, two ft. long, 3/16 ins. thick and 1½ ins. wide. The entire heater is built to withstand hard service and vibration. All parts are enclosed and cannot jar loose. There is no porcelain, cement, asbestos or molded insulation material used, the resistance being encased in sheet mica which in turn is encased in a steel jacket. After sealing, the heater is placed in a hydraulic press and 25 tons pressure applied. Ten of them, constituting a standard package, are packed in a box which affords a handy means of storing and identifying them. C-H space heaters have been used in scores of applications, notable among them being crane and hoist cabs, meter houses, valve houses, sprinkler riser houses, low temperature ovens including the new electrically heated bread ovens and many others. A partial list of the many applications is given in the new pamphlet. Methods of mounting, methods of connecting dimensions, wattage weights, code numbers and prices are also included in the pamphlet. Space is provided for dealers' imprint as a large number of jobbers and supply houses now carry the space heaters in stock. They are a product of the industrial heating department of the Cutler-Hammer Manufacturing Co., Milwaukee.

Electric Service Construction Co., electrical contractor, 322 Sherman street, Chicago, Ill., had an interesting exhibit, especially to wiremen and builders, at the recent Chicago Electrical Show. The repair work done by the company was featured, parts of motors, field coils, commutators, ets., showing samples of the work done by the company. The electrical construction side of the business was played up by over 50 letters displayed in appropriate glass frames. The letters consisted of orders and recommendations received by the company from customers who had expressed their satisfaction with the work done for them by the company. Another part of the exhibit was a display of antique switches, fuse blocks, fuses, lamp sockets and telephone desk sets. Some of these curios were of the vintage of the '80s and attracted much attention. P. C. Moore, president of the company, said numerous inquiries were received at the show for construction and repair work. In connection with the exhibit the Electric Service Engineering Co., an affiliated company, which is the distributor for the Pierce Fuse Corp. in the Chicago district, made an exhibit of Pierce fuses. According to R. S. Blake of the company, several hundred live prospects for Pierce fuses were obtained at the show.

I. P. Morris Co., owned and operated by the William Cramp & Sons Ship & Engine Building Co., has distributed Bulletin No. 4, of the hydraulic department, on hydraulic turbines. The catalog, which is illustrated, contains 90 pages of pictures of important installations and of printed matter. The printed matter consists of a technical discussion of the water power situation in the United States, and the part that the I. P. Morris Co. has taken in the development of hydraulic energy since the organization of the Morris Iron Works in 1828. During the 30 years preceding 1911, the company supplied turbines for the development of 855,835 hp., whereas, in the interval, 1911-1914, it supplied turbines to develop 827,885 hp. The matter in the catalog includes a discussion of factors affecting the success of a hydroelectric plant, a short history of the evolution of the hydraulic turbines, and a discussion of speed regulations. The photographs include views of entire plants in which Morris turbines have been installed, views of the interior of power houses, and of turbines and parts erected in the shops. The views show the details of the operating parts, the methods and apparatus employed to regulate the gates, and the floating lever type of **hydraulic governor. Copies of this bulletin may be obtained upon request.**

Current News

Weekly Record of Construction Activities—Conventions

EASTERN STATES

Cambridge, Mass.—Cambridge Electric Light Co. has completed arrangements for the construction of the proposed one-story addition to its local substation to provide for increased operations. Walsh Brothers, Cambridge, are the contractors.

Holyoke, Mass. — Walsh Steam Boiler Works, Appleton street, has completed arrangements for the erection of a two-story brick and concrete addition to its plant, about 81x140 feet.

Lynn, Mass.—Contract has been awarded by the city council to Bertram & Fox, 45 State street, for the construction of a new municipal engine plant on Chestnut street.

New Bedford, Mass.—National Spun Silk Co. has broken ground for the construction of the proposed power plant at its works to be located at Bullard street. The structure will be one-story, brick and concrete, about 84x123 ft., and is estimated to cost $175,000, including equipment installation.

Springfield, Mass.—In connection with the construction of the proposed additions to the plant of the Fisk Rubber Co., Chicopee, Mass., contract for which was recently awarded to the Fred T. Ley Co., Springfield, plans have been arranged for the erection of a new one-story and basement brick power plant, about 23x40 ft., to be used for general factory operation.

Warren, Mass. — Warren Steam Pump Co. has recently broken ground for the construction of a new one-story boiler plant at its works, about 40x60 ft., in connection with the erection of other additions to the plant to provide for increased capacity.

Middletown, Conn.—Russell Manufacturing Co. has awarded a contract to Dennis O'Brien & Sons, Crescent street, for alterations and improvements in its factory and power plant. The work is estimated to cost $50,000.

Norwalk, Conn. — Fire recently damaged the plant of the Hi-Po Battery Co., manufacturer of electric batteries, etc., to the extent of approximately $10,000. It is understood that the company is planning to rebuild at once.

Norwalk, Conn.—In connection with the construction of the proposed four-story plant of H. Jacob & Sons, about 50x200 ft., to be devoted to the manufacture of shoes, plans are being arranged for the erection of a new brick and concrete power plant to be used for general works operation. J. C. Schaeffler & Co., 38 West 32nd street, New York, are architects.

Pawtucket, R. I.—Collyer Insulated Wire Co., 249 North Main street, has awarded a contract to the Fred T. Ley Co., Springfield, Mass., for the construction of a new two-story concrete addition to its plant to provide for increased output. The structure will be located on Blackstone avenue, about 60x120 ft., and is estimated to cost $100,000.

Westerly, R. I.—New England Silk Co. will erect a new power plant, 30x40 ft., in connection with an addition to its works to cost about $150,000.

Bath, N. Y.—Town council, municipal lighting and power system, James Foster, chairman, is having plans prepared for the construction of a one-story addition to the municipal power plant to provide for increased operations. The structure will be about 42x65 ft. and is estimated to cost $25,000.

Binghamton, N. Y.—In connection with the proposed construction of the plant of the Vulcan Last Co., Portsmouth, Ohio, on property recently acquired at Johnson City, arrangements have been made whereby the Binghamton Light, Heat & Power Co. will furnish electric energy for operation. It is proposed to commence construction at once to enable the company to inaugurate operations early in 1920. The new works will cost about $200,000.

Brooklyn, N. Y.—Riggi Brothers, 1216 Lexington avenue, have had plans prepared for the construction of a new one-story reinforced concrete boiler plant addition to their works to provide increased operations. The structure will be about 25x60 ft. P. Tillion & Sons, 103 Park avenue, New York, are architects.

Brooklyn, N. Y.—Brooklyn Edison Co., Pearl and Willoughby streets, has awarded a contract to the Maxis Engineering & Construction Co., 26 Court street, for the erection of a new one-story extension at its local plant.

Buffalo, N. Y.—Wright-Hibbard Industrial Electric Truck Co., manufacturer of electrically operated trucks, etc., has filed notice with the Secretary of State of an increase in its capitalization from $300,000 to $550,000, to provide for proposed business expansion.

Cato, N. Y.—Northern Cayuga Light & Power Corp. has made application to the Public Service Commission at Albany for permission to begin construction and exercise rights and privileges under its franchise and for authority to issue $25,000 in capital stock.

Glens Falls, N. Y.—Adirondack Electric Power Corp. is having plans prepared for the construction of a one-story extension to its plant on Monican street. The structure will be of brick, concrete and steel, about 21x104 ft.

New York, N. Y.—United Electric Light & Power Co., 130 East 15th street, has been awarded the contract for furnishing electric service in connection with the operation of the new Capitol Theater, 1645 Broadway.

New York, N. Y.—Standard Electric & Repair Co., 50 University place, has completed negotiations for the leasing of property at 64 University place, for a new establishment.

New York, N. Y.—Gryphon Rubber & Tire Corp., Bailey avenue and 192nd street, has had plans prepared for the construction of a new one-story brick boiler plant at its works The structure will be about 40x42 ft., and is estimated to cost $10,000. Frank Sutton, 80 Broadway, is architect for the company.

Rochester, N. Y.— Considerable new electrical equipment will be required by the Rochester Motors Co., Inc., in connection with the proposed construction of a new one-story machine shop addition to its plant, about 100x390 ft.

Harrison, N. J.—Driver-Harris Co., manufacturer of electrical wires, cables, etc., has broken ground for the construction of two additional units at its plant, to provide for increased operations. The structure will comprise a three-story building, about 50x100 ft., brick and concrete, to be used as an addition to the wire department, estimated to cost approximately $60,000; and the other structure will be about 26x60 ft., costing about $5000, and will be utilized as an extension to the hammer department. Edward M. Waldron, Inc., 665 Broad street, Newark, is the building contractor.

Jersey City, N. J.—Leeds Phonograph Record Co., Record and Review streets, Long Island City, N. Y., has awarded a contract to Walter Kidde & Co., 140 Cedar street, New York, for the construction of a new one-story boiler plant, between Harrison and Warren streets, Jersey City, about 28x49 ft.

Keyport, N. J.—Monmouth Lighting Co. has been awarded a contract by the Borough Council for furnishing electric service for the operation of the municipal street lighting system for a period of one year.

Lakewood, N. J.—Gas & Water Co. has awarded a contract to the Pennsylvania Engineering Co., 1119 North Howard street, Philadelphia, Pa., for the construction of a new station at its plant. The structure is estimated to cost $20,000.

Newark, N. J.—Plans have been completed for the immediate construction of the proposed radio station at Heller Field, the main eastern air mail station of the Post Office Department.

Newark, N. J.—Clifton Electric Co. has filed notice of organization to operate in a general electrical contracting capacity at 107 Belmont avenue. Herman and Albert Friedenreich, 156 Spruce street, head the company.

Newark, N. J.—Rubber & Celluloid Products Co., 56 Ferry street, is having plans prepared for the construction of a one-story brick boiler plant at its works, to provide for general factory operation. The structure will be about 20x52 ft. Clark, MacMullen & Riley, 101 Park avenue, New York, are engineers for the company.

Pompton Lakes, N. J.—Tri-County Electric Co. has completed the construction of its power lines in Wanaque Borough as far as the Haskell School site, as well as in a large part of the Riverdale section of Pequannock township.

Easton, Pa.—Pennsylvania Utilities Co. is making rapid progress on the installation of three new boiler units at its Dock street plant. Two of these units will be of 600-hp. rating, and the other of 1000-hp. capacity, and it is expected that the work will be completed during November. Effective Oct. 1, the company has resumed its steam heating service following the yearly summer suspension, during which period alterations and improvements were made in the system to facilitate operations.

Nanticoke, Pa.—Duplan Silk Co., 50 Union Square, New York, has awarded a contract to the United Fireproofing Co., 8 West 40th street, New York, for the construction of the proposed two-story boiler plant at its local works. The structure will be about 90x100 ft.

Nanticoke, Pa.—Delaware, Lackawanna & Western Railroad Co., Scranton, has broken ground for the construction of a one-story boiler plant, about 48x154 ft. at its Truesdale Colliery, near Nanticoke. The structure, with equipment, is estimated to cost $75,000.

Philadelphia, Pa.—Stroudsburg Electric Light & Power Co. and the Industrial Power Co. have reorganized as the Lehigh Industrial Power Co. First mortgages held against the property of the Industrial Power Co. and effective likewise against any extension made in the name of the reorganization of the company's subsidiary concerns into a new corporation which could issue bonds on new improvements.

Philadelphia, Pa.—American Manganese Bronze Co., Rhawn and Hegerman streets, has completed arrangements for the installation of new boiler equipment at its plant, to facilitate operations.

Philadelphia, Pa. — The United States Government has taken bids for the construction of the proposed power plant at the Frankford Arsenal.

Philadelphia, Pa.—American Preserve Co., 946 Beach street, has awarded a contract to Cramp & Company, Philadelphia, for the erection of a new four-story and basement concrete plant, about 80x250 ft., to be supplemented by a power plant for works operation, at Third and Lehigh avenues. The project, including machinery and installation, is estimated to cost $400,000.

Philadelphia, Pa.— Continental Mills, Lena and Armat streets, have completed arrangements for the installation of new boiler equipment at their plant.

Pittsburgh, Pa.—Consolidated Ice Co. has filed plans for the construction of a new one-story brick and steel engine plant on 42nd street, near the Allegheny Valley Railroad. The structure is estimated to cost $15,800.

Pittsburgh, Pa.—Duquesne Light Co., Chamber of Commerce building, is making rapid progress on the construction of its new two-story brick substation, about 50x66 ft., to be located in the Fair Oaks section of Ambridge, Pa. The structure will be supplemented by a wing 17x30 ft., and is estimated to cost $50,000. The Walker & Curley Co., Farmers Bank building, Pittsburgh, is the building contractor.

Reading, Pa.—Philadelphia & Reading Railway Co. has recently inaugurated the new system, work on the installation of which has been completed, for the operation of its trains on the Reading-Harrisburg division by telephone. The lines will be used exclusively for the dispatching of trains.

Baltimore, Md.—Universal Centrifugal Dryer Co. has awarded a contract for the construction of a new two-story brick plant, about 40x131 ft., to be located at Carroll and Weaver streets. The structure is estimated to cost $15,000.

Baltimore, Md.—American Can Co. is planning for the installation of new boiler equipment at its property at Boston and Hudson streets.

Cumberland, Md.—Western Union Telegraph Co. and the Baltimore & Ohio Railroad Co. has inaugurated work on the cabling of the new conduit system, recently installed at a cost of about $50,000, extending from the Queen City building to the Viaduct tower. The conduit will carry telephone, telegraph and electric signal wires, and was completed early in August.

Glen Lynn, Va.—Appalachian Power Co., Bluefield, W. Va., is arranging plans for the immediate construction of a new addition, about 60x75 ft., to its local steam-operated electric generating station. Complete equipment will be installed, including a 20,000-kw. G. E. turbine and other operating apparatus, and contract has been awarded to Viele, Blackwell & Buck, engineers, 49 Wall street, New York, for the proposed work. The project will cost in excess of $600,000.

Cameron, W. Va.—Spang & Co., manufacturers of oil well machinery, equipment, etc., have had plans prepared for the construction of a large new power plant to be used for the operation of the proposed local works of the company, to include machine shop, forge shop and auxiliary structures. The new plant is estimated to cost $150,000. V. Monroe, Butler, Pa., is general manager.

Charleston, W. Va.—Chesapeake & Potomac Telephone Co. has recently filed application with the Public Service Commission for permission to increase its rates for service by approximately 30%.

Pemberton, W. Va.—Three pumping units in the mine of the Pemberton Fuel Co. were destroyed by fire on Oct. 27, caused by an explosion. It is understood that the company is planning for the immediate replacement.

Plains, Ga.—City is understood to be considering plans for the installation of a new municipal lighting plant. Bonds to cover the cost of the proposed improvement will be issued. H. R. McGee is mayor.

Miami, Fla.—City has approved a bond issue for $15,000 to cover the cost of the installation of the proposed police signal system.

Winter Garden, Fla.—City has arranged plans for the installation of a new municipal electric plant, to be used for furnishing electric energy for lighting purposes, as well as the operation of the municipal water works system. It is proposed to install complete equipment, including triple and rotary pumping units, internal combustion engines, generators, and auxiliary apparatus. The work is estimated to cost $70,000. Wilbur A. Ginn, Sanford, Fla., is engineer.

NORTH CENTRAL STATES

Indianapolis, Ind.—Link-Belt Co. will build a one-story addition to its foundry. The new addition will be one-story brick and steel, 70x460 ft., to cost $65,000.

Indianapolis, Ind.—Gale Construc-

DATES AHEAD.

Electrical Supply Jobbers' Association. Semi-annual meeting, Cleveland, Ohio, Nov. 18-20. Headquarters, Hotel Cleveland. Secretary, Franklin Overbaugh, 400 South Clinton street, Chicago.

American Society of Mechanical Engineers. Annual meeting, New York City, Dec. 2-5. Secretary, Calvin W. Rice, 29 West 39th street, New York City.

American Institute of Chemical Engineers. Annual meeting, Savannah, Ga., Dec. 3-6. Secretary, J. C. Olsen, Brooklyn, N. Y.

Electric Power Club. Meeting, Hot Springs, Va., Dec. 11, 12 and 13. Headquarters, Homestead Hotel. Secretary, C. H. Roth, 1410 West Adams street, Chicago.

National Council of Lighting Fixture Manufacturers. Annual convention, Detroit, Mich., February, 1920. Secretary-treasurer, Charles H. Hofrichter, Cleveland, Ohio.

American Electrochemical Society. Annual convention, Boston, Mass., April 7-10, 1920. Friday, April 9, joint session with American Institute of Electrical Engineers on "Electrically Produced Alloys." Secretary, Joseph W. Richards, Bethlehem, Pa.

National Electric Light Association. Annual convention, Pasadena, Cal., May 18-21, 1920. Headquarters, Hotel Huntington. Acting secretary, S. A. Sewall, 29 West 39th street, New York City.

tion Co. has taken the contract for the installation of a new power plant at the Marion County Tuberculosis Hospital at Oakwood, an Indianapolis suburb. The company's bid was $27,-103.

Belvidere, Ill.—The council has under consideration placing of boulevard lights on Logan avenue. Address Alderman Robinson of the electric light commission.

Berwyn, Ill.—Architects, Holabird & Roche, 104 South Michigan avenue, Chicago, have prepared plans for a $20,000 building to be erected by the Chicago Telephone Co., 208 West Washington street. Building to be of brick construction. Specifications include hot water, plumbing and electric lighting.

Chicago, Ill.—John R. Bowes will erect three-story factory building, 268x125 ft., to cost $330,000.

Chicago, Ill.—Charles R. Francis, commissioner of public works, has approved the plans to install complete electrical equipment of the Chicago avenue pumping station.

Dixon, Ill.—Grand Detour Plow Co. works of the J. I. Case Threshing Machine Co. will enlarge its power house. The latest electrical machinery will be installed and the plant will be of sufficient size to provide complete power for the enlarged capacity which the Case company has in view for the Dixon works.

Peoria, Ill.—E. L. Hulsebus, Jefferson boulevard, has prepared plans for a $20,000 building to be erected by the Clinton Telephone & Telegraph Co., Clinton, Ill. Building to be of brick construction. Specifications include passenger elevator, hot water heating, plumbing and electric lighting.

St. Charles, Ill.—Twenty thousand dollars in bonds has been voted to improve the municipal lighting plant. Address the village clerk.

Woodstock, Ill.—Woodstock Typewriter Co. will build an addition to its plant which will increase its production from 55 to 100 machines daily. Address J. P. Swahlstedt, Woodstock, Ill.

Hancock, Mich.—The committee is in favor of installing a meter 700 ft. from the pump and operating the pumping station by electricity. Address the city clerk.

Henderson, Mich.—Henderson Light & Power Co. has organized with a capital of $3000. It will build a plant 30x50 ft. in dimensions and furnish light and power for residences and stores in the town. Harry Coy, president.

Ypsilanti, Mich.—A commitee has been appointed to investigate the cost of boulevard lights on East Michigan avenue. Address the city clerk.

Amery, Wis.—A new electric company has been formed, co-operating with Apple River Milling Co. Lines will be constructed within a radius of four miles. Jake Smith, president; S. Philip, secretary.

Bruce, Wis.—Election will be held Nov. 15 to vote $9000 bond issue for line franchise electric power proposition. Estimate of construction from Ladysmith to Bruce, $12,000. Current will be purchased from Big Falls Power Co., 24-hour service, 3-phase lines.

Darlington, Wis. — City contemplates installing a municipal electric system. Daniel McConnell, city clerk.

Milwaukee, Wis.—Mueller & Sons Box Co., 361 Canal street, will install a generator and electrical equipment. Cahill & Douglas, engineers.

Grand Rapids, Minn.—Prairie River Power Co. will hold public hearing concerning $300,000 electric power plant on Prairie river. Dam will be concrete and stone, two-turbine electric plant of 100 hp. capacity.

St. Paul, Minn.—Lindeke Roller Mills will use 150 hp. of electric energy supplied by the Northern States Power Co., beginning Nov. 1. The West Publishing Co. has installed 44 electrically heated pots in their printing plant. A new $100,000 foundry will be built in the Midway district.

Sioux City, Iowa.—City council will install 3-phase light system to replace 1-phase system; also extend lines to Winnebago, Homer, Walthill, and other towns nearby. J. S. Phillips, mayor; Paul J. Wells, clerk.

Superior, Iowa.—Election carried for electric lighting system, service to be furnished by Northern Iowa Gas & Electric Co., Spirit Lake. E. L. Briggs, clerk.

Joplin, Mo.—In connection with the construction of the proposed local plant of the Junge Baking Co., contract for which was recently awarded, plans have been prepared for the erection of a one-story power plant, about 20x32 ft., to be used for general works operation. The C. A. Dieter Construction Co., Joplin, is the building contractor.

Hugoton, Kans.—An election to vote $70,000 in bonds for waterworks and electric lights will be held Nov. 10.

Hutchinson, Kans.—Contract has been signed by J. H. Springfield, manager of the United Water, Gas & Electric Co., by which this company will furnish electric power for the transmission system of the Pawnee Power & Water Co. of Larned. The contract calls for the furnishing of at least 1500 kw., with the agreement that it furnish as much as 3000 kw. if necessary.

Diller, Neb.—A franchise has been granted to J. H. Krug of Marysville for the construction of an electric line into Diller.

Greenwood, Neb.—Election to vote $15,000 for the construction of a transmission line to furnish Greenwood with current carried.

Wood, S. D.—Wood Electric Light & Power Co. will install a system for light and power here.

Cooperstown, N. D.—City will enlarge its electric plant to furnish light and power in Griggs county and all parts of Nelson and Steele counties.

SOUTH CENTRAL STATES

Lexington, Ky.—Fire originating in the pumping plant of the Stoll Oil Co. recently destroyed the works with loss estimated at $40,000. The company is understood to be considering plans for rebuilding.

Starkville, Miss.—The sum of $55,-000 in bonds has been voted to improve the light and water plant. Address the mayor.

Ashdown, Ark. — Commonwealth Public Service Co. is making extensive improvements in the electric light plant here. The company is putting in new and larger poles, and in the near future will install a 110-hp. oil engine.

Oklahoma City, Okla.—Oklahoma Gas & Electric Co. will expend $3,-000,000 for an electric generating station on Arkansas river.

El Paso, Texas.—El Paso Electric Railway Co. has had plans prepared for the erection of new additions to its power plant for increased capacity. It is proposed to furnish electric energy to the city for the operation of the municipal sewage plant. The extensions are estimated to cost $35,000. The work will include the installation of new motors, the construction of a transformer station and power line. J. L. Alexander is superintendent.

Madsonville, Texas.—The capacity of the Madsonville Light & Power Co. has recently been doubled by the purchase of additional machinery costing $8000 and plants are under wav to supply current to some of the smaller towns in the section.

Marshall, Texas.—A white way to cost $14,000 is soon to be installed.

WESTERN STATES

Craig, Colo.—C. A. Van Dorn, president of the First National Bank; C. H. Wise and R. S. Hamilton have filed application for a certificate of public necessity and convenience for the establishment of a power and light plant at Craig.

New Raymer, Colo.—Fire recently destroyed the electric light plant here, involving a loss of about $2,000. The electric light plant is operated by a kerosene engine. It will be rebuilt, and it is probable that the town will take over the operation. George L. McQuewn, owner.

Powell, Wyo. — Harry Chapple, Greybull, and E. P. Bacon of Natrona Power Co. of Casper contemplate an electric light and power plant here.

Petersburg, Alaska.—The council has been authorized to issue $75,000 light and power bonds. Address the town clerk.

Centralia, Wash.—Washington-Idaho Light & Power Co., which was recently voted a franchise in Chehalis, is considering the erection of a power plant in Centralia. The plant will furnish power to the Eastern mill, using the mill's slab wood as fuel. The erection of the plant is dependent on the securing of a contract to furnish power to the city.

Spokane, Wash.—Crowley Brothers

will build a sash and door factory to be operated by electricity.

Klamath Falls, Ore.—Pelican Bay Lumber Co.'s plant, recently destroyed by fire, will be rebuilt and operated by electricity.

San Francisco, Calif.—Approval of plans for a hydroelectric generating plant on the north fork of Kern river, which, with transmission lines, will cost $9,231,350, was sought from the State Railroad Commission by the Southern California Edison Co.

FOREIGN TRADE

[Addresses of firms referred to in these trade opportunities may be obtained by writing to the Bureau of Foreign and Domestic Commerce, Washington, D. C., or its branch and local co-operative offices. Request for each opportunity should be on a separate sheet and the file number given.]

Electrical Goods, Engines, Etc. (31,083).—Electricians in Australia desire to secure agencies for the sale of accumulators, power engines from ¾ hp. to 3 hp. and generators and motors up to 4 hp.; also any electrical goods. Reference.

Pumping Plants (31,094).—A member of a traders' association in Egypt desires to purchase and represent in that country manufacturers of tractors, motor plows, reapers, binders, threshing machines, drills, cultivators, pumping plants, all sizes, etc. References.

Pumps, Turbine, Etc. (31,129).—A commercial agency firm in France desires to secure the representation of manufacturers for the sale of machine tools, any machinery necessary to industry, oil motors, compressors, pumps, turbines, material for mines, forge material, lathes with horizontal plates, drilling machines (radial type), and planing machines. References.

Electrical Supplies (31,133).—A firm in Italy desires to secure an agency for the sale of telephonic and telegraphic apparatus and electrical supplies. A full list and description of what is required may be had on application to the bureau and its district offices. Correspondence may be in English. References.

Electrical Materials (31,146).—An electrical goods merchant in Spain desires to purchase and secure an agency for the sale of raw insulated materials for electrical construction and repair shops, high-tension apparatus, telephones, porcelain insulators, copper wires, and copper in bars and sheets. Quotations should be given c. i. f. Spanish port. Payment, cash against documents. Correspondence may be in English. References.

Electrical Supplies (31,166).—A company in England desires to purchase electrical fittings and appliances, steel- enameled conduits for electrical wires, and teak blocks for mounting switches. Quotations should be given c. i. f. English port. Reference.

PROPOSALS

Electric Light Plant.—The town council of Homestead, Fla., will receive bids until Nov. 17 for the installation of a new electric light plant to be used for municipal service. J. Burton is president; I. R. Matthews, clerk.

Electric Light Plant.—Bids will be received Nov. 19 for labor and apparatus to install a municipal electric light plant at Maquoketa, Iowa. The specifications include 250-b.hp. oil engine, generator, exciter, belt and switchboard, transformers, meters, etc. Address D. T. Bauman, city clerk.

NEW PUBLICATIONS

Price of Ferroalloys, Nonferrous and Rare Metals is the title of a publication by H. R. Aldrich and Jacob Schmuckler, issued by the War Industries Board. This bulletin, presenting a study of the wholesale prices of metals other than iron and steel in the period 1913-1918, inclusive, is one of a series of 50 class bulletins dealing with prices during the war. In classifying the list of commodities whose prices were to be studied, these metals were grouped together and three subdivisions made on familiar bases, namely, ferroalloys, nonferrous metals, and rare metals, and are collected in convenient form in this bulletin. Aside from presenting a record of price fluctuations for certain metals and their fabricated products, the bulletin gives briefly the causes of these fluctuations and discusses in some detail the industrial significance of each metal, its production, imports, and exports, and other data.

INCORPORATIONS

New York, N. Y.—Universal Superheater Corp. Capital, $100,000. To manufacture superheaters. Incorporators: J. S. Milne, R. McGregor and J. T. Crane, 2 Rector street.

New York, N. Y.—W. E. Nichols Corp. Capital, $50,000. To engage in a general electrical engineering capacity. Incorporators: O. A. Schramm, R. S. King and K. M. Nichols, 882 Eighth avenue.

New York, N. Y.—Traders' Electrical Supply Co. Active capital, $500,000. To manufacture and deal in electrical goods. Incorporators: G. W. Dunn and W. A. and J. Daly, 261 Broadway.

New York, N. Y.—Tiphany Motor Co. Capital, $400,000. To manufacture motors, etc. Incorporators: W. C. Dodge, F. U. Horowitz and L. M. Crumbacher, 1451 Broadway.

New York, N. Y.—Acorn Electric Contracting Co. Capital, $10,000. To engage in a general electrical contracting capacity. Incorporators: S. Wolf, M. Levin and I. Broff, 1155 Longfellow avenue.

New York, N. Y.—Roeser Studios. Capital, $10,000. To manufacture lighting fixtures, etc. Incorporators: R. Y. Barrows, C. V. G. and C. Roeser, 58 West 37th street.

Charleston, W. Va.—Kallmenten-Warner Electric Co. Capital, $10,000. To manufacture electrical goods. Incorporators: I. W. Belcher, O. W. Kallmenten, J. E. Hanley, D. C. and G. E. Warner, Charleston.

Wilmington, Del.—Little Giant Washing Machine Co. Capital, $2,500,000. To manufacture electric operated washing machines, etc. Incorporators: M. C. Kelly, M. L. Horty and S. L. Mackey, Wilmington.

Wilmington, Del.—Ivers-Lee Co. Capital, $2,500,000. To engage in a general electrical and mechanical engineering capacity. Incorporators: P. B. Drew, T. L. Croteau and H. E. Knox.

Tildenville, Fla.—Tildenville Power Co. Capital, $10,000. To operate a local electric light and power plant. C. H. Tilden is president.

Raleigh, N. C.—Carolina Electric Equipment Appliance Co. Capital, $25,000. To manufacture electrical appliances. T. A. Norris is the principal incorporator.

Miami, Fla.—Monad Electric Co. Capital, $10,000. To manufacture electrical supplies. W. B. Scott is president.

Indianapolis, Ind.—R. C. Dunn Manufacturing Co. has been incorporated with capital of $40,000 by R. C. Dunn, J. I. Dunn and S. W. Dunn.

Peoria, Ill.—Continental Electric Sign Co. has been incorporated with capital of $25,000, by W. G. Ronny. R. H. Morey and J. B. Wolfenbarger of Peoria, Ill., and H. H. Marriott, of Kansas City, Mo. The company will manufacture and sell electrical advertisement signs and displays.

Vincennes, Ind.—Indiana Power Co. has been incorporated with capital of $5,000,000 to supply light, heat and power for the city of Vincennes. Address C. E. Gregg, Vincennes, Ind.

Kindred, N. D.—Kindred Light & Power Co. has incorporated with a capital of $15,000. Address John Ottis.

Milbank, S. D.—Milbank Power Co. has incorporated with a capital of $50,000. Arthur M. Savage, Everett P. Winter, Philip G. Saunders.

Boston, Mass.—Massachusetts Electric Dredge Co. has been incorporated with capital of $50,000. Incorporators: Charles E. Fay, Fred C. Fernald and Forrest H. Abbott. Quincy, Mass.

Louisville, Ky.—Peerless Storage Battery Co. Capital, $50,000. Incorporated under Delaware laws. To manufacture storage batteries. Incorporators: D. Warren, A. E. Wolke, and F. A. Kronuer, all of Louisville.

Personal

H. F. Thurber Elected President of New York Telephone—O. T. McLean Resigns from Northwest Utilities—Changes

LEONARD H. KINNARD, Philadelphia, Pa., was elected president of the Bell Telephone Co. of Pennsylvania at a special meeting of the board of directors. Mr. Kinnard succeeds Frank H. Bethell, of New York, recently resigned.

L. L. HILL, Page & Hill Co., Minneapolis and J. D. Burns, inspection engineer for the company, attended a meeting of the committee on "non-pressure treatment for wood preservation" at the Forest Products Laboratory, Madison, Wis., last week. Mr. Hill is chairman of this committee.

MURRAY C. BEEBE, professor of electrical engineering, University of Wisconsin, has accepted a position in the research department of the Western Electric Co., New York City. He will have charge of investigating the financial possibilities of inventions and labor-saving devices that are submitted to the company.

WALTER MCCRUM, assistant manager of the Clark Electric Manufacturing Co., Middletown, Conn., has resigned to accept a position with the Haytian American Corp., which controls the electrical output of the island of Hayti, West Indies. Mr. McCrum has left the country to take up his new duties.

H. E. TOWLE, vice-president and secretary of the American Water Works & Electric Co., 50 Broad street, New York, has resigned, effective Nov. 1, to become a member of the banking firm of W. G. Souders & Co. C. S. ASHDOWN, treasurer of the company has been elected vice-president to succeed Mr. Towle, and W. K. DUNBAR has been appointed secretary.

DR. LEONARD F. FULLER, who recently became assistant manager of the insulator factory of the Ohio Brass Co. at Barberton, Ohio, has been honored with the degree of Ph.D. in electrical engineering by Stanford University in recognition of his work in wireless. Dr. Fuller is said to be the greatest single contributor to the development of long-distance transmission in radiotelegraphy, and his work with the Federal Telegraph Co., Palo Alto, Cal., with which he was formerly connected, has won for him the highest academic honors as well as nation-wide recognition.

SAMUEL B. TUELL, formerly with the Stone & Webster Engineering Corp., Boston, Mass., is now manager of the Houghton County Electric Light Co., Houghton, Mich. He is a graduate of the electrical engineering course of the Massachusetts Institute of Technology and has gained an extensive experience in engineering work in his connection with the Stone & Webster organization, having been employed at Key West, Porto Rico and other places. He was for some time at Pawtucket, R. I., and was later placed in charge of the utility work at Hog Island, later entering the office of the vice-president.

H. F. THURBER, vice-president of the New York Telephone Co., was elected president of the company at a meeting of the board of directors held on Oct. 29. The new president has been vice-president in charge of the companies constituting the eastern group of Bell System Telephone companies, which includes the New York Telephone Co., the Bell Telephone Co. of Pennsylvania, and the Chesapeake & Potomac Telephone Co. Mr. Thurber is one of the best known men in the telephone business. He entered it in 1890 immediately following his graduation from Cornell University as a mechanical engineer. The telephone business was then very young and Mr. Thurber's interest in it was aroused by an address given at Cornell University by Dr. Alexander Graham Bell, inventor of the telephone. His first position was with the Metropolitan Telephone & Telegraph Co. of New York, the predecessor of the New York Telephone Co., and he has risen through the ranks to the position he now holds.

H. F. Thurber.

GUY E. TRIPP, chairman of the board of directors of the Westinghouse Electric & Manufacturing Co., East Pittsburgh, has been elected a director of the American International Corp., succeeding J. Ogden Armour. Mr. Tripp was one of the original directors of the American International Corp., but resigned upon entering the Ordnance Department of the army. He has been chairman of the board of directors of the Westinghouse company for more than seven years.

M. L. MURRAY has resigned his position as branch office manager of the Waterbury Co., 15 Murray street, New York, and has been elected vice-president and general sales manager of the Alloy Metal Wire Co., 146 West 99th street, New York City.

O. T. MCLEAN, who has been connected with the Northwest Utilities Co., has resigned to devote his entire attention to the Electric Service Co., Mankato, Minn., of which he is secretary and treasurer. Mr. McLean entered the employ of the Minneapolis General Electric Co. in 1910, and when the company was sold to H. M. Byllesby & Co. in 1912 he was retained and promoted to the position of accountant. A year later he was sent to Mankato as auditor of the Mankato division of the Northern States Power Co. and later acted as assistant to R. E. Brown, manager. He resigned in 1917 to become acting manager of the Northwest Utilities Co., formerly the Southern Minnesota Power Co. of Spring Valley. On the completion of the transmission line, connecting this division to the line extending from Winona to Chatfield, the plants in the Spring Valley division were closed and he returned to Mankato to assume the duties of general auditor of the company. Mr. McLean's previous public service and merchandising experience in the industry should prove of considerable value to the Electric Service Co.

Obituary.

JAMES HARDIE, head of the financial department of John Robertson & Co., Brooklyn, N. Y., manufacturers of hydraulic pumping equipment, died on Oct. 23, at his home, 154 Eighth avenue, Brooklyn. Mr. Hardie was 79 years of age.

WILLIAM D. WEAVER, formerly editor of *Electrical World*, died suddenly on Nov. 3, at his home at Charlottesville, Va. Mr. Weaver was born at Greensburg, Pa., Aug. 30, 1857. He was educated at Kentucky University and the U. S. Naval Academy, graduating in 1880 as a cadet-engineer. He also engaged in special laboratory work at the Sorbonne, Paris, France. He accompanied the first Greeley relief expedition in 1883. He resigned from the navy in 1892 to become editor of *Electrical World*, which he served continuously until his retirement to his country estate several years ago. Mr. Weaver served in the Spanish-American war as chief engineer of the *U.S.S. Glacier*. He was a member of the American Institute of Electrical Engineers and many other technical, scientific and civic societies and clubs.

Electrical Review

Vol. 75. No. 20. CHICAGO, NOVEMBER 15, 1919 Three Dollars a Year

Electrical Review

WITH WHICH IS CONSOLIDATED WESTERN ELECTRICIAN AND ELECTROCRAFT.

VOL. 75—NO. 20. CHICAGO, SATURDAY, NOVEMBER 15, 1919. PAGE 809.

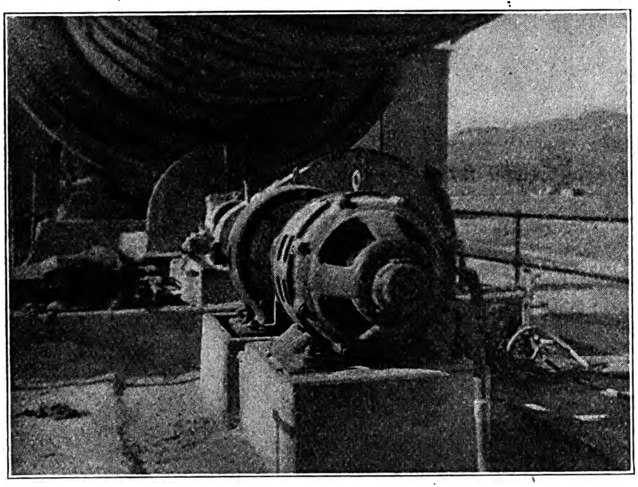


Fig. 1.—60-Cycle, 250-hp. Polyphase Motor Driving Williams Mill and Crusher.

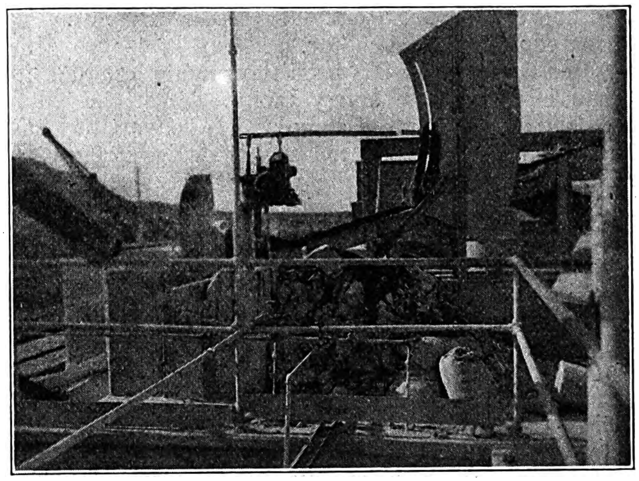


Fig. 2.—¼-hp., Single-phase Motor Driving Kiln-Slurry-Feed Control Dipper.

Electrical Equipment of Western Portland Cement Plant

California Cement Plant Driven Completely Through Motors Supplied from Power System—Features of the Equipment — Practically Dustless Operation Secured

APPLICATION of electric drive in the operation of a cement mill and the advantages to be derived therefrom are unusually well exemplified in the plant of the Southwestern Portland Cement Co. at Victorville, Cal. The town of Victorville is in the southern part of California about one hundred miles from the city of Los Angeles on the Santa Fe Railroad, the tracks of which pass by the plant, affording a convenient outlet for the finished product.

The mill has an output per year of approximately 300,000 bbls. of Portland cement, and employs an average of about eighty men. All of the buildings are of substantial reinforced concrete construction built to withstand the severe conditions imposed by the heavy cement mill machinery installed.

The system of manufacture used is known as the "wet process," and the water required for use throughout the mill is raised to a reservoir on a hill back of the plant by a 15-hp. motor-driven triplex pump.

Electric current is purchased from the Southern Sierras Power Co., thus relieving the cement company of the expense and trouble incident to the operation of a power plant. Current is received at 33,000 volts and stepped down to 440 volts for application to the various motors installed throughout the mill.

All the transformers and the switching outfits are of the outdoor type, located immediately adjacent to the mill. The current is taken from here to a seven-panel marble switchboard, from which it is distributed to the various power and lighting circuits in the mill.

Rock and shale are brought to the mill from the quarry, which is located seven miles distant, by steam locomotive hauling trains of cars which have two compartments or hoppers, one of which is dumped at a time into the crusher hopper.

The lime rock is delivered from the hopper cars direct to the crusher, but a reserve pile of crushed stone, amounting to between 3000 and 5000 tons is maintained sufficient to keep the mill operating for a period of approximately 30 days. This reserve is maintained in the event of an accident, such as a washout, crippling the railroad service from the quarry to the mill.

The crusher and Williams mill are driven by a 250-hp. Westinghouse type CW wound-rotor motor, shown in Fig. 1. Here the rock is broken into pieces about the size of a walnut or a little larger. From here the rock is elevated to a storage bin by a bucket elevator, driven by a 30-hp. motor, and thence by belt conveyor to the pulverizing house. Up to this time no water has been put with the rock except what is thrown on at the time it goes into the crusher, which is done with a hose to eliminate whatever dust rises at that time.

During the process of pulverization, water is added for further eliminating the dust. After being thoroughly pulverized the mixture is taken to the slurry tanks, where it is kept in motion by air agitation until ready for admission to the kiln.

There are six slurry tanks served in pairs by elevators, operating at a speed of approximately 88 ft. per min., for elevating the mixture from the pulverizing house tanks. Each elevator is driven by a 7½-hp. constant-speed motor.

After the mixture has been thoroughly agitated, it is transferred to the slurry tanks nearest the kiln. From here it flows into a sump and is delivered to the kiln by a motor-operated measuring device illustrated in Fig. 2, which shows the rear of the scale. The dipper is made in the shape of the letter "S," the outlet being in the center. By raising and lowering the dipper in the sump the amount of slurry entering the kiln can be controlled. The dipper is driven by an extended shaft, provided with two universal joints, from one of the elevators and is raised and lowered by a ¼-hp., 1725-r.p.m. motor by means of remote control from the klinker end of the kiln. The large scale is visible to the operator at the klinker end and he can feed the proper amount of mixture to the kiln and watch his fire at the same time.

The rotary kiln is approximately 200 ft. long and 20 ft. in diameter, lined with firebrick and heated by an oil burner to a temperature of about 2500° F., which is measured by a radiation pyrometer. It is driven at a speed of one revolution per minute by a 50-hp., type CW, 700-r.p.m. motor through Foote reduction gears, as shown in Fig. 3. The kiln is elevated at the raw end, so that as it rotates the mixture will travel toward the klinker end. Upon coming from the kiln the klinker falls about 20 ft. into a pit to allow it to cool somewhat. It is then elevated by the klinker elevator, which is driven by the 7½-hp., 680-r.p.m. motor shown in Fig. 4 to an automatic scale and dumped into the storage bin.

From the klinker storage it is transferred by means of a locomotive crane with a clam-shell bucket to a bin from which it is fed into the finishing mill. The locomotive crane is also used for mixing the klinker as it will vary somewhat in quality. After being ground and analyzed by the chemical department, it is ready for the packing house, to which it is carried on a belt conveyor over a weighing machine, which automatically records the number of barrels that pass.

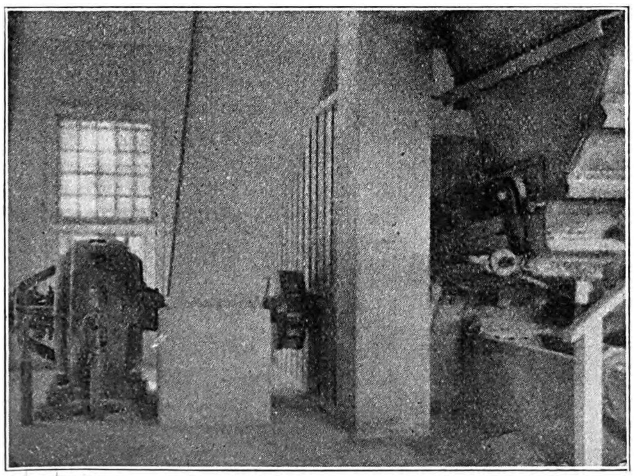


Fig. 3.—50-hp., Three-phase Motor Driving Rotary Kiln Through Foote 14 to 1 Reducer at 1 r.p.m.

From the storage bins, the cement is taken to the sacking machines, driven by a 15-hp. motor. A sack cleaner is driven by a 7.5-hp., 680-r.p.m. motor through a Foote reduction gear. A 15-hp. motor-driven blower for collecting dust from the sacking and sack-cleaning machines is also used.

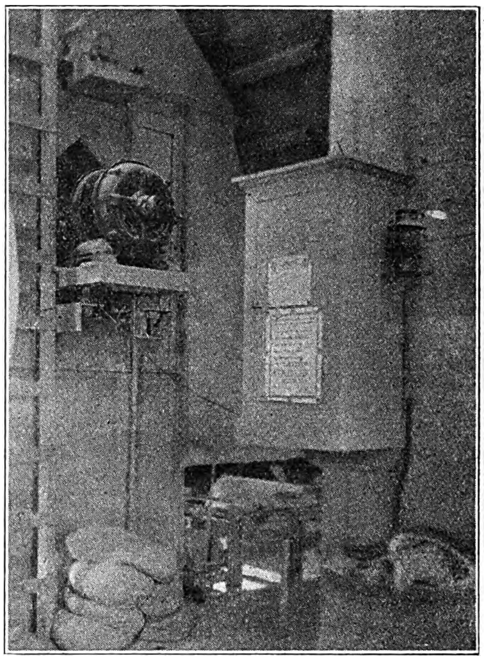


Fig. 4.—7½-hp. Motor Driving Klinker Elevator.

All the motors are of the alternating-current, 440-volt, 60-cycle, three-phase type and were furnished by the Westinghouse Electric & Manufacturing Co.

This plant was designed and built by L. D. Gilbert and has been in operation over three years, during which time no shutdowns have been experienced due to any trouble with the electrical equipment described.

NEON VAPOR LAMPS FOR HIGH VOLTAGE AND LOW CANDLEPOWER.

Previous endeavors to manufacture metal-filament lamps which could give 10 cp. or even less, and operating on the 220-volt lines generally used in many European countries, have been a failure in that the strength of the filaments has been found to be very low. A satisfactory solution of this problem is claimed to have been arrived at by two scientists working in the Pintsch laboratories in Berlin.

The lamp designed by them can be manufactured for a current consumption of only 1 to 5 watts and can be connected to any 220-volt network. It is provided with an ordinary lamp bulb and a standard base, and contains in a clear glass bulb a mixture of neon and helium gas at 8 to 10 mm. pressure. In this bulb is a large surface cathode, and, opposite it, an anode, placed at such a distance that at 190 volts pressure a dim discharge is set up which forms the luminous yield of the lamp. The remainder of the voltage is absorbed by a series resistance, the size of which is arranged to suit the current absorbed by the lamp. This resistance is concealed in the lamp socket. In order to change the color of the light given from orange red to pinkish-white, a little mercury vapor can be added to the gas charge.

Central-Station Rates in Theory and Practice

Nineteenth Article—Combined Energy and Demand Rates—Substitutes for Measured Demand—Encouraging Use of Appliances—Hopkinson, Doherty and Wright Rate Systems — Combination Rates

By H. E. EISENMENGER

This is the nineteenth article of this series which began in the issue of July 12. Part I of the series included seven articles dealing with the cost of central-station service. Part II comprised six articles on the policies governing the choice of a rate system. The present article is the sixth and last of Part III discussing the various systems of rates in use. The remaining six articles will constitute Parts IV to VI and will treat of rate analysis, the accuracy of rates and the current practice in rate regulation by commissions, the last article appearing in the issue of Dec. 27.

PART III—SYSTEMS OF CHARGING—Continued.

II. The Various Types of Rates—(Continued).

D. Rates Based on Both Energy Consumption and Demand—(Continued).

2d. Substitutes to Approximate the Measured Demand.

2. The Various Substitutes for the Measured Demand.

a. Size of Transformer Required.

SECTION 142. To begin with a rather isolated type of substitutes for the measured demand, the size of the transformer actually required for the customer's service may be used as the measure of his maximum demand.[1]

b. The Connected Load.

143. A very frequent substitute for the measured maximum demand is the connected load of the customer in some form or other.

Sometimes the measured demand and connected load are used together in such a manner that the measured demand is limited by the connected load so that the demand is never counted as less than a certain specified percentage of the connected load.[2]

1. The Full Connected Load.—The full connected load as the determining factor of the demand charge is used mostly in power rates,[3] although lighting rates on the same basis can also be found.[4]

The unit of the connected load in these instances is, in case of power rates, frequently the horsepower connected, for instance, the rating of the motor or motors.[5] Otherwise it may be the load in watts or kilowatts as determined by inspection of the installation.[6] The use of the number of 50-watt units installed,[7] or the rather obsolete method of using the 16-cp. lamp or equivalent,[8] as unit for the connected load are varieties of this rating.

2. Percentages of the Full Connected Load.—Instead of the full connected load a certain percentage of the load is very frequently made the basis of the charges and that percentage may be either a fixed one[9] or it may vary—within the same schedule[10] or from one schedule to the other[11]—with the character of the business served.

144. The percentage of the connected load which is to constitute the rated demand is frequently also varied with the *size of the connected load.* This is justified by the following considerations.

With a very small load, consisting, for instance, of one lamp or a very few lamps, the maximum demand will be equal to the connected load. If we have a larger installation the chances are in many installations that not all lamps will burn at the same time. The various lamps will have a diversity among themselves which in the average will be the greater, the larger the installation's capacity is in kilowatts. The same applies to power loads, especially where we have more than one motor installed. The chance that these motors will never be all running at the same time at full load is the greater the larger the number of motors is. Where we have one motor only, even if it be driving a number of power-consuming devices which have a diversity amongst one another, we must assume that this diversity had been anticipated when the selection was made of the size of the motor. At

---

[1]The Electric Welder Service schedule of the Standard Electric Light Co. of Kansas City: Transformer capacity connected for each service.
All schedules of Lansing, Mich., where the demand enters into the rates: Transformers actually required.
Wholesale Power schedule, Erie, Pa.: 75% of the transformer capacity, where installation is greater than 15 kw. (otherwise demand is measured).

[2]Wholesale Lighting and Power schedule, Norfolk, Va.: The demand is never to be counted as less than one-half the connected load.

[3]For instance, in the Wholesale Power rate of Denver, Colo., a three-charge rate system where the monthly demand charge is $2 per horsepower connected.
The Wholesale Power schedule of Omaha (which applies also to lighting where this is not more than 20% of the total load) determines the demand as the motor rating of the connected load, not counting the portion formed by the lighting load.

[4]For instance, in the Retail Lighting Schedule of Washington, D. C., or in the Residence Lighting schedule of Pueblo, Colo., (Wright demand rates).

[5]See footnote 3 above.

[6]See footnote 4 above.

[7]One of the two optional Commercial Lighting rates in Rockford, Ill., is a three-charge rate with a monthly demand charge of 16.6 cents per 50 watts connected.

[8]Denver, Colo.: Combination Lighting schedule, which is a three-charge rate system with a monthly charge of 15 cents per 16-cp. lamp.

[9]General Power, Haverhill, Mass.: For smaller installations 75% of the connected load or by test, but never under 60% of the connected load.

[10]The General Lighting Schedule in Brooklyn rates the demand as 50% of the connected load in residences and 70% elsewhere, with exception of sign lighting where the full connected load is used.

[11]Buffalo: The Residence Lighting schedule and the Commercial Lighting schedules are identical except that the demand in the former schedule is determined as 25% of the total installation and in the latter schedule as 50%. The minimum rated demand for residences of 250 watts is accordingly raised for commercial lighting to 500 watts.

"demand" (number of rooms or number of square feet of floor area, respectively), or in some other more complicated form.[7] This latter form of rates will be discussed and analyzed later (Sections 161 and 167) and here will be mentioned only, anticipating this analysis, that it embodies the equivalent of a customer charge for certain customers.

A variety of the Wright system is based not on the block system of gradation, but on the step system;[8] such systems are exceptions, however.

What has been said before (Sections 119-121) about step meter rates applies also to step Wright rates, for instance that the steps can be formed by discounts, except that in this case the discounts are not quantity discounts but load-factor discounts.[9]

The Wright rate principle can also be applied to block or step meter rates.[10]

d. Combination Rates.

156. In this and similar ways a large number of combinations between the various systems of rates and various principles of rate-making[11] can be put into effect and a great variety of "combination rates" of this kind are found in practice. It is almost impossible and is of little purpose to enumerate or classify all these combination rate systems. Just to show the fertility of this field a few examples from practice will be quoted here at random:

1. The Retail Power schedule of Spokane is a combination of a Hopkinson and a Wright demand rate as follows:

Demand charge: $1.50 per kv-a. connected
plus an energy charge of
Nothing for first 20 hours' use of connected load
3 cents per kw-hr. for next 30 hours' use of connected load
1.5 cents per kw-hr. for next 50 hours' use of connected load
1 cent per kw-hr. for next 300 hours' use of connected load
0.5 cent per kw-hr. for excess.

We see, moreover, that in this particular Wright rate the unit energy charge is not steadily decreasing with increasing load-factors but that it first increases from zero to 3 cents per kw-hr. and then decreases by blocks. We might also look at it in this way that the Wright rate begins only at the load-factor or of 20 hours' use instead at the load-factor zero, as in all other Wright rates.

2. The General Power rate of the Great Western Power Co., of Sacramento, Cal., is a straight meter rate stepped according to the size of the demand (in connected load) as follows:

3.75 cents per kw-hr. under 10 hp. connected.
3 cents per kw-hr. from 10 to 50 hp.
2.5 cents per kw-hr. over 50 hp.

3. The Commercial Lighting schedule of Atlanta, Ga., is a combination of a step, block and Wright demand system as follows:

A. Demand 25 kw. or less:
Primary kw-hr. charge 7.77 cents per kw-hr.
Secondary kw-hr. charge, 6 cents per kw-hr.
Primary charge applies according to the following table:

Demand in 50-watt equivalents.	Primary charge applies to the following number of kw-hr.
1 to 50	150
51 to 60	175
61 to 70	200
71 to 75	225
76 to 85	250
........etc........	

B. Demand 25 kw. to 50 kw.:
Primary kw-hr. charge, 7.77 cents per kw-hr.
Secondary kw-hr. charge, 6 cents per kw-hr.
Tertiary kw-hr. charge 4 cents per kw-hr.
The primary and the secondary charges apply according to the following table:

Demand in 50-watt equivalents.	Primary charge.	Secondary charge.
501-600	First 925 kw-hr.	Next 925 kw-hr.
601-700	First 945 kw-hr.	Next 945 kw-hr.
701-800	First 965 kw-hr.	Next 965 kw-hr.
801-900	First 985 kw-hr.	Next 985 kw-hr.
901-1000	First 1000 kw-hr.	Next 1000 kw-hr.

C. Demand above 50 kw.:
Primary kw-hr. charge 7.77 cents per kw-hr.
Secondary kw-hr. charge, 5 cents per kw-hr.
Tertiary kw-hr. charge 3 cents per kw-hr.
The primary charge applies for the first 20 hours' use of the connected load, the secondary for the next 20 hours' use and the tertiary, of course, for the excess. We see, therefore, that beginning from demands of 50 kw. we have a pure Wright demand rate, but not for demands below that amount.

Some of these rates require more or less study in order to arrive at a thorough understanding of their meaning. This study is very much simplified and the understanding of the various rate systems in general is made much easier by the systems of analysis explained in the following (Part IV), especially by the graphic system.

(To be continued.)

LYNN SECTION A. I. E. E. LEARNS ABOUT ATOMIC STRUCTURE.

In General Electric Hall, West Lynn, Mass., Dr. Saul Dushman, on Nov. 5, gave a lecture on "Structure of the Atom." Dr. Dushman, who is connected with the Research Laboratory of the General Electric Co. at Schenectady, N. Y., illustrated his address with lantern slides and a model.

SIGNALING SYSTEMS TO BE DISCUSSED.

A meeting of the Signaling Systems Committee, National Fire Protection Association, is scheduled for Nov. 18-20 at 141 Milk street, Boston, according to Chairman Ralph Sweetland. Proposed amendments to present regulations and other matters concerning signaling systems and fire hazards will be discussed.

6 Optional Residence Lighting schedule, Oklahoma City, Okla.:
10 cents per kw-hr. for the first 5 kw-hr. per active room,
7 cents per kw-hr. for the next 5 kw-hr. per active room,
3 cents per kw-hr. for the excess.
Residence Lighting schedule of Tacoma, Wash.:
5 cents per kw-hr. for the first 40-watt-hours per sq. ft. active floor area,
1 cent per kw-hr. for the excess.

7 Residence schedule of St. Louis, Mo.:
8 cents per kw-hr. for the first 4 kw-hr. for each of the first 4 active rooms, plus 2½ kw-hr. for each excess room,
6 cents per kw-hr. for excess up to 7 kw-hr. per room for all active rooms,
3 cents per kw-hr. for the excess.
This latter kind of Wright rate is not easy to understand for the beginner; the analysis of Sections 161 and 167 will explain it fully.

8 Retail Power, Akron, O.:
5 cents per kw-hr. for 30 hours' use of the demand
4.4 cents per kw-hr. for 60 hours' use of the demand
3.9 cents per kw-hr. for 90 hours' use of the demand } 21 steps
.... etc. ....
1.5 cents per kw-hr. for 630 hours' use or over

9 Wholesale Combined Light and Power rate of Dallas, Tex., (see next footnote).

10 As, for instance, in the example of Dallas, Tex., where the rate is a step meter rate with a load-factor discount. This discount is given only, however, if the energy consumption is in excess of 50,000 kw-hr., which brings a further element into the rate.
Or, General Lighting rate, Northern Electric Co., Portland, Ore.: Primary rate covering the first 100 hours' use of the demand:
8 cents per kw-hr. for the first 10 kw-hr.
7 cents per kw-hr. for the next 70 kw-hr.
6 cents per kw-hr. for the next 100 kw-hr.
5 cents per kw-hr. for the next 720 kw-hr.
4 cents per kw-hr. for the next 1100 kw-hr.
3 cents per kw-hr. for the next 1500 kw-hr.
2.5 cents per kw-hr. for the excess.
Secondary rate covering the excess over 100 hours' use of the demand:
Demand 5 kw. or less. 3 cents per kw-hr. for next 1000 kw-hr.
2 cents per kw-hr. for excess.
Demand 5 to 30 kw... 2 cents per kw-hr. for next 1500 kw-hr.
1.5 cents per kw-hr. for excess.
.... etc. .... etc. ....

11 Such as, for instance, changes of the unit prices by blocks or by steps, guarantees for a minimum bill or minimum demand or minimum consumption, discounts of various descriptions, such as quantity discounts, discounts for guaranteed bill, for guaranteed consumption, for guaranteed demand, for guaranteed term of contract (for instance, Lowell, Mass.), seasonal discounts, etc.

Pulverized Coal Under Boilers

Relative Theoretical Performance of Stoker-Fired and Pulverized Coal—Comparative Costs—Abstract of A. S. M. E. Paper

By FREDERICK A. SCHEFFLER and H. G. BARNHURST

SINCE the purpose is to present the facts which indicate the coming general adoption of pulverized coal as a fuel for boilers, the discussion is presented in the form of a comparison with stoker firing, the latter being the most efficient method in general use for burning solid fuel under boilers.

The ultimate adoption of a new method depends entirely on its overall commercial efficiency. In the generation of power, overall efficiency may be considered as composed of the following factors: reliability, cost and adaptability. A method may acquire a wide field if it shows improvement in any one or two of these points. Improvement in all three points leads to the general superseding of other methods.

Comparison of Stoker with Pulverized-Fuel Plants.

Reliability.—Let us compare the reliability of a pulverized-coal installation with that of stokers. This factor depends on two items: Apparatus for preparing and presenting the fuel for combustion, and continuity of operation of the furnace itself. In a stoker installation the first of these includes the stoker itself. Neglecting the inherent defects of any system that presents a metal mechanism to the action of high temperatures, it may be admitted readily that the stoker system is satisfactorily reliable, with respect to its apparatus, for preparing and presenting the coal for combustion.

The corresponding mechanisms for pulverized fuel are equally reliable. This fact is proved by their widespread use for years in the cement industry and more recently in an ever-increasing variety of industries. It should be recognized that these mechanisms are not innovations, but are the result of years of development under operating conditions. Proper design of equipment by engineers of standing who are specialists in this line has made negligible the danger of dust explosions.

The second condition for reliability is the continuity of operation of the furnace. Here again we find an apparent balance between stoker and pulverized-fuel installations during operation. The advantage lies with pulverized fuel, however, for several reasons. The mechanism is altogether outside the furnace, hence cleaning and adjustment and the making of the few repairs required need not interrupt the operation of the boiler. In case of sudden necessity the fire may be ignited and quickly brought to full intensity, or it may be extinguished almost instantly. Greater uniformity of flame and temperature is conducive to longer life of the furnace lining in a properly designed furnace, and to the minimum variation in furnace efficiency. Finally, the pulverized-fuel installation relieves the power plant from dependence upon the availability of a certain grade of coal. Stokers will not handle all grades of coal.

Cost.—This second factor refers to the cost per B.t.u. delivered to the boiler. The various items entering into this cost by the stoker system comprise power, repairs and maintenance, labor, interest on investment, depreciation, insurance and taxes.

With pulverized-coal equipment the cost of fuel for the drier should be added to the preceding items. A moment's consideration will show that this item must be taken care of in the furnace of a stoker-fired boiler and that it is clearly cheaper to remove the excess moisture content from the coal in a drier, from which the gases leave at very low temperature, than in the furnace itself, where the evaporation of the moisture damps the fire, increases the content of inert gas and at the same time carries off a very perceptible amount of heat.

Returning to the balanced cost items, it appears that these show a saving in favor of pulverized fuel

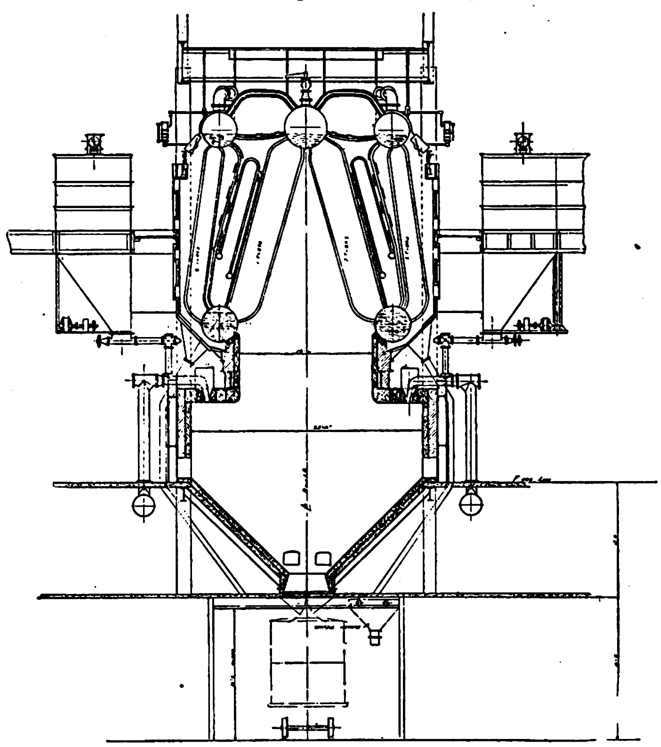


Fig. 1.—2400-Hp. Detroit Edison Type Boiler Arranged to Burn Pulverized Coal at 200% Rating.

in a large power plant and for the stoker in a small power plant. The figures in question are discussed further on in detail. It should be noted that when central pulverizing plants are built, they will relieve small power plants of the necessity for maintaining pulverizing equipment and make pulverized fuel considerably cheaper than stoker-fed fuel regardless of the size of installation. This feature is already being carried out successfully.

The final factor of the cost, furnace efficiency, which governs all the others, results in all respects to the advantage of pulverized fuel for the following reasons:

First: The fuel enters the combustion chamber in a finely divided state, being introduced with air at low pressure, and ingly pays for electric light. Moreover, the use of these appliances improves the central station's load-factor and thereby it cheapens the service eventually to all customers, because a central-station equipment which is being used 24 hours a day is able to produce the unit kilowatt-hour of energy as well as kilowatt of demand more cheaply than one used during a short period of the day only and then resting idly.

The demand and energy consumption of these appliances is as a rule quite considerable and is a large multiple of that of an ordinary household lamp. The capacity of almost any of these household appliances runs into the hundreds of watts and sometimes (ranges, etc.) into the thousands. The capacity of one or two of these devices may exceed that of the whole lighting installation. Therefore the leveling effect of these appliances on the total residential load curve can be a very considerable one.

For these reasons it is generally recognized by central-station managers that the use of domestic appliances should be encouraged in the mutual interest of the central station and of the customers.

150. The ordinary step and block meter methods, either as applied to the energy (step and block meter rate) or as applied to the rating of the demand are a step in this direction. However, with these two methods the lowering of the charges does not clearly apply to the use of appliances, but to the larger user in general.

The reduction of the charges to the user of the appliances, regardless of the amount he is using is more outspoken in the following method used by a number of central stations which base their rated demand on the connected load (either full load or a certain percentage) or on the number of sockets or outlets. The demand of the above mentioned appliances is then exempted from the rated demand [23] or it is counted at a smaller percentage than the lighting load.[24] Where the demand is rated by sockets or outlets the first receptacle in each room may be exempted.[25]

The same object of automatically allowing the residential customers a lower rate for "appliances" than for lights is at the bottom of the most modern system of residential rates, the "number-of-rooms" and the "floor-area" rates. The idea of these rates is that the actual lighting demand of a residence depends on the number of rooms or on the floor area and that the deviations from the average in individual cases are generally not large.

To illustrate this by a simple case, a demand charge might be made of a certain amount for every room or for every 100 sq. ft. of floor area, and an energy charge of, let us say, 5 cents would then be added for every kilowatt-hour consumed.

[23]Residence Lighting schedule of Pueblo, Colo.: The rated demand is the full connected load of lamps only.

Retail Lighting schedule of Washington, D. C. (includes all residence service): The rated demand is the full load, not counting small fans, heating and cooking appliances.

Residence Lighting schedule of Cincinnati: The demand is determined by inspection as 70% of the connected load. Small motors, heating devices and appliances for domestic use consuming less than 1 kw. are not figured in the demand.

Residence Lighting schedule of Cleveland: 17 watts for each outlet. Fans, heating and cooking appliances, charging sets and motors for domestic purposes not counted.

[24]General Lighting schedule of Saginaw, Mich.: Residence customers 80% of first 500 watts connected plus 60% excess. Appliances, such as electric ranges, ovens, etc., will be included at two-thirds of their maximum capacity, while other miscellaneous appliances are not included in determining the active load.

General Lighting schedule, Flint, Mich.: Residence customers full connected load. Electric ranges, ovens, etc., will be included at 75% of their maximum capacity. Other miscellaneous appliances not included.

[25]Cleveland, Ohio. See "Rate Research," Vol. VIII, page 179.

This rate, like every other one with a demand charge apparently penalizes those customers who are using their installation for a shorter time than the average customers of that class, that is, the customers with a small load-factor, inasmuch as the average price paid by them *per kilowatt-hour* is higher. Conversely, it apparently favors the customers with a large load-factor by reducing their average charge per kilowatt-hour. A special feature of the rates under discussion is the fact that the customer who has not installed lamps of sufficient size and number to give adequate illumination in the whole house is also penalized by being charged a relatively higher price, because he has to pay the same amount for the demand—though not for the energy—as if he had installed lamps of sufficient or ample total wattage. On the other hand, he gets additional service for "appliances" against payment of not more than the energy charges for the additional service.

151. The question is hard to decide whether the number of rooms or the floor area is a better basis theoretically. It depends to a certain degree on the size of the rooms, as we can see from the following. If we imagine a very large hall, an auditorium, a skating rink, or the like, the wattage required for a given illumination (with a given type of lamp, etc.) depends obviously only on the floor area. If we subdivide the hall by partitions into several smaller rooms, these partitions will cast shadows and shut off the light of certain lamps from certain parts of the floor, thereby reducing the illumination. Every room will get light only from the lamps immediately above it and the rest of the light will be lost (neglecting the fraction which is reflected from the partition walls). To maintain the illumination the wattage per floor area must therefore be increased as the number of rooms in the same total floor area increases, that is as the size of the rooms decreases.

In practice the great majority of central-station managers who have chosen this system of rates have decided for the number-of-rooms in preference to the floor-area[26] basis, probably because the number of rooms is easier to determine than the floor area and the method of determination is easier understood by the average customer.

It is possible to combine the number-of-rooms principle to a certain degree with the floor-area principle by stipulating in a number-of-rooms rate that rooms with an area over a certain size count as two rooms[27] or that they count as many times as they exceed that maximum area.[28]

In at least one instance the floor-area principle is combined with the connected-load principle for determining the demand, in such a manner that the demand is rated as the connected load with the restriction that lighting equipment in excess of one watt per square foot of floor area is not considered.[29]

152. It has been shown above (Section 148) that, where the number of sockets is the basis of the rated demand the sockets in certain localities are not counted. In the same manner and for the same reason certain rooms—or their floor area, respectively—are exempted in the number-of-rooms and floor-area rates. We thus get "active" and "nonactive" rooms.

[26]For statistical figures see the end of Section 152.

[27]El Paso, Texas, 300 sq. ft.

[28]Superior Water, Light & Power Co., Superior, Wis., 300 sq. ft.

[29]Portland Railway, Light & Power Co., Portland, Ore.: Nor are heating, cooking and power appliances considered in this residence rate.

The definition of an active and a nonactive room is as a rule made by simply enumerating the different kinds of rooms which fall under one or the other or both classes. The rates of different companies differ from each other to a slight degree in that respect. Nonactive rooms are in all or almost all schedules: halls, bathrooms, basements, attics, closets, and porches. In several of the schedules we find further specified as inactive: The first three bedrooms, laundry, pantry, alcoves, garage, unfinished rooms, coal shed, storage rooms, etc. The real estate rating[30] or the architect's rating simply is made the criterion to distinguish the active from the nonactive rooms in isolated cases. The rooms of the first floor are rated differently in one case.[31]

The rates on the number-of-rooms principle and the floor-area principle have not yet found as wide an application in this country as they would deserve. An investigation (which does not claim completeness) showed 16 companies in the United States employing the number-of-rooms principle in 17 cities, and two companies only using the floor-area principle in three cities.

The number-of-rooms rates and the floor-area rates are almost exclusively designed on the principle of the so-called Wright demand rate or its modifications. Further discussion will therefore be put off until that principle has been explained (see Section 155 *et seq.*).

3. Description of the Various Rate Systems Based on Both Energy and Demand.

a. The Hopkinson Rate.

153. The simplest system of rates which embodies both an energy charge and a demand charge is the rate system which was devised by Dr. John Hopkinson in 1892. The customer's bill under the Hopkinson system consists of two separate portions, a demand charge and an energy charge. The demand charge is figured as the product of a certain fixed unit demand charge times the number of kilowatts (or horsepower or whatever unit has been chosen for the demand), and likewise the energy charge is the product of the unit charge times the number of kilowatt-hours consumed.[1] (It goes without saying that the energy charge is lower than it would be under a straight meter rate for the same service.)

The unit demand charge as well as the unit energy charge can be varied with increasing demand or energy, respectively, according to the block system ("demand block," "energy block" and "double block" systems), or according to the step system as shown for the pure meter rates in Sections 122 and 119.[2] "Demand block" and "demand step" systems with unchanged energy charges do not occur in practice as far as the author's knowledge goes.

b. The Doherty Rate.

154. This rate is an amplification of the Hopkinson rate by the addition of a customer charge.[3] It is named after Henry L. Doherty, the well-known New York engineer and financier who, to the author's best knowledge, introduced this system for the first time in Denver in the first decade of this century.

The Doherty rate can also be found in practice with a graduation of the energy charges.[4] Graduations of the demand charges by blocks or any graduations by steps are not found in practice with Doherty rates, as far as the author's knowledge goes.

c. The Wright Demand Rate (Multiple Rate).

155. This rate, which is one of the most generally used systems, has been designed by Arthur Wright, of Brighton, England, after whom it is generally called. Sometimes, especially if it embodies more than two steps, it is also called the "multiple rate."

This rate mentions only kilowatt-hour charges and yet, as will be demonstrated later (Sections 160, 161, 166 and 167) it embodies the equivalent of a demand charge and sometimes of a customer charge as well. A certain charge per kilowatt-hour ("primary charge") is made for the first block of kilowatt-hours of every customer; another one ("secondary charge") is made in the next block of kilowatt-hours, and so on, just like in the block meter rate, with this difference that the blocks are not determined by a certain fixed absolute number of kilowatt-hours but by some relation of the customer's kilowatt-hours to the customer's demand, in most cases as a certain fixed number per every kilowatt (or other unit) of demand. In other words, the blocks are not energy blocks, but generally load-factor blocks.[5]

Practically all the rates on the number-of-rooms or floor-area basis are Wright demand rates, either in the simple form just discussed that the number of kilowatt-hours in each block is proportional[6] to the

---

[30] Minneapolis. (See "Rate Research," Vol. XI, page 164.)

[31] Pittsburgh. (In apartment houses bedrooms and bathrooms are counted as second-floor rooms, all other rooms and halls as first-floor rooms).

[1] Refrigerating rates of the Universal Electric & Gas Co., San Francisco: Demand charge $2 per hp. connected, plus an energy charge of 1 cent per kw-hr. Auxiliary service of the same company: Demand charge of $2.25 per kilowatt connected plus an energy charge of 2 cents per kw-hr.

[2] Energy Block System (demand charge unchanged):
Wholesale Lighting and Power, South Bend, Ind.:
Demand charge $1 per hp. connected, plus an energy charge of—
6 cents per kw-hr. for the first 50 kw-hr.
4 cents per kw-hr. for the next 50 kw-hr.
3 cents per kw-hr. for the next 100 kw-hr.
2.3 cents per kw-hr. for the next 300 kw-hr.
2 cents per kw-hr. for the next 500 kw-hr., etc.
Double Block System:
Wholesale Lighting and Power, High Tension, Boston:
Demand charge—
$60 per year per kw. for the first 15 kw. of demand.
$36 per year per kw. for the next 40 kw. of demand.
$30 per year per kw. for the next 100 kw. of demand.
Energy charge:
5 cents per kw-hr. for the first 1500 kw-hr.
3 cents per kw-hr. for the next 4000 kw-hr.
1.5 cents per kw-hr. for the next 50,000 kw-hr.
1.25 cents per kw-hr. for the next 50,000 kw-hr., etc.
Step System of Demand Charges and of Energy Charges:
Primary Power, Atlanta, Ga.:

Kw. demand	Demand charge.	Plus energy charge of
10 to 20	$1.70 net	0.9 cents per kw-hr. net
21 to 50	1.70 net	0.7 cents per kw-hr. net
51 to 100	1.60 net	0.6 cents per kw-hr. net
101 to 200	1.40 net	0.5 cents per kw-hr. net

Etc.

[3] Optional Lighting rate, Denver, Colo.:
Customer charge $9 per year, payable monthly
plus a demand charge of $1.80 per year per 16-cp. lamp of demand payable monthly (one-third of connected load)
plus an energy charge of 5 cents per kw-hr.
Wholesale Power, St. Joseph, Mo.:
Customer charge $100 per month.
plus a demand charge of 25 cents per hp. connected
plus an energy charge of 1 cent per kw-hr.
In this latter case the object of the customer charge is obviously to restrict the use of these cheap unit charges for demand and energy to the wholesale customer.

[4] Optional Commercial Lighting schedule of the Universal Electric & Gas Co., San Francisco:
Customer charge $10 per month
plus a demand charge of $1 per kw. maximum demand.
plus an energy charge of 1.5 cents per kw-hr. for the first 4000 kw-hr. and 1 cent per kw-hr. for the excess.

[5] General Lighting rates of Sioux City Service Co.:
12 cents per kw-hr. for the first 40 hours' use of the connected load
6 cents per kw-hr. for the excess.
General Lighting schedule, Portland Railway, Light & Power Co.:
9 cents per kw-hr. for the first 6% of the "monthly maximum consumption"
7 cents per kw-hr. for the next 6%
4 cents per kw-hr. for the excess.
"Monthly maximum consumption" means the number of kilowatt-hours which would result from continuous use of the demand.

the same time the choice of a smaller percentage for the rated demand in larger installations expresses the principle of granting lower unit prices to the larger consumer.

The percentage which determines the rated capacity is therefore reduced as the *connected load* increases or as the *number of motors* in the installation increases, or both.

145. Where the connected load is the determining factor of the percentage—which is quite frequent practice—we can use methods entirely analogous either to the "step" or the "block" method, explained in the description of the step meter rate and the block meter rate, respectively (Sections 119 and 122). The same laws which govern the decrease of the energy charge per kilowatt-hour with increasing energy consumption in the step and block meter rates apply here to the decrease of the percentage with increase of the connected load.[12]

As regards those rather infrequent cases where the number of motors installed is used to determine what percentage of the connected load is to make up the rated demand, the simplest conceivable method, and the only one used in practice, is to state how large the percentage of the connected load is which corresponds to every number of motors. Usually only two or three different percentages are used in this manner; for instance: one for one motor, another one, say, for two to five motors, and the third one for more than five motors.

The use of the number of motors alone, without any reference to the size of the connected load, does not occur. It is either combined with the step or block method of the connected load as just described in such a manner that the percentages for the various numbers of motors are different for the different steps or blocks of the connected load[13] or the use of the number of motors applies to a certain range of the connected load only and outside of that range the percentage is entirely independent of the number of motors.[14]

Another measure to take into account the effect of the diversity of the motor loads can be made by assigning a lower percentage of the connected load to the rated demand if the motors are driving a group of power-consuming machines than if we have individual drive of the power-consuming devices. In both cases we will have the same diversity between the power demands of the various machinery,[15] but in case of the group drive—if the size of the motors has been chosen intelligently—the diversity of the loads on an individual motor has been anticipated and the capacity of the motor, that is the "connected load," is selected correspondingly smaller than in case of the group drive, although the character of the mechanical load on the motors is exactly the same in both cases. Consequently the actual maximum demand is a larger percentage of the motor capacity in case of group drive than in case of individual drives[16].

In a few cases the size of the largest motor installed is chosen to determine the percentage of the connected load which is to form the rated load. In these cases the block method is used: The rated demand is a certain percentage of the capacity of the largest motor plus another percentage of the rest of the connected load.[17]

146. Instead of reducing the percentage of the connected load which is to be used as the basis for the determination of the rated demand, we can get the same numerical results by rating the demand as the full connected load and reducing the demand charge accordingly. Whichever law—step or block—we use for the reduction of the percentage of the connected capacity, the same law will apply to the equivalent reduction of the unit demand charge and the latter will be reduced in the same proportion as the per-

[12] Step method: Power rates, Cincinnati:

Connected Load.	Rated demand in % of connected load.
Under 5 hp.	90%
5 to 10 hp.	75%
10 to 20 hp.	70%
20 to 50 hp.	65%
50 to 100 hp.	60%
100 hp. and over	55%

Block method: Optional Commercial Lighting schedule, Bay City, Mich.:

Connected Load.	Rated demand in % of connected load.
First kw.	95%
Next kw.	90%
Next 2 kw.	85%
Next 6 kw.	80%
Over 10 kw.	Varies with the class of business.

[13] A. Combined with steps of connected load:
1. Optional Commercial Lighting and Power schedule, Cleveland:

Connected load.	One motor.	Two or more motors.
Up to 5 kw.	80%	75%
5 to 10 kw.	75%	70%
Over 10 kw.	70%	65%

2. Wholesale Power, Newark:

Connected load.	One motor.	Two or more motors.
Up to and incl. 50 hp.	70%	60%
Over 50hp.	70%	50%

B. Combined with blocks of connected load:
General Power schedule of the Portland Railway, Light & Power Co., Portland, Ore.:

Connected load.	One motor.	2 to 5 motors.	Over 5 motors.
First 5 kw.	95%	90%	85%
Next 5 kw.	75%	70%	65%
Excess	65%	60%	55%
Minimum	75%	70%	65%

[14] Retail Power schedule, Philadelphia:
Rated demand:

One motor connected—85% of connected load	If less than 10 hp. are connected.
Two or more motors connected—75% of connected load	

Optional Power schedule, Lancaster, Pa.:
Rated demand:

One motor connected—85% of connected load	If 25 to 50 kw. are connected.
Two or more motors connected—80% of connected load	

When the connected load is different from that specified (under 10 hp. or between 25 and 50 kw., respectively) another method of determining the rated demand applies.

[15] This means that their joint maximum demand will be smaller than the sum of their individual maximum demands because their maxima do not occur at the same time.

[16] This discrimination of the demand charges between group drive and individual drive is very rare; only one example could be found, that is the Retail Power schedule of Wilmington, Del.:

Connected load. Kw.	One motor.	Two motors. Group.	Two motors. Indv.	3 to 5 motors. Group.	3 to 5 motors. Indv.	6 to 10 motors. Group.	6 to 10 motors. Indv.	11 to 19 motors. Group.	11 to 19 motors. Indv.	Over 19 motors. Group.	Over 19 motors. Indv.
Under 3		98%	95%								
3 to 4.9	99%	97%	93%	90%	82%						
5 to 9.9	97%	95%	90%	88%	80%	85%	78%				
10 to 19.9	95%	92%	86%	85%	77%	82%	73%	75%	68%		
20 to 49.9	93%	90%	83%	82%	75%	78%	70%	73%	65%	70%	62%
50 to 99.9	92%	85%	78%	80%	72%	75%	68%	70%	62%	68%	60%

[17] Wholesale Lighting and Power schedule of San Francisco: For installations under 50 hp. the demand may be estimated at the option of the company as 100% of the rated capacity of the largest motor installed, plus 60% of the rated capacity of the additional motors or other devices.

Retail Power, Louisville:

Up to 10 hp. connected—30% of largest motor	+40% of the total connected load.
10 to 50 hp. connected—25% of largest motor	
Over 50 hp. connected—20% of largest motor	

This might also be written to conform with the form of expression chosen above, as:

Up to 10 hp. connected—70% of largest motor	+40% of the capacity of the additional motors.
10 to 50 hp. connected—65% of largest motor	
Over 50 hp. connected—60% of largest motor	

centages of the connected load have been reduced.[18] Both principles of reduction—step and block—are sometimes found combined with each other as block-block, step-block or step-step systems. For instance, the percentage of the connected load decreases with increasing connected load according to the block law and the unit demand charge also decreases with the increasing connected load according to the block law. This "block-block" or "double-block" system can be reduced to one single-block system[19] either based on full connected load instead of percentages of the same and employing a varying demand charge or, if preferred, with a constant demand charge and varying percentages of connected load. (This does not mean that either of these single-block systems is always preferable to the double-block system or vice versa; the fact is mentioned here only as an instance of the interchangeability of various forms of rates with the same numerical effect, to introduce the reader to the methods of analyzing the meanings of the various rate schedules). Similarly a "double-step" system is equivalent to a "single-step" system with the number of steps generally equal to the sum of the numbers of steps in the two systems. Finally a "step-block" system is conceivable which would be resolved into a combined step and block system, again either based on full connected load, or with a constant demand charge.

147. The block and the step method and their combinations are the simplest methods of varying the demand charges with the connected load. There are other methods which are very frequently used. In these the demand charges depend on the energy consumption as well. The demand charge is then generally altered not when the *demand* but when the *load-factor* exceeds a certain limit. These less simple methods will be discussed later (Wright system, etc.).

c. The Number of Sockets or Outlets.

148. Just as the connected load is an approximation of the maximum demand so the number of sockets or outlets is an approximation of the connected load, and just as the introduction of the connected load in lieu of the maximum demand brings about certain advantages and disadvantages, namely an increase in simplicity and a decrease in accuracy, so this same advantage and disadvantage is correspondingly further enhanced by the introduction of the number of sockets as basis for the demand charge.

The use of the number of sockets is an exception in case of rates which are based on both demand and energy consumption. The basis for the demand may be in these cases either the full number of sockets connected[20] or a certain percentage of that number,[21] in accordance with the parallel proceedings with the connected load (Section 143).

Sockets for lights which are liable to burn a few minutes only at a time (so-called convenience lights) and for lights which are liable to burn only occasionally or not at peak-load time are sometimes exempted from the rating for the demand,[22] so as to avoid a restricting influence on the installation of the customer and to let him get the benefit of the convenience of electric lighting without unduly high charges.

d. Encouragement of the Use of Domestic Appliances. Number-of-Rooms and Floor-Area Basis.

149. Whereas in the earliest times of central-station history electricity was used in residences purely as a lighting agent, it is now being employed more and more for heating and power purposes around the house, in radiators, stoves, toasters, percolators, milk-warmers, flatirons, ranges, washing machines, vacuum cleaners, fans, battery chargers for automobiles and in similar domestic appliances.

These appliances are used as a rule at a different time of the day than the electric lights and their use increases the peak of the central station in a far smaller measure, if at all, than the use of the same capacity in lamps would. Therefore, their operation costs the central station much less than their capacity implies. Their use should be cheapened also from the point of view of the value-of-service principle, since nobody would, for instance, care to use an electric range if he had to pay the same price for current as he will-

[18]To quote a simple example, the demand charge of the (optional) Commercial Lighting rate of Bay City, Mich., is $2 (net) per kilowatt of active load and the active load is—
95% for the first kw. connected.
90% for the next kw. connected.
85% for the next 2 kw. connected.
80% for the next 6 kw. connected, etc.
This plainly amounts to the same numerical effect as if we would change the demand charge to
95% of $2 = $1.90 for the first kw. connected.
90% of $2 = $1.80 for the next kw. connected.
85% of $2 = $1.70 for the next 2 kw. connected.
80% of $2 = $1.60 for the next 6 kw. connected.

[19]The following example will illustrate this:
The Lighting and Power rate of Grand Rapids, Mich., charges a yearly demand charge of—
$24 per kw. of the first 50 kw. of active load (rated demand).
$18 per kw. of the next 50 kw. of active load.
$15 per kw. of the excess.
Plus an energy charge which is of no interest in this connection.
The active load or rated demand is determined in the following way from the connected load:
100% of the first 20 kw. connected.
90% of the next 20 kw. connected.
80% of the next 20 kw. connected.
60% of the next 20 kw. connected.
50% of the next 20 kw. connected.
30% of the excess.
To reduce this rate to one based on the full connected load we proceed as follows:
The first 20 kw. connected are evidently charged at $24 per kilowatt connected.
The demand charge for the next 20 kw. connected is obviously $0.90 \times \$24 = \$21.60$.
The demand charge is changed from $24 per kilowatt of active load to $18 as soon as the active load reaches 50 kw. We have first to determine what the corresponding connected load is.
40 k.w connected corresponds to $20 + (0.90 \times 20) = 38$ kw. rated load.
60 kw. connected corresponds to $20 + (0.90 \times 20) + (0.80 \times 20) = 54$ kw. rated load.
Consequently 50 kw. of rated load lies in the third block of the original load system, that is, between 40 kw. and 60 kw. connected load. The first two blocks of connected load together comprise 38 kw. rated load; this leaves 12 kw. rated load reaching into the third block or, as 80% is the prevailing percentage in that block, $12/.80 = 15$ kw. connected load. The total connected load corresponding to 50 kw. rated load is therefore $40 + 15 = 55$ kw.
After 50 kw. of active load (55 kw. connected) has been reached, the demand charge changes from $24 per rated kw. to $18 per kw., that is, from $0.8 \times \$24 = \$19.20$ per connected kw. to $0.8 \times \$18 = \$14.40$ per connected kw.
In this manner we arrive by successive steps at the following table:

First 20 kw. connected	$24 per kw. connected
Next 20 kw. connected	21.60 per kw. connected
Next 15 kw. connected	19.20 per kw. connected
Next 5 kw. connected	14.40 per kw. connected
Next 20 kw. connected	10.80 per kw. connected
Next 20 kw. connected	9.00 per kw. connected
Next 80 kw. connected	5.40 per kw. connected
Excess over 180 kw. connected	4.50 per kw. connected

In the same manner we might also express this rate as a rate with one single kilowatt charge applying to different percentages of the connected load.
The reader who is familiar with elementary mathematics will find preferable the algebraic methods as described in Part IV.

[20]Residence Lighting schedule, Indianapolis, Ind.: All lighting sockets; sealed sockets, baseboard and floor receptacles for small power appliances not counted.

[21]Residence Lighting schedule, Youngstown, Ohio: Of the sockets in the principal rooms as specified in the schedule (that is, omitting closets, bath room, attic, etc.) seven-tenths are considered as 50 watts each and three-tenths as 25 watts each. Four-tenths of the wattage so obtained is then counted as the customer's demand. An easy calculation reveals that this simply means 17 watts are counted for every one of the sockets in the respective rooms. The demand charge per kilowatt may thus be reduced to a demand charge per socket.

[22]Residence Lighting schedule, Youngstown, Ohio: Lamps in the following rooms are not counted: Vestibule, porch, closets, bath room, lavatories, dressing rooms, attic, basement, pantries, summer kitchen, servant's room, back halls, back stairways, billiard room, barn and yard.

is approximately perfectly mixed with the air for theoretically perfect combustion. Therefore no excess air is required for complete combustion. The units of heat taken up by heating excess air reduce the combined boiler and furnace efficiency. It is impossible to get a uniform fuel bed on a stoker or a grate and, therefore, impossible to approach complete combustion without introducing excess air. Should it be desired for other reasons to introduce excess air with pulverized fuel, it can be done in exact amounts, evenly distributed, without affecting the uniform nature of the flame and flue gases. This uniformity, which cannot be obtained in either grate or stoker installations, means maximum efficiency in all parts of the furnace and a maximum rate of heat transference to the boiler throughout its exposed area. It also means that flue-gas analysis gives an accurate determination of conditions in the furnace and that control of coal delivered and air supply can be adjusted with great accuracy.

Second: In pulverized form all of the combustible is burned, a consummation certainly impossible in lump-coal firing by either hand or stoker. It is not unusual to find 20 to 30% of carbon in ash refuse from grate or stoker-fired boilers.

Third: With pulverized fuel there are no standby losses with change of load or when shutting down, such as banked fires, etc.

Fourth: With properly designed pulverized-fuel apparatus nothing of a mechanical nature takes place in the furnace. In stoker and grate firing not only is the mixing with the air done in the furnace, but the presentation of fresh surfaces of combustible to the air supply must take place by the removal of the ash and its discharge through the grate bars, or the pressure must be great enough to force the air supply through the ash bed.

Adaptability.—Pulverized fuel is here pre-eminent. The primary feature is the possibility of burning all

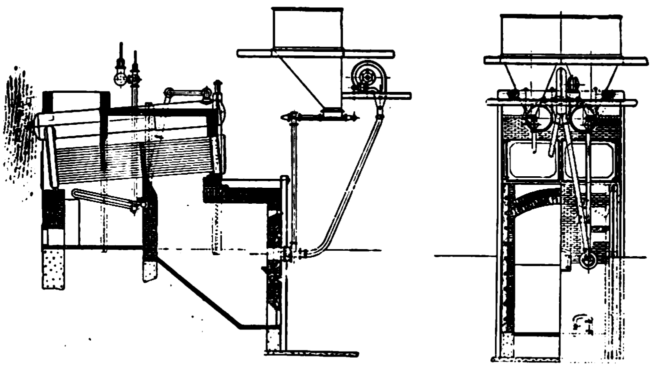


Fig. 2.—425-Hp. Heine Boiler Arranged for Pulverized-Coal Firing.

grades of fuel without affecting the efficiency of the furnace. To burn anthracite and very low grades of fuel requires a furnace allowing a return flow of the flame past the incoming flame, to heat up the incoming fuel, and in furnace of this type fuel containing over 50% ash has been burned with high efficiency. The stoker is very much restricted in comparison.

The flexibility in the use of pulverized fuel is perfect, and the fire may be instantly adjusted to suit any condition of overload or lower load, including the cutting in and out of the boilers. The paramount importance of this feature and the utter impossibility of approaching it with stoker or grate firing is readily evident. Furthermore, the operation and the determination of conditions for complete combustion may be made automatic, the result being a smokeless and sootless boiler plant, which is essential in modern cities.

Furnace Design.—A few words on the design of furnaces for pulverized fuel may be of interest. The primary requisite for good results is to maintain low velocities in the furnace. The combustion is no less perfect with high velocities, but this will result in damage to the linings and in their erosion. A furnace cubical in shape usually gives the most satisfactory results.

The burners should inject the coal under low pressure and should permit of varying the density of the mixture in the burner itself. Their location and number will depend upon the size of the boiler and rating required, and also may be varied to suit the grade of fuel. High boiler ratings such as are used in modern boiler practice can be obtained when desired, and such overratings should be predetermined and the furnace volume designed accordingly.

It will be noted that pulverized coal behaves more nearly like liquid and gas fuels than it does like lump coal and that it is in the ideal state for burning with the highest possible efficiency. It has been shown that it is superior to lump coal as regards all three factors of overall efficiency and these statements are susceptible to proof upon investigation. The novelty of the pulverized-fuel plant is rapidly beginning to disappear, and on account of the fact that all obtainable coals are apparently becoming more inferior in quality, the interest in the use of pulverized fuel is very general throughout the United States and other countries.

In Table 1 will be found an itemized statement of the costs of pulverizing coal, and elsewhere some statements as to the cost of stoker operation for comparison purposes. Table 2 gives a list of boiler in-

TABLE 1—COST OF DELIVERING PULVERIZED FUEL TO BOILERS.

	100-ton plant, dollars per net ton.	1000-ton plant, dollars per net ton.
Power at ¾ ct. per kw-hr. and 17 kw-hrs. per net ton	$0.1275	$0.1275
Labor at 40 cts. per hr.	0.14	0.04
Drier coal at $5 per net ton delivered	0.06	0.06
Repairs	0.07	0.07
Total actual cost of pulverizing per net ton	$0.3975	$0.2975
Interest at 6%	0.105	0.039
Depreciation	0.12	0.04
Taxes and insurance	0.035	0.013
Total cost per net ton	$0.6575	$0.3895

stallations using pulverized coal and Table 3 reports of preliminary tests made on some of the pulverized-fuel installations now in operation. While these do not show the maximum efficiency to be expected with the further development of the art, they nevertheless indicate that the inherent difficulties have been solved and that at the present moment pulverized fuel is in a position to compete advantageously with any other method of burning solid fuel under boilers.

Comparison on an Efficiency Basis.

One of the most prominent engineers in this country, a member of the society, has stated that the combined boiler and furnace efficiency by the month, day in and day out, of a modern stoker-fired power plant with the best average plant operation is not better than from 63 to 65%, although a carefully conducted test on one boiler and furnace might show during several hours' run 75% efficiency. This statement has been confirmed by other engineers.

The results with pulverized fuel would be totally different. This is no apparent reason why a combined furnace and boiler efficiency of 75%, and even higher, could not be maintained throughout the year, as the operation of the plant would be practically equivalent to that of a fuel-oil installation, in which stand-by losses, banked fires, etc., are almost entirely eliminated. Unquestionably there should be a saving, under these circumstances, of 12 to 15% of the total coal consumption in favor of pulverized coal, and this reduction, on a basis of even a 2000-boiler-hp. plant, will show a very fair return on the investment, neglecting the fact that a lower-grade and cheaper coal could be used.

Cost of Pulverizing Coal.

The cost of pulverizing the coal is of prime importance as low costs are essential for success and are achieved when the quantity used per day of 24 hours exceeds 100 tons. The cost of pulverizing is made up of a number of items as follows:

Power.—The power required is from 12 to 13 kw-hrs. per net ton of coal crushed, dried and pulverized. The additional power required for transferring the coal to the point of use and feeding it to the boilers will vary considerably, depending upon the distance transported, the size and number of the boilers, and the conditions under which they operate. The power required for this latter purpose varies between 4 and 6 kw-hrs. per net ton, so that the total power is 17 or 18 kw-hrs. per net ton. In the following paragraphs the cost of power has been assumed at ¾ ct. per kw-hr.

Repairs.—The item of repairs, including material, labor and general upkeep of the plant or maintenance, for the entire pulverizing plant and burning equipment will vary from 7 to 10 cts. per net ton of coal handled. The figures depend upon local conditions, and the size and general arrangement of the entire installation.

Drier Fuel.—The item of coal for drying depends directly upon the percentage of moisture and upon the price of coal. Ordinarily only from 1 to 1¼% of the total amount of coal used is required for drying. Assuming coal to have an average of 7% moisture as received and the cost to be $2.50 per net ton, the cost per net ton of drying the coal will be 3 cts. At $5 per net ton the cost of the drier coal will be 6 cts.

Labor.—This item is the greatest variable in connection with the pulverizing of coal, due to the increased output that can be obtained in larger plants per man employed. It is also subject to local rates of wages. For example, assuming labor at 40 cts. per hour, a plant of 100 tons daily capacity, properly designed and equipped, will require approximately 34 labor-hours to prepare the fuel and deliver it to the conveyors, whereas in a plant having a daily capacity of 1000 tons, approximately 115 labor-hours are required. Therefore the labor cost would be 14 cts. per net ton in a 100-ton plant, only 4 cts. per net ton in a 1000-ton plant, and as low as 2½ cts. per net ton in a plant of 5000 tons daily capacity.

Interest.—The interest item is based on 6% of the entire investment, and the cost of the pulverized-coal plant and burning equipment will of course vary considerably with the conditions under which the plant is installed. Roughly speaking, however, the actual investment will vary from $12.80 per kw. output in a 5000-kw. plant down to $4.80 per kw. in a 50,000-kw. plant and $4.12 in a 100,000-kw. plant (assuming a turbogenerator water rate of 16 lbs. and continuous boiler and furnace efficiency of 75%).

All these figures in relation to cost are based on the present high prices. The investment required for a 5000-kw. plant using 100 tons of pulverized coal daily is approximately $64,000 and for a 50,000-kw. plant using 1000 tons of pulverized coal daily, approximately $240,000, so that on a basis of 6%, and allowing for 365 days' continuous operation, the interest item will vary from 10½ cts. per net ton in a 100-ton plant down to 3.9 cts. per ton in a 1000-ton plant.

Depreciation.—Depreciation in a coal-pulverizing plant is usually calculated as follows: The life of the building is considered as 40 years, of the coal driers as 15 years and of the balance of the equipment as

TABLE 2—BOILER INSTALLATIONS USING PULVERIZING COAL

Date of installation.	Name of Company.	Location.	No. of boilers.	Horsepower rating and make of boilers.	Furnace design, per cent of rating.	Coal used.
Aug., 1916	M., K. & T. R. R.	Parsons, Kan.	8	250 O'Brien	125-150	McAllister Cherokee slack, Kan. semi-anthracite. Texas lignites, San Bois coal, Oklahoma.
Nov., 1916	American Locomotive Co.	Schenectady, N. Y.	1	300 Franklin	150	
June, 1918	U. S. Verde Extension Mining Co.	Verde, Ariz.	2	439 Stirling	150	Gallup and semi-lignite.
Feb., 1918	Ash Grove Lime & Cement Co.	Chanute, Kan.	1	371 Heine	150	Various grades of Kansas coals.
June, 1918	Garfield Smelting Co.	Garfield, Utah	2	371 Stirling	150	Wyoming lignite, Wyopa, Wyoming lignite, Keystone, Utah, bituminous from various mines.
Nov., 1918	Puget Sound Light and Power Co.	Seattle, Wash.	10	4-300 B. & W. 2-600 B. & W. 3-400 B. & W. 1-500 B. & W.	150	Renton buckwheat. Washington bituminous lignite and sub-bituminous.
Nov., 1917	Sizer Forge Co.[1]	Buffalo, N. Y.	5	250 Rust	125	Pittsburgh and Pennsylvania.
Mar., 1919	British Columbia Sugar Refinery Co.	Vancouver, B. C.	13	2-504 Badenhausen 2-250 B. & W. 9-110 HRT	150	Vancouver, B. C., bituminous and lignite.
July, 1918	Milwaukee Electric Railway & Lighting Co.	Milwaukee, Wis.	5	468 Edge Moor	150	Indiana and Illinois bituminous, Pittsburgh and Youghiogheny.
Mar., 1919	Allegheny Steel Co.	Allegheny, Pa.	1	333 Wickes	...	Pittsburgh coals.
June, 1919	Inland Steel Co.	Chicago Heights, Ill.	1	250 Heine	150	Illinois bituminous.
June, 1918	Pacific Coast Coal Co.	Seattle, Wash.	10 8	150 HRT 100 HRT	... ...	Renton buckwheat. Washington bituminous, lignite and sub-bituminous.
Nov., 1918	Susquehanna Collieries Co.	Lykens, Pa.	1	250 B. & W.	200	All grades of anthracite washery culm, mine dirt, No 3 buckwheat, Lykens slush, Lytle slush.
June, 1919	Lytle Coal Co.	Lytle, Pa.	6	333 B. & W.	200	All grades of anthracite, washery culm, Lytle slush.
May, 1919	Garfield Smelting Co. (2d installation)	Garfield, Utah	4	371 Stirling	150	Wyoming lignite, Wyopa, Wyoming lignite, Keystone, Utah, bituminous from various mines.
Sept., 1918	L. S. Smith Bldg.	Seattle, Wash.	2	1-300 B. & W. 1-200 B. & W.	... ...	Obtain and use coal from Pacific Coast Coal Co.
Sept., 1918	Crystal Natatorium	Seattle, Wash.	2	72x18 HRT	...	Obtain and use coal from Pacific Coast Coal Co.
Sept., 1918	Crystal Natatorium	Seattle, Wash.	2	72x18 HRT	...	Obtain and use coal from Pacific Coast Coal Co.
Sept., 1918	Pacific Coast Coal Co.	Seattle, Wash.	12	2-250 Wickes 2-125 Ames (72x16) 6-125 Chandler & Taylor 2-125 Casey-Hedges	...	Obtain and use coal from Pacific Coast Coal Co.

[1]Also use some waste heat from pulverized-coal-fired furnaces.

to the high voltage *per se,* and can remember no case where a person has received a dangerous shock on the motor side of the distributing switchboard. Certainly the record of 2300-volt motor equipment is as good if not better than that of low-voltage equipments as regards fire and personal accidents.

In view of favorable experience with such equipment from the safety standpoint, it is now proposed to omit the requirement calling for the lead sheathing where no moisture is liable to be present, it being claimed that the lead sheathing does not contribute to safety in dry places. Assuming that the cable will not be subjected to moisture, there have heretofore been five possible advantages attributed to the lead sheathing.

First and most important, the sheathing may serve as a protection to life in that being a conductor it will bridge across any poor joint in the conduit system and insure that the portion of the conduit beyond the faulty joint will be effectually grounded. In other words, it is expected that the sheathing will serve as a bond between the various lengths of conduit, junction boxes, etc. If we could be sure that there were no poor joints between conduit, boxes, etc., there would be no need of the sheathing as a bonding medium. While all joints may be well made when the equipment is installed, there may be some question as to whether they will remain so indefinitely, especially when in buildings where there is a considerable amount of vibration.

Second, it has been claimed that the lead sheathing tends to protect the insulation over the conductors from mechanical injury while the cable is being drawn into the conduit. Injury to the insulation is more liable to give trouble than would be the case if the voltage was lower.

Third, owing to the metallic sheathing intimately surrounding the insulation on the conductors, it is nearer the conductors than the conduit wall except at one point, and therefore if a breakdown to ground occurs followed by arcing a short-circuit between phases is liable to occur quickly and cause the circuit-breaker protecting the faulty cable to open the circuit more promptly than if the sheathing was not present.

Fourth, another claim made for the sheathing is that it tends to prevent flattening out of the larger rubber-insulated cables, which results in the insulating wall between conductors and conduit decreasing in thickness.

Fifth, it has been claimed that the sheathing tends to preserve the insulation, especially when varnish cambric is used.

The weight to be put on the advantages claimed for the sheathing is problematical and the question is whether they are of sufficient importance to require the sheathing with the attendant increased cost of the installation. During the period when 2300-volt installations were being tried out, there is but little doubt that the increased cost was warranted. In view of the satisfactory results obtained, however, from the equipment, the question now is whether the increased cost due to the sheathing is justifiable. The second, third, fourth and fifth advantages claimed are of minor importance and should not be considered except in connection with the first. From the standpoint of fire hazard it is possible that the sheathing could be left off in dry places without unduly increasing the hazard, but from a personal hazard standpoint there may be objection.

The Code at present requires rubber insulation on 2300-volt conductors, but there have been many installations put in where varnished cambric was used. This kind of insulation has been used to a large extent in power houses, etc., where high voltages were involved. The experience has been uniformly good even in places where the requirements are most exacting. While there may have been some failures, these have not been more than would have been expected if the insulation were of rubber. There is now a demand that the Code recognize and permit the use of this insulation and there seems to be justice in this.

Discussion on Change in Code Limit for High-Potential Systems.

Another matter now under consideration involving a possible change in the Code is whether 4150-volt Y-connected systems have a sufficiently greater hazard than 2400-volt delta-connected systems to require them to fall under different classes of the Code. Many systems have started out 2400-volt delta-connected and then to meet the needs of increased load have been changed to 4150-volt Y-connected. The change has put them in the extra-high-potential class, and therefore the Code requires that they be kept off from buildings and that certain other precautions be taken. The limitation of 3500 volts for the high-potential class has been used for many years. When this was first decided upon, electrical apparatus and insulation were undoubtedly inferior to that of today, so that it is possible that this limitation may be moved higher without unduly increasing the hazard. If the voltage limitation under discussion is increased, it may be wise to limit the voltage which may be used at motors scattered throughout buildings and accessible to anyone, to that at present permissible, namely 3500, but practically 2300 volts.

Possibly another change which might be made to advantage in the Code would be to make provision for allowing cables carrying voltages up to the limit now permissible to enter noncombustible transformer buildings or vaults located in the midst of a group of buildings, provided the cables were run underground the entire distance between property line and transformer building. Again why not, under favorable conditions, permit motors of voltage up to, say, 13,000, to be installed in separate noncombustible rooms accessible only to the electrician, provided the high-voltage cables are in underground conduit just as mentioned in the case of the lines to transformers?

It seems that the demand for high-potential equipment in and about buildings is sure to increase under certain conditions, and the Code should be in such shape that they will not be discouraged when the conditions are favorable. It is hardly necessary for the Code to go into detail regarding such equipments. Broad fundamental rules, together with good judgment on the part of the inspectors, are all that are needed.

NEED OF ELECTRICAL GOODS IN RUSSIA.

At the weekly meeting of the Electric Club of Chicago, held Nov. 11, Marcus Stowe Hill, who has been in Russia for two years on export work, addressed the members, telling them of industrial conditions in that country. He said Russia was five years in arrears on imports and he showed by inquiries the large demand for electrical material of all kinds. Valuable suggestions for methods of making quotations and handling shipments were also given.

POWER PRODUCTION OF COUNTRY DURING FEBRUARY TO APRIL.

Division of Power Resources, United States Geological Survey, Issues Report on Power Production by Fuels and Water Power.

Continuing a practice inaugurated a few months ago, the United States Geological Survey, through its Division on Power Resources, has compiled the accompanying data on the production of electric power and the consumption of fuel by public utility power plants in the United States for the month of April, 1919. The figures as given are tabulated alongside the corresponding data for February and March for ready comparison. Table I gives the power production in thousands of kilowatt-hours segregated as to production by water power and by fuels. Table II gives the details of the latter classified as to the three principal kinds of fuel and amounts thereof.

The reports of electric power output and fuel consumption for February, March, and April are based on returns received from about 3100 electric power plants engaged in public service, including central stations, electric railways, and certain other plants, the output of which contributes to the public supply. Returns were received from plants whose aggregate capacity is about 90% of the generating capacity of all public utility plants. Estimates of the output of plants which did not make returns were made from available information. The total "estimated" power is only about 7% of each monthly total. The average daily output in kilowatt-hours for the different months is as follows: February, 106,540,000; March,

TABLE I—THOUSANDS OF KILOWATT-HOURS PRODUCED

State.	By Water Power			By Fuels		
	February.	March.	April.	February.	March.	April.
Ala.	39,341	30,275	28,488	11,059	4,907	4,477
Ariz.	3,967	6,689	7,577	17,448	21,807	16,488
Ark.	79	72	69	6,252	6,625	6,030
Calif.	187,486	215,914	227,775	38,268	33,939	33,645
Colo.	13,141	14,254	15,019	17,279	17,144	14,365
Conn.	7,043	14,884	15,804	42,589	37,469	35,525
Del.	......	......	......	5,551	4,784	4,655
D. of C.	......	......	......	18,094	19,331	18,457
Fla.	678	892	777	8,582	8,789	7,776
Ga.	35,909	37,264	31,404	6,054	6,082	6,200
Idaho	41,430	39,913	36,019	168	257	155
Ill.	15,611	15,282	16,134	198,899	207,673	194,109
Ind.	3,682	3,654	3,511	52,342	54,617	51,980
Iowa	44,182	48,696	48,737	23,993	24,964	23,646
Kans.	1,267	1,223	913	29,619	30,458	30,870
Ky.	4	4	4	18,794	19,127	18,555
La.	......	......	......	14,130	14,876	14,582
Maine	18,831	20,157	18,708	73	73	93
Md.	284	371	358	18,435	13,898	11,442
Mass.	18,898	31,365	32,322	101,799	100,030	90,601
Mich.	52,236	59,649	65,211	97,285	96,125	88,363
Minn.	18,303	32,740	43,204	26,826	15,220	7,261
Miss.	......	......	......	5,115	5,393	4,927
Mo.	4,297	5,920	4,418	37,207	40,551	36,245
Mont.	68,408	77,869	77,853	883	888	821
Nebr.	748	959	1,118	15,493	16,413	16,004
Nevada	3,198	2,812	2,470	137	121	727
N. H.	4,946	5,763	5,683	2,309	2,114	1,898
N. J.	162	197	187	75,665	76,412	76,642
N. Mex.	57	57	86	1,416	1,556	1,455
N. Y.	195,219	223,078	220,667	288,271	288,537	270,644
N. C.	42,645	46,318	45,755	7,149	7,426	7,082
N. Dak.	......	......	......	2,312	2,400	2,103
Ohio	3,053	3,932	3,565	189,041	194,937	183,702
Okla.	167	183	149	13,080	13,796	12,989
Oregon	27,876	29,113	27,248	4,754	3,759	3,539
Pa.	55,098	62,509	58,466	238,970	246,930	233,597
R. I.	562	1,042	726	28,767	18,405	16,839
S. C.	43,899	43,394	43,287	3,876	4,010	3,676
S. Dak.	2,683	3,579	4,104	2,949	3,208	1,920
Tenn.	43,640	45,222	37,999	9,774	10,680	10,405
Texas	266	284	305	43,070	47,616	44,816
Utah	13,135	15,463	17,434	......	......	......
Vermont	13,428	18,574	19,482	173	179	187
Virginia	17,833	20,122	19,298	17,254	18,709	16,539
Wash.	70,779	79,346	74,575	4,171	4,521	4,164
West Va.	1,378	1,593	1,642	52,620	58,108	59,396
Wis.	32,534	47,531	48,880	32,916	33,075	24,682
Wyo.	248	172	138	3,580	3,898	3,514
Totals	1,148,634	1,308,329	1,308,573	1,834,487	1,841,837	1,717,778
Total, by water power and fuels				2,983,121	3,150,166	3,026,361

TABLE II—FUELS REQUIRED FOR POWER PRODUCTION.

State.	Coal—Short tons			Petroleum and derivatives, barrels			Natural gas Thousands of cu. ft.		
	February.	March.	April.	February.	March.	April.	February.	March.	April.
Alabama	27,026	16,467	14,836	8	8	8	......	......	......
Arizona	6,316	6,160	5,360	124,520	88,011	65,824	......	......	......
Arkansas	13,386	11,177	9,902	447	489	456	63,430	85,398	97,726
California	......	......	......	199,388	185,127	161,651	21,611	181,785	273,642
Colorado	41,507	44,079	36,135	100	95	98	......	......	......
Connecticut	63,942	62,234	58,094	333	323	279	*20,766	*12,615	*11,309
Delaware	8,610	7,713	7,000	......	17	......	......	......	......
District of Columbia	21,418	21,440	20,983	......	......	......	......	......	......
Florida	3,424	5,594	3,056	32,714	32,025	28,785	98	151	3,780
Georgia	16,529	11,934	12,009	120	120	167	......	......	......
Idaho	120	111	121	10	10	10	......	......	......
Illinois	335,309	350,824	318,378	3,918	3,198	2,142	......	......	......
Indiana	141,060	157,931	143,829	448	167	420	2,159	2,108	1,909
Iowa	85,745	79,694	72,211	787	730	743	......	......	......
Kansas	47,588	51,022	48,636	47,747	60,803	58,432	83,405	86,901	65,374
Kentucky	38,252	39,386	37,380	358	351	353	......	......	......
Louisiana	14,305	13,885	13,878	30,811	30,094	28,192	55,092	47,458	49,599
Maine	383	348	357	7	7	17	......	......	......
Maryland	28,452	23,657	20,755	19	18	30	1,500	1,500	1,500
Massachusetts	129,171	143,525	129,877	24	14	17	......	......	......
Michigan	129,417	124,941	113,623	191	104	139	......	......	......
Minnesota	57,282	39,810	25,038	1,138	1,016	854	......	......	......
Mississippi	16,381	16,542	16,008	370	320	311	......	......	......
Missouri	86,645	89,531	82,143	33,571	21,053	19,519	......	......	......
Montana	5,537	5,591	5,455	530	492	488	1,008	960	907
Nebraska	29,946	30,956	29,813	3,512	3,509	3,433	......	......	......
Nevada	198	180	140	900	1,044	997	......	......	......
New Hampshire	5,395	3,911	3,241	20	20	3	......	......	......
New Jersey	112,366	115,711	114,137	92	103	80	......	......	......
New Mexico	4,045	4,438	3,627	1,060	1,360	1,373	......	......	......
New York	368,569	363,338	325,474	544	546	501	149,831	164,408	164,956
North Carolina	15,648	16,234	15,612	20	20	20	......	......	......
North Dakota	16,638	17,153	14,473	539	514	8,085	......	......	......
Ohio	314,873	321,643	289,610	739	842	764	250,488	323,320	333,684
Oklahoma	11,136	13,203	13,203	8,109	5,675	5,675	423,813	477,050	477,050
Oregon	223	433	223	27,684	19,459	15,456	......	......	......
Pennsylvania	401,874	412,561	396,096	22	14	16	42,301	54,450	53,533
Rhode Island	29,692	22,024	20,819	......	......	......	......	......	......
South Carolina	9,844	9,540	8,811	78	82	93	......	......	......
South Dakota	7,082	8,395	4,371	3,164	3,379	3,091	......	......	......
Tennessee	23,726	28,724	24,710	86	84	81	......	......	......
Texas	25,330	33,963	26,618	170,905	181,397	178,033	173,695	179,760	177,778
Utah	65	61	31	......	......	......	......	......	......
Vermont	542	412	246	2	2	2	......	......	......
Virginia	29,127	31,444	28,453	122	153	52	......	......	......
Washington	3,611	3,473	2,411	17,810	18,804	17,879	......	......	......
West Virginia	62,459	70,717	69,426	52	58	52	118,029	142,688	180,069
Wisconsin	69,225	74,987	53,037	644	662	565	......	......	......
Wyoming	12,450	13,384	12,242	8,470	9,062	8,840	16,294	18,349	16,129
Totals	2,873,265	2,920,031	2,651,888	722,133	670,381	614,045	1,423,520	1,778,901	1,908,945

*Artificial gas.

Discussion of Code Rules on High-Potential Systems

Comments on Relation of Present Rules to Developments in Field Practice, with Suggestions for Proposed Changes in Rules Given in Paper Presented to National Association of Electrical Inspectors

By G. S. LAWLER

Electrical Engineer, Associated Factory Mutual Fire Insurance Companies.

WHILE some manufacturing plants and large properties have been served with energy at high voltage for a number of years, the potential has been over 6600 volts in but few cases until comparatively recently. Within the last few years, however, the number of plants obtaining electrical energy from central stations has increased, this being due to the increased production of the factories having limited generating capacity and to coal shortage.

The amount of power purchased in the individual cases has generally become larger and the transmission voltages higher. Some manufacturing plants also generate and transmit large amounts of electric power at high voltages for their own use. The power involved in the supply required by a single manufacturing plant may be as great as many thousand kilowatts and the voltage as high as 150,000 volts. The greater the amount of power consumed the greater the tendency for high voltages.

Questions Involved on High-Potential Systems.

There are only a few rules in the National Electrical Code applying solely to high-voltage installations, and except for those covering constant-current systems and those pertaining to high-potential pole lines, the rules for voltages above 3500 are limited to the following: "Primary wires must not be brought into or over buildings except power stations and substations." There are also a few restrictions on the parts of an equipment supplied at low voltage through transformers connected to extra-high-potential lines.

Even though both the life and fire hazards increase with the voltage, there has never been any demand that the Code cover such equipment in detail. This has probably been due to the fact that the design, construction and installation of such equipment has been in the hands of those who usually understood all the factors entering into the varying problems. Engineers have been called upon to handle the installations and in order that the installations may be reliable from the standpoint of continuity of service they must also be reasonably safe from a fire standpoint. If the installation of high-voltage equipments was not generally in the hands of experts, it is probable that no amount of detailed Code rules would make them safe.

Owing to expediency, the need of keeping costs down and the desire to improve operating conditions, those responsible for the so-called extra-high-voltage installations may be inclined to slight certain features bearing on the fire hazard. To meet such situations the inspector should have sufficient engineering knowledge to say what should be done to correct the weakness under the particular conditions. In many ways it is better to have each case dealt with on its own merits with a few sound fundamental rules as a guide than to have rules which go into such detail that unwarranted inconvenience and hardship will result. The high-voltage installations must be safe, but no unnecessary obstacles should be put in their way, for they generally mean progress and are a real necessity under present conditions.

Except for 2300-volt motor installations and some occasional installations necessary in connection with the particular processes carried on, high-voltage equipments will be found in connection with power houses, substations, transmission lines, constant-current series lighting systems and transformer installations.

Fire Hazard in Power Stations.

Power houses and substations handling high voltages are usually operated by skilled men. This is especially true when they belong to public service companies and generally applies when they are under private control. The expert knowledge of the operators, combined with their natural desire to keep all apparatus in good condition and to have the property in their charge clean and neat, goes a long way to prevent serious fires occurring even when other conditions are adverse.

In modern noncombustible power houses and substations the danger from fire due to arcing between conductors removed from oil is reduced to a minimum, but in those of older design, where considerable woodwork is present, this must be considered, especially if the electrical equipment is of early design. It is not always feasible to change the arrangement in the older stations to remove this hazard, even though the management may fully recognize the desirability of improvement.

Another hazard of considerable importance is grouped combustible insulation on conductors. This may be corrected by putting the conductors in iron conduit, by ample spacing, or when this is impossible, by providing a noncombustible outer covering over the insulation of the separate cables or wires.

High voltages always mean the presence of apparatus containing oil. The higher the voltage and the greater the capacity of the apparatus the greater the amount of oil used. Some switches and circuit-breakers require several barrels of oil per tank, while large transformers may contain as much as 10,000 or 12,000 gals. of oil, the flash point of which may be as low as 300 deg. F. Under certain conditions the oil may be violently thrown from the apparatus and ignited. It is important that this apparatus be well chosen as to its capacity and suitably for the conditions to be met. It is also important that it be so installed that fire at one piece of apparatus will damage as small an amount of other property as possible.

That the oil type circuit-breaker should have ample rupturing capacity is especially important. It frequently happens that the breakers may be all right in this regard when installed, but that increase of generating or transforming capacity has rendered them inadequate. It is not always possible to provide this capacity with the smaller breakers, but in such cases protection may be afforded by larger breakers between them and the source of power, and the time-limit attachments can be set with discretion. The use of suitable reactances may also be advisable.

Another piece of apparatus which may be a fire hazard is the aluminum type lightning arrester. So far as its functions are concerned it is effective, but due to one of several causes it may fail and it should therefore be separated from other apparatus so that if ignited oil is thrown from it the damage will be confined to the particular arrester where the trouble originated. These arresters should be installed outdoors, but if indoors they should be in separate noncombustible rooms or inclosures by themselves. If the arresters are large it may be advisable to drain the floors of the rooms. The new oxide-film arrester contains no oil and therefore is without oil hazard.

The hazard due to the oil-insulated transformers is sometimes disregarded by those responsible for their installation. Transformers installed indoors should be segregated and placed in proper noncombustible drained rooms or vaults cut off from adjoining rooms. A design of transformer has recently appeared on the market having entirely inclosed terminals and large overflow drain pipes. This type seems to possess considerable merit for installation where the primary voltages are high and the transformers must be located close to buildings.

Present substation practice tends toward installations of the outdoor type when sufficient space can be obtained. With these substations care should be taken that they are so located and arranged that danger to other property will be avoided. The ground should not grade in such a way that burning oil will tend to flow towards nearby buildings.

Fire Hazards Incident to High-Voltage Lines.

The principal fire hazards incident to high-voltage lines are, first, that they may fall on lower voltage lines entering buildings and start fires; second, the lines may break and fall on buildings if any are beneath; and third, if they pass near a building on fire, the fire may be poorly fought owing to the natural hesitation of firemen to use hose streams in the vicinity of the lines due to fear of receiving dangerous shocks. There is another hazard incident to long transmission lines, namely, the increased liability of trouble in the power houses due to lightning.

The first hazard is at present inadequately cared for in the Code, but is receiving attention. The Bureau of Standards has put a great deal of thought on it and has prepared comprehensive rules to guard against it.

The remedy for the second and third hazards is obviously to keep the lines away from important buildings. The Code requires that they keep off of buildings, but is somewhat remiss as to keeping them a sufficient distance from buildings. The minimum safe distance between lines and buildings depends upon the voltage, the height of the buildings, the value of the buildings, etc. Even though a certain distance may be safe, it may not be enough to allow firemen to work without fear; therefore the distance should be liberal.

Experiments made by Prof. F. C. Caldwell indicate there is no danger of shocks from a hose stream when the distance between nozzle and transmission line is more than 25 ft., irrespective of the voltage. At this distance from the nozzle the stream has apparently broken up into drops and the electric path has been interrupted. However, most of us would feel decidedly uneasy handling a hose line if the water could reach a high-voltage conductor even though we were sure the stream had become well broken up into drops.

While emergency switches may be installed on poles outside a property under consideration, they do not entirely eliminate the hazard, for when out of sight of the switches especially at night, fire fighters cannot be certain that the switches have been opened or remain open. There have been instances where a second person has closed an emergency switch, believing he was opening it, when the switch had already been opened. Again, there is the possibility that the presence of the switch may be entirely overlooked. The only safe way is to keep the lines away from property where serious fire is liable to occur so that all consideration of them may be eliminated.

The installation of high-voltage transmission lines with the necessary transformers also causes the well recognized hazard that, through leakage or breakdown of transformer insulation, high voltages may be impressed on low-voltage circuits. When the potential of the secondary circuit is below 150 or possibly 250 volts, the hazard may be guarded against by grounding the low-voltage side of the transformers. When the voltage is higher, grounding the circuits may cause more of a hazard than it prevents.

One way of partially guarding such circuits is to provide a substantial spark gap on the secondary side of the transformers, the gap being such that it will break down if the voltage increases much over the normal voltage of the circuit. Arcing across the gap may create such a disturbance that attention will be drawn to the conditions and cause the affected circuits to be opened. In the meantime the voltage on the secondaries will probably be prevented from increasing unduly. This arrangement may be somewhat crude, but it has its advantages.

The most common high-voltage installation in buildings other than power houses and substations is the 2300-volt motor equipment. Special needs in some instances may require high voltages and special apparatus, but these are relatively few and are special cases which may be dealt with on their merits.

Code Rules on High-Voltage Motors.

The sections in the Code applying especially to high-voltage motors and their wiring are few, but apparently they have met the needs of the situation in the past. In brief they require that there be no exposed high-voltage conductors or parts; all wires must be inclosed in iron conduit; junction boxes, cases, etc., and non-current-carrying metal inclosures must be thoroughly grounded; wires must be lead sheathed with suitable means of preventing entrance of moisture at the ends of the sheathing.

These requirements call for a high-grade installation. It is probably due to this and to capable maintenance that 2300-volt motor equipment has been so successfully used inside buildings where many nonelectrical persons are about. I have yet to learn of any fire caused by such equipment which can be attributed

TABLE 3.—REPORT OF PRELIMINARY TESTS MADE ON PULVERIZED-FUEL PLANTS.

Date of test.	Location of plant.	Duration, hrs.	Coal used.	Efficiency maintained, per cent.	B. t. u. per lb. of coal as fired.	Ash, per cent.	Rating, per cent.
Apr. 16, 1917	Seattle, Wash.	14.5	Renton buckwheat	77	10,000	11.60	122
Dec. 4, 1917	Chanute, Kan.	5	Kansas bituminous	72	11,996	17.7	125
Dec. 12, 1917	Chanute, Kan.	5	Kansas bituminous	83.94	12,500	18.25	125
Jan. 28, 1918	Chanute, Kan.	(25 days)	Kansas bituminous	78.1	11,435	.....	100
Apr. 26, 1918	Parsons, Kan.	6	Kansas bituminous	80.3	12,900	17.49	...
Apr. 28, 1918	Parsons, Kan.	6	Kansas bituminous	80.9	12,289	17.49	130.8
June 14, 1918	Milwaukee, Wis.	12	Illinois and Indiana screenings	83.3	10,897	15.89	117.7
Nov. 5, 1918	Lykens, Pa.	10	Lykens No. 3 buckwheat anthracite	84.2	12,530	16.92	135
Nov. 15, 1918	Lykens, Pa.	5	Lykens slush buckwheat anthracite	81.2	13,653	11.09	142
Nov. 22, 1918	Lykens, Pa.	5	Lykens slush buckwheat anthracite	85	12,753	18.04	146
Nov. 23, 1918	Lykens, Pa.	5	No. 3 buckwheat anthracite	72.7	12,530	16.91	115
Dec. 2, 1918	Lykens, Pa.	5	Lytle slush anthracite	75.3	15,420	23.92	188
Feb. 1, 1919	Seattle, Wash.	24	Issaquah screenings	78.95	11,660	14.31	126
Feb. 2, 1919	Lykens, Pa.	4	No. 3 buckwheat anthracite	78.9	13,067	14.02	177
Apr. 7, 1919	Vancouver, B. C.	4	Nanaimo slack	83.3	9.364	28.4	125
Apr. 17, 1919	Vancouver, B. C.	5	Nanaimo slack	77.1	10,050	24.3	160
Feb. 3, 1919	Lykens, Pa.	5.5	No. 3 buckwheat anthracite	78.9	12,530	14.00	...
Sept. 24, 1918	Verde, Ariz.	(6 days)	Gallup, New Mexico	79.5	10,680	14.31	155

20 years. With a 100-ton pulverized-coal plant and burning equipment the depreciation item will be approximately 12 cts. per net ton, and in a plant of 1000 tons daily capacity it will be approximately 4 cts. per net ton.

Taxes and Insurance.—Taxes and insurance are based on 2% of the entire investment and for a 100-ton plant this item is approximately 3½ cts. per ton and for a 1000-ton plant, 1.3 cts. per ton. Summarizing, the foregoing results show that the total cost of pulverizing and delivering pulverized coal to boilers is approximately as given in Table 1. The cost of the pulverizing equipment complete compares favorably with the stoker equipment when everything, such as coal and ash-conveying machinery, etc., is taken into consideration, and in large plants it is considerably less.

The equipment required for a first-class stoker installation must necessarily be taken into consideration when making a comparison of the costs of the different installations. The cost of pulverizing is an item of expense which must be included with the cost of the fuel, and since it includes the complete handling of the coal, the expense of crushing, handling, power, repairs, maintenance, interest, taxes and insurance covering the stoker equipment must also be considered when making comparisons.

Stoker installations and operation are expensive and the investment is as great, if not greater, than that required for a pulverizing equipment in plants of 10,000 kw. and upward. For example, in a plant using 1000 tons in 24 hours the cost of operation will be approximately as follows:

Power for stoker, 2% of the total boiler hp. developed	$180.00
Power for fans, 2% of the boiler hp. developed	180.00
Coal handling, 100 kws. at ¾ ct. per kw-hr.	18.00
Labor for coal handling, 2 men per shift and 3 shifts at 40 cts. per hour	19.20
Repairs for stokers at 30 cts. per boiler hp. per annum	17.50
Repairs for coal-handling equipment	10.00
	$424.70
Total cost per net ton	$0.425

To this must also be added the cost of fuel used to heat the moisture in the coal, interest, depreciation,

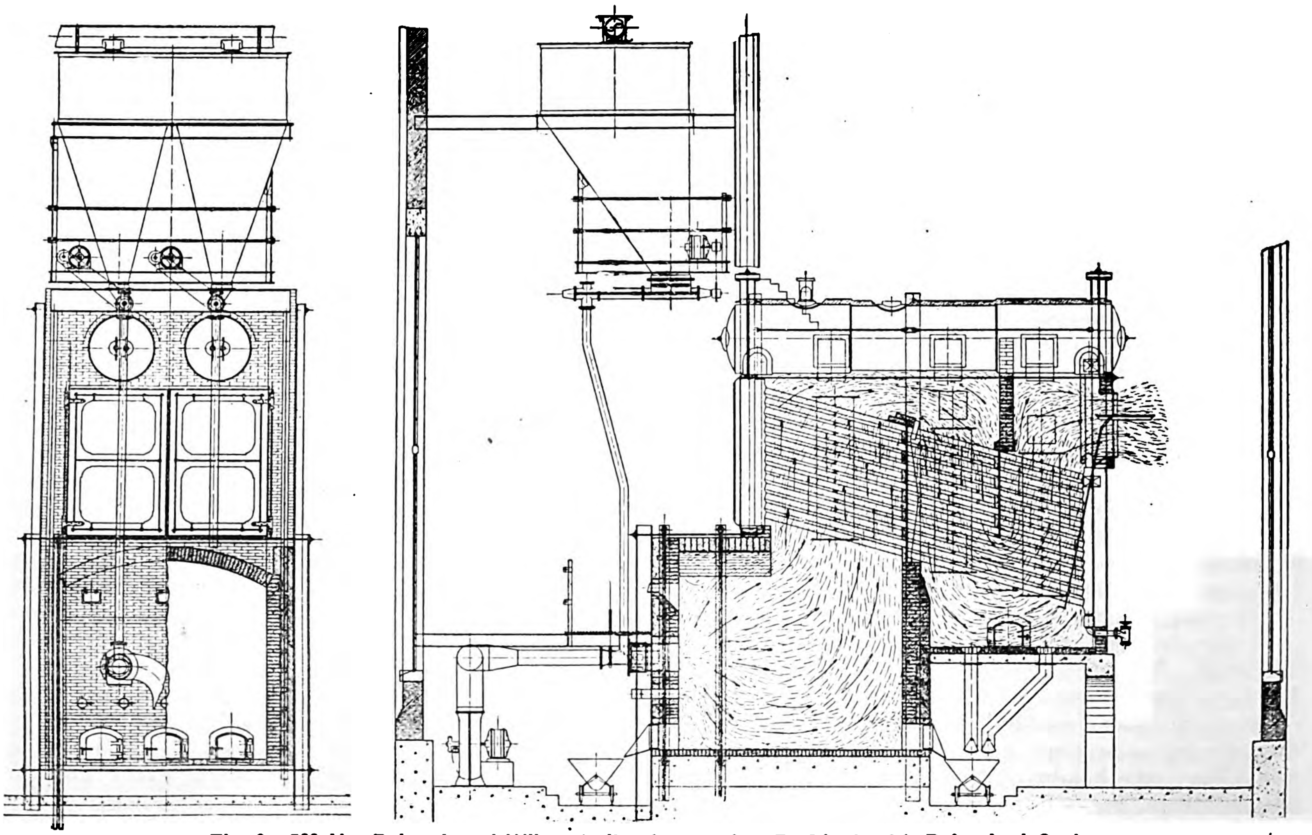
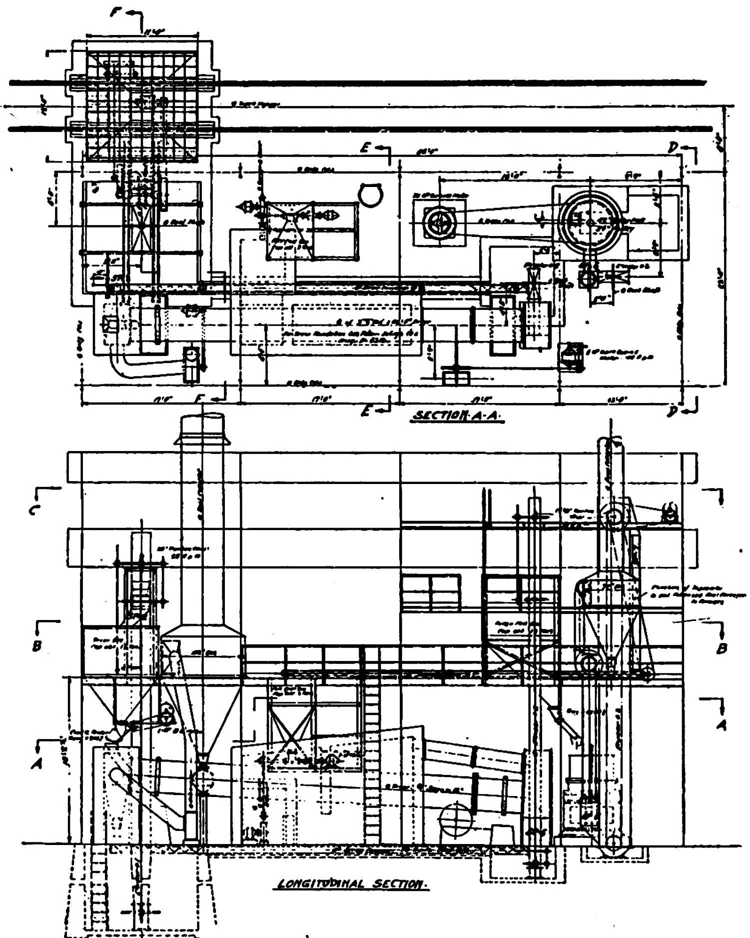


Fig. 3.—500-Hp. Babcock and Wilcox Boiler Arranged to Be Fired with Pulverized Coal.



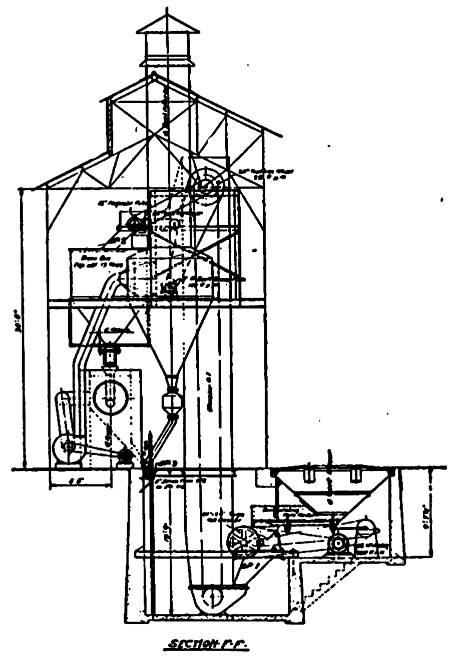


Fig. 4.—Standard Pulverized-Coal Plant With 42-In. Mill and 3½ by 42-ft. Drier.

insurance and taxes, showing that even on a basis of equal efficiency the cost of operating a pulverized-coal equipment is considerably less than the cost of operating an equivalent stoker installation. It should be stated that the figures just given are based on present average results in both cases.

NEW ELECTRIC IRON-ORE REDUCTION WORKS IN ITALY.

Hydroelectric Works Smelt Iron Ore Direct—Competitive Practicability Not Yet Assured.

The Ansaldo Co. has just started up its new 20-ton electric furnaces for smelting iron ore at Cogne, Val d'Aosta, in the northwestern corner of Italy, adjacent to the French and Swiss frontiers. The country is rugged in the extreme, with Mont Blanc towering in the near background. Considerable deposits of iron ore have been found, which in quality ranks with the best Swedish ore. Falling water capable to developing 80,000 hp. of electrical energy is near at hand. Conjunction of this latent electrical energy with native iron was hailed a few years ago as an epoch-making find for Italy. The Ansaldo Co., which undertook to develop the Italian ore deposits, after three years of preparation and the expenditure of an enormous sum, has actually begun to smelt iron ores in electric furnaces.

It is a question, says Commercial Attaché A. P. Dennis, of Rome, whether the venture will be successful. Can Italy turn out iron and steel in electric furnaces as cheaply as it can buy the material from Germany and the United States? An expert estimates that the cost of hydroelectric energy in the form of continuous current working 24 hours per day and 365 days in the year must be held down to $9 per horsepower-year to assure commercial success to electric smelting. Before the war the cheapest hydroelectric plant in the world was at Trondhjem, Norway, with an annual horsepower cost of $6. In Italy hydroelectric undertakings rarely run under $100 per horsepower for installation, which gives an interest charge of $6 to start with; adding to this $2 for amortization and $3 for overhead, we get $11 as the cost per horsepower-year.

It is stated on good authority that German pig iron is now being offered for Italian delivery at 40% lower cost than it can be produced in the new works.

It is suggested that the new electrical energy developed by the Ansaldo Co. at Cogne might be profitably conducted to the plains of Lombardy for the actuation of industrial plants and the electrification of steam railways. Undoubtedly the iron ore deposits in the Cogne region form no inconsiderable addition to the known wealth of Italy. These ores some day, when the prices of coal are lower than at present, may be transported on an easy down-grade haul to the port of Savona on the Gulf of Genoa for treatment with coal imported by sea.

PROPOSE POWERFUL WIRELESS STATION NEAR VANCOUVER.

Construction of a high-powered wireless station, which when completed will be the most powerful radio station in the British Empire, is proposed for the vicinity of Vancouver, B. C., by the Canadian Marconi Wireless Co.

The station, which will cost, it is estimated, in the neighborhood of $2,000,000, is designed to handle commercial business between Canada and the Orient, and a station of like power and cost will be built in Japan.

101,620,000; April, 100,880,000. Amount produced by water power: February, 39%; March, 42%; and April, 43%.

In view of the temporary curtailment in the coal supply resulting from the strike of bituminous coal miners, it may be of interest to note the amount of coal required for operating public utilities in the United States. The average monthly consumption of coal by electric power plants engaged in public service for the three months covered by this report was 2,815,000 tons, or about 95,000 tons per day. This is equivalent each day to about 2100 carloads of 45 tons. The amount needed for electric public utility plants in New England, New York, Pennsylvania, and New Jersey is 36,900 tons per day, or about 820 carloads.

BRITISH ELECTRICAL INSPECTOR REPORTS ON FACTORIES AND ACCIDENTS.

Mr. Ram Reviews War-time Work and Practice in Central Stations and Factories.

G. S. Ram, the British Government electrical inspector of factories, has issued his report on the use of electricity in factories during the last four years of the war. His prewar reports will be recalled by our readers as forming instructive reviews of the technical and other defects, accidents, etc., that occurred in connection with factory and public electrical installations. The one now issued, though it has not reached former proportions, is a commendable attempt to resume normal publication and it contains a great deal of useful information. As we have already put before our readers particulars of the vast extension made during the war in the use of electricity in factories for munitions production, we need not deal with the sections relating to this matter excepting to note that in connection with the building and equipment of some of the new stations and supply extensions some very remarkable feats were accomplished under most trying conditions.

Mr. Ram briefly reviews the work performed by women as substitutes for men in central stations or electricity works and the efforts made to train and employ disabled soldiers and sailors. While the new generating station work is described as good, attention is directed to an important matter which was overlooked. In stations intended to maintain a continuous supply, night and day and Sundays, medium-pressure three-phase boards were so arranged as to make it impossible to carry out any work, e. g., overhaul of an oil switch, in safety. No isolating switches had been provided between the busbars and the oil switches and no divisions between the panels. This arrangement was found on the main switchboards where the supply had been at medium pressure and in high-pressure stations in regard to the medium-pressure auxiliary switchboards. These switchboards controlling all the auxiliary plant in the station are just as important as regards maintenance of the supply as the main switchboards.

The electrical work for explosives works and filling factories necessitated special precautions on account of explosive risks or liability of damage to wiring and apparatus from acid fumes. "Danger" buildings had wherever possible been lighted entirely from outside, and motors and all switchgear, fuses, etc., being either in separate buildings or in rooms completely shut off. In some the lighting was necessarily inside, special well-glass or bulkhead type of fittings being used. Motors, where inside, were pipe-ventilated or provided with forced draft ventilation with spray-washed air. In no case was any explosion or fire attributable, so far as could be ascertained, to any electrical installation or defect therein.

Several new steel rolling-mill installations had been put in, but the most striking development, says the inspector, has been that made in the application of the electric furnace in steel manufacture. In this connection the large currents required necessitate the provision of a transformer room as close as possible to the furnace. The main supply is in many cases at 11,000 volts. Unfortunately the equipment of the transformer house was in many instances carried out in a dangerous manner. The apparatus was often badly arranged and the protection of the high-tension conductors was totally inadequate, these being treated as of no more consequence than if at 100 volts.

In discussing the great increase in the use of electricity for welding during the war, Mr. Ram says that for resistance or contact welding there is of course no danger from handling the metal being welded at very low pressure, but there is danger in case of a breakdown of the insulation of the transformer causing the welding jaws and the metal being welded to become charged at the pressure of the supply circuit, generally 200 or 400 volts, and fatal accidents from electric shock have occurred in this way. The danger can be overcome by grounding one point of the secondary circuit. Mr. Ram found a number of welding machines in different works, notably for the welding of chains, where serious dangers existed through exposure of conductors, terminals, switches, etc., of the primary circuits. In regard to the use of screens to protect the eyes of operators in welding with metallic electrodes, he finds that masks or helmets are not liked by workmen, who prefer to use the hand screen wherever possible.

In the case of alternating-current welding it is very necessary that the electrode holder should be so constructed that it is impossible for the worker to touch any live part with his hand while holding the handle. Many electrode holders were found in use which did not comply with this elementary requirement. Another important point is that one pole of the circuit, that which is connected to the article to be welded, shall be efficiently grounded. Where this is done the only danger point, assuming that the flexible conductor is properly insulated and protected and the resistances, etc., are properly guarded, is the electrode holder and the electrode. There should, of course, be no switch or fuse in the grounded conductor. Except when the arc is actually maintained, the electrode is at the full pressure of the circuit. When the welding is done in a workshop, the welder is usually close to the switch controlling the circuit and can readily cut off the pressure when he has finished or when he requires to renew the electrode. In other cases he may be at a considerable distance from the switch and it may be inconvenient to get to it and he may put the electrode and holder down or hang it up and it will remain live and be a source of danger, or he may be tempted to renew the electrode while it is alive, a dangerous proceeding unless he is insulated from earth or wears insulating gloves. To get over this difficulty, says Mr. Ram, it has been suggested that there should be an auxiliary low-voltage circuit in the flexible cable, with a push-button thumb-switch in the handle of the electrode holder, arranged to operate a contactor switch at the fixed end of the circuit. The electrode and holder would then normally be dead and would only be made alive when actually put to use.

Mr. Ram, in reviewing progress of the last few years in the science of illumination and the design of efficient fittings for factory lighting, said that in some of the new works he found some excellent examples of modern scientific lighting, but he also found in other cases instances of very bad lighting with gas-filled lamps which were unscreened and placed where they caused glare and harm to the eyesight of workers.

Except as regards districts in the United Kingdom which have been supplied for many years with direct current, the inspector says the development in the use of electrical power is mostly by alternating current, three phase or two phase, and from the point of view of electric shock risk at low voltage this is very much more dangerous if proper care is not taken. Mr. Ram found some good installations spoiled by not being properly finished off. The most prevalent fault in this connection was that even though the conductors were well protected in screwed steel conduits throughout almost their entire length, the conduit was not taken right up to switch boxes or motor terminal boxes, so that loops of unprotected cable were left, often in positions where liable to damage, e. g., on the floor at the motors. This was partly due to the slight extra cost of providing switch and fuse boxes and motor-terminal boxes having properly made sockets for the attachment of the conduit. Several large manufacturers supply their motors without any terminal boxes, cable tail ends being brought through the casing for connecting up to the circuit.

Owing to the great expansion in the use of electrical energy during the period under review it might have been expected that the number of electrical accidents would have increased. Mr. Ram says, however, that this was not the case. "The reduction in the number reported is so great that after making a liberal allowance for cases unreported owing to the stress of war conditions, it would appear to be a fact that the real number is considerably less than in the preceding period, and if the increase in the use of electrical energy is taken into consideration the proportion is very much reduced. New installation work has generally been found to comply with the regulations and the freedom from accidents is chiefly attributable to this cause. On the other hand, the number of fatal accidents has somewhat increased, 99 having been reported in the four years, 1915-18, as against 70 in the period 1911-1914. Of these 99 fatalities, 14 occurred in electrical stations of public supply or traction undertakings, the remainder on ordinary factory premises. In addition there were four fatalities indirectly due to electricity; one caused through explosion of gas from a secondary battery, by electric spark; one through failure of the current of a crane magnet allowing the load to fall on a man; one from burns where a girl got her dress set on fire by knocking the lead out of a terminal of a motor; and one from burns where a man short-circuited conductors with a benzine blowlamp; 95 out of the 99 fatalities occurred with alternating current, 19 being on systems of less than 250 volts, while 47 occurred on three-phase systems from 346 to 440 volts, but where the pressure to earth would not exceed about 250 volts, most of the systems having the neutral point grounded. Many of them occurred on lighting circuits taken from one phase and the neutral. In three or four cases only is it likely that the shock was received from contact with two of the phase conductors, the accidents being nearly all due to contact with one conductor only, the current passing through the victim to earth. Three direct-current cases were on medium-pressure traction systems having one pole grounded.

The inspector concludes his report with a reference to the importance of artificial respiration being applied in cases of electric shock. In three of the nonfatal accidents the victims were saved by this means.

TURBOELECTRIC SHIP PROPULSION AND ELECTRICALLY WELDED SHIPS.

Report by Lloyd's Register on Progress in These Lines in Great Britain.

"Lloyd's Register of Shipping" in its recent report upon its operations during the year 1918-1919 mentions that four vessels classed by the society were fitted with turboelectric propelling plant. The largest of these vessels, the *Wulsty Castle* of 3566 tons, was built in the United Kingdom and has a total shaft horsepower of 1500. The *Turbinia*, of 2259 tons, was built in Sweden and her engines have a shaft horsepower of 1020. Both these vessels were fitted with Ljungstrom turbines. Two smaller vessels were completed in America, the *Panoil* and the *Mexoil*, each of 1370 tons, the engines in each case having a total shaft horsepower of 820. These two vessels were fitted with Rateau turbines,

In referring to the use of electric welding for shipbuilding the report makes mention of the fact that in 1917 the committee arranged for an exhaustive series of tests to be carried out under the direction of the society's chief ship surveyor, to determine, as far as possible, the general trustworthiness of structural connections effected by electric welding and their capacity to withstand the strains to which they would be subjected. As a result provisional rules were adopted, as a tentative measure, for the classification in Lloyd's Register Book of vessels electrically welded, subject to the notations "experimental" and "electrically welded." The committee also formulated its requirements regarding the test to be complied with by all systems of electric welding for which approval was desired, and a notice was issued stating that the committee was prepared to consider applications from any electric welding companies, for their processes to be recognized by the society for use in ship construction and for their names to be inserted in the approved list.

Plans for the first vessel in which the butts, seams and other connections are to be electrically welded have been submitted and approved. This vessel, which is about 150 ft. in length, and in which the use of rivets will be entirely dispensed with, is now nearly ready for launching and the behavior of the vessel after completion will be carefully followed by all who are interested in the new system of construction. Applications have also been received by the committee for approval of a scheme of construction in which both riveting and welding processes shall be employed, but in such a manner that the vessel might be classed without the notation "experimental." After careful consideration the committee approved in the case of a vessel framed on the longitudinal system, a design in which electric welding will be employed in the construction of the bulkheads and for the attachment of the longitudinal frames to the structural plating, this approval being contingent upon a special notation being inserted against the vessel's name in the register book.

WILLIAM DIXON WEAVER.

Born August 30, 1857—Died November 2, 1919.

An Appreciation by William E. Keily.

"Engineer—journalist—scholar." These are the words descriptive of William D. Weaver on the memorial tablet placed in his honor in the rooms of the American Institute of Electrical Engineers. They are truthful characterizations, but it might be added that Dr. Weaver was not only an engineer but a man of the true scientific spirit; not only a journalist, but also a man of letters; and he was a scholar who possessed a warm human interest in the welfare of his fellowmen. Withal he was truly kind, sympathetic and companionable—one who "bore without abuse the grand old name of gentleman." He did much for electrical advancement, and all electrical men should hold his memory in honor.

For several years Dr. Weaver had been troubled by a weak heart, and he died suddenly at his home in Charlottesville, Va., early on the morning of Nov. 2. Dr. Carl Hering of Philadelphia, an old friend, was visiting at the hospitable Weaver homestead at the time. The man of the house seemed quite well on retiring. He died in his sleep. The funeral took place on the afternoon of Nov. 3.

Mr. Weaver was born on Aug. 30, 1857, at Greensburg, Pa., a city also noted in electrical history as the scene of the first or second commercial alternating-current system in the United States, established in 1886. After a year spent in preliminary study at the University of Kentucky he entered the United States Naval Academy at Annapolis, from which he graduated as cadet engineer in 1880. It may be remarked that only a few months ago Dr. Weaver received the honorary degree of LL.D. from the University of Kentucky. After graduation the young officer served in the Navy for twelve years except for one year's leave of absence in 1884, during which he studied electricity and conducted some investigations in the electrical laboratory of the Sorbonne, Paris, and the School of Electrical Engineering, London. In 1883 he accompanied, on the *U. S. S. Yantic,* the first expedition sent to the relief of Lieutenant Greely, the Arctic explorer. He was assistant engineer of the Navy on the *U. S. S. Omaha* which made a cruise of the world and spent two years in the waters around China, Japan and Korea. When he resigned from the Navy in 1892 he held the relative rank of ensign. While stationed at the New York Navy Yard he designed an electrical recorder which was largely used in speed trials and at launching of naval vessels. He also made other inventions, being resourceful in expedient. If he wanted to rebind his own books, he could do it, and one of the achievements of his later years was the preservation of the life of a prematurely born baby by means of an electric heating-pad incubator of his own devising.

After resigning from the Navy the young man had a year's experience with E. G. Bernard, of Troy, N. Y., in the manufacture of electrical appliances. Mr. Bernard died in 1915, and his former associate showed that he had not lost his business aptitude by winding up his deceased friend's affairs at that time. But it was as a technical editor, as a writer on engineering subjects, as a journalistic exponent of the science, art and industry of electricity, that Mr. Weaver found his life work.

He became editor of the *Electrical World* in 1893. In 1896 he enlisted the aid of James H. McGraw and established the *American Electrician* as a successor to *Electrical Industries,* a monthly originally established in Chicago in 1889. This new monthly magazine, with Mr. Weaver as editor, became notably successful. In 1899 the *Electrical World* and *Electrical Engineer,* weekly journals, were consolidated, and Mr. Weaver and T. C. Martin, the latter an able and experienced electrical journalist, became joint editors of the combined paper, which absorbed the *American Electrician* in 1906. In 1909 Mr. Martin became secretary of the National Electric Light Association, and thereafter Mr. Weaver was the sole editor of the *Electrical World* until May, 1912, when he retired, removing to Charlottesville, Va. The *Electrical World* has had many able men on its staff at various times, but it is perhaps fair to say that the editor who gave it the most distinctive impress of his individuality and to whom it was mostly indebted for its international standing as an electrical journal was W. D. Weaver.

Thus for nearly twenty years Mr. Weaver was prominent as an electrical editor. But he did many other things; he had much to do with the electrical advancement of his time, often remaining in the background, co-operating with others whose names appeared in connection with the work.

Always keenly interested in science, in engineering, in education and in literature, Mr. Weaver was a worker in the American Institute of Electrical Engineers for over thirty years. He became an associate as far back as 1887, when the society was only three years old. Later he became a member and still later a fellow. He served as manager for six years in two different periods. He was a member and afterward chairman of the committee which made the constitutional revision of 1900-1901. He always was opposed to the policy of allowing the society to be dominated by a small coterie of New Yorkers. On several occasions he was urged to become a candidate for the presidency, but such was his retiring disposition that he always refused, although he could probably have been nominated and elected.

In 1918 a group of friends and admirers, including Thomas A. Edison and Dr. C. P. Steinmetz, memorialized the president and directors of the American Institute of Electrical Engineers, requesting that a bronze tablet be placed in the headquarters of the Institute as a recognition of Mr. Weaver's services. This offer was accepted, and the tablet was unveiled on May 16, 1919. It bears a bas-relief portrait of Mr. Weaver and an inscription "To record his influence in the development and promotion of the art and science of electrical engineering." On that occasion Dr. A. E. Kennelly spoke briefly in appreciation of Mr. Weaver's efforts. He said the tablet was largely the result of the work of B. A. Behrend, and concluded by stating that the bronze portrait represented "the lineaments of a man who always thought of others and served others because he understood them." This memorial pleased Mr. Weaver greatly, but it is characteristic of his modesty that he should write, when the proposal was accepted by the directors, "I am still rather nervous over the affair, as it assigns to me a character to which I could not live up were I to have the longevity of a Methuselah." Alas, that was written less than a year and a half before the death of the recipient of this honor at the untimely age of sixty-two!

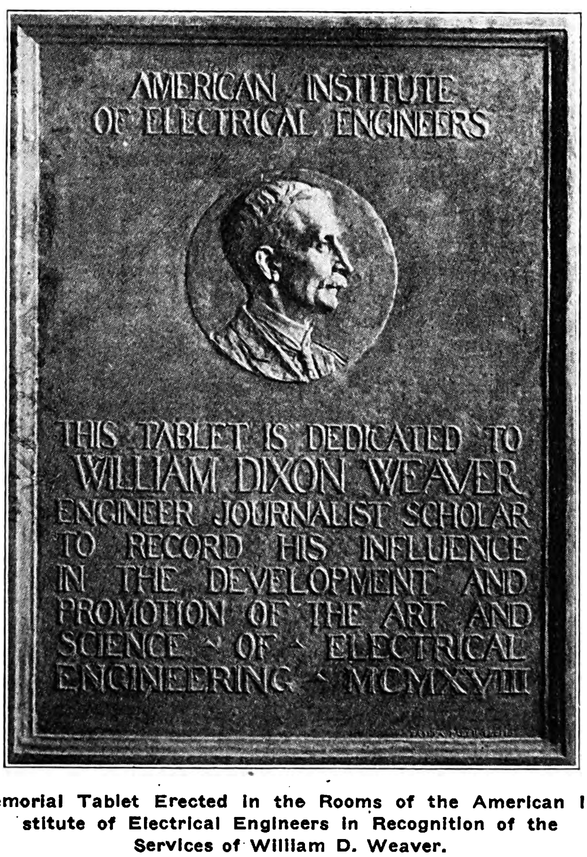
A great admirer of the clarity of the French intellect, of the beauty and precision of French literature and of French achievements in science, Mr. Weaver was nevertheless a thorough, ingrained American.

During the Spanish-American war of 1898 he served as volunteer chief engineer on the *U. S. S. Glacier*. In 1915, after his retirement, he was asked to become a member of the Naval Advisory Board but declined on account of his health. However, he was keenly interested in war work, and among other things he stimulated, by his vigorous articles in the daily press, and by other means, naval recruiting in Charlottesville and vicinity.

In 1900 he was appointed by the United States Government as an official delegate to the International Electrical Congress at Paris, but, upon his suggestion, the appointment was transferred to Dr. Kennelly. He had much to do with the St. Louis (1904) International Electrical Congress, of which he was treasurer and business manager. With Dr. Kennelly, who was general secretary, he supervised the publication of the Transactions of that Congress in three large volumes published in 1905. It is characteristic that this work bears the inscription: "Not copyrighted; publicity invited."

The engineering fraternity of New York City and vicinity is to a considerable extent indebted to Mr. Weaver for the Engineering Societies Building and the adjoining Engineers' Club. These fine structures were due to the generosity of the late Andrew Carnegie. A plan for a home for the engineering societies was submitted to Mr. Carnegie by Mr. Weaver as far back as 1895. Others made similar suggestions later, and it was in 1903 that Mr. Carnegie offered to give $1,000,000 for a suitable union building for all of the national engineering societies. A year later this gift was increased to $1,500,000, of which about one-third was for the Engineers' Club, the societies providing the land for the buildings.

Mr. Weaver was an excellent and discerning judge of engineering literature. He labored in season and out of season to build up the library of the American



Memorial Tablet Erected in the Rooms of the American Institute of Electrical Engineers in Recognition of the Services of William D. Weaver.

Institute of Electrical Engineers, which became a part of the engineering library in the Engineering Societies Building in New York. For several years he was chairman of the Library Committee of the Institute. He consulted with Andrew Carnegie and Dr. S. S. Wheeler in relation to the purchase of the large collection of electrical books and pamphlets made by Latimer Clark of London. In 1901 Dr. Wheeler purchased this library and presented it to the American Institute of Electrical Engineers. Mr. Carnegie donated the money to house, catalog and complete the collection. Thereafter, as a labor of love, Mr. Weaver, collaborating with the late Brother Potamian and others, prepared the elaborate "Catalogue of the Wheeler Gift" that, published in two volumes in 1909, stands as one of the monuments to his memory. By Dr. Wheeler's deed of gift it was provided that a copy of this catalog raissonné should be placed in the hands of every member of the Institute. These books are not only intrinsically valuable but are good examples of book making, for Mr. Weaver was a litterateur and bibliophile as well as a lover of science.

In 1916 Mr. Weaver became interested in the possibility of securing the electrical library of the late Dr. S. P. Thompson of England for an American or Canadian college or library. However, the negotiations to this end fell through, although through no fault of Mr. Weaver. At one time there was a possibility that the John Crerar Library of Chicago would buy this collection, but finally, as the result of the efforts of British engineers, the library was retained in England.

The activities of this indefatigable man were not confined to one society. He had much to do with the organization of the Illuminating Engineering Society. Of this society as well as the American Electrochemical Society he was one of the founders. He served for three years as manager of the Illuminating Engineering Society and three years as manager of the American Electrochemical Society. He had also a great deal to do with the successful formation of the Commission on Resuscitation from Electric Shock, composed of representatives of several societies. He was a member of the Societé Internationale des Electriciens and had been honored by the French Government as an officer de l'Instruction Publique. Further, he was a member of the Naval and Military Order of the Spanish-American War, a member of the Sons of the American Revolution and an honorary member of the Philosophical Society of the University of Virginia. He was a member of the Engineers' Club of New York, the Army and Navy and Cosmos Clubs of Washington, the Country Club of Charlottesville and the Colonnade Club of the University of Virginia.

Always a scholar and an investigator, Mr. Weaver was familiar with college life in America and always a friend of technical schools and technical education. After his removal to Charlottesville in 1912 he became closely associated with members of the faculty of the University of Virginia, established at Charlottesville by Thomas Jefferson. It is reported that he was offered a place on the faculty of this university a few years ago. Some time before his death Mr. Weaver gave nearly his entire collection of technical books, including a number of complete sets of the transactions of societies, to the University of Virginia. Mr. Weaver was also a liberal donor of technical books to electrical societies.

A man of high ideals, Mr. Weaver felt strongly that cultural studies should not be neglected in tech-

Current Events

Commission Regulation Again Upheld — Illinois Utilities Begin Extensive Building—Tribute to William D. Weaver

STATE COMMISSION'S RIGHT TO RAISE FARES UPHELD.

Federal Supreme Court Says Utility Commissions Have Ample Right to Revise Franchise Rates.

The United States Supreme Court has dismissed the appeal of Kansas City municipal officials from the decree of the Missouri Supreme Court upholding orders of the Missouri Public Service Commission in increasing carfares in that city to six cents. In 1918 the Public Service Commission established the six-cent fare, although the franchise of the Kansas City Railways Co. provides for a five-cent fare without reservation or modifying clauses. The Missouri Supreme Court held that when the Legislature created the Public Service Commission, it restored to the State the power formerly vested in cities by charter to fix rates and public utility charges within the State. In its appeal to the Federal Supreme Court, the city argued that a contract franchise was sacred under all conditions and the State had no power to abrogate it.

PRESIDENT BALLARD OF N. E. L. A. BANQUETED ON RETURN HOME.

California Electrical Co-operative League Gives Dinner to Mr. Ballard for Bringing Big Convention to Southern California.

On Oct. 29 soon after his return home from an eastern trip of nearly two months in the interests of the National Electric Light Association, President R. H. Ballard of the association was given a banquet at the Hotel Alexandria in Los Angeles, Cal., by the electrical men of that city and surrounding cities. The dinner was given by the Electrical Co-operative League and was attended by a large number of the active electrical men from southern California, who wished to show their appreciation of Mr. Ballard's successful efforts to secure the next annual convention of the association for Pasadena on May 18 to 21.

A. Emory Wishon acted as toastmaster. Dr. John Willis Baer, of Pasadena, made a hearty address of welcome in which he spoke of the pleasure it will be to that particular city to have so great a gathering honor it next spring. He promised that nothing would be undone in the way of entertainment to make the stay of the guests from all over the country pleasant and memorable.

John B. Miller, chairman of the Southern California Edison Co., spoke of the change in attitude of eastern financiers and investors toward utility investments and other opportunities in California. William A. Brackenridge, president of the Southern California Edison Co., dwelt on the rapid progress in power transmission in California and how the achievements in this line are now being recognized throughout the country.

When Mr. Ballard responded he spoke especially of the opportunities that the convention will give to the utility men of the West in showing central-station men from all over the country the high state of development that has been attained. He said: "Two hundred and fifty million dollars can be used to advantage in electrical developments in California in the next ten years, half of which would be spent in the state for wages, raw materials and manufactured products. Large manufacturing industries would be attracted, thousands of acres of land irrigated, hundreds of thousands of homes electrically equipped from cellar to garret, making labor more productive and helping to solve the servant problem."

Others who spoke were Charles H. Pierson, E. O. Edgerton, chairman of the California Railroad Commission, John S. McGroarty, K. E. Kuran, committeeman of the California Co-operative Campaign, Glenn Arbogast, William H. Onken, Ben M. Maddox, E. B. Criddle and William Baurhyte.

BIG UTILITY BUILDING PROGRAM IS STARTED IN ILLINOIS.

Favorable Public Attitude Attracting Investors to State; Half Billion Dollar Expenditure Under Way.

High construction costs which now are 80 to 100% above the average of five years ago, are not to prove a bugaboo to public utility companies of Illinois. Believing that prices will not drop materially for some time, that the trend of general conditions is toward settlement and they have the substantial public sentiment of the state behind them, the companies are starting their after-the-war building program which in the aggregate calls for the expenditure of millions of dollars in developing the public service facilities.

According to the Illinois Committee on Public Utility Information, within the last month more new building projects have been reported as under way than in the full 18 months previous. This is directly attributed to the favorable public sentiment, which has not only given the industry confidence and the initiative to proceed, but is again giving investors the courage to invest their money within the state. The utility industry, as a whole, has plans laid for half a billion dollars of new work in the state in the coming five years. This is made possible by the growing confidence of investors who already have more than a billion dollars of their savings invested in the electric, gas, telephone and traction companies of the state.

"The greater understanding on the part of the public of the problems of the utility industry and the present generally favorable attitude is at the bottom of the determination of the managers of the properties to go ahead with construction," a prominent utility manager said. "Possessors of savings are free agents in the disposition of those savings, and they will invest them only in those enterprises where a fair interest return is in prospect and where the safety of investment is assured. If Illinois did not provide sufficient inducement for the investment of the money here, it would simply be taken elsewhere and the state would lag in development.

"The move of the utility companies is bound to find reflection in all lines of business. The realization upon the part of the general public of the indispensable character of the utilities and their relationship to general prosperity and the fair treatment which all concede must be accorded them is going far towards encouraging investment. This investment must be heavy in order to overcome the halt in new building necessitated by the war."

TACOMA'S HYDROELECTRIC PROJECT AT LAKE CUSHMAN.

City Expects to Develop 75,000 Hp. by Damming Lake, Securing Large Reservoir and 580-Ft. Head.

The city of Tacoma, Wash., in its negotiations to acquire the Lake Cushman power site, will be ready to make plans for hydroelectric development there as soon as the former owners are in position to give a clear title thereto. Lake Cushman is an expansion of the Skokomish river, and the future plans contemplate the construction of a dam on the stream below the lake and thereby raising the water level of the lake about 60 ft. higher than the present level, and greatly increasing the capacity of the storage basin. Then, the plan is to convey water from a point above the dam through an open canal to a forebay from which it will be conducted through pipe lines and penstocks to the proposed power plant on Hood canal. This will give a head of about 580 ft. at the plant. Under this scheme it is expected to make possible the development of about 75,000 hp.

REPORT ON ELECTRIC POWER SUPPLY OF TWIN CITY UTILITIES.

Geological Survey's Report on Power Facilities of Minneapolis and St. Paul and How These May Be Improved.

During the war the United States Geological Survey co-operated with the United States Fuel Administration in studies and investigations undertaken for the conservation of coal. The possibilities of saving coal in different parts of the United States by interconnecting electric power systems, by substituting hydroelectric power for steam-generated power, and by closing down competing power plants in places where one power plant could better handle the total load were investigated at the request of the United States Fuel Administration by the engineers of the United States Geological Survey, Department of the Interior.

The public utilities in the cities of St. Paul and Minneapolis were investigated and a detailed report of their conditions was submitted Sept. 30, 1918, by the Survey to the United States Fuel Administration. This report was prepared by W. G. Hoyt, district engineer, United States Geological Survey, and F. W. Huels, engineer of the Wisconsin Railroad Commission.

The report describes the facilities for power production in the vicinity of St. Paul and Minneapolis, gives curves showing the power production of the operating companies and maps of power systems, states existing and prospective load conditions and gives load curves, shows existing interconnections and opportunities for additional interconnections, efficiency of power stations in utilization of fuel, utilization of water power, coal saving possible by further development and utilization of water power, possible increase of water power by developing water storage, coal consumption and cost, extent of power shortage, and use of exhaust steam for heating.

The report, which consists of about 120 typewritten pages and diagrams, will probably not be printed and thus is not available for general distribution, but it may be consulted at the office of the United States Geological Survey, Interior Department building, Washington, D. C., or at its district office, care of the Railroad Commission of Wisconsin, Madison, Wis.

NATIONAL SAFETY COUNCIL ESTABLISHES ENGINEERING SECTION.

Will Help Meet the Technical Demands of the Industrial Sections of the Council.

The formation of an engineering section of the National Safety Council has been authorized by the Executive Committee of the Council and the new section will be organized immediately by a special committee appointed for the purpose. In announcing this action, Sidney J. Williams, secretary and chief engineer of the National Safety Council, said the decision to form a distinct engineering section was prompted by three things:

First, the growing recognition of the imporance of the engineering factor in safety work;

Second, the growing interest in safety work on the part of civil, mechanical, electrical, mining and chemical engineers;

Third, the growing volume of experience and investigation in the engineering problems involved in safety work.

"The formation of an engineering section," Mr. Williams said, "will provide a vehicle for concentration of the engineering brains of the several thousand member companies of the Council on the solution of engineering problems affecting safety work in large groups of industries, in specific industries and in industry generally.

"The development of the Council has been largely along the lines of industrial sections. The Council now has 19 sections each with its own officers and program and each interested largely in the safety problem of its own particular field. These sections are as follows:

"Automotive, Cement, Chemical, Construction, Education, Electric Railway, Health Service, Marine and Navigation, Metals, Mining, Packers, Paper and Pulp, Public Safety, Public Utilities, Rubber, Steam Railroad, Textile, Women in Industry and Woodworking.

"The greatest contribution of the new engineering section will be with respect to problems that cut across the interests of several sections and affect whole groups of industries as, for instance, the hazards of poisonous dust or gas. The new engineering section will also facilitate contact and co-operation between the various national engineering societies, the engineering departments of the Government and the National Safety Council."

Editorial Comment

Shorter Working Day Means More Electrics

BRITISH electrical men who have been working hard for many years to boost the electric vehicles for public service in the big centers feel highly gratified at the large measure of success that has lately followed their efforts. Many towns and cities have placed orders for two to six electrics and in the aggregate the total is considerable, at any rate for England. It was expected that the end of the war would be followed by a big move forward as soon as vehicles became procurable, but the shortening of the working day has accelerated the rate of progress in one case already—that of Sheffield.

Here, consequent upon the introduction of the 47-hour week, reorganization of the entire city refuse removal service has had to be considered. Experience with 12 electrics during several years' working has been so satisfactory that 51 more are to be ordered and a new garage is to be built and equipped for their accommodation. The total outlay will be about $500,000, a figure far in excess of any other scheme yet carried out in England. It may reasonably be supposed that this will be a signal for a regular forward movement in other big towns which have already experimented with electrics for similar service.

Though new factories have been laid out for production of such vehicles during the war, and others are being erected, it is more than probable that British factories alone will not be able to cope with the requirements if the business grows rapidly, as it may do. American electric vehicle producers may well note this opportunity.

Charging for Estimating Expense

CONTRACTORS, as a general rule, conduct their businesses on a profitable basis, and their customers pay for the expense of preparing estimates, since a profit is made on the aggregate contracts. But this expense is not shared by all customers in proportion to amount of work done for each one, for which reason general opinion favors some plan to equitably apportion this expense.

A number of plans have been presented from time to time, but none of them have been considered thoroughly workable, so that little has been accomplished toward putting into practice a method of securing payment for estimating. Most of these plans have failed to make provision for paying the contractor for submitting estimates on work that does not go ahead. It often occurs that bids are asked just for the purpose of ascertaining what prices will be quoted. Then again, an entire set of estimates may be thrown out because the one calling for the bids may have set too low an amount as the maximum figure for the work to be done. Some plan should be devised whereby the contractor will receive compensation for all estimates prepared, so that the necessity for burdening contracts received with the cost of preparing estimates on work for which no contracts were received will be obviated.

A new plan which has come to our attention has several interesting features. It provides that an owner must stipulate that the work involved in the estimate shall not cost over a stated amount, and of this maximum cost a certain percentage would be set aside for division among the three or four lowest bidders. The size of the contract would determine the number of bidders who would be paid for estimating. Any bidder who could not get close enough to the lowest bid to be counted in would receive no pay, the inference being that his estimate was mostly guesswork.

While the plan is not complete these features seem worthy enough to be incorporated into a plan that would help solve this question of unfair practice.

Instruments in the Boiler Room

INSTRUMENTS are not installed in the boiler room to "show up" the boiler-room force. They are installed to assist the boiler-room crew in their work and thereby enable fuel and equipment to be used more economically and advantageously. Boiler-room instruments are a boon alike to their owner and to the user, saving money for the one and saving effort for the other.

The instruments of the boiler room, using the term instruments in its broadest sense to mean anything instrumental in obtaining efficient operation, may be divided into four classes, namely, those indicating totals, conditions, rates and relations. It is only when firemen know what they are doing and how they are doing it that they can work sensibly, obtain results economically and meet conditions as they arise by co-ordinating air and fuel with the demand for steam.

It is important to know how many pounds of water are being evaporated per pound of coal, per shift or per hour. But it is of more immediate concern to know the rate of steaming, told by the steam-flow meter, the rate of combustion as told by the tachometer on the stoker drive or the coal-weighing machine, and the rate of air supply as told by the draft gages. To work efficiently and successfully, one must know what is required to be done, whether it is being done and how it is being done. When these conditions obtain, consuming fuel for raising steam no longer remains a hit or miss process but becomes an engineering function.

Knowing how something is being done without knowing what is actually being done is of little use. Only when the results are known and the manner of accomplishing them are also known can operating conditions be met and fulfilled efficiently. In other words, the boiler room needs instruments that record results and instruments that show conditions, and only when these are used can fuel be saved with certainty.

For showing quantity there are the ash and coal-weighing instruments; for measuring steam and water, steam-flow and water meters. For determining quality there are the coal calorimeter and moisture scales, feed-water thermometers and steam pressure gages and thermometers. For controlling and indicating conditions there are the familiar flow indicators, draft gages, thermometers and flue-gas analyzers. Each of these has its place and each is a good investment when properly used and intelligently applied. This means properly training the boiler-room force and offering sufficient incentives for them to do their best.

Coal is money today. Much of the waste that goes on would not be tolerated an instant longer if the quantity of coal consumed were converted to dollars and cents. Looked at from the aspect of money spent, coal-saving becomes something tangible, a financial matter of vital concern to the purchaser of coal. Considered in this light and remembering that the term "instrument" is used in its broadest sense to mean anything enabling a knowledge of operating and efficiency conditions to be known, that oft-asked question would not be "what are the fewest instruments I can do with?" but "which instruments can I afford to do without?"

Drawing Up Specifications

PURCHASE of materials or structures by specification safeguards the purchaser insofar as he knows with a certain degree of assurance that the material or structure purchased meets with those properties stipulated by him. Specifications safeguard the manufacturer in that if he meets the specifications he completes his part of the bargain, the onus for the wisdom and correctness of the specifications resting with him who specifies.

There is much to be said in favor of standardized specifications, although in this case as in all other cases, standardization has its drawbacks—drawbacks that are greatly lessened when standardization is sufficiently flexible to keep pace with progress. Standard specifications enable the producer to shape and make his product to the standard specifications, thus enabling specialization in comparatively few forms or types of product in contrast to many and varied types, as when every purchaser draws up his own specifications according to his own whim and ideas regardless of what others may be doing or have done. By so doing, the producer is handicapped, which reacts to increase the average cost of his products by limiting bulk production and all that goes with it. So, too, the purchaser is handicapped since his order may be classed as special, increasing the cost, adding to the delay in deliveries, and creating still further delay when the time comes for hurry-up repeat orders.

A specification is very largely a matter of viewpoint. It may, perhaps, be said that the specification having the greatest simplicity, the utmost brevity and sufficient completeness is the specification that meets the situation and fulfills best the need of the purchaser and the producer. In other words, a specification should stipulate what is necessary, what is fundamental, but should not deal needlessly with secondary factors not strictly germain to the condition to be met or the manner of meeting it.

A fact often overlooked is that purchase by specification may tend to add to the cost of the product, as when every purchaser draws up his own stipulations and specifications. On the other hand, standardized specifications tend to lower the purchase price because the one specification meets the need of many purchasers, hence calls for a standardized product instead of a special one. It may be pointed out, further, that the standardized specification tends to be the better all-round specification on the theory that two heads are better than one, and so several interested parties are ordinarily able together to create a broader and better specification than one party alone.

It used to be the fashion to specify voltage taps on all transformers regardless of whether there was any reasonable likelihood of using them. Better voltage regulation, appreciation that such taps cost money, cause complications and troubles, and the understanding of the fact that the cost of taps is investment wasted if the taps cannot be used, have done much to eliminate the stipulations for many needless and objectionable voltage taps on transformers. So, too, with insulation, specifications often call for the inclusion in the insulation of ingredients whose characteristics cannot be readily determined nor their presence proved. The only effect of such stipulations is to add to the cost of the product if bid upon by the conscientious bidder and offer opportunity for fraud on the part of the unscrupulous manufacturer. Specifications are of little use if no means is taken to determine whether the specifications are adhered to.

A specification should endeavor to stipulate such requirements as will enable a product to be obtained that will be able to meet its definitely prescribed function, and assure that quantities of the product will vary in uniformity only between clearly defined limits.

The specification that meets the situation best is the specification that is brief and to the point, yet is sufficiently complete without omitting any salient requirement. The thing is to say as little as feasible, not as much as possible.

nical education. "It seems to me," he wrote, "that technical engineers (as distinguished, say, from civil engineers) will some day have seriously to face the question whether they are members of a learned profession or merely followers of a technical vocation. In electrical engineering, for example, I have been shocked at the prevailing lack of pride in ancestry and interest in posterity—the only object of graduates being apparently to make a living or acquire riches from knowledge acquired with no recognition of those who in the past contributed to that knowledge, nor thought of making enduring offerings to the future in return for those received gratis from the past." He deplored a purely materialistic attitude in technical schools and thought that perhaps the reason that engineers are not accorded greater recognition in important public work is due to the opinion "that their vision is too narrow and their lack of touch with the human element in life has been too restricted to fit them to pass upon matters that must also be adapted to public policy and presented in such a form as most to assure favorable action from the public at large or from those who represent the public with full knowledge of how to placate its prejudices."

As may be judged from the above, Mr. Weaver always insisted on preserving his independence of mind. He himself said: "My name is probably more generally associated with the thought that I view things critically—though not necessarily in a hostile spirit—than with that of docility in acceptance of opinion backed by influential forces." Ordinarily the mildest and gentlest of men, he nevertheless was very tenacious in adhering to his opinions. On occasion he could express himself energetically, and he was a master of sarcasm if he desired to employ it.

He was a lover of books, both of the inside and outside of books. He was particularly interested in the French Revolution, and his collection of material relating to that period was probably excelled by few collections in the United States. He was a French scholar, reading that language with ease and speaking it well. He was, or at least was until recently, a member of three French societies for the rehabilitation of Robespierre, and in 1913 he was invited by a "maire" of one of the arrondissements of Paris to become an honorary member of a committee to forward a movement to erect a statute to Robespierre. The character of Robespierre was to him a fascinating study, and he returned to it again and again.

At one time he wrote about Paris: "I feel more at home in that city than in any other in the world, on account probably of my first impressions of the real world having been received there." He was a great admirer of Prof. André E. Blondel of Paris, who, he thought, possesses one of the finest intellects of the age. In recent years Mr. Weaver had given much study to the life and works of Thomas Jefferson. He was also an admirer of much in Russian literature.

An original thinker, a many-sided man, witty, not without his prejudices, and also, perhaps, not without a spice of malice occasionally, William Dixon Weaver was a brilliant, lovable man. He was steadfast to his friends and his kindness to them was unbounded. For young men and newcomers in the electrical field he always had a helping hand. He was an admirer of method, although those who worked in the office with him declared that he was not always methodical in doing his own editorial work. But nevertheless his was a charming personality. His home life was ideal. In 1900 he married Miss Mildred Niebuhr, and the union was blessed with six charming children. Mr. and Mrs. Weaver were most hospitable, and their home was characterized not only by books and objects of beauty and taste but also by a delightful spirit of comradeship, sprightliness and family affection. Retiring in disposition, with an acute distaste for public appearances, Mr. Weaver found his greatest joy at his own hearthside. In his later years he was able to obtain relief from the merciless daily grind of the editor's duties, applying himself thereafter to those intellectual diversions which were such a pleasure to him. From his library this brave, subtle, kindly spirit looked out on the world with the serenity of a philosopher and now, "Home is the sailor, home from sea."

NEW YORK STREET CAR COMPANIES DISINTEGRATING.

Federal Judge Julius Mayer signed an order recently directing the Brooklyn Rapid Transit Co., New York, that leases and operates several small traction lines as a single system, to return the property of the Brooklyn City Railroad Co. to its owners for independent operation. The reason for the order was the inability of the Brooklyn Rapid Transit Co. to pay $200,000 rental to the Brooklyn City Railroad Co. due on Oct. 1. The separation, which took effect at midnight, Oct. 18, results in considerable hardship to people who use the released line since, by eliminating transfers at 450 transfer points, users are required to pay two fares.

The failure of the Brooklyn Rapid Transit Co. to pay the rentals on its leased lines is caused by the general inability to operate on the 5-cent fare. Public Service Commissioner Lewis Nixon, after public hearings granted for the purpose of ascertaining the reasonableness of present rates and the increased rates petitioned for by the street railway companies, has permitted certain lines in Manhattan to institute a 2-cent charge for transfers and has authorized certain other lines to increase fares. The authorization has been suspended by a writ issued by the Supreme Court of New York prohibiting the Public Service Commissioner from acting on the application for an increase in fares because the franchise of the railway company specifically provided for a 5-cent fare.

The disintegration in the street railway systems is due to the general inadequacy of the fares being charged. Increases in fares have been prevented by the Hylan administration which contends that the railway companies should be compelled to perform their contract obligation to supply transportation for the nickel fare. Already several small lines have suspended operation. Relief for residents along these lines has been afforded by jitney buses. The relief is only partial, however, since they make no provision for transfers.

TRACTION EXPENSES STILL INCREASE.

In spite of the numerous fare increases granted during the last year, the latest figures show operating expenses of the electric railways increasing at a greater rate than revenues. Net income after payment of taxes and fixed charges was 1.54 cts., as compared with 2.23 cts. per car-mile in 1918, a falling off of 30.94%. The operating ratio in July, 1919, was 75.30, compared with 70.85% in July, 1918, an increase of 6.28%.

Commercial Practice

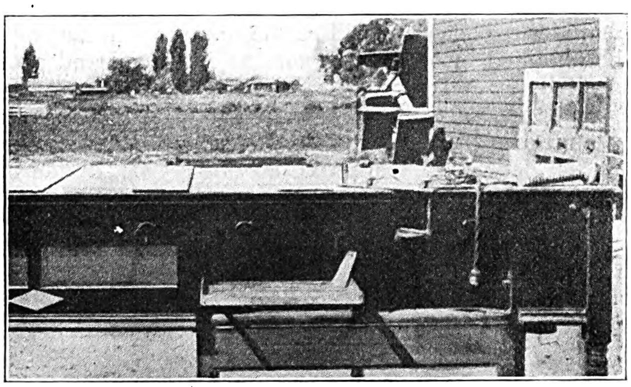
Successful Application of Electricity to Incubators—Electric Trucks in England—Surcharge for Power Service Approved

THE APPLICATION OF ELECTRIC HEAT TO INCUBATORS AND BROODERS.

Automatic Electric Incubator Proves Superior to Other Types Because of Economy and Safety Features—Description of California Installation.

Many methods of heating have been used in the past to hatch eggs, among them being the kerosene lamp, gas heater, solar heater and steam, but the only successful automatic incubator is that operated by electricity, with the possible exception of nature's method—the hen.

In the vicinity of Artesia, Calif., is located the largest electric hatchery in the world. This plant now has a capacity of approximately 100,000 eggs and a weekly output capacity of about 30,000 chicks. During seven months of the year this plant is working at full capacity most of the time and the annual output will average close to 750,000 chicks. It is here that the first successful electro-incubation was achieved, says P. J. Denninger in *Edison Current Topics,* the publication of the Southern California Edison Co.



Close-up View of Electric Incubator.

Construction of the incubator itself need not be described because electric heat and control may be applied to any type of incubator. The electric heating unit consists of a cylindrical, grooved porcelain core, and in the groove is wound a resistance coil made of nichrome wire. The resistance coil being laid in a groove, makes the heater self-insulating and there is no danger of the coils coming in contact with the metal flue or any other cover with which it may be surrounded. The current-consuming capacity of each element is 600 watts. One element is used to an incubator and the brooders contain one or more elements depending upon the size and capacity of the brooder house.

The controlling device is unique in construction yet simple in operation and easily adjusted. It is a thermostat and known as the tandem wafer type. The wafer is composed of two brass disks soldered together and the air space between is filled with ether. To the center of the top wafer is attached a perpendicular control rod. This rod extends up through the framework and operates a horizontal control lever which is weighted at the opposite end from the control rod to give a positive and steady action. The lever is attached by means of a coil spring to a rocker-arm pivoted at the center of its length. It is this rocker-arm that makes the contact and opens or closes the circuit as the wafers expand or contract. The connection between the lever and the contact arm is made in such a manner that the arm will not move until there is a considerable tension on the spring and when it does move the action is positive and the opening or closing of the circuit instantaneous. In this way burning or fusing of the contact points is practically eliminated. The entire mechanism is operated by the contraction or expansion of the tandem wafer, the ether confined in the disks being so volatile that a slight variation in temperature will cause immediate contraction or expansion sufficient to move the control up or down, thus opening or closing the circuit.

An automatically heated brooder house has also been devised using the same heater and control to which has been added an alarm bell system which warns of any undue change of temperature.

Very attractive rate schedules have been established for this business although small installations can be operated profitably on the lighting schedule. Where consumers have the combination schedule for lighting and cooking, incubators can be added to the circuits without increasing the minimum, thus obtaining advantage of the cooking rate of 3.5 cents per kw-hr. The consumer who is operating a pumping plant may apply his pumping plant rate to the incubator and brooder load by increasing the minimum charge $1 per month or horsepower equivalent added in incubator or brooders. There has also been provided a schedule for the monthly minimum of $10 per month and the rate of 3 cents per kw-hr. which may be applied exclusively to electric incubation. The cost of operation depends a great deal on local conditions, but it is generally estimated at 1 cent per chick.

The advantages of electric incubation are many and such as to make this method far superior to any other. There is no danger of fire, no loss of chicks from chilling or overheating, no lamps to clean, fill and adjust, no gas burner to go out and asphyxiate the chicks with escaping gas. It is only necessary to push the button or turn the switch and then one can devote his time to other pursuits, as the automatic control needs little attention. All these advantages spell increased profits, not only from economy of operation, but by virtue of the uniform heat control more and better chicks are assured. With the perfection of electric hatching and brooding the hen is left free to devote her entire time to egg production and even here electricity is rendering aid by illuminating the coops and chicken yards, thus getting the hens on the job earlier in the day.

Contractor-Dealer

Society for Electrical Development Prepares Holiday Helps for Dealers—Figuring Retail Prices—Merchandising Ideas

HOLIDAY HELPS PREPARED FOR THE ELECTRICAL DEALER.

Society for Electrical Development to Provide Extensive Co-operation for Entire Industry to Assist Holiday Selling.

There is a point in holiday selling that the retailer frequently overlooks. It is the fact that, in spite of natural increase in buying by the public at Christmas time, selling pressure should be kept up at that time and the retailer should add to his force and his stocks, if need be, to capitalize the holidays to the utmost. While the public is liberal in opening its purse for buying at Yuletide, it ties up the purse strings immediately after Christmas and there is usually a "valley" following the peak of holiday purchasing.

Window Trim Furnished as Dealer Help in "Electrical Christmas" Campaign.

The Society for Electrical Development has developed an extensive Christmas campaign for making the coming holidays most profitable for the retailer, and to help him provide against the post-holiday drop in buying by building up a good reserve.

The underlying motive of this campaign is to make this "an electrical Christmas," which idea is brought out forcibly in a beautiful poster design, lithographed in seven colors. This can be hung in windows, on doors and in the store. The same idea is dominant in the window-cards, poster-stamps and price-cards, all of which show the poster. Constant reiteration of this "theme" will have a favorable effect on the shoppers if the retailer uses the sales helps consistently.

Another notable fact about this campaign is that the society does not limit all the co-operative help to members exclusively but distributes certain things to non-members as well without charge. This material may be had by writing to the Society for Electrical Development, 29 West 39th street, New York City.

A CONVENIENT METHOD OF FIGURING RETAIL PRICES.

Simple Formula for Adding Profit and Overhead to Cost in Order to Obtain the Correct Price to Be Charged for Appliances.

In speaking before a recent convention of the Missouri State Association of Electrical Contractors and Dealers, M. S. Seelman, chairman of the committee on relations with contractors, dealers and jobbers, Commercial Section, National Electrical Light Association, made the following suggestions:

A simple method of arriving quickly at a fair price for which merchandise should be sold or work done to cover the cost, overhead and profit is to add the percentage of profit decided upon to the percentage of overhead, deduct the sum from 100, and divide the cost of merchandise or labor and material by the remainder. The result will be the selling price that must be obtained in order to cover the overhead and profit desired.

For instance, if the cost of some article of merchandise is $5, overhead is 25% and profit desired is 20%; deduct 45 from 100, leaving 55%; divide the cost, $5, by 0.55. The result, $9.09, is the price that must be obtained to cover the stated percentages of overhead and profit.

Poster Design to Be Used in "Electrical Christmas" Campaign.

Profit may be considered as the net return after all expenses are added to cost. Therefore, if goods are to be carried for a certain length of time the percentage added is necessarily larger because of increased costs resulting from storage and fixed charges. On the other hand, if goods are sold soon after being purchased the profit percentage may be less. Seasonal articles carried in stock depreciate and must be sold promptly to insure a rapid turnover of capital.

Merchandising Suggestions for the Electrical Dealer

Fire Protection a Sales Point for Christmas-Tree Outfits—Dealer Service for Farmers — How Arcade Shop Sells Electric Cleaners

NOW is the time for the sale of lighting outfits for Christmas trees. The general public has come to learn and appreciate the convenience and beauty of electric lighting in comparison to the old-fashioned candles, and on the appeal of these advantages the electrical dealer is able to make a rapid turnover of such equipment.

But there is still another advantage the dealer can use. It is the fact that electric tree-lighting outfits are safer from fire hazard.

What better selling argument can one use than to tell a father or mother that electric lamps afford their little ones and their homes protection against the disastrous fires that are caused by Christmas-tree candles and the matches necessary to light them?

There isn't any question about the fact that there are many fires caused by candles, for the National Fire Protection Association recently issued a bulletin giving a warning against their use, and recommending that electric illumination is safer. Almost every one of us know of a case where a candle-lighted tree caused a serious fire. It is a point that strikes close to home and dealers ought to make use of it.

Convenience and beauty are excellent selling points, but when you add fire protection to them you have a trinity of arguments that simply must make room for sales.

Service for Farm Lighting Plants.

Introduction of farm electric plants in recent years has brought up an important question of service, says a prominent electrical dealer.

Service, according to his interpretation, means the expert attention to his electric plant which the owner may never need, but which he can have on short notice if he requires it.

The average farmer looks on an electric light and power plant as more than a piece of machinery. To him it is a means toward the end of furnishing complete and dependable isolated electric service.

The farmer is not an electrician and doesn't want to be one. He knows machinery and knows how to take care of it, but he also knows that the best machinery in the world sometimes needs expert attention. He wants to know that there's an experienced mechanic within reach to give his electric plant attention when necessary.

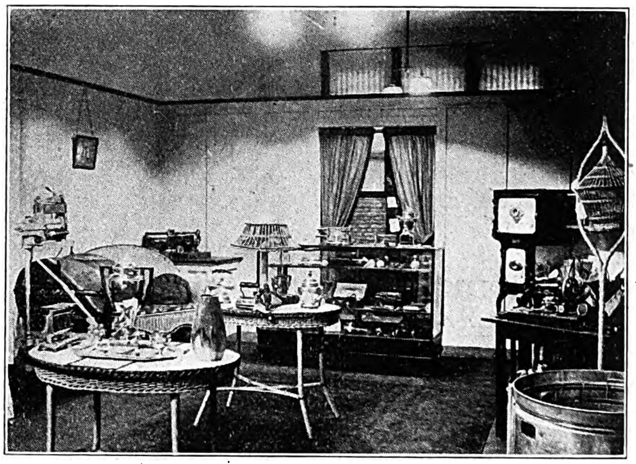
Two main things are to be considered in the purchase of a farm electric plant; first, other users' experiences. With the great increase in the use of electricity on the farm in the last few years there is scarcely a community where electric plants are not in use. It is easy for the prospective buyer to inquire among his neighbors as to the satisfaction they are receiving from their plants.

The second and equally important factor to consider is the local representation of the particular plant he plans to buy. An established representative of the plant in the community assures service when needed.

The average farmer is a careful buyer, and will doubtless take these things into consideration. If he does he is more likely to be assured of continuous and dependable electric service in his home.

Arcade Shop Features Vacuum Cleaners.

Cleveland—noted for its arcades as well as for being the "sixth city"—has quite a number of arcade electric shops. One of the advantages of an arcade is that it affords window space. Shops are not so deep as those with street frontage, and for a corresponding amount of floor space considerably more window space is secured. This permits of a larger exhibition of goods, so passersby may do more "window shopping" of things electrical.



View of Part of Electric Shop in Cleveland Arcade.

One of these arcade electric shops—the Electrical Necessities Co.—recently had a display in which was arranged tables devoted to a single household necessity—electric irons, percolators, vibrators, toasters, grills—while one table was set for breakfast, holding all the electric implements for preparing same. At one side of the room were the kitchen and laundry conveniences, and at the other an array of electric lamps with silk, parchment and art glass shades.

The firm makes a specialty of vacuum cleaners, and, according to Mr. Burgess, the manager, business the past season has been exceptionally good. Patrons are circularized regularly, and whenever a special display is made announcements are sent to customers and advertisements as well as making statements in the daily papers. A recent vacuum cleaner display attracted the attention of all who passed through the arcade. In the center was a small, ancient looking vacuum cleaner, with a card which informed the public was "Grandpa Hoover—the first suction sweeper made —sold for $125 cash." Nearby was one of the 1919 models, selling for $57.50. A card beside it observed: "Over 40,000 Hoover grandchildren have been sold in Cleveland."

nual charges for material and maintenance for the automatic substation would be $620 and the total actual cost $355.80. Of this latter amount, 82% would be for labor.

The automatic substation, consisting of one 500-kw., 60-cycle, 660-volt, six-phase, G. E., synchronous converter has now been in service for almost one and one-half years. During the first year the substation failed only on four occasions. On two of these occasions the auxiliary relay, the purpose of which is to keep the station from starting up when the alternating-current supply is below a definite voltage, failed to open, a condition since remedied by the adoption of a different type of relay. The second form of trouble responsible for another shutdown was that the thermostat protecting the machine from dangerous temperatures of the bearings functioning. The thermostat had been set at a needlessly low temperature and changing the setting has done away with this trouble. The third cause of shutdown was lightning, which entered the station before the lightning arresters had been installed, blowing a fuse and burning off a wire connecting up a lightning circuit with a 660-volt feeder.

Obviously, the above troubles are not serious and are merely incidental as contrasted with fundamental or inherent ones. In fact the automatic substation has proved so reliable that another station of similar type is expected to be installed at an early date. When this second unit is installed copper will be enabled to be recovered to the extent of $9000 and this proposed station would be available should either of the other two stations fail.

INTERESTING METHOD OF MOVING LARGE NUMBER OF POLES.

Use of Jacks Enables Pole Line to Be Moved Ten Feet to the Side Without Opening Circuits.

In building the King's Highway between Dover and Smyrna, Del., it was necessary for the telephone company to move 430 poles sideways a distance of 10 ft. Three methods of moving the pole line without interrupting the circuits in any way were tried.

The first method used consisted of digging a trench 10 ft. long and approximately 6 ft. deep. When several of these trenches were completed the poles were skidded to the new location, after which trenches were refilled and tamped. This method was not considered satisfactory, though, due to the high cost, which averaged about eighteen hours per pole, and introduction of a storm hazard due to disturbing the earth at the side of the poles, although with this method practically no circuit trouble was experienced.

Method No. 2 consisted of digging ten holes in the new location and removing poles 1, 3, 5, 7 and 9 and setting them in their new location. To do this it was necessary to remove the crossarms, after which they were placed on the poles in their new location, and then the wires were transferred. Next the crossarms were removed from poles 2, 4, 6, 8 and 10. Poles were taken down and set in their new locations, then crossarms were replaced and wires tied in. With the second method the hours of labor per pole were reduced from eighteen to twelve, as compared with the first. However, the trouble caused on the circuits with this method was excessive and, due to the importance of the circuits, it became obvious that some other plan of doing the work must be followed, as it was essential to keep the circuits in working order at all times.

The third and most successful method consisted of digging a number of holes in the new location and moving the poles by the use of simplex jacks. The following method was used in doing the job:

First operation—pole 1 guyed in direction away from which pole was to be moved.

Second operation—poles 1, 2, 3, 4 and 5 raised 1 ft. on simplex jacks.

Third operation—poles 1, 2, 3 and 4 raised 2 ft. on simplex jacks.

Fourth operation—poles 1, 2 and 3 raised 3 ft. on simplex jacks.

Fifth operation—poles 1 and 2 raised 4 ft. on simplex jacks.

Sixth operation—pole 1 raised to a sufficient height to allow a 2 by 12-in. by 10-ft. oak plank to be placed under butt of pole, after which pole was skidded on plank to new hole and lowered.

Seventh operation—the jack used at pole 1 transferred to pole 6. Pole 6 raised one foot.

Eighth operation—poles 2, 3, 4 and 5 raised 2 ft. on simplex jacks.

Ninth operation—poles 2, 3 and 4 raised 3 ft. on simplex jacks.

Tenth operation—poles 2 and 3 raised 4 ft. on simplex jacks.

Eleventh operation—pole 2 raised to a sufficient height to allow a 2 by 12-in. by 10-ft. oak plank to be placed under butt of pole, after which pole was skidded on plank and lowered.

The work of moving all poles continued in the order above and men followed with shovels and tampers, lining up the poles in their new locations.

With Method No. 3 it was found that the work could be done in approximately seven hours per pole and without causing any trouble on the circuits or damage to the wires, which was the objection to the second system.

By the improved process it was found perfectly feasible to raise the pole with the simplex jack completely out of the ground and then skid it to the hole at the new location. This dispenses with the intermittent or step-by-step process of raising the poles and resulted in a further reduction in the cost of moving the line.

The pole is first pulled out of the ground by means of the simplex jack, operated by two men while a third man holds the pole against the lean of the line with a rope guy on the road side. The pole is then launched on a plank or metal strip and skidded over to the new hole, using the simplex jack as a lever. This latter operation is usually in two stages, because the jack is not sufficiently long to permit the pole to be pushed ten feet in one operation. While the pole is being skidded to its new hole the man with the rope guy changes his position to the field side of the line so as to assist in pulling the pole over and lowering it into the hole.

The pole is lowered into the hole with no interruption of service and without any damaging effect to the open wire construction. The outfit of six men is divided into three-man gangs, each of which works at one pole; in this way two poles can be jacked over simultaneously. The gradual lean of the reset poles toward the pole that is being raised out of its old location takes care of all the slack required to permit the removal without untying the wires.

After about fifteen poles have been set in their new location the gang goes back to line up the poles and fills in the holes. The last poles of this newly lined up section are then supported with pikes or rope guys to prevent them from pulling out of line by the lean of the succeeding poles in process of being moved.

QUESTIONS AND ANSWERS

All readers are invited to submit questions and answers to this department. Anonymous communications will not be considered. Questions should relate to electrical matters of any kind. Answers contributed by readers should be submitted preferably within eight days of the date of publication of the question and should be limited, if possible, to 300 words. Payment will be made for all answers published.

Questions.

No. 467.—Operating Cost of Electric Household Refrigerators.—I would like to know from some reliable source what is the operating cost of the electrically operated refrigerators that are being recommended for household use. What is the experience as to their dependability?—R. H. T., New York, N. Y.

No. 475.—Pricing Motor Repair Work.—Can some of the readers through the questions and answers columns give me the best methods of pricing repair work on electric motors, armature winding, etc., and the best methods of setting the selling price of insulating materials and of magnet wire?—D. D., Indianapolis, Ind.

No. 476.—Colored Lighting Effects in Theater.—In producing the various changeable colored lighting effects in a theater that are now becoming so popular what is the smallest number of primary colors that will serve? Is it possible to get more pleasing gradations of color through using more sets of differently colored lamps than of primary colors alone? What is the most practical way to secure such color effects?—H. M. P., Seattle, Wash.

Answers.

No. 471.—Ringlemann Charts for Determining Smoke Density.—The use of Ringlemann charts is frequently mentioned in connection with the determination of the density of smoke emitted from smokestacks. I would much appreciate an explanation of what the Ringlemann chart actually is and how the density of smoke may be determined from its use.—M. A. P., Spokane, Wash.

(*Answer A* appeared in Oct. 11 issue.)

Answer B.—In order to make its enforcement easier and more certain a smoke ordinance must state definitely what density shall not be emitted. Some practical standard of comparison by which the density of the smoke may be determined should be specified. The Ringlemann smoke chart is one of these standards and consists of four cards having black lines forming squares upon them, the squares thus formed being of varying widths. Desirable widths and spacings as suggested by Professor Ringlemann are:

Card 1.—Black lines 1mm. thick 10mm. apart, leaving spaces 9mm. square.

Card 2.—Lines 2.3mm. thick, spaces 7.7mm. square.

Card 3.—Lines 3.7mm. thick, spaces 6.3mm. square.

Card 4.—Lines 5.5mm. thick, spaces 4.5mm. square,

Card 5.—All black—not always used.

Card 0.—All white—not always used.

In making observations of smoke proceeding from a chimney the four cards, printed in a horizontal row on one chart are hung at a point about 50 ft. from the observer and as nearly as convenient in line with the chimney. At this distance the individual lines become invisible, the cards ranging in tint from very light gray to black. The observer glances from the smoke coming from the chimney to the cards, determines which card most nearly corresponds with the color of the smoke, and makes a record accordingly, noting the card number and time of observation. The observations are repeated at one-fourth or one-half minute intervals. From these records the smoke density may be determined for each hour or fraction thereof for each day.—H. E. W., Chicago, Ill.

No. 473.—Changing Motor Frequency.—I would like information regarding changing of a 1/8-hp. Holtzer-Cabot single-phase motor of 1130 r. p. m. and 12 poles now operating on 133 cycles to make it possible to operate on 60 cycles at a speed of 1200 to 1300 r. p. m.—M. B., Dekalb, Ill.

To convert a 1/8-hp. motor designed for 133 cycles to use on 60 cycles at approximately 1200 r. p. m. it is necessary to rewind the motor, using a six-pole winding. To determine the proper winding, size wire and number of conductors per slot it is necessary to have detailed dimensions of the core and slots. It is also desirable to know the size of wire and number of conductors per slot used in the original winding.—H. S. R., Wahpeton, N. D.

No. 474.—Inferior Wire for Fixtures.—In my experience I have often run across fixtures wired with old Code wire and with No. 20 and even No. 22 low-voltage wire. I understand that considerable quantities of these wires are being used. What can be done by a contractor who wants to live up to rule 30*c* of the National Electrical Code to meet the competition of those who ignore this rule?—B. T. F., Morgan Park, Ill.

Any contractor that knows of a violation of the rules of the National Electrical Code, or of any city electrical code, should expose such violation publicly. This may be done in various ways. First he should assure himself that the parties perpetrating the violation are doing so intentionally and are not unaware of breaking the rules. With this fact established there is practically no limit as to how the exposure may be made. If there is municipal inspection, the inspection department should be informed. If insurance inspection alone prevails, the underwriters should be notified. If there is an organization of electrical contractors in the city, action should be brought through it to stop unfair competition. In the absence of any of these agencies the contractor who wants to see good construction carried out should expose the unscrupulous contractor to architects and builders directly and, if necessary, through newspaper advertisements or other means. This may stir up spirited disputes, but the honest contractor has all the merits of the dispute on his side. If he is well informed on the rules of good practice and can back them up with the reasons for their existence, he will readily get the public's support in his effort to safeguard the community against fire and accident hazards. If more contractors had the courage to take this stand poor construction would quickly become very rare.

The particular rule in question is one of the best rules of the National Electrical Code, although there are many electrical men who would like to see it made stiffer by making No. 16 B. & S. wire the smallest permissible size for fixtures instead of No. 18. I believe that where wire inferior to No. 18 approved wire is used it is by fixture men and contractors who, in the effort to save a few cents thereby, purchase the wire under various subterfuges. If the manufacturer could insist on knowing for what purpose the wire was to be used, he might refuse to sell low-voltage wire for fixtures. But some of these purchasers may ask for wire for automobile use and then wire fixtures with it. This makes the matter almost exclusively one for inspectors and competing contractors to work out.—S. D. C., Detroit, Mich.

SHEFFIELD, ENGLAND, TO PLACE BIG ORDER FOR ELECTRICS.

$500,000 for 51 Electric Trucks for Refuse Removal, and for Electric Garage.

By far the most important move that has taken place in England in the adoption of electric vehicles for refuse removal is reported from Sheffield, where 51 vehicles of the kind are to be added to the 12 already in use and 3 on order, making a total of 66 for the whole city.

It is interesting to note that the establishment of the 47-hour working week led Cleansing Superintendent J. A. Priestley to report to the City Health Committee on the question of the future policy of the department in relation to the equipment needed for the collection and disposal of the house refuse.

The reorganization plans have had to take into account the fact that the alteration in hours will mean 8% reduction in the working time of the men and a corresponding decrease in the work accomplished is anticipated. This involves the necessity of adding to the equipment to the same extent in order to obtain equal results. During the war equipment could not be added to and the system at present does not give sufficient elasticity to deal with pressure or rush periods. The department must possess equipment to meet any emergency.

Mr. Priestley in his report, upon which the city has decided to take action, says:

"The experience of the past four years with electric motors has been eminently satisfactory and has demonstrated that the work can be done by their agency more expeditiously and economically than by horse labor. I am satisfied that for house-to-house collection work the electric vehicle cannot be approached by petrol (gasoline) motors. Steam wagons approach more nearly to electrics in suitability and economy for this work, but the latter possess advantages in noiselessness and ease of maneuvering that are not shared by steam wagons and require the services of one man only to drive them, and that not necessarily a skilled man. Since electric vehicles were introduced in Sheffield we have added to the fleet from time to time such a number of vehicles as would compensate for the wearing out of the horses engaged on refuse collection but no surplus vehicles have been obtained. With the conclusion of the war and the greater facility for obtaining delivery of motor vehicles, I think it is desirable that the policy of the department should now proceed on settled lines and that horses should be replaced as rapidly as possible by electric vehicles.

"The total weight of refuse collected in the city during the year ended March 25, 1919, was 110,855 tons which gives an average weekly collection of 2131 tons, but as the amount varies as between summer and winter the maximum amount to be collected during the heaviest period of the year may be taken at about 2600 tons weekly. To collect this quantity of refuse by electric vehicle will require about 60 electrics, or allowing a 10% margin to cover breakdowns, 66 vehicles would be necessary. We have at present 12 vehicles in use and 3 on order and the full program would therefore require the provision of 51 additional machines."

Garage accommodation is available for the existing vehicles and by conversion of stables not now fully occupied provision can be made for a small number of additional machines, but the garaging of 60 or 70 vehicles will necessitate the erection of a properly designed and equipped building for this purpose. For charging the batteries of this number of vehicles three 100-kw. motor-generators would be required in addition to the present charging facilities and as a standby machine is imperative four generator sets of this capacity must be provided. Charging panels, switchboards, measuring instruments, etc., will also be required in proportion to the vehicles and Mr. Priestley estimates that the total cost of the equipment as described would be about $500,000. The process of substitution is to proceed regularly and systematically and it will be spread over a number of years which, having regard to the age and condition of the major part of the stud of horses, should not be longer than six years.

COURT UPHOLDS RIGHT TO FIX POWER SERVICE RATES.

New Jersey Supreme Court Approves Surcharge for Power Service—Private Contracts Must Give Way to Public Welfare.

The State Supreme Court of New Jersey handed down a decision on Nov. 3 upholding the right of the Board of Public Utility Commissioners to allow an increase in the power rates of the Public Service Electric Co. The case in question was brought by the Edison Storage Battery Co., West Orange; Snead & Co., iron works, Jersey City; Crucible Steel Co., Harrison; Independent Lamp & Wire Co., Weehawken, and the Bound Brook Oilless Bearing Co., Bound Brook, these plaintiffs contesting the authority of the Commission to allow a 25% surcharge for power service to industrial consumers.

This order of the Board was made on July 16, 1918, and the rates allowed were to apply to electric energy supplied after Feb. 1, 1918, at which date the company had submitted a revised schedule of charges to the Board as a war measure. The industrial plants contended that they had contracts with the utility company covering a period later than the time noted (Feb. 1, 1918) which fixed the rates at a lower sum than that allowed by the board, and this, it was held, impaired the obligation of their contracts in violation of constitutional rights. In its decision the court said:

"Private contracts as to rates to be charged for furnishing electric power must yield to public welfare, and the state may fix a just and reasonable rate without regard to that reserved in the contract. Whether the Utility Commissioners are required to determine private rights, arising on contracts, in fixing rates for the public good, and to discriminate between those of the public who have contracts and those who have not, and otherwise make a discrimination according to agreements between citizens, or whether their orders should be general as to all who are within the class affected, we are not required to pass upon this case, although inclined to the opinion that such orders should be general, leaving the contracting parties to settle their rights in an action raising that question in which they are parties and not by certiorari. The record sustains the findings of the Board that the rates fixed are just and reasonable and we being of opinion that the order properly relates to the initial proceedings changing the rates, and that private contracts must give way to public welfare when they conflict, if that question can be raised in these proceedings, the writs in all the cases will be dismissed with costs."

Operating Practice

Window for Forced-Draft Chain-Grate Stokers—Automatic Substation Performance and Cost—Moving Long Pole Line

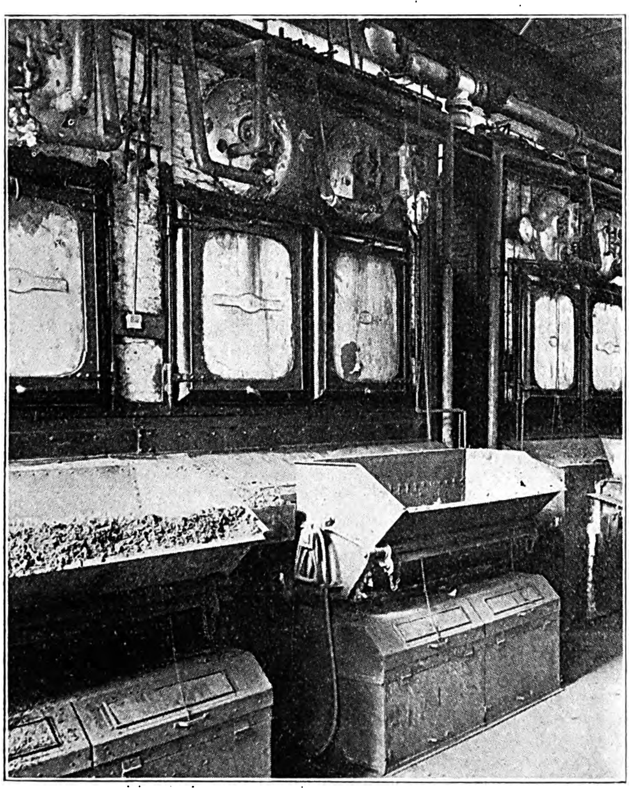
PROVISION FOR WATCHING FORCED-DRAFT CHAIN-GRATE STOKERS.

Window in Casing Enables Chain to Be Watched and Troubles to Be Avoided by the Breaking of Links.

When forced draft is applied to the chain-grate type of stoker, it is necessary to install wind plates underneath the grate to guide the air blast to the position where it is wanted, and to encase the stoker so that the air is forced through the fuel bed and not out into the boiler room or between the stoker grate and the bridge wall, etc.

There is, however, an objection to encasing or enclosing the chain-grate stoker in that the chain, or the grate bars, cannot then be seen. If a link or chain breaks, and these do break sometimes, it is necessary to replace the broken link otherwise the damage will spread and the chain will spread and finally fail altogether. The remedy is, of course, watchfulness on the part of the fire-room crew. When a link breaks, the rate of stoker travel can be reduced—the fire can be banked and the stoker stopped altogether, if necessary—until new links have been put in. This is a comparatively simple job, and is looked upon as merely an incident in a year's work.

With the stoker encased with sheet metal, which is invariably chosen, a link may break and the grate continue to be revolved without the fact being known, because the grate is invisible to the firemen. Under such conditions a broken link becomes a menace because of the extensive damage that may follow. The accompanying illustration shows the manner in which one company has overcome the objections to enclosing its chain-grate stokers, which was necessary when equipping their stokers with forced draft.



Windows in Stoker Casing as Used Successfully with Chain-Grate Stokers Using Forced Draft and High Rates of Combustion.

Two windows are provided in the casing of each stoker, these windows being of leaded glass. In the casing are installed two electric lamps, so arranged that they cast their light upon the grate. In this way the grate is visible at all times, and trouble due to broken links existing without knowledge is no more probable than when the grates are not encased.

The boilers shown are of 250 boiler hp., of which there are twelve in the station, and operate at ratings of 185% above normal. The use of the glass windows has reduced troubles due to breaking links which is, of course, more likely to occur with mechanical forced draft than with natural draft, because of the more rapid combustion rates and higher rate of travel of the grate and tendency toward higher fuel-bed temperatures.

AUTOMATIC RAILWAY SUBSTATION AT BUTTE PROVES ECONOMICAL.

Economy of Investment and Reliability in Service Cause Second Installation to Be Planned.

It was necessary for the Butte Electric Railway Co. to rearrange its railway distribution system because an existing power contract was lapsing and in order to reduce leakage current in the return because of electrolysis of underground pipes. This latter was eventually accomplished by adopting the insulated return-feeder system.

Were a railway substation located at the load center of the down-town of the company's system the cost was estimated to be $19,800 for copper plus $1700 expended for line loss in excess of that occurring if one substation were located in the down-town district and another in the South Butte residential district. As station operators receive $7 per day it would have been more economical to suffer the line loss than to install a manually operated substation on the basis of two 8-hour shifts for operators at $7 per diem, or $5110 per annum.

It was therefore decided to install an automatic substation, the decision being based upon the following estimates. The cost of the land, building, synchronous converter and control apparatus would be $9000, giving the fixed charges. One day's cleaning and inspection per week would cost $7 per day, or $364 annually. Materials and such incidentals as oil, brushes, contacts for the contactors, wiping cloths, etc., would cost about $256 per year. The total an-

New Appliances

Powerful Electric Locomotive for Mountain Division—Automatic Light Plant—Automatic Projector—Carpet Washer

New Direct-Current Gearless Passenger Locomotives for C., M. & St. P. Railway.

The new 3000-volt direct-current locomotives here described are now being placed in operation for the passenger service on the Othello-Seattle-Tacoma electric zone of the Chicago, Milwaukee & St. Paul Railway.

A large group of railroad officials, mechanical and electrical engineers inspected this new type of passenger locomotive at the General Electric works at Erie, Pa., on Nov. 7. After detailed inspections, the locomotives were subjected to numerous running and control tests.

The original electrification from Harlowton to Avery, 440 miles, has now been operating for a number of years under the extremely bad weather conditions of the Rockies and Bitter Root mountains and, as a result of its unqualified success, the same system will now be used to meet the severe grades and snow conditions of the Cascade range. All the equipment for the original electrification was manufactured by the General Electric Co. including substations and locomotives. The motive power consisted of 42 locomotives for freight and passenger service and four switchers. Of this original equipment, the freight and passenger locomotives were practically the same and differed from each other only in the gear ratio between motors and driving axles.

The new locomotives are an entirely different design, built distinctively for passenger service and possess some very interesting mechanical and electrical features. They will be used on the new Cascade electrification strictly for passenger service and the present passenger engines will be adapted for freight service by changing their gear ratio. The new locomotives are of the bipolar gearless type, with motor armatures mounted directly on the driving axles. In this fundamental feature, they follow the design of the gearless locomotives in use on the New York terminal of the New York Central Railroad, which have given remarkable operating results during the past ten years. The chief advantage of this method of construction is the great simplicity of mechanical design which eliminates all gears, armature and suspension bearings, jackshafts, siderods or other transmitting devices. The remarkably low cost of maintenance of the New York Central locomotives over the entire period is attributed largely to the gearless type of construction.

Each of the new C., M. & St. P. passenger locomotives weighs 265 tons with 229 tons on drivers. They have 14 axles, 12 of which are driving and two guiding axles. The weight of the armature and wheels is the only dead weight on the track and this is approximately 9500 lbs. per axle. The total weight on drivers (458,000 lbs.) is 86% of the weight of the locomotive but, being distributed among 12 axles, results in a weight of only 38,166 lbs. per axle.

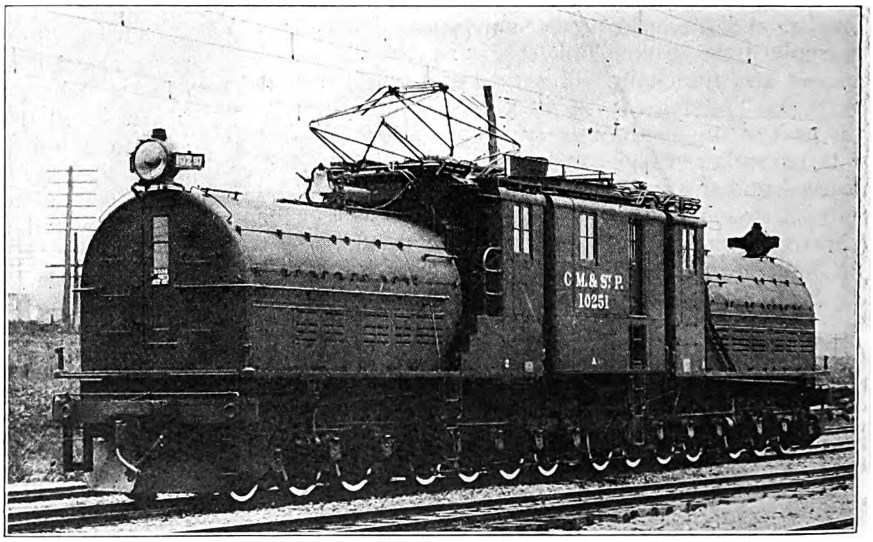


Fig. 1.—3000-Volt, Direct-Current, Gearless Passenger Locomotive for C., M. & St. P. Cascade Electrified Zone.

One of the most interesting and important features of the locomotive is the design of the leading and trailing trucks and the method of suspension of the cab weight upon them. The successive trucks are coupled together in such a way as to deadbeat or break up any lateral oscillations which may be caused by inequalities of the track. The weight of the main cab is so supported on the front and rear trucks that any lateral thrust or kick of the leading or trailing wheel against the track is cushioned by the movement of the main cab, which increases the weight bearing down on the wheels at the point where the thrust occurs, and automatically reacts to prevent any distortion of the track. The result of this design is such as to give riding qualities at high speeds which have probably never been attained before in a double-ended locomotive. Exhaustive tests on the General Electric test tracks at Erie, Pa., have demonstrated the remarkable riding qualities of the new locomotive at speeds as high as 65 m. p. h., which is the limit of speed on the length of test track available. These tests also indicate that the locomotive will operate at much higher speeds with equal success.

The locomotive is designed for handling in normal service a 12-car train weighing 960 tons trailing against a grade of 2% at 25 m. p. h. This performance requires 56,500 lbs. tractive effort which is equivalent to a coefficient of adhesion of 12.3% of the weight upon the driving axles. The wide margin thus provided between the operating tractive coefficient and the slipping point of the wheels, as well as the ample capacity of the motors, will allow this locomotive to haul trains with as many as 14 cars in emergencies. For continuous operation, the locomotive is designed to operate at 42,000 lbs. tractive effort at a speed of 25 m. p. h.

The total weight supported on driving axles is practically the same as that on the present geared passenger locomotives, weighing a total of 300 tons. The table below gives the principal dimensions, weights and capacity of the gearless locomotive.

Length inside knuckles	76 ft. 0 in.
Length over cab	68 ft. 0 in.
Total wheel base	67 ft. 0 in.
Rigid wheel base	13 ft. 11 in.
Diameter driving wheels	44 in.
Diameter guiding wheels	36 in.
Weight electrical equipment	235,000 lbs.
Weight mechanical equipment	295,000 lbs.
Weight complete locomotive	530,000 lbs.
Weight on drivers	458,000 lbs.
Weight on guiding axle	36,000 lbs.
Weight on each driving axle	38,166 lbs.
Number of motors	12
One-hour rating	3240 hp.
Continuous rating	2760 hp.
Tractive effort—1-hour rating	46,000 lbs.
Tractive effort — continuous rating	42,000 lbs.
Tractive effort — 2% ruling grade with 960-ton train	56,500 lbs.
Coefficient of adhesion ruling grade	12.3%
Starting tractive effort—25% coefficient of adhesion	115,000 lbs.
Rate of acceleration starting 2% ruling grade	0.48 m.p.h.p.s.

Control equipment for the new locomotive is similar in most respects to that used on the original locomotives which have now been operating nearly four years. Modifications were, of course, necessary to comply with the different arrangements of motors. Advantage is taken of a new scheme of connections by means of which four of the main locomotive motors are utilized to furnish exciting current during regeneration, thus reducing the size of the motor-generator set used for control, accessories and train lighting. An appreciable reduction in the weight of control equipment is obtained, at the same time providing for effective regenerative electric braking on the down grades. The motor-generator set furnishes control current for operating the contactors and for charging an 80-volt storage battery which supplies lights and power for the accessory apparatus. This battery is, in general, similar to those used on the passenger coaches. The master controller is constructed in three sections arranged for both motoring and regenerating, all of the cylinders being suitably interlocked to prevent incorrect manipulation.

Each of the 12 driving motors is bipolar, two fields being supported upon the truck springs with full freedom for vertical play of the armature between the pole faces. Fig. 2 shows the end outline of the locomotive with a sectional view of one of the motors indicating the location of the armatures and the magnetic section. For full-speed operation, the 12 motors are connected three in series with 1000 volts per commutator. Control connections are also provided for operating 4, 6 or 12 motors in series. Additional speed variation is obtained by tapping the motor fields in all combinations. Cooling air for each pair of motors is supplied by a small motor-driven blower. This arrangement avoids

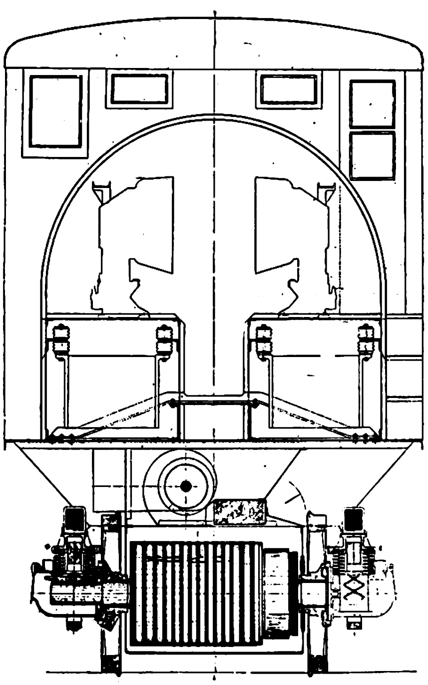


Fig. 2.—End Outline and Motor Cross Section of New Gearless Locomotive.

the heavy duct losses encountered with a single large blower.

As may be seen from the curves of Fig. 3, the gearless locomotive shows a much better efficiency at high speeds than the geared type, owing to the elimination of the gear drive. In passenger service, where there are long stretches of level track and stopping points are comparatively few, a much higher efficiency is obtained in all-day service. These curves show an efficiency at 50 m. p. h. approximately 10% higher than the geared type of locomotive.

The 3000-volt contactors and grid resistors are mounted in the curved end

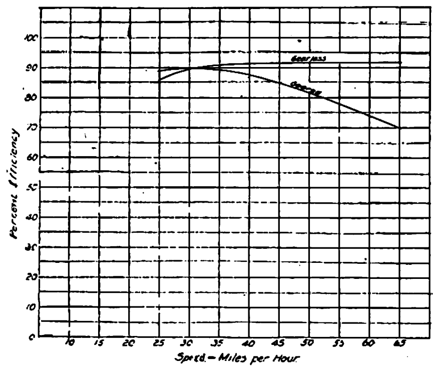


Fig. 3.—Comparative Efficiency Curves of Geared and Gearless Locomotives.

cab at each end of the locomotive. In one of these cabs there is also located the 3000-volt air compressor and storage battery. In the other is located a small motor-generator set and the high-speed circuit-breaker. The operating cabs contain the master controller, indicating instruments, and a small air compressor (in No. 2 cab) operated from the battery circuit with sufficient capacity for raising the pantograph when first putting the locomotive in operation. Near the controller are the usual air-brake handles for standard braking equipment.

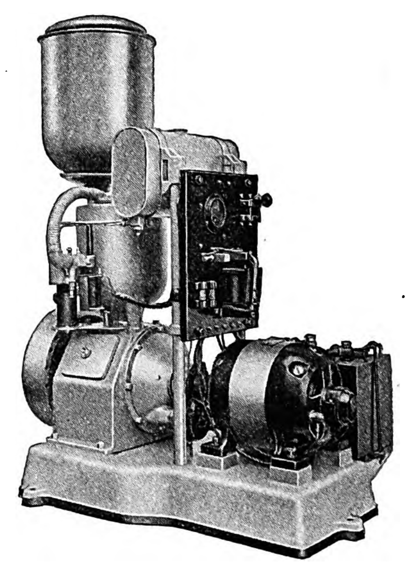
In the center cab is the oil-fired steam boiler for heating passenger trains with accessories including tanks for oil and water, circulating pumps and a motor-driven blower for furnishing forced draft. A slider pantograph, similar in construction to those now in use, is mounted on each of the operating cabs. This pantograph has two sliding contacts, giving a total of four points per slider with the double trolley. The pantograph and flexible twin trolley construction enable the locomotives to collect currents as high as 2000 amperes at speeds up to to 60 m. p. h. without noticeable arcing at the contact points. The second pantograph is held in reserve as a spare. Sand boxes, with pipes leading to each pair of driving wheels, are located directly beneath the pantograph and outside of the operating cab.

The new locomotives will operate over the section between Othello, Seattle and Tacoma, including 17 miles of 2.2% grade from the Columbia river west and 19 miles of 1.7% grade between Cedar Falls and the summit of the Cascades. The traffic over this division consists of the heavy main line transcontinental passenger trains "Olympian" and "Columbian," carrying from 8 to 12 steel passenger coaches which will be handled over the maximum grades without helpers. Freight pushers are already in operation on the 2.2% grade using two of the locomotives from the original electrification. It is expected that electrical operation during the coming winter will assist in overcoming many of the delays which are commonly met with during almost every winter's operation in this district in Washington.

Holt 110-Volt Automatic Electric Light and Power Plant for Rural Service.

Among farmers and other rural residents who cannot secure electric service from central-station lines there is an increasing call for a simple, self-contained electric light and power plant of standard voltage. Such a plant permits of a standard wiring installation, use of standard-voltage lamps and appliances, eliminates need for a large storage battery, and enables a change-over to be made readily at any later time to central-station service when power lines are brought near to the farm or ranch. A plant to meet this need has been developed by the Automatic Light Co., Inc., Ludington, Mich. It is known as the Holt 110-volt automatic power-light plant.

This plan thas been developed during several years and incorporates the results of much experience in this line. It consists of a four-cycle, water-cooled gasoline engine with a six-volt ignition and starting storage battery o1 86 ampere-hour capacity. The engine is direct-connected to a General Electric 750-watt compound geenrator with double armature winding and double commutator, one for 6 volts and the other for 110 volts. The 6-volt winding feeds the ignition and starting battery; the 110-volt winding the load. On closing a switch on any of the load circuits the battery is thrown on the low-voltage winding which acts as motor and starts the engine just like any standard automobile self-starter. The control is simple and compact. Constant voltage is



Holt Automatic 110-Volt Power and Light Plant.

secured through the compound winding regardless of the amount of load up to the capacity of the set.

The Owen Automatic Stereopticon.

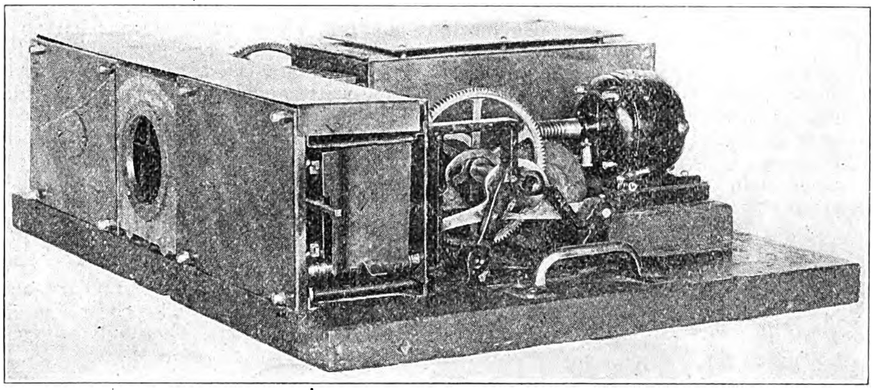
The Owen automatic stereopticon illustrated herewith demonstrates a new use of electricity and is a simple device that can be carried in a suitcase. It is claimed that it costs little to operate, it has nothing to wear out or replace, and will last practically a lifetime.

Its essential parts are a 1000-cp., gas-filled Mazda projection lamp, condensing and objective lenses, a screen upon which the pictures are to be projected, the necessary slides, and a small General Electric motor to be attached to an electric light socket and which operates on either direct or alternating current.

The usual size projects 46 slides upon the screen, allowing each to remain in position twelve seconds, when it is automatically replaced by the next. Machines which project 100, 200 or more slides may be built to order.

The picture may be shown either large or small by merely varying the distance of the objective lens from the screen. The projection is in the form of a cone with the small end at the lens, and the large end on the screen, and the farther the screen from the machine, the larger the picture.

This automatic stereopticon is invaluable for store and window advertising, for educational work, home entertainments, and for a variety of purposes that will suggest themselves. Attractive and interesting, tireless and reliable, it is one of the best sellers of all commodities.



Easily Portable Stereopticon for Automatically Exhibiting Advertising or Educational Slides.

Electrically Operated Carpet Washer for Hotels, Clubs and Similar Institutions.

One of the displays at the recent Chicago Electrical Show that attracted special attention from the thousands who daily visited the Coliseum was the electrical carpet washer, shown for the first time. The machine is a brand new invention and was demonstrated daily in the booth of the Hamilton-Beach Manufacturing Co., of Racine, Wis. This machine scrubs and cleanses rugs of any size right on the floor.

For demonstration purposes, an offer was made to all attending the show to clean without cost all rugs brought in. Hundreds of rugs, ranging all the way from priceless orientals to humble domestics, were cleaned daily. The hundreds who wedged themselves about the exhibit were astonished to behold rugs, which had been given hard wear and become so dirty that scarcely any pattern or design could be distinguished in them, emerge from the washing process looking as bright as on the day they were purchased.

The washer is extremely simple in construction and does not require experienced help to operate it. Soap suds are made from pure water and a special soap compound. This compound is said to be free from all chemicals and animal fats, its base being a vegetable oil that leaves the carpet sweet-smelling and sanitary. The suds are poured into an aluminum container and are fed through a small tube into a heater and mixer which is electrically warmed. From there, the rich, creamy suds flow down to the brushes which rest lightly on the surface of the rug. The brushes are made of the same soft porous rubber as a bath sponge and when the washer is in operation oscillate 500 times a minute. The movement of the human hand is thus exactly duplicated by the machine, only hundreds of times more effectively. The cleaning compound is scrubbed down to the very bottom of the nap, cleaning every fiber of the rug or carpet and bringing back all the colors that delighted the eye when the rug was new. A vacuum suction draws all the dirty suds back into a separate container and when the cleansing of the rugs is completed this dirty water is thrown away.

Rug experts who have watched the machine in operation state that it is harmless to the finest rugs and they have no hesitancy in endorsing it in the highest terms. Reports received from hotels, clubs and other institutions which have tried the machine indicate that it cleans the rugs in a very satisfactory manner and at a minimum cost.

The saving effected in cleaning rugs without removing them from the floor will quickly offset the cost of the machine. The additional advantage offered is that it does not become necessary to leave bare and unsightly floors while rugs and carpets are being cleaned. The work is done very quickly and at a very low cost.

Ship Cleaning by Electricity.

An important invention has recently been made in connection with the cleaning of ships' hulls while afloat. The present method is to dry-dock the vessels periodically and set a small army of workers out to chip away the marine growths which have accumulated during a voyage. The expense involved is heavy. For the dry-docking of a 7000-ton ship a charge of about $750 a day is incurred, exclusive of the cost of cleaning, which is a big additional item. With the new apparatus described below it is claimed that this operation can be performed in eight hours by a party of four men, and without any necessity of dry-docking. The new patent is known as the torpedo submarine ship cleaner, and the Rapid Submersible Ship Cleaner Co., London, Eng., has acquired the existing patent rights in connection with it. The apparatus consists of a frame containing a revolving cylindrical brush worked by a submersible motor. At the back of the frame is a screw propeller which forces the brush firmly against the side of the vessel. The power is supplied by a generating set on board a barge carrying a jib from which the machine is suspended, and the only connection between the barge and the ship being cleaned is the fore and aft mooring ropes used for maneuvering purposes. In operation the machine is lowered overboard from the jib, the motor is started, and the screw at once forces the brush against the side of the vessel, and while rotating is lowered down to the required depth, cleaning as it is moved up and down.

New Storage-Battery Jar That Has Proved Practically Unbreakable.

The storage battery in the mind of the average layman is apt to mean a "black box of mystery" mounted on his automobile to start his motor and furnish current for his lights. He is very apt to regard the battery as being delicate in construction, whereas the storage battery actually is today playing a very important part in the most strenuous service. As an instance of this the mine locomotive may be cited.

This mine service is usually very severe and the battery must be exceptionally rugged to withstand the bangs and bumps they receive. The tracks as a rule are bad and head-collisions are not unusual. The battery has in this service, however, made a wonderful record. In the past there has been but one serious objection—the battery jars would sometimes crack under an unusually severe jolt.

The Electric Storage Battery Co., Philadelphia, manufacturer of the Ironclad-Exide battery, realizing this, has for some time been experimenting to develop an unbreakable jar. What is known as the Giant jar is the result. This was briefly described in our issue of Nov. 1, 1919, since which time the following additional data have been secured.

The Giant jar of the Ironclad-Exide battery is made of a semiflexible compound, exceptionally tough and strong. Exhaustive tests have proved that these Giant jars will stand a pressure of 2000 lbs. at their weakest point, whereas the old type jar broke at less than 1000 lbs.; that the Giant jar will support at its weakest point the weight of four husky men, whereas the old jar would not support the weight of one man; that an electrical test of 30,000 volts does not puncture the Giant jar.

Moreover, thousands of these jars have in actual service demonstrated their ability to withstand the hardest and most severe service. This jar is now the standard for the Ironclad-Exide battery that is so very extensively used for mine locomotives, industrial trucks and tractors.

Trade Activities

Mack Searchlight Truck Exhibit—Sterling Manufacturing Erecting New Plant—Special Literature Distributed

Belden Manufacturing Co., Chicago, is sending out Bulletin 1214 on winding machines and coil winding apparatus. This bulletin, which is issued in advance of the new catalog No. 8, introduces a number of new machines which have been developed for use by the trade. These machines are described in detail with illustrations accompanying the text.

Attachment Plug Patent Litigation.—In the suit of Harvey Hubbell, Inc., vs. the General Electric Co. and Bryant Electric Co., for infringement of Hubbell patent Nos. 774,250 and 774,251 covering attachment plugs, decisions have been filed by Judge Thomas in the United States District Court upholding the Hubbell patents and finding infringement thereof. In the suit of Bryant Electric Co. vs. Harvey Hubbell, Inc., charging infringement of the Burton patent, a decision has been filed by Judge Thomas in the United States District Court, finding the Burton patent invalid.

Sterling Manufacturing Co., Cleveland, Ohio, manufacturer of ammeters and voltmeters, is constructing a new plant, which it is expected will be ready for occupancy within three weeks. The building, which is of reinforced concrete construction, is two stories, 65x100 ft. Provision has been made for the erection of another story should this be found necessary. In addition to this structure, the company is now planning to erect an office building, 60x75 ft. and expects to start construction work very shortly.

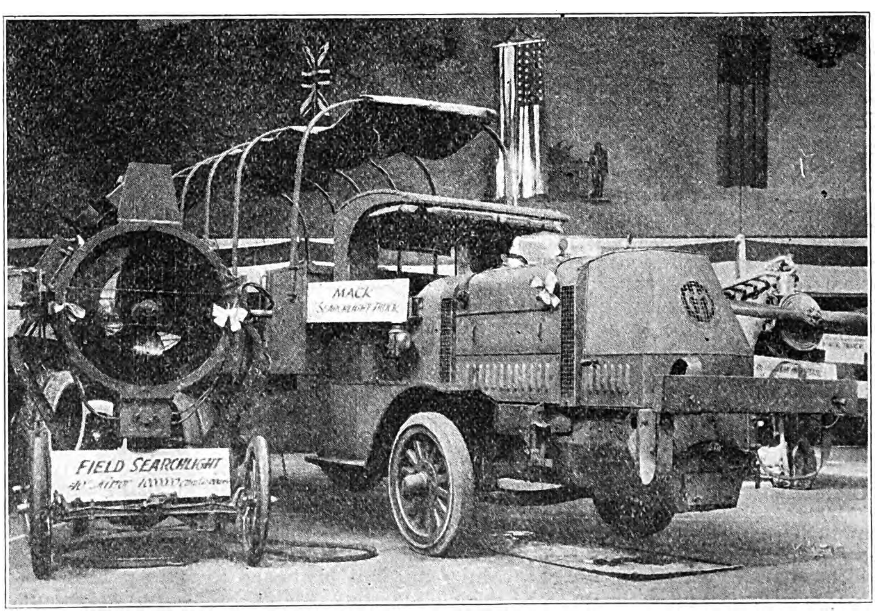
Benjamin Electric Manufacturing Co., Chicago, is sending out a new and very complete catalog of 96 pages descriptive of Benjamin illuminating and wire devices and specialties. Several pages are devoted to illustrated descriptions of new Benjamin material, comprising elliptical angle and other reflectors, reflector socket with wire-glass guard, shade-holder reflectors, moisture and dustproof fixtures, safety flash receptacles, clusters for stand lamps, etc., which are bound in the front of the catalog. For the convenience of the user, the standard line of Benjamin products is grouped in schedules as follows: wireless clusters and plug clusters, reflectors and lighting fixtures, special Mazda C fixtures, wiring devices and specialties, accessories, tool sets and automobile devices. In addition to the detailed and illustrated descriptions of these products, the catalog contains considerable valuable data on illumination. A convenient feature of this publication is the numerical index, which gives full details covering standard package quantities, weights and discount schedules.

Hugh L. Cooper & Co., 101 Park avenue, New York City, has issued a neat book of views of water power projects entitled "Hydro-Electric Developments." The projects illustrated are some of those in the construction of which the company has been engaged and include the Mississippi development at Keokuk, Iowa, the Electrical Development Co.'s plant at Niagara Falls, N. Y., the McCall Ferry development at Holtwood, Pa., the Sao Paulo dam in Brazil, and the Winnipeg. Electric Railway development at Lac du Bonnet, Canada. The views indicate some of the difficulties that the water power engineer has to contend with in some instances.

Ingersoll-Rand Co., 11 Broadway, New York City, has issued a number of new pieces of literature on its various products. Form 8707 is a 40-page bulletin on "Little David" pneumatic drills, grinders and saws. Various sizes and models of the different machines are illustrated and detailed descriptions concerning the particular tool to use for a given purpose are included. The descriptive matter is supplemented with a number of tables giving air consumption of the various tools, etc. Another publication is entitled "'Tis a Good Investment," illustrating and briefly describing Class ER and Class FR compressors in small machine shops, power houses, garages, etc. A third bulletin describes the air lift method of pumping and shows a view of the installation of the Ingersoll-Rand air lift in a Georgia water works. The company will soon have ready for distribution Form 9029 which will be a pictorial products catalog, illustrating and describing practically the entire line of products marketed by this concern. Copies of these bulletins will be sent free on request to either the New York office or any of the branch offices.

Mack Searchlight Truck Exhibited in New York.—One of the interesting exhibits made during the Motor Transport Corps' show in New York on Oct. 16-18, was the Mack 5-ton searchlight truck illustrated herewith. This truck was made by the International Motor Co., New York City, and formed one of a fleet of trucks used by army engineers for night work in building roads, bridges and similar works. The engine on the truck is arranged to drive the truck and also to drive a 15-kw. generator, for furnishing energy to the 1,000,000-cp., 40-in. field searchlight. The latter is mounted on a separate chassis and can be easily removed from the truck and placed in any position desired.

The Motor Transport Corps controls all army motor equipment except heavy artillery tractors, tanks and hospital ambulances. When we entered the war, the United States Army did not own more than a thousand motor trucks. A year and a half later it had 124,800 trucks and passenger cars and 21,780 motorcycles in France, and 33,700 trucks and passenger cars, and 10,170 motorcycles in this country. Of this total of 190,450 motor vehicles, all but 7800 were American made.



Mack 5-ton Searchlight Truck with Portable 40-in. Searchlight Displayed at Motor Transport Corps Exhibition.

Current News

Weekly Record of Construction Activities—Conventions

EASTERN STATES.

Rutland, Vt.—Rutland Railway, Light & Power Co. has recently completed the installation of a new generating unit in its Mendon station, and it is expected that service will be inaugurated at once.

Springfield, Vt.—Colonial Power & Light Co. has been awarded a contract for furnishing additional service for the proposed addition to the Orchard Park Hotel, Manchester, Vt., as well as to the new addition to be erected by the Equinox Co., operating the Equinox Hotel.

Boston, Mass.—Charles H. Tenny & Co., 201 Devonshire street, operating gas and electric light plants in the vicinity of Boston and throughout New England, have completed arrangements for the purchase of the Worcester Gas Light Co., Worcester. It is understood that the new owners will continue the operation of the plant.

Lowell, Mass.—A number of the large textile plants in this vicinity are arranging for the use of fuel oil at their power plants, and oil burning equipment, including burners, pumps, tanks, etc., will be installed. These mills include the Merrima Manufacturing Co. and the Tremont & Suffolk Mills. The American Woolen Co. is now using oil fuel almost exclusively at its mills at Lawrence, Mass.

Meriden, Conn.—Cuno Engineering Co. is having plans prepared for a two-story steel and reinforced concrete plant, 190x230 ft., on a site recently acquired on Colony street. Max J. Unkelbach, New Britain, is architect.

Brooklyn, N. Y.—Brooklyn City Railroad Co. has completed negotiations for the disposal of its property on Flushing avenue and Hopkins street, between Nostrand and Marcy avenues, formerly used for power station and other service, to new interests.

Middleport, N. Y.—Niagara Spray Co. is having preliminary plans prepared for the construction of a number of local manufacturing buildings, including a large machine shop, chemical buildings, with power plant for general works operations, and auxiliary structures. The buildings will be of brick and reinforced concrete construction.

Rochester, N. Y.—American Laundry Machinery Co. has awarded a contract to John Luthere & Sons, 176 North street, for the erection of a new one-story machine shop addition to its plant, located in the Lincoln Park district, about 160x200 ft. Considerable electrical equipment will be required. The structure is estimated to cost $50,000.

Schenectady, N. Y.—General Electric Co. has filed plans for the erection of a new one-story brass foundry addition to its local plant, to be erected at Building No. 89. The structure will be about 100x100 ft., and is estimated to cost $30,000. Contract for construction has been awarded to the H. K. Ferguson Co., Cleveland, Ohio.

Dover, N. J.—New Jersey Power & Light Co. has arranged plans for the construction of a 33,000-volt transmission line to the Replogle mine of the Wharton Steel Co., for furnishing additional electric service for the operation of the properties, at which location a quantity of new machinery is now being installed. The plans include the erection of a new 33,000-volt substation at the mine. The company has also been awarded a contract for furnishing electric power for the operation of the proposed plant of Paul Guenther & Co., Inc., to be located at Wharton.

Harrison, N. J.—Crucible Steel Co. of America, Middlesex street, has completed plans for the construction of a new one-story brick and steel boiler plant addition to its works, to be located on South Fourth street.

Jersey City, N. J.—Pennsylvania Railroad Co. has filed plans for the erection of a new brick cable building at Railroad avenue and Warren street.

Newark, N. J.—Splitdorf Electrical Co., 98 Warren street, has had plans prepared for alterations and improvements in its plant. It is proposed to commence the work at once.

Newark, N. J.—In connection with the construction of the proposed group of hospital buildings at the County Hospital, Overbrook, contracts for which were recently awarded, considerable new electrical and mechanical equipment will be required. The work will include the erection of five structures, and contracts for all miscellaneous work, including heating, plumbing, etc., have been awarded to insure the early completion of the work.

Philadelphia, Pa. — Philadelphia Storage Battery Co., Ontario and C streets, has completed negotiations for the purchase of property at the southwest corner of Ontario and C streets, about 120x195 ft., for a consideration of approximately $13,500.

Philadelphia, Pa.—Plans and specifications for the proposed improvements in the filtration plant at the municipal waterworks plant, Queen Lane station, have been approved by the State Commissioner of Health, and it is proposed to call for bids immediately. The new improvement will approximately double the present capacity of the plant, and is estimated to cost $500,000. Considerable electrical equipment will be required in connection with the work.

Philadelphia, Pa.—Board of managers of the Chester Hospital, Chester, has had revised plans prepared for the construction of a new boiler plant at the institution, as well as other improvements and alterations, including the installation of new heating equipment, plumbing, etc. Ballinger & Perrot, 17th and Arch streets, Philadelphia, are architects.

Pittsburgh, Pa.—Negotiations have been completed by the J. A. Williams Co. for the leasing of the three-story brick building at Shadyside station on the Pennsylvania railroad, about 212x222 ft., on property 212x275 ft., formerly used by the Westinghouse Electric & Manufacturing Co. for the manufacture of shells. The structure comprises approximately 170,000 sq. ft. of floor space.

Reading, Pa.—Metropolitan Edison Co. is arranging for extensive improvements and extensions in its plants and system, including the completion of work on the construction of new high-tension lines. The company, which operates in West Reading, Reading, Lebanon, and Norristown, as well as neighboring sections, has recently authorized an increase in its capital stock from $5,000,000 to $8,000,000, a portion of the proceeds to be used for the proposed expansion.

York, Pa.—Otto Eisenlohr & Brother, Ninth and Market streets, Philadelphia, have completed plans for the erection of a new boiler plant, one-story, to be constructed in connection with other additions at their local plant. The entire work is estimated to cost $50,000. John Hamme, 31 West Market street, York, is architect.

Baltimore, Md.—Park commissioners have approved an appropriation of $18,000, of which $12,000 will be utilized for the lighting of the Mill Race Drive; $3000 for improvements in the lighting system in Carroll Park; and $3000 for improvements in the electric lighting system in Druid Hill Park.

Riverton, Va.—Shenandoah Valley Milling Co. will install a 1600-hp. hydroelectric plant on Shenandoah river and will let contract for electrical equipment. Address Alfred M. Quick, consulting engineer, 418 Equitable building, Baltimore, Md.

Stanley, Va.—Pool Brothers are having plans prepared for the construction of a new electric transmission system and plant.

NORTH CENTRAL STATES.

Cincinnati, Ohio—As a means of protecting the city against possible shortage of electric power, W. W. Freeman, president of the Union Gas & Electric Co., asked the Rapid Transit Commission to let the water into the canal again between the present dam and Charles street. Mr. Freeman proposes to build a dam at Charles street and to use the water power until such a time as the city is ready to proceed with its work on the new rapid transit system.

Dover, Ohio—The $100,000 bond issue for extension to the city light plant and waterworks probably will be submitted to a referendum vote.

Lebanon, Ohio—The city has under consideration the erection of a municipal electric power plant.

Marion, Ohio—An ordinance was passed by the council authorizing the Columbus, Delaware & Marion Railway Co. to install a large number of street lights in this city. Address city auditor.

Columbus, Ind.—S. J. Peabody Lumber Co. will double the capacity of its hardwood mill. The machinery will be operated by electricity.

Portland, Ind.—The city will expend $100,000 building a municipal electric light and power plant, the public service commission having given authority to issue bonds.

Carlinville, Ill.—Standard Oil Co. is making plans to bring the electric power from the big Schoper power to the Berry mine. When this is done the electrical machinery will be installed and the steam engines will be taken out. The power will also be brought to Mine No. 1-A and the steam plant taken out as soon as the work is completed to the Berry mine. The wires will be brought underground from Barry to Mine No. 1-A.

Chicago, Ill.—Chicago Electric Manufacturing Co., 2811 South Halsted street, will build a two-story plant, 100x133 ft., to cost $60,000. George Knouff, president.

Chicago, Ill.—Century Rubber Works have plans for erection of a large plant, to cost $300,000, to be ready for occupancy June 1, 1920.

Chicago, Ill.—Crane Medicine Co. will erect an eight-story concrete factory building, 99x130 ft., at an investment of $300,000.

Chicago, Ill.—Architect E. H. Froh-man, 64 West Randolph street, has prepared plans for a $125,000 electric specialty factory to be erected by Birdman Electric Co. Brick and stone construction. Specifications include freight elevator, steam heating, plumbing and electric lighting. A. Appel, 1422 West Randolph street, is president of the company.

Chicago, Ill.—Kirk D. Holland will erect a three-story factory building, 25x130 ft., for the Double Seal Piston Ring Co., to cost $80,000.

Chicago, Ill.—Plamondon Co., manufacturer of transmission machinery, has purchased property on which it proposes to erect a plant to cost $1,000,000. Work has started on a 200x500 ft., one-story concrete building, to cost about $250,000, which will be the first unit of the plant; and will have approximately 100,000 sq. ft. of floor space.

DATES AHEAD.

Electrical Supply Jobbers' Association. Semi-annual meeting, Cleveland, Ohio, Nov. 18-20. Headquarters, Hotel Cleveland. Secretary, Franklin Overbagh, 400 South Clinton street, Chicago.

American Society of Mechanical Engineers. Annual meeting, New York City, Dec. 2-5. Secretary, Calvin W. Rice, 29 West 39th street, New York City.

American Institute of Chemical Engineers. Annual meeting, Savannah, Ga., Dec. 3-6. Secretary, J. C. Olsen, Brooklyn, N. Y.

Electric Power Club. Meeting, Hot Springs, Va., Dec. 11, 12 and 13. Headquarters, Homestead Hotel. Secretary, C. H. Roth, 1410 West Adams street, Chicago.

National Council of Lighting Fixture Manufacturers. Annual convention, Detroit, Mich., February, 1920. Secretary-treasurer, Charles H. Hofrichter, Cleveland, Ohio.

American Electrochemical Society. Annual convention, Boston, Mass., April 7-10, 1920. Friday, April 9, joint session with American Institute of Electrical Engineers on "Electrically Produced Alloys." Secretary, Joseph W. Richards, Bethlehem, Pa.

National Electric Light Association. Annual convention, Pasadena, Cal., May 18-21, 1920. Headquarters, Hotel Huntington. Acting secretary, S. A. Sewall, 29 West 39th street, New York City.

Chicago, Ill.—Wilson-Jones Loose Leaf Co. will erect a two-story building, 260x360 ft. at Franklin boulevard and Spaulding avenue and will cost $750,000. The new building will have a total floor space of 187,000 sq. ft.

Chicago, Ill.—Property has been purchased by the Union Wire Mattress Co. on which it is proposed to erect a plant to cost $500,000, with a floor area of about 200,000 sq. ft. The first unit of the plant will be started in spring.

Chicago, Ill.—Arthur Jones Electrical Co., 2837 South State street, is planning to build a two-story plant, 125x125 ft., to cost $60,000.

East St. Louis, Ill.—Home Ice Cream Co. will erect plant, 98x100 ft., three stories high, to cost $70,000.

Galena, Ill.—Several short electric extensions to serve farmers near Platteville and Hazel Green are being run by the Interstate Light, Heat & Power Co. at the expense of the farmers.

Mound City, Ill.—G. Murphy will expend $20,000 for the equipment for the Mound City ice plant.

Ottawa, Ill.—Illinois Farmers Packing Co. will erect $100,000 addition to plant and will install $50,000 worth of equipment. The new building will be 95x45 ft., four stories and basement.

Springfield, Ill.—The sum of $600,000 in bonds has been authorized to finance the municipal light plant. Address Commissioner Walter J. Spaulding.

Antigo, Wis.—Red River Manufacturing Co., whose plant at Phlox was destroyed by fire Nov. 4, will rebuild on a larger scale.

Oshkosh, Wis.—Doman Manufacturing Co., which has acquired the assets of the Oshkosh Washing Machine Co., will build a one-story plant addition, 40x200 ft., and enlarge its power plant. H. C. Doman is general manager.

Grand Rapids, Minn.—Prairie River Power Co. has been granted permission to construct a dam in falls of Prairie river as soon as construction contract can be let. A high-tension transmission line will also be constructed.

New Ulm, Minn.—Minnesota Flint Rock Co. contemplates erection of a high-tension line from light plant to its quarry at Redstone. Address A. R. Voss.

Shevlin, Minn.—The city contemplates erecting an electric light plant. John N. Desjardins, village recorder.

St. Paul, Minn.—A 100-kw. electric brass furnace has been installed by the Union Brass & Metal Co., and will be in operation within thirty days. Electric current will be supplied by the Northern States Power Co.

Ulen, Minn.—J. F. Heiberg will install electric lighting system and power.

Sac City, Iowa—Thirty farmers of Sac county have incorporated the Pleasant Hill Electric Co., which will construct and operate a high-tension electric line in Clinton and Bayer Valley townships.

Sioux City, Iowa—The work of inspecting the Bell telephone line between Sioux City and Sioux Falls has just been completed by a crew of men working under the direction of John Duncan of St. Cloud, Minn. This inspection is a preliminary survey, the ultimate object of which is the virtual rebuilding of the line in 1920. The improvement work on this is expected to begin in the spring. Estimated cost $100,000. Copper wires will replace the worn copper and steel wires with which the line is equipped at present.

Koshkonong, Mo.—It is reported that the Missouri Iron & Steel Corp., St. Louis, plans a hydroelectric development here.

Lexington, Mo.—Lexington Electric Co. contemplates the erection of a transmission cable across the Missouri river and to Richmond. Estimated cost, $50,000.

Richmond, Mo.—A new lighting system to cost approximately $35,000, will be installed by the city. Address city clerk, Richmond.

Wichita, Kans.—An estimate of $6250 was presented the city commissioner as the cost of installing system of lighting on First street, from Main to Water street, and on Water street from First street to Douglas avenue. The cost will be apportioned among property owners.

Kimball, Neb.—Bond issue for $25,000 issued for additional electric light construction was purchased by the Lincoln Trust Co., 126 North 11th street, Lincoln.

Armour, S. D.—Townships of Ethan and Dimock have raised $25,000 for installing lights here.

Claire, S. D.—Special election has

been held which authorized village to construct an electric distributing system and purchase current from New Effington Electric Co., New Effington.

Hartford, S. D.—Hartford Light & Power Co. will extend its wires to Chancellor to furnish electric lights.

Sioux Falls, S. D.—A local quarry will increase its daily output to 800 cu. yds. or four times its present capacity by means of new machinery to be installed soon.

Calvin, N. D.—Plans are in progress for establishing an electric light plant.

Carthage, N. D.—City granted L. W. Liddle a franchise to install an electric light plant.

Fargo, N. D.—The city commission will take immediate steps to obtain estimates on the cost of an electric light plant of sufficient capacity to supply the city.

Sawyer, N. D.—Cook Robinson has been granted franchise to install an electric light system. Contracts have been let to Northwestern Electric Co., Minot, N. D.

SOUTH CENTRAL STATES.

Covington, Ky.—Willard Manufacturing Co., manufacturer of machine tools, plans the erection of a one-story building, 63x160 ft.

Harland, Ky.—Bowers Manufacturing Co. will install electrically driven lathe, hammer, etc.

Kaplan, La.—Electrical equipment will be purchased for the light plant. Address Eugene Clymer, mayor.

Hobart, Okla.—City is planning for the issuance of bonds for $135,000, the proceeds to be used for the installation of a new municipal electric light plant.

Miami, Okla.—Miami Traction Co. is understood to be arranging plans for the rebuilding of its electric power plant recently destroyed by fire, with loss estimated in excess of $75,000. B. B. Tatum is president.

Oklahoma City, Okla.—Deignan Motor Co. will construct a $200,000 factory for rebuilding Fords.

Pawhuska, Okla.—The system of municipal electric lighting and water works will be improved here shortly through the addition of new generating machinery and pumping apparatus. The present lighting equipment has proved inadequate to meet the demands of the city.

Tonkawa, Okla.—Bonds to the amount of $15,000 have been voted for improving electric light service. Johnson & Benham, consulting engineers. Firestone building, Kansas City, Mo.

Albany, Tex.—Albany Light & Power Co., which has been incorporated with a capital of $30,000, will install an electric light and power plant. The incorporators are: T. B. Wood, J. J. Mahan and R. A. Cox.

Brady, Tex.—Contract has been awarded by the city council for the installation of a new municipal electric plant.

Kileen, Tex.—City Light & Power Co. has had plans prepared for the reconstruction of its electric light and power plant, recently destroyed by fire with loss estimated at about $28,000.

Wichita Falls, Tex.—Wichita Falls Electric Co. has increased its capital stock from $775,000 to $1,775,000. It plans to make large additions to its electric light and power plant here.

WESTERN STATES.

Drummond, Mont. — Drummond Light & Power Co. has organized with capital stock amounting to $10,000. H. J. Faust, chairman of board of directors. Work on the installation of the plant will be started at once.

Superior, Mont.—Montana Power Co. is now surveying a line from Taft to Amazon Dixie at Sildix to furnish power to that mine. Construction of the line will be commenced when the survey is completed.

Yuma, Ariz.—New King Mining Co., operating in the Kola mining district, is understood to be arranging plans for the construction of a new high-power transmission line from Yuma to its properties, a distance of approximately 70 miles. W. J. Johnson is manager of the mine.

Millville, Utah—City council has recently completed work on the construction of a new electric distributing system to be used for municipal service.

Boise, Ida.—Ashton-St. Anthony Power Co. has filed application with the Public Utilities Commission for permission to make extensions in its transmission system to the municipality of Drummond, Fremont county.

Sandpoint, Ida.—Western Pole Preserving Co. is installing an additional 43 hp. in motors for the operation of the plant at Sandpoint. Electrical energy is furnished by the Mountain States Power Co.

Petersburg, Alaska—City council has acquired a site for a hydroelectric power plant, and the plans are to build a plant of the capacity of 5000 hp.

Burbank, Wash.—The Burbank Irrigation district has voted a bond issue of $400,000, the proceeds of which are to be used to complete the water system of that project. An expenditure of $200,000 will be required to line 18 miles of canals with concrete. Another requirement will be the installation of two auxiliary pumping units for which electric motors will be used.

Centralia, Wash.—The city commission has signed a contract with the Sherman County Light & Power Co. to furnish current to the city for the five-year period from Oct. 1, 1920.

Centralia, Wash. — Washington Light & Power Co. is considering the erection of a plant here.

Wenatchee, Wash.—As a solution to the power problem of the Wenatchee Valley, General Manager George D. Brown of the Wenatchee Valley Gas & Electric Co. has submitted to the power users and the public a proposition to buy the bonds necessary to finance an enlargement of the Chelan Falls plant. It is estimated that the cost of adding another 1000 hp. to the Chelan Falls plant will be $80,000. The company proposes to issue first mortgage bonds bearing 6% interest, secured by this plant and the contracts for the sale of the power and asks the power users of the valley to buy these bonds, so that the machinery can be ordered and the unit installed in time for next season's business. The Wenatchee Valley Power Users' Association and the special committee of the commercial club voted unanimously to endorse the plan.

Astoria, Ore.—The Port Commission has taken up the matter of installing an underground electric power system throughout the port property.

Astoria, Ore.—Power house of the Pacific Power & Light Co. has been damaged by fire. Loss amounting to $20,000.

Astoria, Ore.—Pacific Power & Light Co. has recently inaugurated work on the construction of its proposed electric station. It is understood that large oil-operated turbines will be installed.

Portland, Ore.—Canadian Marconi Wireless Co. is understood to be arranging plans for the construction of a large new high-power wireless station in the vicinity of Vancouver, B. C., which will be the most powerful radio depot in the British Empire, it is said, when completed. The station is estimated to cost in the neighborhood of $2,000,000.

The Dalles, Ore.—Cluster lights will be installed along Second street, the main thoroughfare of the city. Ten city blocks will be lighted with three clusters to each block.

Avalon, Calif.—City council has completed plans for the installation of new generating equipment at the municipal electric light plant.

Calipatria, Calif.—Imperial Utilities Corp., which recently completed negotiations for the acquirement of a waterworks plant at Calipatria and Niland, as well as at Monterey Park. The company operates a water works and ice manufacturing plant at Barstow, and has filed application with the Railroad Commission for permission to issue bonds for $54,000, a portion of the proceeds to be used for the construction of a new ice plant and improvements in the various plants.

El Centro, Calif.—An election will be held to decide the question of issuing $30,000 in bonds for a new light system. Address Mayor George Watkins.

Fillmore, Calif.—Board of trustees is considering plans for the issuance of bonds to cover the cost of the installation of a new water supply system, including necessary equipment such as pumping units, drilling of wells, etc.

Fullerton, Calif.—City council is arranging plans for the installation of a new electric lighting system in sections of Spadra and Commonwealth avenues, as well as in the residential districts. It is proposed to utilize cast-iron lighting standards for the former installation, and Marbelite standards for the latter service.

Los Angeles, Calif.—The city attorney, city engineer and city electrician were instructed by the city council to prepare the necessary ordinance for the ornamental districts of Los Angeles. It is proposed to ask for bids covering the period of 5 years, from July 1, 1920, to June 30, 1925, on 41 ornamental lighting systems. The city's proportion of the cost of maintaining the systems is $23,893 per year.

Richmond, Calif.—City council is considering plans for the installation of a new electrolier street lighting system in the business section of the city. The installation will cover Washington, Macdonald, Barrett, and Richmond avenues, as well as other thoroughfares.

Salinas, Calif.—City council has plans under consideration for the installation of a new ornamental street lighting system on Market and North Main streets.

NEW PUBLICATIONS

Some Tests of Light Aluminum Casting Alloys; the Effect of Heat Treatment is the title of technologic paper No. 139 issued by the Bureau of Standards, Washington, D. C. The mechanical properties of a number of different compositions of cast light aluminum alloys have been determined as well as the resistance to the action of alternating stresses of three commonly used alloys. Comparison was made of the resistance of some well known alloys to corrosion in the salt spray test. It was found that the effect of heat-treatment of cast alloys, consisting of annealing at 500°C and cooling in air from that temperature, followed by aging for several days before testing, produced an increase in the tensile strength and the hardness, with an attendant decrease, usually, in the elongation. The application of such a heat-treatment to light aluminum castings seems to have commercial possibilities. The price of this publication is 10 cts. and copies may be obtained by addressing a request to the Bureau.

Electrical Goods Trade on the East Coast of South America—Opportunities for American electrical goods in Argentina, Uruguay, and Brazil are described in this booklet now being distributed by the Bureau of Foreign and Domestic Commerce, Department of Commerce. It is the work of Trade Commissioner Philip S. Smith, whose previous reports on other Latin-American markets are well known to the trade. The use of electricity is widespread in Argentina, Uruguay, and Brazil, but especially so in the last named, where there is abundant waterpower. In all three the work of the American manufacturer is cut out for him, as competition will soon be keener than ever it was before the war. The price of this booklet is 20 cts. and copies may be obtained by addressing the Superintendent of Documents, Washington, D. C., or to any of the district offices of the Bureau of Foreign and Domestic Commerce.

PROPOSALS

Electric Pumps.—Bids will be received for the purchase of four electric pumps to be installed in the city pumping station, Sault Ste. Marie, Mich. Address A. J. Eaton, city clerk.

Ranges and Ovens.—Bids will be received by the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., for 8 electric ovens for delivery at eastern yards, and 6 electric ranges for delivery at South Brooklyn and Mare Island yards. (Schedule 4937.)

Pumping Equipment, Etc.—Eugene Eleazar, mayor of Kaplan, La., will receive bids until Nov. 25 for extensive improvements in the municipal light and water plants, including the installation of new pumping equipment, alternator, switchboard, and auxiliary apparatus. Xavier A. Kramer, Magnolia, Miss., is consulting engineer.

Electric Light Plant.—Bids will be received Nov. 19 by the mayor of Rolling Fork, Miss., for furnishing all materials and constructing a water works and electric light plant. The work consists of a power house building, oil-engine pumping machinery, alternators, switchboards, reservoir, water pipe lines, tower and tank, electric lines and street lighting system. Address J. B. Sinai, mayor. Xavier A. Kramer, consulting engineer, Magnolia, Miss.

Machines and Machine Tools.—Bids will be received by the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., for electric hoisting cranes, delivery at various navy yards (Schedule 4938); electric portable drills, delivery at various eastern and western yards (Schedule 4968); electric bench grinders, delivery at various eastern and western yards (Schedule 4968), and one motor-driven shaping machine, delivery at Washington navy yard (Schedule 4994).

Electrical Material.—Bids will be received by the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., for the following material: 2 Type B annunciators, for delivery at Brooklyn navy yard (Schedule 4993); 3000 ft. brush-holder cable and 300 lbs. underwriters' wire, delivery at Mare Island (Schedule 4983); a miscellaneous quantity of lighting and power cable, lighting and power wire, incandescent lamp cord and 15,000 ft. triple-braid weatherproof wire, for delivery at Mare Island (Schedule 4982); turbogenerators, delivery at Puget Sound (Schedule 4810); 9 automatic motor compensators, delivery at Washington navy yard (Schedule 4809); miscellaneous electrical equipment, f. o. b. (Schedule 4806); 150 lbs. phosphor-bronze wire, delivery at Boston (Schedule 4966).

FOREIGN TRADE

[Addresses of firms referred to in these trade opportunities may be obtained by writing to the Bureau of Foreign and Domestic Commerce, Washington, D. C., or its branch and local co-operative offices. Request for each opportunity should be on a separate sheet and the file number given.]

Copper Wire (31,183).—A merchant in Argentina desires to purchase iron in bars, woods, construction materials, copper wire, hardware in general, and will also accept commissions, shipments and agencies. References.

Electrical Measuring Instruments (31,190).—The general purchasing agent of a firm in Spain desires to purchase and secure an agency of iron-piping installations, with faucets, valves, connections, etc.; belting for power transmission; greases and mineral oils; electrical measuring instruments (meters), and electrical equipment of all kinds; and gas motors. Quotations should be given c. i. f. Spanish ports. Correspondence should be in Spanish. References.

Motors, Turbines, Etc. (31,191.)—A commercial agent in Belgium desires to secure an agency for the sale of all kinds of articles connected with heating installation, such as boilers, radiators, taps, ventilators, turbines, motors, hydrometers, thermometers, regulators, tools, and joints in asbestos and rubber. Quotations should be given c. i. f. Brussels or Antwerp. Correspondence may be in Spanish.

Electrical Goods (31,194).—Agencies are desired by a firm in France for the sale of textiles, rubber goods and electrical goods. Correspondence should be in French. References.

Electrical Machinery (31,203).—An agency is desired by a man in Italy for the sale of hydraulic turbines, machine tools, electrical machinery and supplies, and mechanical goods in general. Correspondence may be in English. Reference.

Motors, Machinery, Cables, Etc. (31,207)—A company in Greece desires to secure agencies from manufacturers for the sale of iron concrete reinforcement bars; structural and shipbuilding sheets; steel iron and copper pipes; internal-combustion engines; Diesel and semi-Diesel engines, principally of small power; 2 to 6 hp. engines suitable for well pumping, also 10 to 25-hp. engines for small flour mills, etc.; marine engines, 100 to 300 hp.; windmill pumps; cylinder flour mill of from 5 to 10 tons daily output for country districts; electric motors and other electrical machinery and appliances, telephones, etc.; plain and insulated electric cables and wires; and steel ropes and wires. References.

Vacuum Cleaners (31,209).—A company in England desires to secure agencies for the sale of electric vacuum cleaners and all kinds of labor-saving devices for the home. Quotations should be given c. i. f. English port, or f. o. b. New York. References.

Personal

H. L. Everest Sales Manager of Hart & Hegeman — L. H. Kinnard New President of Pennsylvania Bell Telephone

GEORGE M. GRIFFITH is now in the construction department of the Oklahoma Gas & Electric Co., in charge of substation construction at Sapulpa, Okla.

R. C. GOSROW, sales engineer for the Pittsburgh Furnace Co., Milwaukee, Wis., has opened a branch office for that company at 504 Maynard building, Seattle, Wash.

C. C. DAVIS, field representative of the California Electrical Co-operative Campaign for the San Francisco district, has resigned to become manager of the electrical department of the Turner Hardware & Implement Co., Modesto, Calif.

WILLIAM A. BAEHR, consulting engineer of Chicago, through the purchase of the Southern Illinois Light & Power Co., Hillsboro, Ill., has been elected president of that company, taking up the duties of J. J. Frey, of St. Louis, formerly president of the company.

WARREN B. LEWIS, Providence, R. I., has been appointed provisional manager of the Taunton (Mass.) municipal lighting plant. Mr. Lewis maintains consulting engineering offices in the Grosvenor building, Providence, but will devote considerable time to problems of the Taunton plant.

O. A. JENNINGS, formerly manager of the oil field electrification department of the Oklahoma Gas & Electric Co., has been appointed manager of the commercial department of the company with supervision of the commercial activities of the company throughout the state of Oklahoma, with headquarters at Oklahoma City.

J. P. DAVIS, purchasing agent of the Belden Manufacturing Co., has been elected president of the Purchasing Agents Association of Chicago. Mr. Davis was formerly assistant purchasing agent for the Standard Underground Cable Co., of Pittsburgh, coming with the Belden Manufacturing Co. as purchasing agent in 1916. The position in the Purchasing Agents Association, which he now holds, is especially important since the 1920 convention of the national association is to be held in this city.

E. B. CRAFT, assistant chief engineer of the Western Electric Co., delivered an interesting address at a meeting of the Rochester (N. Y.) Section of the American Institute of Electrical Engineers, held at Rochester, N. Y., on "Wartime Electrical Communciations." Mr. Craft served as a major in the United States Signal Corps, and the lecture was illustrated with stereopticon slides, showing pictures of wire and wireless telegraphy and telephony, airplane control, airplane and gunfire detection, as well as submarine detection.

JAMES H. MANNING, consulting hydraulic engineer for Stone & Webster, was recently appointed assistant engineering manager. Mr. Manning joined the Stone & Webster staff in 1910 and served as superintendent of construction in the Franklin, Verdi and White Salmon hydroelectric developments, besides preparing various engineering reports. He later was placed in charge of the hydraulic division, and in 1917 he became chief engineer of the American International Shipbuilding Corp. Early in 1919 Mr. Manning was made consulting hydraulic engineer for Stone & Webster, continuing in this capacity until his recent promotion.

H. L. EVEREST, one of the best known and most popular electrical men in the Middle West, has just been appointed general sales manager of the Hart & Hegeman Manufacturing Co., Hartford, Conn. Although a native of the East, Mr. Everest has resided in Chicago for the past 12 years where he has made a host of friends who rejoice at his well earned promotion. He joined the sales force of the Hart & Hegeman company Jan. 29, 1907, his headquarters being in the Chicago territory. In October, 1914, owing to the death of G. S. Searing, he was made western sales manager, which position he has held continuously since. In this capacity Mr. Everest obtained a thorough understanding of the problems of the electrical industry that will be of peculiar advantage to him in his new position. He was born at Lyon, N. Y., and spent his early life at New Haven, Conn. Previous to his connection with Hart & Hegeman he was employed for five years by the New York, New Haven & Hartford railroad. He is a member of the Jovian Order and the Electric Club of Chicago, having been particularly active in the latter.

Haynes L. Everest.

B. H. GARDNER, for the past two years manager of the New Britain district of the Connecticut Light & Power Co., has been promoted to the position of sales manager of the commercial department of the company with headquarters in Waterbury, Conn. He is succeeded by N. S. Franklin, assistant superintendent.

CHESTER BARNHART, formerly auditor of the Oskaloosa Railway, Light & Gas Co., Oskaloosa, Iowa, has accepted a position as office manager and auditor of the Urbana & Champaign Railway, Gas & Electric Co., with headquarters at Champaign, Ill. Both properties are owned by the Illinois Traction System or the McKinley syndicate as it is known.

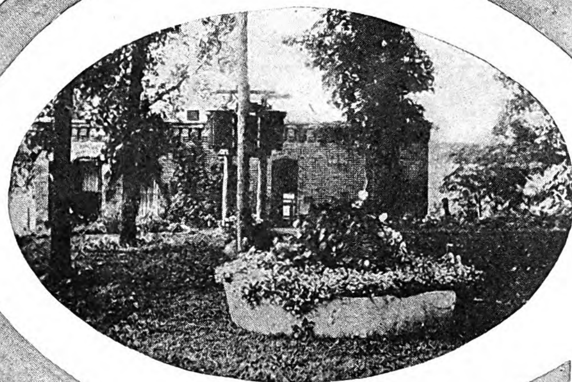
L. H. KINNARD, after 30 years' service with the Bell Telephone Co. of Pennsylvania, has been elected president of the company and head of the eastern group of telephone companies of the American Telephone & Telegraph Co., to succeed Frank H. Bethell, resigned. Mr. Kinnard entered the service of the old Pennsylvania Telephone Co. at Harrisburg in 1888 as clerk, a year later became assistant local manager, and after a few years local manager at Carlisle, then at Harrisburg. In 1896 he became division superintendent of the southern division of that company, with headquarters at Harrisburg, and in 1902 was advanced to general superintendent and the same year was made general manager. In 1908, the Bell Telephone Co. was formed, the various companies being consolidated, and Mr. Kinnard moved to Philadelphia as general contract agent in charge of what is now known as the commercial department. In November, 1912, he became second vice-president and general manager of the companies, continuing in this capacity until the present time, the word "second" being dropped from his title in 1913. Mr. Kinnard's career in the telephone field has been a long and comprehensive one and he has helped to lead the service and the Bell system through its difficulties and has contributed much toward making the system what it is today. Mr. Kinnard will continue to make his headquarters in Philadelphia. He will be succeeded by John C. Lynch, general superintendent of traffic.

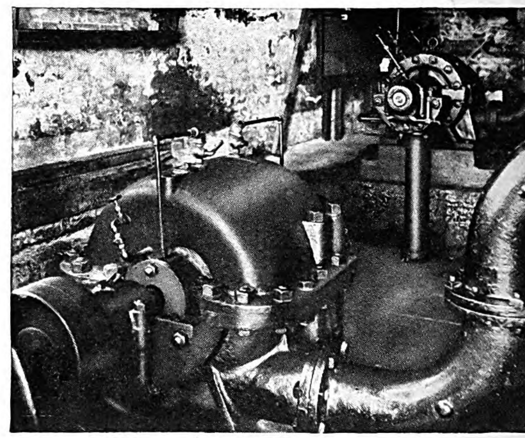
Obituary.

FREDERICK W. WALLACE, Plainfield, N. J., general manager and treasurer of the Waclark Wire Co., Elizabeth, N. J., died on Oct. 30 at his home, following a short illness with pneumonia. Mr. Wallace was 55 years of age.

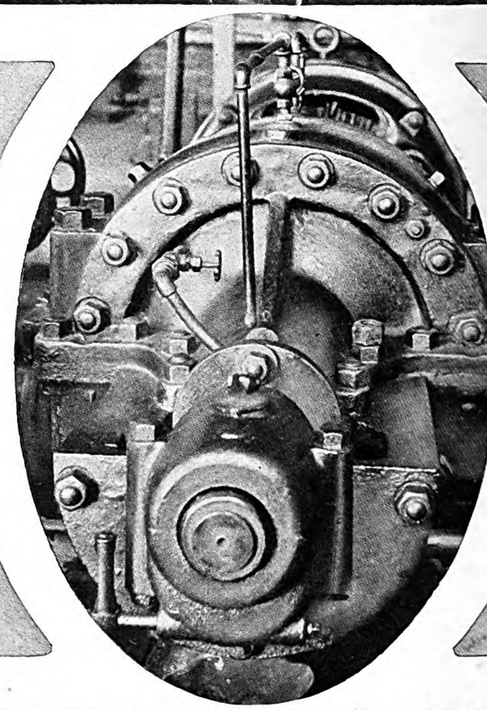
Electrical Review

Vol. 75. No. 21. CHICAGO, NOVEMBER 22, 1919 Three Dollars a Year





ALLIS-CHALMERS Centrifugal Pumps In Fairmont Have No Maintenance Expense



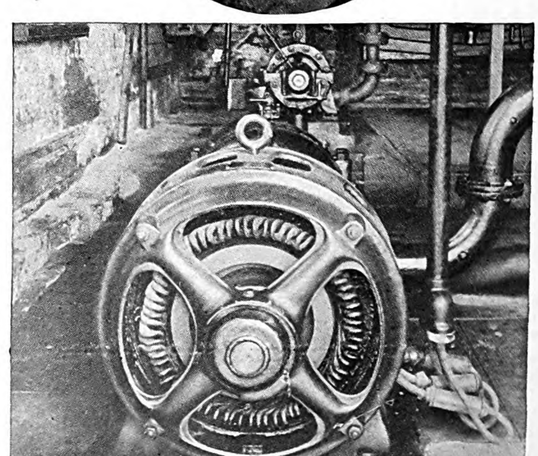
The three Allis-Chalmers Centrifugal Pumping Units in the Fairmont, Minn., pumping station lift the city water 4½ feet from the lake to an elevated tank 212 feet above the pumps.

Two of the Centrifugals are each of 800 G.P.M. capacity, driven by a 75 H.P. motor. They have been in operation eight years. The other, of 350 G.P.M., with a 35 H.P. motor, has been running five years.

These Units have required practically no expense for maintenance other than repacking once in a while, during the entire life of the apparatus, a fact that greatly pleases the Fairmont Water and Light Commission.

As Allis-Chalmers Pumping Units are designed and built complete by one concern, under the supervision of a single group of engineers, they are remarkably efficient in operation. Furthermore, all responsibility for satisfactory performance is centered in one concern.

Bulletin sent on request.



ALLIS - CHALMERS MFG. CO.

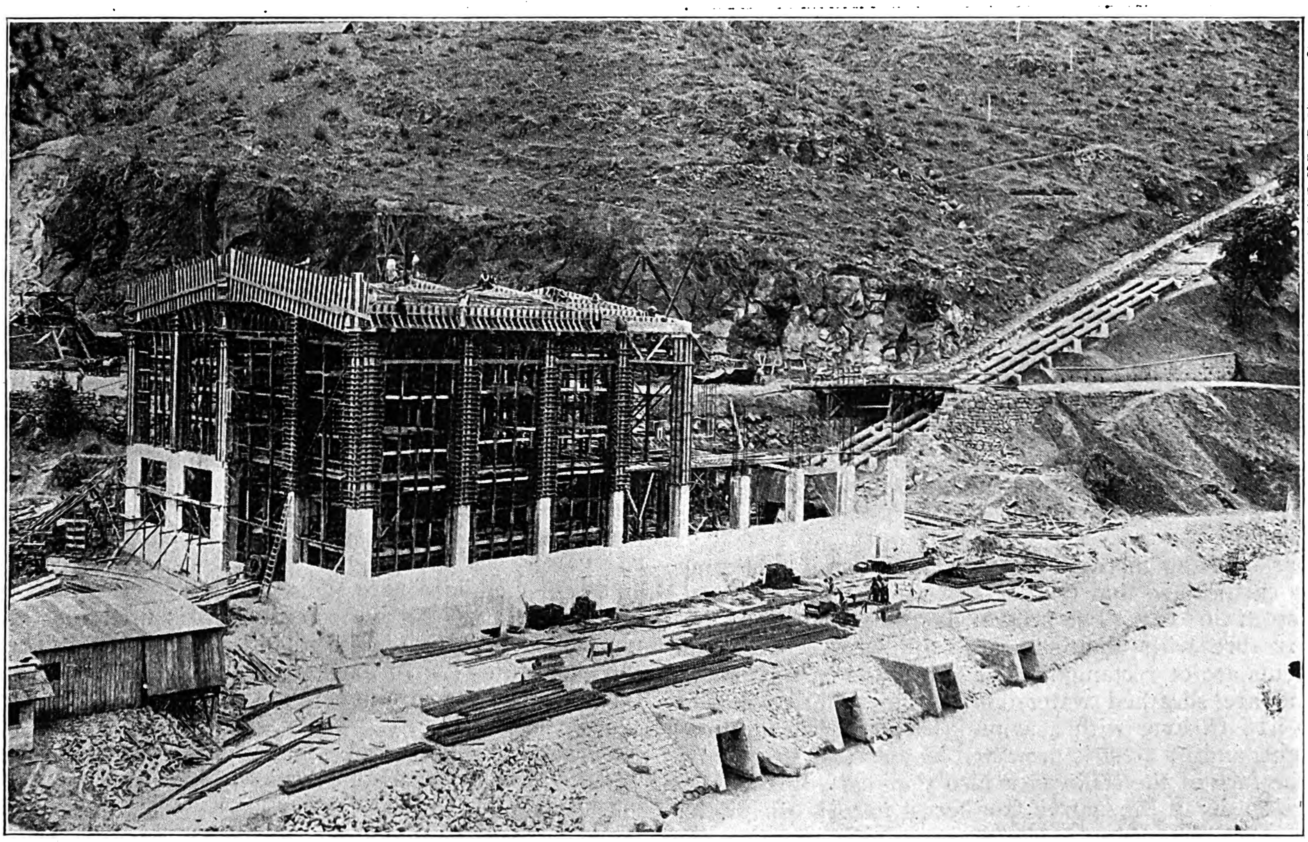
Milwaukee, Wis.

Sales Offices In All Principal Cities.

Electrical Review

WITH WHICH IS CONSOLIDATED WESTERN ELECTRICIAN AND ELECTROCRAFT

VOL. 75—No. 21. CHICAGO, SATURDAY, NOVEMBER 22, 1919. PAGE 853



Pangal Power House of Braden Copper Company While in Course of Construction.

New Hydroelectric Power Plant at Rio Pangal, Chile

Construction Features of Diversion Dam, Seven-Mile Pipe Line, Penstocks and Waterwheels for New Plant Built by the Braden Copper Co. to Supply Power to Its Works at Sewell, Chile

By HUGH L. COOPER

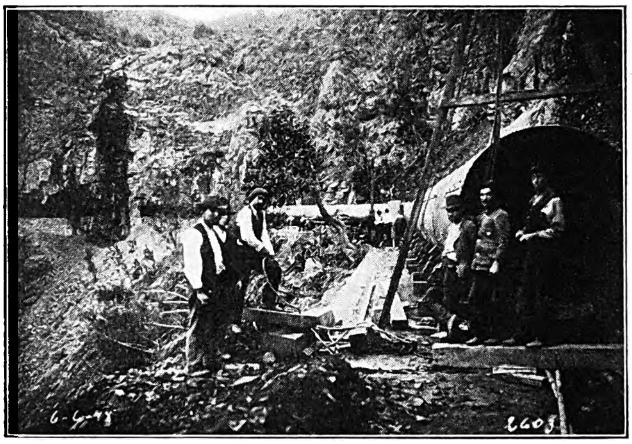
FOR the purpose of supplying additional power to its works at Sewell, Chile, the Braden Copper Co. is building a new hydroelectric plant, which is a development of Rio Pangal for power purposes. This stream, which is a tributary of Rio Cachapoal, has its headwaters in the high mountainous regions along the Argentine boundary, and its course is westward through a deep and precipitous valley to its junction with the Cachapoal, 20 miles east of Rancagua.

The waters of the stream will be impounded by a diversion dam at a point about 10 miles up the river. Water will be conducted from the diversion dam by a combination wood-stave and riveted-steel feeder pipe about 7 miles long, located along the north side of the canyon, to a surge tank. From the latter point it will be conducted down the mountain side in a straight line to the power house, by means of a welded-steel pipe penstock about 4000 ft. long.

Above the diversion dam is a drainage area of about 220 square miles, which is in precipitous mountain slopes, practically devoid of vegetation and subject to torrential storms. The estimated quantity of water available for power purposes has been based upon continuous records of runoff kept by the company for several years. A comparatively large quantity of stored water will be secured by means of the diversion dam. A large storage reservoir site has been located further up stream, which may be utilized to augment the natural stream flow. The plant has been designed to utilize 220 cu. ft. of water per sec.

Diversion Dam and Head Works.

The diversion dam was first built to its low level with its crest at an elevation of 4610 ft. Provision was made to increase its height at some future time by earth fill so that the pond level will be at an elevation of 4680 ft. The present dam is a framed timber structure with abutments and spillway. The abutments are of rectangular crib construction, rock filled, and are sheathed water-tight. The spillway section is 215 ft. long with a sloping back, sheathed water-tight, and its crest is protected by armored steel plate. The face of the spillway is also sloping, with the lines broken in an easy curve from crest to toe—all for the purpose of carrying discharge water safely away from the foundations of the dam. The entire structure is founded upon a deposit of compacted gravel, with some sand and boulders. This accounts for the extreme width of its base and the care used in providing suitable bearing for the bed timbers. The heel of the dam and the abutments are connected and sealed to a continuous concrete cutoff or core wall, which fills a trench excavated to bed rock or to a stratum which is considered impervious.



Pangal Hydroelectric Development—One of the Riveted Steel Sections of the Pipe Line Which Were Installed on All Curves of Less Than 375-Ft. Radius.

In addition to the dam, the head works comprise an intake tower, located 100 ft. upstream from the core wall of the dam, and a feeder-sluice conduit, extending from the intake tower through the dam to a point 500 ft. downstream. Concrete was used in the construction of the intake tower, which is octagonal in plan. with an operating deck on top connected to the dam abutment by a front bridge.

The central circular well is the beginning of the main feeder pipe supplying water to the power house by connection through the feeder-sluice conduit. Water is admitted to the well by seven radial ports, which are simultaneously controlled by a large cylindrical valve in the well. Each port is provided with a removable steel screen and a timber gate or stop log for emergency use. At the bottom of the tower and near its outer circumference are seven circular sluice openings, each controlled by a cylindrical valve. These holes open downward and merge into the lower opening of the feeder-sluice conduit. The purpose of these openings and valves is to remove deposits of sand, silt, etc., from the immediate vicinity of the tower, by sluicing from time to time, and thus prevent their entry into the feeder. The entire tower, including the sluice valve, may be closed by the outside stop logs provided. All valves, screens, stop logs, etc., are operated by a crane at the top of the tower.

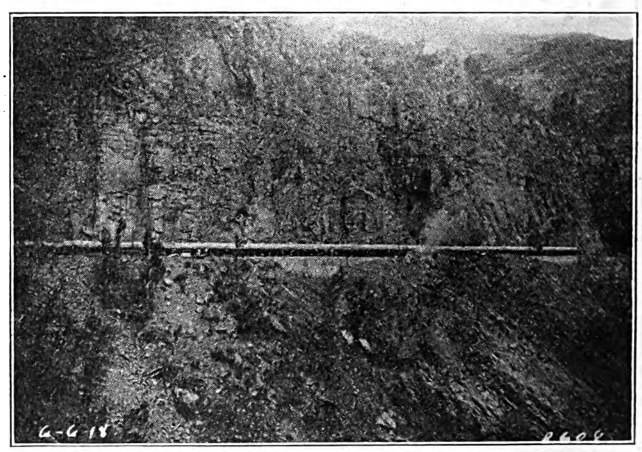
Concrete with steel reinforcements was used for the feeder-sluice conduit, which has an upper opening 80 ins. in diameter, which is an extension of the feeder pipes, and a lower opening 54 ins. in diameter from the sluice valves for discharge into the river. The two openings, or pipes, are conected by a cross-over valve near the end of the conduit. This valve is so constructed that in case of accident or necessity for repair to the main control valve in the intake tower, backwater may be excluded from the well and water for power purposes supplied by the sluice valves, thus contributing to uninterrupted service.

Construction of the Feeder Pipe.

The feeder pipe is 80 ins. inside diameter and 36,723 ft. long from the dam core wall to the surge tank. The center line is at an elevation of 4590 ft. at the intake tower, from which it slopes uniformly downward 15 ft. per mile along its developed length to an elevation of 4485.67 ft. at the surge tank. In plan it follows a winding course along the tortuous side of the canyon. All bends of less than 375-ft. radius are of riveted-steel pipe, built from 3/8-in. plates in 6-ft. inside and outside cylindrical rings alternately, with single-riveted transverse joints and double-riveted longitudinal lap joints.

Standard wood-stave construction is used for the remainder of the pipe, which is its principal part. The staves are of California redwood, finished true to form all over, 48 in number, 3½ ins. thick and of an average length of 14 ft. When delivered, the redwood lumber was rough sawed. It was finished at the site by special wood-working machinery installed for this purpose by the Braden Copper Co.

The bands are of 7/8-in. diameter mild steel rods, in two parts around the circle, with standard malleable iron shoes at the connections. The band spacing varies, according to pressure, from 26 to 54 per 10-ft. length of pipe. The pipe terminates in an expansion joint and cast-iron tee connection to the surge tank.



Pangal Hydroelectric Development—Showing Some of the Difficulties Met in Construction of Pipe Line.

Framed timber saddles, spaced 6 ft. apart, are used to support the entire feeder pipe line. Manholes are provided at intervals of 500 ft. and drain valves with piping are fitted near the surge tank.

Preparation of foundation along the mountain sides was a difficult undertaking because of the great length of pipe, inaccessibility and the varying conditions and nature of materials encountered. This work involved many timber bridges, masonry culverts and retaining walls, tunnels and other special construction.

Surge Tank.

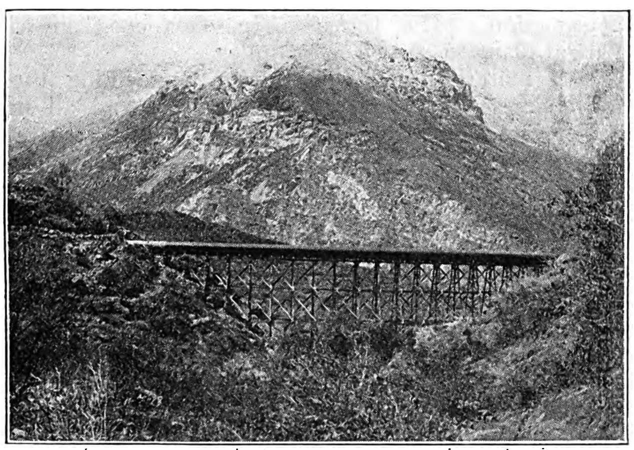
The surge tank is of the differential type, selected because of its economy and effective control of sudden fluctuations in flow. It is built of steel throughout. The outside shell is 16 ft. inside diameter and 129 ft. high, with base at elevation 4525, thus providing for a maximum surge of 34 ft. above the pond surface. The inner tube is 64 ins. outside diameter.

To insure stability and true form because of the great height and small diameter, the inner and outer shells are connected and braced from top to bottom by four lines of radial trussing in vertical planes. The feeder pipe approaching the surge tank and its extension from surge tank to penstock is placed in a tunnel through a spur of the mountain. This was done for the purpose of removing the surge tank back from the sloping surface and so reliable rock foundations could be secured.

Penstocks.

In plan, the penstocks are in a straight line from the end of the feeder pipe to the power house, a distance of 4000 ft. They are connected to the feeder pipe by an expansion joint and Y-lateral, for its upper portion (about one-third) consists of two pipes of 46 ins. inside diameter. Each of the 46-in. pipes branches into two pipes of 30-in. inside diameter by means of Y-laterals, and the four pipes extend to the power house, the last 600 ft. being reduced to 28 ins. inside diameter, each to serve one of the four waterwheels.

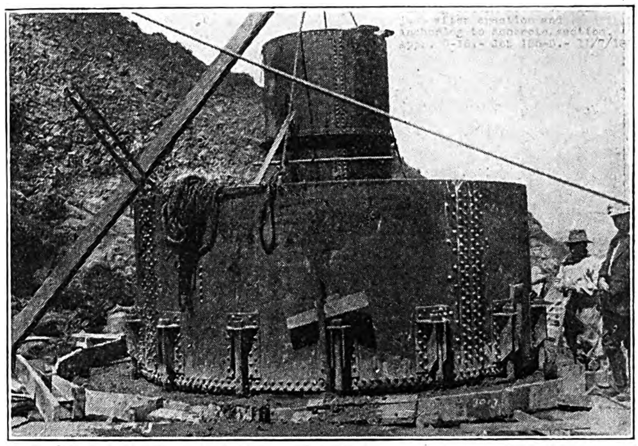
Standard construction is of pipes 20 ft. long, providing a length of 19½ ft. from center to center of joints. The joints are known as trumpet joints, with heel and spigot ends specially formed to receive rubber packing secured by cast-steel flanges and gland. The bell or female end of each pipe is the uphill end



Cerrillos Bridge on Pipe Line of Pangal Hydroelectric Development of Braden Copper Company.

and the shoulder of the bell rests in a molded concrete saddle. The pipes are therefore supported every 19½ ft. along their center line, and the nature of the joints is such that no other provision for expansion and contraction is necessary. Heavy concrete anchorages are provided at vertical breaks in alignment and elsewhere as required. A special flanged section with manhole is inserted immediately below each anchorage to facilitate repair or replacement anywhere along the line.

Each pipe is bedded and anchored into the concrete substructure of the power house and terminates in a heavy Johnson hydraulic valve for the control of flow to the wheel nozzle. The upper end of each 30-in. pipe line is also fitted with a Johnson valve and air inlet valve. These valves are about 2600 ft. from



Surge Tank at Pangal Hydroelectric Development, Showing Bottom Steel Section Just After Erection and Anchoring to Concrete Section.

the power house and are operated electrically from the switchboard. Any accidental break, resulting in a drop in pressure below these valves, will cause them to close automatically, and the time of such closure may be adjusted as desired.

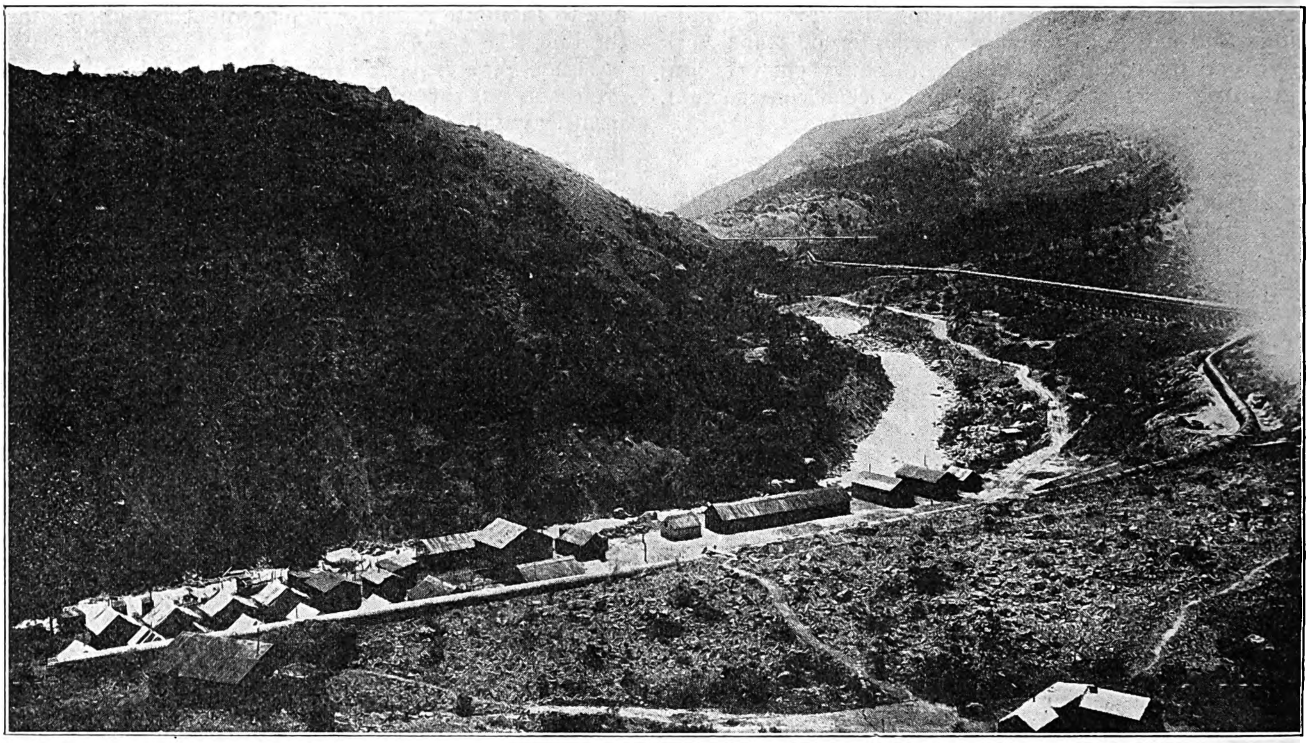
Waterwheels.

The waterwheels are of the impulse type, direct-connected to horizontal-shaft generators. The runner disk is of annealed cast steel and is bolted to the flanged end of the generator shaft. The buckets are of annealed cast steel with spare sets of bronze for comparative trials against erosion, and are secured to the disk by press-fit steel studs. Great care has been taken in fitting the buckets and holding studs to insure accuracy and interchangeability. Each bucket has been brought to uniform weight and the complete number will remain accurately balanced even if parts are interchanged. The complete runner is guaranteed to withstand a runaway speed of 720 r.p.m. without causing stresses of more than 85% of the elastic limit of material in any part affected.

The manufacturer's guarantees as to performance, regulation, etc., of the waterwheels are based upon an operating speed of 360 r.p.m. and direct connection to an a-c. generator of 5000 kv-a., 90% power-factor and 400,000 ft-lbs. flywheel effort. At 1475 ft., net operating head, each wheel will deliver a maximum of 8700 hp. at 82% efficiency and 7300 hp. at maximum efficiency of 84%.

The power nozzle providing a jet of water for each wheel is at elevation 3015 ft. and is of the type known as a needle valve nozzle. This valve is operated by direct connection of the needle stem to the piston of a high-pressure service motor. The pressure medium is oil and its service to and from the motor is controlled by a hydraulic governor with speed element actuated by the generator shaft in the usual manner.

Direct connected to the power nozzle is an auxiliary relief nozzle of the same type and size. The



View From Diversion Dam of Rio Pangal Development, Looking Downstream and Showing a Section of the Seven-Mile Pipe Line.

auxiliary operates automatically, is subject to regulation, and its function is to prevent excessive pressure rise in the penstock from sudden drop in load without undue waste of water. Such pressure is limited to 10% for a decrease in load of any magnitude within the capacity of the equipment. In case of full load suddenly thrown on, the governor apparatus is capable of adjustment so as to limit the resulting pressure drop in the penstock to 15% below static.

Speed regulation is well within the standard practice for impulse wheels. The governor is equipped with hand-control mechanism and also with a hand-power high-pressure oil pump of sufficient one-man capacity to operate the service motor in emergency. A jet of water from the auxiliary relief nozzle or from the power nozzle in case of accident will not appear outside of the power house but will be caught and made inert by a vortex baffle plate secured in the masonry surrounding the wheel pit.

Power House.

Tailwater discharged by the wheels will be conducted to the river by underground concrete passages, where provision has been made to gage the quantity of water so discharged by standard weir measurement. It is expected that the tailwater side of this power house will be clear and accessible, even though impulse wheels are employed.

Oil at high pressure for the governor system is supplied by a central power-driven pumping plant, containing sump, pumps, accumulators, air compressor, filter, piping, etc. This plant is in duplicate as to pumps and accumulators and either side is capable of supplying the station. The pumps are driven by motors or by waterwheels interchangeably. Full supply of oil at constant pressure is insured by automatic control of the pump motors or waterwheels.

The superstructure of the power house is of reinforced concrete and contains the electrical machinery and apparatus and other features usual in generating stations of this kind.

The total static head obtained is 1595 ft., with pond surface at an elevation of 4610 ft., the crest elevation of the diversion dam as now built. This may be increased to 1665 ft. at some future time by raising the diversion dam.

The plant capacity will be 20,000 kv-a., available at the low-tension busbars of the generating station. When generating this amount of power the net operating head will be about 1460 ft. and the quantity of water utilized will be about 204 cu. ft. per sec.

The company owns and operates a hydroelectric plant located on the Cachapoal five miles below the new power station. The two plants will operate in conjunction. The transmission distance from the Pangal plant to Sewell is 18 miles.

All materials for construction (excepting those for concrete and some of the timber) and all machinery and apparatus have been shipped from the United States. All construction work is being done by the Braden Copper Co. through its own construction organization.

The hydraulic work for this plant was designed in detail by Hugh L. Cooper & Co., consulting engineers, New York, who have also supervised the manufacture of all parts shipped from the United States. The electrical work was designed by Percy H. Thomas, consulting electrical engineer of the Braden Copper Co.

NEW INSULATING MATERIAL.

A new product suitable for use in electrical insulation is being obtained from the treatment of kelp in Australia. The moist precipitate is subjected to pressure and formed under pressure, after which it is hardened by treatment with formalin. The finished article is made by turning on the lathe, a process which is said to be perfectly successful, and a high polish is applied. The raw product is to be found in large quantities around the coast of Australia and in particular on the Tasmanian shores.

Central-Station Rates in Theory and Practice

Twentieth Article—Arithmetical and Algebraic Analysis of Rate Schedules—Making Seemingly Involved Rates Simple — Calculations Simplified and Basic Errors Exposed

By H. E. EISENMENGER

This series of articles, of which this is the twentieth, began in the issue of July 12. Part I included seven articles on the cost of electric service. Part II contained six articles on the principles determining the selection of a rate system. In Part III, comprising six articles, the various systems of rates found in practice were described. The present article opens Part IV on rate analysis; this subject will be concluded in next week's article. The remaining five articles will constitute Parts V and VI and deal with accuracy of rates and the practice of rate regulation by commissions.

PART IV—RATE ANALYSIS.

SECTION 157. In case of the more complex rate systems it is not easy to get a clear general conception of what the rate means to the various customers. It is, of course, very easy to figure out what the amount is which a certain given customer has to pay under the rate system, but that is not enough for a critical examination of the character of the rate. A little arithmetic, algebra or geometry can be applied with astonishing results to get an insight into the nature of a certain rate or rate system.

I. Arithmetical and Algebraic Rate Analysis.

158. The arithmetical system of rate analysis has been demonstrated incidentally in a few of the simplest cases in the previous sections and will now be discussed more fully.

Let us call

a = the *amount* of the customer's total bill in cents for the period to which the bill applies.

d = the customer's maximum *demand* in kilowatts, horsepower, number of rooms, or whatever else the unit is.

e = the customer's *energy* consumption in kilowatt-hours.

Let us now take first the example of the straight meter rate, for instance, charging 10 cents per kw-hr. Then we obviously get $a = 10e$, or in the general case if z cents[1] are charged per kilowatt-hour we get $a = ez$.

Likewise, we get in a straight demand rate $a = dy$, where y is the demand charge in cents per kilowatt, horsepower, or per room, etc.

In a Hopkinson rate we get $a = dy + ez$
and in a Doherty rate: $a = x + dy + ez$,
where x is the specified customer charge.

Conversely, if we can express a rate by a formula composed of three members, one of them being constant (x), the second (dy) being proportional to the demand d, and the third (ez) being proportional to e, we have the equivalent of a three-charge system as follows: The member (x) which is free from demand and energy consumption is the equivalent customer charge, the member containing the demand d indicates the equivalent unit demand charge times the multiplier of d, and the member containing the energy consumption e indicates the equivalent unit energy charge times the multiplier of e. Since x, y or z, or any two of these values may be zero, we may accordingly get a two-charge or a single-charge system.

If we include those cases where one or two of the values x, y and z are zero, we can state that practically every rate system can be reduced to an equation of the type described and we have in every rate, whatever its apparent shape, the equivalent of a three-charge, a two-charge or a single-charge rate with the unit charges expressed in the way described above.

The quickest and easiest way to show the working and the principles of this arithmetical and algebraic analysis is to work out a few examples. The generalizing deductions will then offer themselves automatically.

159. Supposing we have a block meter rate which charges 10 cents per kw-hr. for the first 100 kw-hr. per month (first block), 9 cents per kw-hr. for the next 50 kw-hr. (second block), and 8 cents per kw-hr. for the balance (third block). The amount of the bill is then in the first block,

$$a = 10e$$

In the second block ($100 < e < 150$) it is

$$a = 10 \times 100 + 9(e - 100) = 100 + 9e$$

This means that all customers in the second block are charged just the same amount as they would have to pay under a rate having a customer charge of 100 cents ($1), plus an energy charge of 9 cents per kw-hr. We can thus say, although we have no customer charge *specified* in the rate system, yet we have the equivalent of a customer charge of $1. We have no equivalent demand charge, or, more accurately expressed, the equivalent demand charge is equal to zero.

Likewise we get in the third block

$$a = (10 \times 100) + (9 \times 50) + 8(e - 150) = 250 + 8e.$$

The equivalent customer charge has increased to $2.50, the demand charge is still zero, and the energy charge has decreased to 8 cents per kw-hr.

A customer, for instance, who has used 200 kw-hr. will have to pay, being in the third block, 250 cents +

[1] Although the symbols x, y and z are usually employed to designate variable quantities, they are used in the following equations for the quantities: customer charge, unit demand charge and unit energy charge, respectively, although these charges are constant in the first rate systems to be discussed and the variables are d and e. The reason for this choice of symbols will become apparent later.

$(8 \times 200) = \$18.50$, which means a simplification of the computation even in this simple case.[2]

160. Next let us take the example of a plain Wright demand rate charging, for instance, 10.5 cents per kw-hr. for the first 35 hours' use of the demand, 8.5 cents per kw-hr. for the next 25 hours, 5 cents per kw-hr. for all the balance. In the first zone, block or "range," that is from 0 to 35 hours' use, we have

$a = 10.50e$; this means $x = 0$, $y = 0$, $z = 10.5$ cents per kw-hr.

In the second block (35 to 60 hours' use) the customer is made to pay for all kilowatt-hours which correspond to the first 35 hours' use of the demand at the rate of 10.5 cents per kw-hr. and the balance at 8.5 cents per kw-hr. The number of kilowatt-hours which corresponds to the first 35 hours of use of the demand d is $= 35d$ and the unit price to be paid for these $35d$ kw-hr. is 10.5 cents, so that the total price for them is $10.5 \times 35d$. The balance of $e - 35d$ kilowatt-hours is to be paid at 8.5 cents per kw-hr. and the total amount paid for that balance is therefore $8.5\,(e - 35d)$. The total bill is therefore

$a = (10.5 \times 35d) + 8.5\,(e - 35d) = 70d + 8.5e$.

This means a customer charge $x = 0$, a demand charge of 70 cents per kilowatt per month and an energy charge of 8.5 cents per kw-hr. (equivalent of a Hopkinson rate).

In the third block we get likewise $70d + 8.5e$ to be paid for the kilowatt-hours corresponding to the first 60 hours' use, that is for $e = 60d$, and 5 cents per kw-hr. for every kilowatt-hour of the balance. Therefore

$a = 70d + (8.5 \times 60d) + 5(e - 60d) = 280d + 5e$.

A customer having, for instance, 1.5 kw. demand and 100 kw-hr. energy consumption would have to pay $(280 \times 1.5) + (5 \times 100) = 420 + 500 = \$9.20$. Compare this simple calculation with the explicit method of figuring the price for 100 kw-hr. at 1.5-kw. demand under this rate:

I.	(35×1.5) kw-hr. $\times$ 10.5c/kw-hr.	= 551.25c
II.	(25×1.5) kw-hr. $\times$ 8.5c/kw-hr.	= 318.75c
III.	$(100 - 60 \times 1.5)$ kw-hr. $\times$ 5c/kw-hr.	= 50.00c
		920.00c

161. As the next example, consider the St. Louis Residence Lighting rate, which is a Wright demand rate on the number-of-rooms basis, but no longer a simple load-factor Wright rate but of somewhat more complicated specifications as given below. The charges are as follows:

8 cents per kw-hr. for the first 4 kw-hr. for each one of the first 4 active rooms, plus 2.5 kw-hr. for the excess rooms;

6 cents per kw-hr. for the excess up to 7 kw-hr per room for all active rooms;

3 cents per kw-hr. for the excess.

The unit for the demand d is here not the kilowatt but the active room. To determine the different "ranges" or "zones" in which the three unit kilowatt-hour charges of 8, 6 and 3 cents per kw-hr., respectively, apply, it is convenient to draw a diagram (Fig. 8), plotting the number of rooms in horizontal direction (as abscissæ) and the number of kilowatt-hours in vertical direction (ordinates). The 8-cent-per-kilowatt-hour zone reaches from

0 to 4 kw-hr. for 1 room
0 to 8 kw-hr. for 2 rooms
0 to 12 kw-hr. for 3 rooms
0 to 16 kw-hr. for 4 rooms.

This means, anything below the straight line OA in Fig. 8 is to be paid at 8 cents per kw-hr. For 5 rooms and upwards we have to add only 2.5 kw-hr. for each room, which means the 8-cent-per-kw-hr. zone reaches

from 0 to 18.5 kw-hr. for 5 rooms
0 to 21 kw-hr. for 6 rooms
0 to 23.5 kw-hr. for 7 rooms
..........etc..........., see line AM.

The range below the line OAM is therefore a straight meter rate at 8 cents per kw-hr. or $a = 8e$.

The 6-cent-per-kw-hr. zone (zone 2 in Fig. 8, consisting of $2a$ and $2b$) reaches from this line up to the line ON, which represents 7 kw-hr. per room (7 kw-hr. for one room, 14 kw-hr. for 2 rooms, etc.). What is the equivalent three-charge system in this zone?

Dealing first with that part where the number of rooms is not greater than 4 (zone $2a$), we find in the same manner as before (using the symbol d for the demand in rooms):

$$a = (8\text{c/kw-hr.} \times 4d) + 6\text{c/kw-hr.}(e - 4d)$$
$$= 8d + 6e \quad \ldots\ldots (1)$$

The customer charge $x = 0$, the demand charge $y = 8$ cents per room per month, and the energy charge $z = 6$ cents per kw-hr.

Where the number of rooms is greater than 4 (zone $2b$) we have to pay 8 cents per kw-hr. for a certain number f kw-hr. and 6 cents per kw-hr. for the balance, so that

$$a = 8f + 6(e - f) = 2f + 6e \quad \ldots\ldots (2)$$

where f is composed of two parts: 4 kw-hr. for every one of the first four rooms and 2.5 kw-hr. for every room in excess of 4, so that $f = (4 \times 4) + 2.5(d - 4) = 6 + 2.5d$. Substituting this into the equation (2) we get

$$a = 12 + 5d + 6e \quad \ldots\ldots (3) \text{ zone } 2b$$

We see, therefore, that for all customers in this range ($d > 4$ rooms) the equivalent of a three-charge system applies with

a customer charge $x = 12$c per customer per month,
a demand charge $y = 5$c per room per month, and
an energy charge $z = 6$c per kw-hr.

Thus this is practically a Doherty rate, although the rate schedule mentions nothing but kilowatt-hour charges.

On the dividing line between the two portions $2a$ and $2b$ of the 6-cent-per-kw-hr. zone, that is, for $d = 4$ rooms, we can, of course, use either of the formulæ (1) or (3) as each one furnishes $a = 32 + 6e$ for $d = 4$. Likewise, we can, of course, use the formula for either zone on the dividing line between any two zones in any rate system, because the formulæ must of necessity furnish identical numerical results for the dividing line that lies between them.

The bill in the third zone (3-cent zone) where $e > 7d$ (zone 3, consisting of $3a$ and $3b$) is figured for $d < 4$ (zone $3a$ in Fig. 8) in analogy with what has been explained previously [using equation (1)] $a = 8d + (6 \times 7d) + 3(e - 7d) = 29d + 3e$ (equivalent of Hopkinson rate).

Or, if we wanted to work this out without reference to formula (1), applying to the second zone, we

[2]Using general symbols where $z_1, z_2, z_3 \ldots$ are the energy charges in the first, second, third, etc., block and $e_1, e_2, e_3 \ldots$ are the sizes of the successive blocks in kilowatt-hours we get in the first block $a = ez_1$
in the second block, that is for energies between e_1 and e_2 kw-hr.,
$$a = e_1 z_1 + (e - e_1) z_2 = e_1 (z_1 - z_2) + ez_2$$
The customer charge is $e_1\,(z_1 - z_2)$, the energy charge is ez_2.
In the third block: $a = e_1 z_1 + e_2 z_2 + (e - e_1 - e_2) z_3$
$$= \underbrace{e_1 (z_1 - z_3) + e_2 (z_2 - z_3)}_{\text{Customer Charge}} + ez_3$$
Energy Charge $= ez_3$. Likewise we get analogous terms for the customer and energy charge in the following blocks.

get $a = (8 \times 4d) + 6(7-4)d + 3(e-7d)$ with the same result as above.

For the third zone with $d > 4$ (zone $3b$ in Fig. 8) we get, using the formula (3) for zone $2b$, as far as that zone applies, that is up to $e = 7d$, $a = 12 + 5d + (6 \times 7d) + 3(e - 7d) = 12 + 26d + 3e$; this means $x = 12$ cents per customer per month, $y = 26$ cents per room per month, and $z = 3$ cents per kw-hr. (equivalent of Doherty rate).

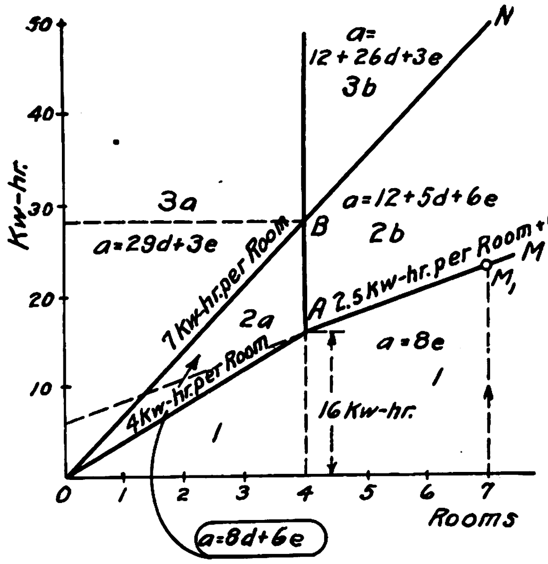


Fig. 8.—Analysis of Number-of-Rooms Rate.

162. Another example for the working of this method will be given in the analysis of the High-Tension Wholesale Lighting and Power rate of Boston. This rate is a double-block Hopkinson demand rate as follows:

Demand charge

$60 per year per kw. for first 15 kw. of demand
36 per year per kw. for next 40 kw. of demand
30 per year per kw. for next 100 kw. of demand
15 per year per kw. for next 100 kw. of demand
12 per year per kw. for excess demand

plus an energy charge of

5 cents per kw-hr. for the first 1,500 kw-hr.
3 cents per kw-hr. for the next 4,000 kw-hr.
1.5 cents per kw-hr. for the next 50,000 kw-hr.
1.25 cents per kw-hr. for the next 50,000 kw-hr.
.... etc. ....

We will restrict ourselves to the investigation of the rate for such customers who come into the highest demand block ($d > 255$ kw., or the $12 demand block) and into the energy block of more than 55,500 kw-hr. per month (1.25-cents-per-kw-hr. block).

$$a = (6000 \times 15) + (3600 \times 40) + (3000 \times 100) + (1500 \times 100) + 1200(d - 255) + (5 \times 1500) + (3 \times 4000) + (1.5 \times 50{,}000) + 1.25(e - 55{,}500).$$
$$= 403{,}125 + 1200d + 1.25e \text{ (in cents).}$$

We see that we have in this rate a very considerable customer charge amounting, for instance, to $4031.25 per month per customer for all customers with a demand over 255 kw. and an energy consumption between 55,500 and 105,500 kw-hr. Yet the rate schedule mentions only demand and energy charges.

163. The great importance and extreme usefulness of a proper rate analysis is clearly demonstrated in the following example of a rate of a large company in the West which the present author analyzed in the *Journal of Electricity, Power and Gas* of July 27, 1912. Quoting from there: Under the rate the consumer had to pay a certain monthly fixed charge f cents per kilowatt maximum demand; let us say[3] $4 per kw. ($f = 400$ cents). This entitles him to use current up to the load-factor L (for instance, $L = 300$ hours' monthly use of the maximum demand), the excess to be paid at z cents per kw-hr. (for instance, 2.5 cents per kw-hr). Without mathematical analysis, this rate looks perfectly correct and harmless, and it was not until the customers themselves happened to find out the defects and took advantage thereof that the rate was revoked. With a little mathematical analysis, as follows, the defects of the rate would have shown up glaringly at once and the rate would never have been put into effect.

In the range of load-factors smaller than L hours (300 hours) we have $a = fd$, where a is again the customer's bill and d his maximum demand; and if L is larger than 300, the customer with a total energy consumption of e kw-hr. has to pay, on top of this, for the excess of e over Ld kw-hr. at the rate of z cents per kw-hr., so that his total bill will be:

$$a = fd + (e - Ld)z$$
$$= (f - Lz)d + ez \qquad (4)$$

The first term on the right side is proportional to d and independent of e; the second term is proportional to e and independent of d. Consequently, $f - Lz$ is the equivalent demand charge and z is the equivalent energy charge in the range of load-factors larger than L hours.

Substituting now the above values from the schedule for f, L and z, we get

$$a = (400 - 300 \times 2.5)d + 2.5e = -350d + 2.5e.$$

We thus have a *negative* demand charge of $3.50 per kw.!

In other words, all the customer has to do in order to reduce his bill—provided he has a load-factor of more than 300 hours' use per month—is to *increase* his maximum demand before the meter reader comes, with as little increase of the energy consumption as is feasible, until he has reduced the load-factor to 300 hours per month. For instance, let us assume his demand meter reads 50 kw. near the end of the month and his kilowatt-hour meter 30,000 kw-hr.; his bill therefore would be

$$50 \times 400 = 20{,}000 \text{ cents}$$
$$(30{,}000 - 50 \times 300) \times 2.5 = 37{,}500 \text{ cents}$$
$$57{,}500 \text{ cents} = \$575.$$

If now, before the meter reader comes, the consumer for a short time purposely puts on a heavy load on his motors, or for instance lets them all work simultaneously (instead of with the diversity they show under ordinary operation) and thus runs his maximum demand meter up to 80 kw. with a practically unchanged kilowatt-hour consumption, he will have to pay

$$80 \times 400 = 32{,}000 \text{ cents}$$
$$(30{,}000 - 80 \times 300) \times 2.5 = 15{,}000 \text{ cents}$$
$$47{,}000 \text{ cents} = \$470.$$

He has increased his demand by 30 kw.; therefore, his bill must be smaller by $30 \times \$3.50 = \$105$. This reduction of the bill with increasing maximum demand of course goes on until the load-factor is reduced to 300 hours.

To avoid this drawback with a rate of the type quoted we must choose f, L and z so that $f \geqq Lz$, then the demand charge will be $\geqq 0$, as equation (4) dem-

[3] The figures are changed for obvious reasons, but in such a way that the characteristic features of the rate are preserved.

onstrates. If, for instance, we maintain f at \$4 per kilowatt and z at 2.5 cents per kw-hr., L must not be chosen larger than $400/2.5 = 160$ hours per month. If f is just equal to Lz (in our case, if L is chosen at just 160 hours per month) the demand charge is zero and the rate for all customers with a load-factor above 300 hours is a straight kilowatt-hour rate; if $f > Lz$ ($L < 300$ hours' use) the rate for all load-factors above L is a Hopkinson rate. In both cases the rate for all load-factors $< L$ is a straight demand rate

(To be continued.)

THIRD HARMONICS IN ALTERNATOR WINDINGS.

Peculiarities of Harmonic Voltages and Their Effects on Grounding Practice of Large Systems.

The third harmonic is the most troublesome of all harmonic voltages and is present in practically all generator windings. Unless steps are taken to deal with it from the commencement, says L. C. Grant in the London *Electrical Review*, it is likely to give a great deal of trouble to those having to deal with the working of electrical plant.

The harmonic frequency may be such that it runs in opposition, or, on the other hand, it may run in phase, with the power waves. In the former case the respective voltages coincide at their peak values, giving to the power wave a peak formation; when, however, the waves are in phase the peaks do not coincide and the power wave is altered in an entirely different manner. This results in a flattened formation, with a dip instead of a peak, but broadens out the wave considerably. Should the harmonic be entirely out of phase—not out of step, of course—it merely results in a complicated wave form, in which the two halves of the cycle are dissimilar.

With a polyphase generator the phase windings have an important bearing on the harmonic voltages. Should the machine be wound in delta, a difference in potential will exist at various points of the delta, which should normally be at similar potential; this results in circulating currents flowing through the windings which will dissipate the harmonic, but in a questionable manner.

Now, if the phases are connected in star, the line voltage will be the sum of two phase voltages displaced by 60°. The result of this phase displacement is that all harmonic frequencies are displaced by a like amount. For the third harmonic this means that the frequencies are displaced in each phase by half a cycle, resulting in their cancelling one another through being in opposition. Obviously the same holds good with any other harmonic frequencies which are a multiple of three. Thus, as far as the line is concerned, the third harmonic is wiped out. It must be borne in mind, however, that the harmonic frequencies still exist between any phase and the neutral point of the star.

With generators operating in parallel it is usually necessary to ground the neutral point, to limit and define the voltage to earth and also to allow the protective apparatus to operate. It is also essential that one generator neutral be grounded if absolute reliability is to be depended upon, as in case of a generator failure should only one neutral be grounded, and this machine be the one to fail the supply system will then be minus a neutral and circuit-breakers will be rendered useless.

On the other hand, should there be more than one neutral connected to earth all phases will be paralleled through the neutral points and earth, and the harmonic voltages again exist and may assume extremely dangerous proportions. In consequence it becomes necessary to ground through some current-limiting device such as a resistance or reactance; a reactance is advantageous in that it has a much greater impedance for third and any other harmonics than for the power frequency.

In any case, circulating currents of greater or less magnitude will be set up unless the harmonic voltages happen to coincide exactly at all points and all times, and this, of course, is too much to expect, even with the best of machines with varying loads, irregularities of material, etc. These circulating currents may very easily reach a high value and can be up to the full-load current of the machine; hence the value of the neutral resistance or similar device.

On account of the modern generator now being of purposely high reactance in itself, third and other harmonic trouble is not now so pronounced as it was some years back, when the main feature in generator design was good regulation, and consequently low reactance in the windings.

As previously pointed out, this reactance opposes a considerably higher impedance to harmonic frequencies than to the power frequency, and thus, in some cases, it is found quite feasible to parallel two generator neutrals directly without the use of external current-limiting devices.

In grounding generator neutrals it is always advisable to use a fairly heavy oil switch and to include an ammeter in the circuit, as with the two machines it is not possible to gauge even approximately the earth current by comparison with machine and feeder readings, owing to the wide variation that may exist in the load and earth components.

TESTS OF TELEPHONE RECEIVERS FOR RADIO USE.

Bureau of Standards Determining Best Types of Receivers for Specific Radio Purposes.

A comprehensive study of the telephone receivers used in radiotelegraphy and in radiotelephony is in progress at the Bureau of Standards, Washington, D. C. The tests include measurements to determine the loudness of response given by different types of telephones, as well as the electrical characteristics which determine how satisfactorily they fit the electrical apparatus in which they are used. Accurate methods are being devised for these measurements. It is expected that observations will be made by a large number of persons, so as to express results in terms of the average ear. It is also expected to use an electrical or artificial ear, and determine the relation of the average ear to this device which will then serve as a standard.

The results of these tests should make it possible to determine which type of receiver is required in a given radio apparatus in order to obtain the loudest signals. The methods developed will be of value in making measurements of the strength of signals received at radio receiving stations and will be utilized in connection with a study of the properties of electric waves, in which it is expected to obtain the co-operation of a large number of observers throughout the country.

Limitations and Performance of Large Steam Turbines

Papers Presented Before New York Meeting A. I. E. E. —Salient Features Given in Somewhat Abridged Form

Present Limits of Speed and Power of Single-Shaft Curtis Turbines

By Erskil Berg
General Electric Co.

For the purpose of discussing the limitations of the types of turbines used in the more important work now done by the General Electric Co. and to show the relative results which can be accomplished with such designs under different conditions of load, two machines have been selected, one representative of the largest size built for 1800 r.p.m. and one of the largest size now built for 3600 r.p.m. The figures given relate to the turbine alone and do not include generators.

The turbines in question are both of the single-flow type and may be considered representative of capacity limitations of that type. The single-unit turbine and generator is naturally preferable over the tandem and compound type on account of simplicity, lightness and efficiency. There are, however, certain definite limitations in the size for a given speed that these units can be built with material available at the present time. The limitation in the size of a unit for a given speed is entirely dependent upon the turbine and not upon the generator.

Fig. 1 shows the load curve of the large 1800-r.p.m. machine above mentioned, designed to operate with 250 lbs. steam pressure, 28.5 ins. vacuum and dry steam. This turbine has 23 stages, all wheels being of the single-bucket type. The first stage wheel has a pitch diameter of 35 ins., which increases with each successive stage until the last wheel, which has a pitch diameter of 88 ins. This curve shows that for 1800 r.p.m. a turbine can be designed for a 28.5-in. vacuum, giving its best efficiency at 21,000 kw. This curve also shows that with a sacrifice of 5% in efficiency, an output of 36,000 kw. can be delivered to the turbine shaft. Above a load of 21,000 kw. live steam is bypassed to the eighth stage shell, the effect of which is shown by the break in the curve.

The dotted line gives the load curve of a similar turbine in which the first 11 stages are replaced by one two-bucket stage. This turbine is designed with multiple valve steam admission, a modification that may be desirable for the purpose of simplification or where better efficiency at very light loads is important, as in propulsion of warships.

Many large size turbines are now designed for a vacuum of 29 ins. The volume of 1 lb. of steam at this vacuum is 652 cu. ft., almost 50% greater than at 28.5 ins., and about twice as much as at 28 ins., which calls for a corresponding increase in the area of the steam passage in the last stage wheel. If this area is made too small, the steam when leaving the last row of buckets must have a high velocity, giving a large loss of energy, this loss being in proportion to the square of the velocity. That this area be made as large as possible and that the exit angle of the blades be made small enough to give good extraction is therefore important.

Efficient action can only be accomplished by using a bucket speed that bears a proper relation to the steam velocity. Consequently to get the largest capacity, long buckets moving at a very high speed must be used. In order to obtain good bucket action, the buckets should not be more than about one-fourth as long as the pitch diameter of the wheel. If made longer than this, poor bucket action with consequent loss in efficiency will result, due to the great difference in peripheral speed between the base and the tip of the bucket, the design being made correct for the middle point or pitch line. The flare also becomes excessive so that the space between the buckets at the tip will be so large that steam can flow between the buckets without doing any work.

The use of a high steam speed in this last stage naturally implies that a relatively large proportion of

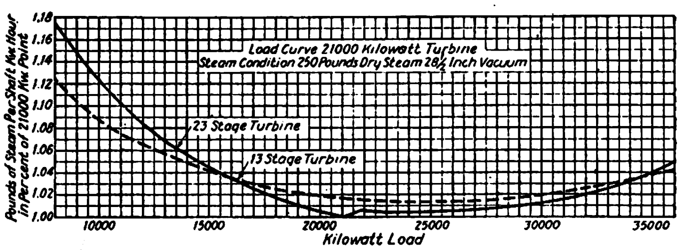


Fig. 1.

the total steam energy must be utilized there. Such concentration of work into a single stage has its disadvantages, since even if the best relation of velocities is maintained, such a stage doing a large amount of work is naturally less efficient than one of similar character doing less work.

The design of the last stage in such a turbine constitutes the most important limitation. The large 23-stage 1800-r.p.m. turbine already mentioned is designed to operate at 250 lbs. steam pressure, 28.5-in. vacuum and dry steam. The pitch diameter of the last wheel is 88 ins., length of buckets 22 ins. and bucket angles 60 deg. entrance and 40 deg. exit. The wheel is subject to the following stresses at normal speed:

Stresses in hub, 23,450 lbs. per sq. in.
Stresses in web, 22,950 lbs. per sq. in.
Stresses in bucket, 20,100 lbs. per sq. in.

Elastic limit (limit of proportionality) of material, 55,000 lbs. per sq. in. The material of the wheel and bucket is quenched and tempered 3% nickel steel.

The wheel is stiff enough to avoid vibration effects and in the absence of such effects the centrifugal strains afford ample factors of safety even if we assume considerable irregularities and imperfections of metal structure.

Cause of Wheel Breakages.

In some of the first large machines of the type here discussed, very serious trouble has developed due the formation of cracks in the forged wheels, causing

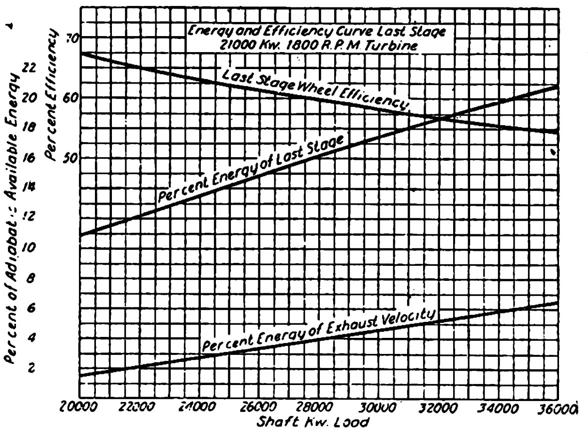


Fig. 2.

wheels to break in three important installations. The cracks formed in these wheels have started at holes in the wheel provided either for balancing steam pressures on the two sides of the wheel or for the attachment of balance weights. Calculation showed that the wheels which broke were less stressed than many which were made from weaker metal and had operated for long periods of time. Holes in a centrifugally stressed wheel greatly increase the fibre stress in the vicinity of the hole itself, but such conditions had not caused the formation of cracks in large numbers of wheels in which such localized high stresses existed. Many evidences have now shown that the trouble with these wheels has not resulted from stresses in excess of those which had been previously found to be practicable, but has been caused by fluttering and vibrations of the wheels, which had become possible through the lightness and thinness of their construction. Such vibrations give a periodic character to the stresses normally imposed and so give rise to the formation of fatigue cracks.

In machines of this type relatively light and narrow buckets have been used and the wheels have been

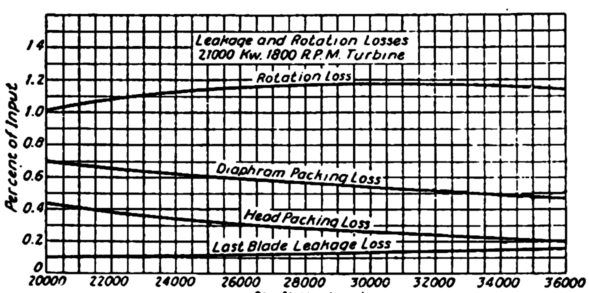


Fig. 3.

proportioned with a view to ample centrifugal strength but with maximum economy of space and weight, consequently these wheels have had much less lateral stiffness than wheels used in turbines of previous types. To overcome such troubles as have developed, it is simply necessary to make the wheels stiffer and to put in holes in parts of the wheel near the hub where a suitable reinforcement of thickness can be provided which both stiffens the wheel and reduces stresses near the holes. Very slight changes of this kind make a great difference in the vibrating characteristics of such wheels, and the proportions used are such that they can easily be brought to the same standards of safety in these respects as have long prevailed in wheels of heavier construction in machines having less numbers of stages.

In the absence of a tendency to form fatigue cracks through vibration, overspeed in such turbine wheels involves relatively little danger as compared with other types of high-speed machinery. Experimentally and in actual service, wheels have been stretched to a considerable degree of enlargement without the formation of any cracks, and such stretching is a normal condition if the cracks do not exist.

It has been discovered that such fluttering or vibration of the web of wheels has not only been responsible for the formation of fatigue cracks in the wheels themselves, but has also caused loosening and breakage of buckets. The remedy is to use stiffer wheels, and such wheels can carry stiffer buckets, so that the whole structure is incapable of vibration of any amplitude through such forces and periods as arise from the conditions of operation.

Fig. 2 gives the energy and efficiency curves of this last stage. It will be noticed that at the most efficient

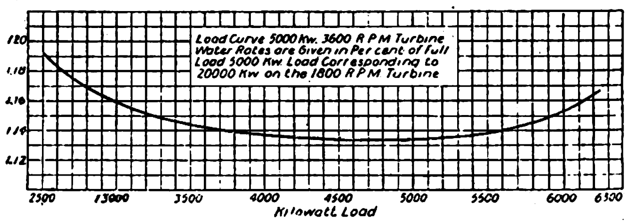


Fig. 4.

point (21,000 kw.) this stage absorbs 11.5% of the total adiabatic available energy and that the wheel efficiency is 66.25%. The energy represented by the exhaust velocity which is all wasted in the condenser is 1.5% the total energy. As the load increases on the turbine shaft, the energy in this stage also increases, decreasing its efficiency until at 36,000 kw. the energy in the last stage is 20.9% of the total energy. The wheel efficiency however has been reduced to 54.2% and the energy represented by the exhaust velocity has been increased to 6.4%. This great amount of work in the last stage at such poor efficiency naturally lowers the efficiency of the whole turbine, and in this case the efficiency at 36,000 kw. is 5% lower than at 21,000 kw.

Fig. 3 shows leakage and rotation losses of the same turbine in percent of input. From the above it will be seen that for 1800 r. p. m., a turbine can be designed efficiently for 21,000 kw. which, with a sacrifice of efficiency can deliver 36,000 kw.

Fig. 4 gives a load curve of the smaller 3600 r. p. m. turbine. The water rates are here given in reference to that of the larger machine, the load of 5000 kw. corresponding to that of 20,000 kw. on the 1800-r. p. m. turbine. This turbine has only five stages, one two-bucket wheel in the first stage, the other four stages having single-bucket wheels. The first wheel has a pitch diameter of 35.5 ins., and the remaining four wheels a pitch diameter of 51 ins. The bucket height of the last wheel is 9.125 ins., the turbine being designed for a maximum of 6250 kw.

The reason for such a discrepancy in the number of stages calls for explanation. As the output of a turbine, keeping approximately the same stresses, goes up inversely as the square of the r. p. m., if the same number of stages could be used and clearance and all dimensions proportionately reduced, a 5000-kw. machine at 3600 r. p. m. could be made nearly as efficient as a 20,000-kw. machine at 1800 r. p. m., and developments of smaller multi-stage machines at our Lynn Works have already been made which approximate such possibilities. Constructions however which are practicable on a large scale are not practicable on a small scale, consequently there are difficulties in getting the space economy in small high-speed machines which would be necessary for accomplishing the result stated. One of the difficulties has lain in the construction of diaphragms, the casting in of nozzle partitions being easy in a large diaphragm and very difficult on a small one. We are working upon types of diaphragms, and other parts which may make possible the development of multi-stage high speed machines which afford improved degrees of economy.

If a 10,000-kw. turbine is designed for 1800 r. p. m., the only change necessary would be to make the nozzle and bucket heights about half the height of those in the 20,000-kw. unit. This reduction in height of buckets and nozzles would affect the weight, size, and cost of the turbine very little as compared with the 20,000 kw. unit. In regard to economy, the lower bucket heights would reduce the rotation loss somewhat but far from 50%. The diaphragm packing loss, head packing losses, and bearing losses would be practically the same as on the 20,000-kw. unit, so that while a turbine designed for 10,000 kw. would be more economical than the large turbine running at half load, the difference would be small, being only about 6%.

It will be seen from this paper that for a given speed there is one particular size of turbine which can be designed to be most economical as to steam consumption, weight, space, and price per kilowatt. Even if a size smaller than this is required, it would in many instances pay for the central station to install the larger unit, even though it would have to run at reduced load for some time before the station load increased sufficiently to utilize the full capacity.

Present Limits of Speed and Power of Single-Shaft Turbines

By J. F. Johnson

Westinghouse Electric & Manufacturing Co.

With the employment of high vacua, such as is the present universal practise, the limit of power of a turbine operating at a given speed will be determined largely by the area obtainable through the last stage for the final expansion and passage of the steam power to its entering the condenser. The significance of this will be apparent when attention is called to the fact that whereas a pound of steam, when entering the first stage, has a volume of less than 2½ cu. ft., when passing through the last stage it has a volume of approximately 395 cu. ft. when expanded to 28½ ins. vacuum, and 585 cu. ft. when expanded to 29 ins.; a ratio in the latter case of 1 to 234.

Consequently, in any discussion of limits of power, it will be necessary to assume conditions of pressure and superheat of the steam entering the turbine, the vacuum to which the steam is to be extended in the blading, and the efficiency or rate of steam flow per unit of power. For these conditions 250 lbs. gage pressure with 200 deg. F. superheat and 29 ins. vacuum referred to a barometer of 30 ins., and efficiencies as are commonly obtainable with them, will be used.

Limiting factors may be divided into three classes: First; Theoretical, including limiting steam velocities and effect on efficiency of velocity remaining in steam after leaving the last stage, and the area through the blades as affected by blade angle. Second; Physical, including methods of construction, material, stresses, factor of safety against rupture, reliability factor, and limitations of transportation facilities. Third; Economic, including limits beyond which it may be physically possible, but economically inadvisable, to go, such as effect of size of structure or of character of materials employed on cost, and time required to make inspection and repairs. This paper will be restricted to a discussion of some of the factors which determine or influence such limits as applying particularly to turbines of the reaction type.

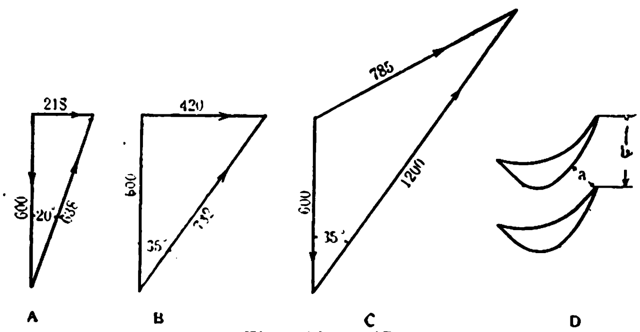
Theoretical Limits.

In this class there are but few limitations as affecting capacity at a given speed because with materials of infinite strength and rigidity available it would be possible to build units of infinite capacity; but for a given diameter and blade height the capacity will be limited by chosen maximum values of steam speed through the blades, in order to keep the leaving losses, or available energy in the steam discharged to the condenser, within permissible limits. Throughout the entire turbine, with the exception of the last few stages, steam speeds only about 25% in excess of the corresponding blade speeds are employed in order to secure maximum efficiency. In the latter stages, however, the volumes become so great that a compromise between maximum theoretical efficiency and physical dimensions becomes advisable by increasing the steam speed sometimes to approximately 100% in excess of the blade speed. The steam after being discharged from the last stage, therefore, still contains a small portion of available energy the recovery of which would involve disproportionate expense.

For example, if the pressure drop in the last stage is such as to render available for work thirty heat units which will produce an equivalent velocity of 1225 ft. per sec., and if the blade speed is such that the steam after leaving it still has a velocity of 600 ft. per sec., which is the equivalent of 7.2 B. t. u., this 7.2 B. t. u. will be totally lost, whereas probably 80% of it (or 6 B. t. u.) might be recovered were it practicable to use an additional stage of proper proportions. This would improve the total efficiency of the turbine approximately 1½%. Higher blade speeds will tend to improve the efficiency by reducing leaving losses, but generally not as effectively as would larger blade areas with lower steam velocities and correspondingly increased number of stages.

With height of a row of blades fixed, the area of the steam space is dependent upon the angle formed between the center line of the row of blades and the outlet portion of the blade. The smaller this angle is the smaller will be the area and vice versa. On the other hand the smaller this angle the higher the efficiency because of the lesser absolute velocity left in the steam leaving the last stage to discharge to the condenser.

In Fig. 1A is shown a relation between steam speed and blade speed to give highest efficiency. The blade speed is 600 ft. per sec., steam speed 638 ft. per sec., blade angle 20 deg. and steam speed after leaving



Figs. 1A to 1D.

blades, 218 ft. per sec. in direction at right angles to direction of rotation. Fig. 1B shows a similar condition giving maximum obtainable efficiency employing a 35 deg. blade angle and Fig. 1C a condition in which the steam speed is 100% greater than the blade speed.

The leaving losses are, in Fig. 1A, 218 ft. per sec., Fig. 1B, 420 ft. per sec., and Fig. 1C, 785 ft. per sec., which is the equivalent of 0.95, 3.5, and 12.3 B. t. u. respectively.

The steam area is ordinarily expressed as a ratio of the perpendicular distance between blades, to the pitch of the blades, as a/b (see Fig. 1D). Highest actual efficiency is obtainable by keeping this ratio between 0.25 and 0.3, and this is done in all stages except the last few in high vacuum machines where it is increased to a maximum of 0.5, the equivalent angle being about 35 deg. which includes proper allowance for blade thickness; this ratio having been determined upon as a proper compromise between cost of increased blade height and loss of efficiency due to increased terminal loss.

Some European manufacturers have employed ratios as large as 0.65 and 0.7.

Physical Limits.

Chief among the physical factors limiting turbine capacity are the physical characteristics of the material employed and the chosen limits to which these materials may be safely stressed, bearing in mind that either uniformity of quality, or factor of safety sufficient to cover all possible variations, together with inaccuracies in calculation and irregularities of operation, must be provided for. While alloy steels possessing exceptionally high physical characteristics are procurable, their high qualities depend on relatively sensitive metallurgical processes which in the opinion of some engineers cannot as yet be carried out by regular workmen as a manufacturing process with a sufficient degree of reliability to justify their use, and that until this can be done, conservatism demands adherence to the lower strength, lesser sensitive materials. Such materials may, with suitable forms of construction, be safely stressed under the maximum test condition to within a few thousand pounds of their true elastic limits.

When the construction of the rotor is not limited to any one special form, the design may be varied so as to take full advantage of the low speeds in the high and intermediate stages (where low speeds must be used in order to secure high efficiency) by employing a drum the thickness of which may be varied to keep the stresses within desired limits; while in low-pressure stages where the stresses are highest, either disks carried on a shaft, or solid disks suitably held together, may be employed. With the solid disk construction the stresses may be kept within any reasonable limits up to speeds at which the design becomes too massive and expensive.

The steel regularly used by the Westinghouse company for turbine rotors conforms to the following characteristic specifications:

Test rings taken as close as possible to the point of maximum stress must show the following characteristics with standard 2-in. specimens:
Tensile strength 65,000 to 70,000 lbs. per sq. in.
True elastic limit 22,000 to 25,000 lbs. per sq. in.
Elongation 15% of 18%.
Reduction of area 20% to 25%.
The steel must be of best quality, having approximately 0.25% carbon, 0.50 to 0.60% manganese, 0.25% silicon, and not over 0.025% sulphur or of phosphorus.

The material is obtained ordinarily in the form of castings, though occasionally as forgings. The specifications in either case are the same. Especially in the larger sizes the forgings have been difficult to obtain, excessively expensive, and no more uniform or reliable in quality than the castings.

Fig. 2 shows the form of casting for a rotor end. It is cast vertically with the small end down, and after casting is allowed to cool very slowly in the sand. After removal, the entire upper portion which constitutes the riser, is cut off and the casting then thoroughly annealed by being heated slowly and evenly to a temperature of about 1650 deg. F. and allowed to cool very slowly. It is then rough machined to within about ¼ in. of finished surface, after which it is put in a furnace and heated to about 1100 deg. F. and allowed to cool slowly to remove any possible internal stresses set up by reason of the metal removed in machining. It is then finish machined and given no further treatment of any kind.

The limit of stress to which this material is sub-

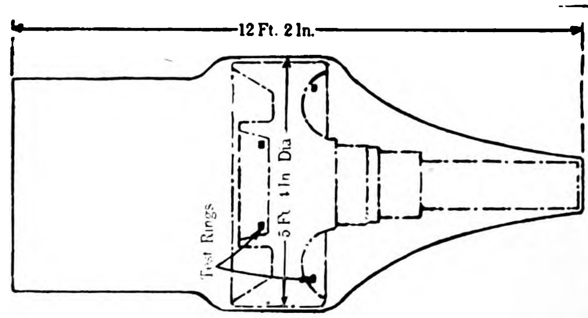


Fig. 2.

jected is 20,000 lbs. per sq. in. when operating at a speed 20% in excess of the normal operating speed.

The stress at normal speed is therefore $\frac{20,000}{(1.20)^2} =$ 13,900 lbs. This stress is 63% of the minimum allowable true elastic limit, about 46% of the yield point and 21½% of the minimum ultimate strength. It is not generally appreciated that should the stress, by reason of defect or excessive overspeed, exceed the true elastic limit, no injury will result other than a slight permanent stretch, together with such blade damage as may result therefrom. In an extreme case of overspeed the rotor drum or solid disk will stretch sufficiently to cause blading to rub to such an extent as to practically insure entirely destroying it, and thus prevent further overspeed, before the ultimate strength and elongation of the material is reached.

If the rotor design can be so modified as to always keep the stresses within necessary limits, then the stress at the base of the blades, or in blade fastenings, determines the maximum capacity obtainable with a given speed.

There exists two interesting relations between the stress at the base of blades, steam passage area through the blades and rotative speed. For any given rotative speed and blade angle, the steam capacity or steam area through the blades is directly proportional to the stress at the base of the blades, regardless of the diameter and blade height selected. This stress can only be modified by unevenly varying the cross sectional area of the blades such, for example, as thickening the blade near the base. Also for any given stress the area through the blades will vary inversely as the square of the speed, i. e., if at a speed of 1800 r.p.m. a given stress and area are obtained, then at 900 r.p.m. the area will be increased four times if the stress is kept constant.

The area and stress are therefore each equal to a constant times the product of mean diameter and blade height, and when the stress is constant this product will vary inversely as the square of the revolutions per minute. The ratio of blade height to rotor diameter is, therefore, not a factor in determining physical limit of capacity, but only in determining efficiency, cost and, to some extent, reliability of the turbine.

Blading used in impulse stages and in low pressure reaction stages in which stresses exceed 15,000 lbs. per sq. in. at 20% overspeed is made of a 5% electric furnace nickel steel in which the carbon sulphur and phosphorus are kept very low. It is really a nickel iron having a very fine close structure.

Its physical and chemical characteristics are as follows:

Tensile strength	65,000 lbs. per sq. in. minimum
True elastic limit	35,000 lbs. per sq. in. minimum
Elongation in 2 ins, %	30
Reduction of area, %	60
Carbon, %, not over	0.08
Silicon, %, not over	0.10
Phosphorus, %, not over	0.025
Sulphur, %, not over	0.04
Manganese, %	0.40 to 0.50
Nickel, %	4.5 to 5.5

This material is annealed by heating to 1425 deg. F. and cooled in open air after rolling into sections required for forming into various blade shapes and is given no further heat treatment.

The maximum stress at 20% overspeed to which this material is subjected is 25,000 lbs. The corresponding stress at normal speed is, therefore, 17,350 lbs., this being 49% of the true elastic limit and 26½% of minimum ultimate strength.

For the lower stress reaction blading, a copper, tin and phosphor bronze is employed, consisting of:

Copper, %	97 to 98
Tin, %	2 to 3
Phosphorus, %	0.03 to 0.07

Satisfactory methods of blade fastening involve no problems unless allowable stresses in the blades are very materially higher than those in the blade carrying element.

Increased capacity without decrease of rotative speed or increase of stresses may be obtained by employing multiple low pressure stages. This well-known and popular expedient possesses the merit of permitting high-vacuum turbines to be built at speeds and capacities up to approximately the present limits of generator construction, without exceeding moderate diameters, blade lengths and stresses.

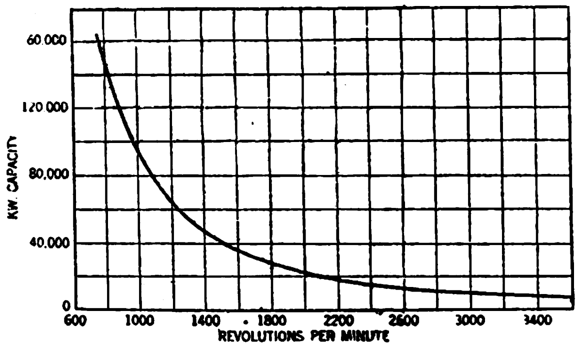


Fig. 3.—Limits of Capacity of Steam Turbines With Double-Flow Low-Pressure Stages.

Having steel blades of uniform cross-section stressed to 25,000 lbs. per sq. in. at base of blades at 20% overspeed and maximum efficiency at 80% of rating—250 lbs. steam pressure—200 deg. superheat—29-in. vacuum referred to a 30-in. barometer—with steam velocity through blades of 1225 ft. per sec. at a volume of 585 cu. ft. per lb.

Fig. 3 is a curve showing approximate maximum capacities at various speeds which are physically possible, employing double-flow construction without exceeding the limits of stresses previously given. For equal capacities employing single-flow construction the stresses would have to be doubled. The points marked (x) at 3600, 1800 and 1500 r.p.m. represent capacities which have already been built. This curve must not be interpreted as indicating suggested practicable present or ultimate limiting capacities of turbines, but merely as showing a physical relation between speed and capacity with given limiting stress values and operating conditions.

An important limit of size and capacity now being approached is that imposed by transportation facilities. Stationary elements may be readily sectionalized as required and assembled after shipment. Ways may be devised also for partial dismantling of rotor elements, although diameter will be one of the limiting factors, and this cannot be reduced beyond the point of omission of blading.

While the physical dimensions and capacities of turbines are being constantly increased it is essential that the reliability factor be not decreased. The employment of special materials and higher stresses does not usually permit increased capacity or efficiency without a corresponding increase in weight and cost unless reliability be compromised.

If, having given a satisfactory reliable design of a given capacity employing low stresses, it is proposed to transform it by modification of design and substitution of higher stresses into a unit of larger capacity, greater blade lengths and probably greater blade weights, operating at higher speeds and involving higher centrifugal forces will be necessary, in order to secure the required area. The rotor structure may possibly be shortened somewhat but unless its total weight is increased nearly in proportion to the increase in stored energy in the individual blade, the unbalanced effect or disturbance caused by one or more blades breaking (which must be recognized as an inevitable occurrence in any turbine) will be greater, imposing higher stresses in the rotor shaft, bearings and bearing supports, and a greater factor of strength will be required to withstand these stresses. The greater blade weight and higher speed will also require increasing the mass of the casing in order to prevent the blades from permanently injuring and possibly breaking through it if they should fail. The endurance factor of a turbine when operating under imperfect or abnormal conditions will be higher in proportion to the ratio of stator mass to rotor mass and of rotor mass to blade mass. The incorporation in the design of a turbine of features which increase the endurance factor will appreciably increase its cost but will also (to a very much greater extent) increase its value to the user.

In the study of economic limits of turbines of large capacity, consideration must be given to the fact that as yet such units are not required in sufficient quantity to warrant equipping and operating shops for their exclusive manufacture and that they must, therefore, be produced by largely the same processes and equipment as are used for smaller sizes which are built in greater quantities. As sizes become larger, a greater proportion of special equipment and processes becomes necessary, resulting in increased rates of cost unless accompanied by very material increase in quantity of production. Under present conditions this economic limit of capacity agrees closely with the physical limit of 1500 r.p.m. units.

In the larger low-speed structures the physical proportions become such that using ordinary steel and cast iron, to which we are limited by the metallurgical art, the distortions due to temperature changes and elastic properties of the materials are such that increased clearances and bracing have to be employed in order to maintain equal reliability and rigidity to a degree which causes the cost per kilowatt for a given efficiency to increase with increasing capacity. Further development of the allied arts and increased demand for larger units will tend to reduce the influence of this limitation factor.

Another factor tending to limit capacity of single units is the generating capacity loss resulting from suspension of service for inspection or repairs. For example, if a 30,000-kw. unit must be kept out of service ten days for a certain inspection or repair, a 60,000-kw. unit would have to be kept out probably 14 days for a similar purpose because of the greater time required to handle the larger structure. Therefore, if two 30,000-kw. units were used and each held out of service 10 days, the outage loss would be only five-sevenths as great as if a single 60,000-kw. unit were kept out 14 days.

In order to avoid the limitations or undesirable characteristics just referred to, a number of turbine units of capacities varying from 30,000 to 60,000 kw. have been built in which the turbines have been divided into two or three separate compounded elements, each driving its own generator and each capable of operating alone on high pressure steam in emergencies.

It is believed that units of this type will continue to be employed for the larger capacities because of the advantages not obtainable in single cylinder types which will justify their somewhat greater cost.

Turbine blading of the low-pressure stage should be designed so as not to throttle unduly the enormous volume of steam passing through it to the condenser. A turbine utilizing 28.5 ins. vacuum will be less expensive than one designed for 29 ins. The turbine chosen should be one able to utilize the best vacuum economically justified.

BRITISH COOKING AND HEATING APPARATUS USED IN WAR SERVICE.

A Total of 160,650 Pieces of Apparatus Aggregating 164,050 Kw. Used by British Army and Navy.

A. B. Gridley and A. H. Human in a report on electric power supply during the war contributed to the *Journal of the Institution of Electrical Engineers* (England) review various sections of electrical industry which contributed their part in providing requirements for the forces. In cooking and heating apparatus production there was great activity and much of the heating apparatus supplied to British Government departments was of a special nature. It is impossible even now, we are told, to give details that would be of the greatest interest because of "the confidential purpose of many of the processes adopted." We may give some data, however, affording some indication of the abnormal amount of work done for the particular purposes named.

There were provided for canteens, munition works, hospitals and national kitchens 4800 pieces of electrical cooking apparatus, aggregating 71,055 kw. capacity, which enabled 316,500 persons to be catered for daily. Electrical cooking apparatus supplied for use afloat consisted of 12,750 pieces, aggregating 27,750 kw., serving 63,000 persons daily. There were produced 55,500 heaters for gun mountings to prevent guns from jambing or freezing when in use in airplanes, aggregating 1020 kw. Some 24,000 pieces of apparatus (12,000 kw.) were made in the form of heaters for airplane engines to prevent freezing when standing awaiting orders. In addition, 39,600 pieces of auxiliary plant or apparatus, aggregating approximately 52,500 kw., were used in connection with the heating of oil for furnaces, primers for airplane engines, smoke screens, decoys, metal baths, muffles and crucibles, branders, glue pots, soldering irons, special heaters for explosive works, band heaters for shrinking bands onto shells, wood-seasoning ovens for seaplane work, armature dryers, airmen's suits, resin boilers, radiators and heaters, immersion heaters, copper circulator heaters for seaplane engines. The foregoing figures total out at 160,650 pieces of apparatus with a total capacity of 164,050 kw.

The material used was almost wholly of British manufacture, with the exception of regulation switches and, to a small extent, the wire used for heating, such as Nichrome. In the earlier part of the war the importation of Hart switches and Nichrome and Nichrome-2 from America was permitted, but later on British manufacturers supplied a good deal of the heating wire, and the import of Nichrome was prohibited. The type of element employed afloat differed from that employed on land. In the former case mica was almost universally used, and in the latter case fireclay. There was some slight difference in the method of construction, but the main feature in each case was similar.

Among a great deal of information respecting manufacturing operations in the United Kingdom during the war, Messrs. Gridley and Human give the following approximate particulars of the annual rate of production of electrical equipment during the latter half of the war period:

Generating apparatus........	400,000 kw. per annum
Motors	600,000 kw. per annum
Transformers	500,000 kw. per annum
Converting apparatus........	110,000 kw. per annum

Value of Statistics in Central-Station Operation

Manifold Uses of Statistical Data — How They Should Be Used—Methods of Organizing and Maintaining the Work of Compiling Essential Statistics for the Central Station

By EDWIN J. FOWLER

Statistician, Commonwealth Edison Co., Chicago.

FINANCIAL reports from the accounting department of a central-station company are usually shown only in dollars and cents. Statistical reports, using as a basis the dollars-and-cents figures from the accounting department and the kilowatt-hours, number of meters, number of customers and other unit figures, as obtained from the operating and engineering departments, consolidate these, showing figures on a per-unit, a percentage and perhaps on a graphical basis. In other words, statistics connect up the engineering side of the business with the accounting and financial sides.

Central-station statistics should deal, not only with what has happened, but should also estimate the probable demands and tendencies of the future. An enumeration of some of the principal uses that are made of statistics should give some idea of their real value in central-station operations:

Uses Made of Statistics.

(1) To compare operating expenses and other operating results and also construction costs, in order to know where and how the best results are being obtained and in order to follow up operating forces and instill some rivalry and pride in results.

(2) Statistics are absolutely essential in case of rate revision, either voluntary or taken up by the Public Utilities Commission or local regulating body, and in case of other investigations by the authorities; they are necessary in connection with the questions submitted by the government census officers.

(3) As a basis for estimates in advance of the probable maximum load, in order to determine how much additional capacity should be ordered for the coming year and as a basis for future fuel requirements.

(4) Load diagrams are considered necessary and are used regularly by those in direct charge of operating the distribution system.

(5) Load diagrams and statistics are also furnished daily and used regularly by the large railway customers of the Commonwealth Edison Co. in operating their extensive systems of substations and in an effort to hold their maximum demands within bounds, their primary charge per kilowatt being based on the maximum demand.

(6) To supply bond houses and bond salesmen facts regarding the business that are very useful, if not essential, as an aid in selling securities.

(7) Some of our statistics have been very useful for advertising purposes. Such advertisements have been used in the newspapers, in the street cars, in the financial magazines and publications, and by the contract department.

(8) Detailed statistics are usually necessary whenever a bonus or commission system of paying employes, such as solicitors, meter readers and billing clerks, is in use.

(9) Statistics are the foundation on which the studies of diversity-factor have been made in recent years. These studies have disclosed the great importance of this factor in the central-station business. This knowledge, heretofore so little understood or appreciated, has suggested the advisability of and pointed out the way to the making of rates which have materially helped in the development of a large industrial load and income.

(10) Statistics have been helpful, perhaps necessary, in many other ways in connection with rate making. For instance, in connection with street and interurban railway contracts, statistics reveal the relation between the maxima of various periods of time—half-hour, one hour or average of several hours—also they reveal what rate each class of business should pay from a cost standpoint and many times avoid the making of rates which would be unprofitable.

(11) The investment budget and property records in connection with fire insurance are reports which are usually and appropriately kept by the statistical department. As to their value, probably mention of them is all that is necessary.

(12) Customers' statistics, showing the load characteristics of all kinds of industrial or wholesale customers and of retail power customers, and showing the average bills and average rates earned by various classes of business served on retail schedules, have proven of great value.

Examples of Graphic Statistics.

For instance, there is a great deal to be gained from the statistics given graphically in the accompanying illustrations.

Fig. 1 gives the sources of the earnings of the Commonwealth Edison Co. It shows that the receipts from wholesale light and power customers increased nearly four times in five years. It also shows that the economic advantage arising from the diversity of different classes of demand in the community is being utilized by the development of not only retail electricity supply but also wholesale and railway electricity supply. The wholesale power load has increased from 65,450 hp. in 1913 to 110,200 hp. in 1916.

Fig. 2 shows the reduction in rates of two typical wholesale customers, each having a maximum load of 75 hp., one using the equivalent of his maximum six hours a day and the other twelve hours a day. These reductions in rates have been made in spite of the advancing cost of labor and fuel. The last reduction shown, in 1916, reduced the bills of wholesale customers $216,000 per annum.

Fig. 3 is a diagram showing the relative growth in investment and in electricity sold during the years 1896 to 1915.

Who Should Use Statistics and How Statistics Should Be Used.

The large companies do much of the pioneer work along statistical lines and work out many of the reports and much of the data on which changes in policy in the various engineering, operating or commercial branches of the business are based. Some smaller companies not having statistical organizations to work out their own problems often adopt the policies of the larger companies without knowing all the facts regarding their own business. Assuming that what is correct for one is correct for another, the smaller companies sometimes make expensive mistakes.

We have reached the time when there are relatively few companies whose operations are restricted to the corporate limits of any single village or small town. A large proportion of the former small companies have enlarged their operations and supply adjacent communities or have been absorbed in one of the group utility companies which operate over a considerable territory. Outside of a few remaining companies which operate in a single small community, electric lighting companies cannot afford to be without a distinct statistical organization, even though it consists of only one man of the right type devoting his entire time to the work. The larger and more complicated or varied the business or organization the greater the necessity for statistics and the greater their value.

A comparison of costs and other operating results as presented in the form of statistical reports usually results, after analysis and investigation, in uncovering certain definite causes for any differences that may exist. Usually these causes cannot be altered or changed, but in some cases these comparisons bring to the attention of the operating head conditions or methods of operating which, upon more careful analysis, it is found can be improved, with resultant economies or better service.

Another point regarding the value of statistics is that after having prepared the statistics in proper form and on the right subject at the right time it is necessary to *study* and *use* them if any benefit is to be realized. This, of course, is self-evident, but the point is that the statistical man must not only be able to prepare statistics but he must also study them and be able to discover the important facts which are hidden herein and to recommend and bring to the attention of the higher officers such action as is advisable.

Organization for Statistical Work.

The statistical man should not be tied down to routine work, but at least a considerable part of his time should be free for special studies of the various phases of the business and in keeping informed on what is being done elsewhere, both within and outside of his own organization.

His work should partly consist in keeping the essential basic records on (a) analyzed expenses in dollars and cents (as obtained through the auditing department from a properly balanced classification of accounts); (b) the number of customers, the important divisions of earnings according to rate schedules, kilowatt-hours sold, and according to towns or territory, and (c) maximum output and kilowatt-hour

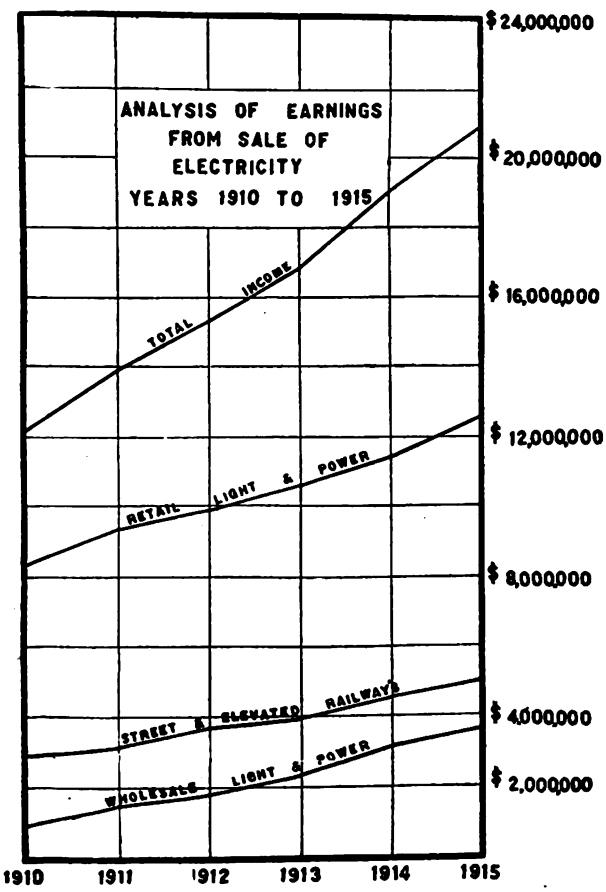


Fig. 1—Analysis of Earnings from Sale of Electricity.

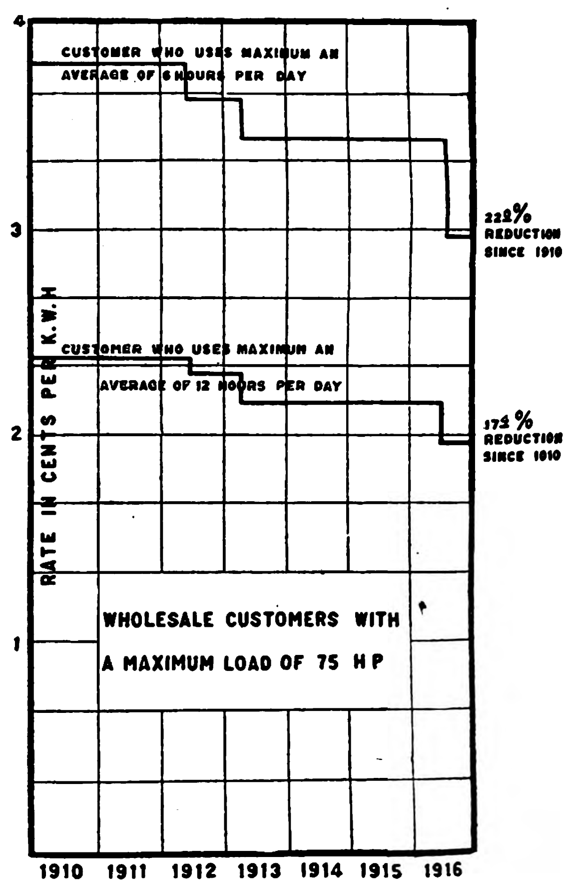


Fig. 2—Reduction in Rates to Wholesale Customers.

output of the stations and substations as obtained from the load records.

Another part of the statistical man's work should consist of obtaining such reports and comparisons from these basic statistics and from other sources, and in making investigations and special reports of any company matters which involve statistics to any extent.

The statistical department, to be at all successful, should have authority to go into other departments of the business and get any information or figures necessary. This information should be not only that easily available, but within reasonable limits the statistical department should have authority to have any special data or figures worked up by other departments. The statistical men should be independent and should have the privilege of reporting on any branch

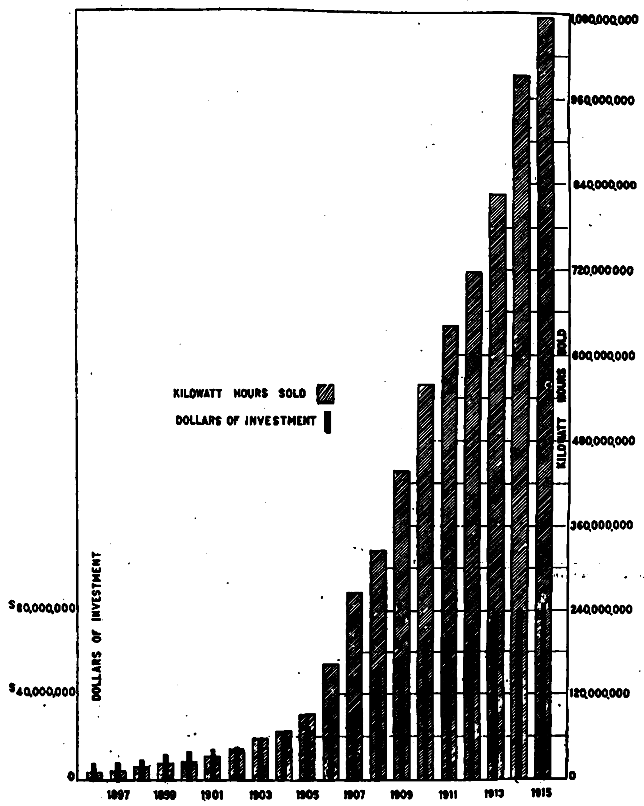


Fig. 3—Relative Growth in Investment and in Electricity Sold

of the business, even though the report may reflect in a way upon results that are being obtained in that branch. These reports should be made to the department interested and should be given enough circulation among the other higher officials so that the matter may receive general attention. This, of course, must not be in the spirit of censure, but in the spirit of educating and keeping the officials informed on what is developing and what is being accomplished, whether it is favorable or unfavorable. It goes without saying that the statistical department should be conducted on the highest plane of disinterested service for the good of the whole enterprise.

It is important to keep a record of only the essential statistics, which should be as simple as possible and usually without comparisons and without adding percentages or unit costs. Few printed forms are usually advisable. It is preferable in a great many cases to typewrite the forms once a year, filling in the data each month as the year progresses. These basic statistics are usually kept only in the statistical department and are available for drawing off any information requested and for making up special reports and special comparisons.

An occasional timely report made up specially and in complete form usually commands much more thorough and immediate attention than a regular periodical report on a printed form and costs very much less.

In the foregoing it is not meant that there should be no regular periodical reports on printed forms showing percentages and comparisons. Some are really essential, but in too many cases a regular periodical report is started and then, after a short period, it falls into disuse, although the making of it and the consequent expense go on indefinitely.

The statistician should not find it necessary to build up a large organization—that is, a large number of employes—as he will usually find that a large part of the detail reports and data he wants is already prepared by and in the hands of the various departments of the company.

The man in charge of the statistical work should either have had some engineering education or be scientifically inclined enough to grasp the underlying engineering principles involved in the business.

Conclusion.

To sum up, every company, no matter how small, has an accounting record in dollars and cents of expenses, income and investment, but if it is to get the best results a study of the dollars and cents alone is not sufficient. The accounting figures should be coordinated with the other statistical facts of the business and the small company as well as the large should realize a definite advantage by developing or bringing into their organization some statistical talent.

Statistics should not be kept a little in this department, a little in that department and a little somewhere else, and given minor consideration as a relatively unimportant clerical matter, but the statistical work of any organization should be independent of the auditing and financial work and should also be independent of the operating, engineering and construction side of the business. Although small in number of employes and in expense it should be recognized and respected and given the independence of a separate department reporting to one of the higher officers, if not to the president.

EDINBURGH POWER PLANT ORDERED IN SWITZERLAND.

The lowest three out of 16 tenders submitted to the Edinburgh (Scotland) municipality for three turbo-alternator sets for its new Portobello generating station were from Swiss manufacturers. The municipality, acting on the advice of its consulting engineer, Sir Alexander Kennedy, accept the tender of Brown, Boveri & Co., of Baden, at $533,090. The tender of the British firm of C. A. Parsons & Co. was $350,000 higher and, as the British Government desires reasonable preference to be shown to British products when required for public undertakings, the matter was referred to the Board of Trade, which did not consider that so high a difference should be paid in order to keep the work in England. The Board invited British bidders to reduce their prices, but they intimated that they were unable to do so.

The contract for the boiler-house equipment for Portobello station (six boilers, etc.) went to the Stirling Boiler Co., at $1,003,305.

Editorial Comment

Some Factors Affecting the Coal Problem

COAL production is not keeping pace with consumption, and every day that passes brings nearer the time when, unless the striking miners go back to work, the country will face a serious situation. The coal strike will ultimately be settled by compromise, why delay?

Coal has assumed a prominent place in our national life. It seems as if at most only a few consecutive months can pass without coal coming into the limelight. During the war the demand for coal brought about the fuelless days, cessation of industry in some cases and lightless nights. Last winter, although the war was over, the question of shortage and of high cost, kept the consumer in uncertainty and suspense. This winter the bituminous coal miners are on strike for radical changes in their working week and in their rate of pay. Today, little coal is being mined and a famine comes nearer with every day of delay.

The fact is that coal is the beginning and the end, the *alpha* and *omega,* of our national life. It is vital, it is expensive now. It will be vital tomorrow and in the far future—and probably more expensive. The question, therefore, before every coal user, and everyone is potentially and indirectly a user of coal, is how best to solve this coal problem—a problem of transportation, of labor and of consumption.

There is every reason to believe that railroad freight rates will increase directly the roads are given back to their owners, perhaps before that takes place. The cost of haulage is a considerable item in the cost of fuel. The cost of coal at the mine will also in all probability increase before long, making more efficient use of coal imperative. The question as to how best to accomplish this, a difficult problem embracing many aspects, is a pressing one. But in attacking it, it is well to tackle those matters that are most easily accomplished.

The clean coal ruling instigated and somewhat enforced by the Fuel Administration when coal was a factor in winning the war should not only continue in vogue, but should be prosecuted more stringently than ever. Coal is already too expensive for the nation to continue to pay for slate and dirt at the price of coal. Freight rates are already too high without paying for the movement of slate and stone dirt, something that is of no use and whose presence does considerable harm. One of the most urgent needs then toward a partial solution of the coal problem and incidentally for placing our railroads upon a proper basis, is to institute coal inspection stations at the mines, adopt a clean-coal policy and adhere to it religiously.

Another practice that came with the war that should be made permanent gradually and yet early is that of insisting upon the use of local coals. It is estimated that with the present annual rate of coal consumption within less than ten years present railroad facilities would be completely occupied with the the movement of coal. The zoning of coal is a matter that is closely allied with those of transportation and lower coal costs.

If it were made compulsory, gradually of course, to use coal contiguous to the place of consumption, new methods of burning coal would be developed and new fuels would come into usage. There is no scarcity of fuel. But the fuels we have become accustomed to using are becoming more and more inaccessible, necessitating going further way from the markets for them or deeper into the ground after them. When the zoning of coal comes, and it will come eventually—it is only a matter of time—lignites and peat; culm banks and other sources of combustible now despised will receive the attention and the utilization that they deserve. Coal prices and high freight costs are bringing that day nearer.

The coal strike will, of course, be settled ultimately. Coal will be mined again and production and consumption will keep pace. But the coal situation will not have been solved. It will only have been shelved. The use of coals near at hand, the utilization of fuels now left in the discard, insistence upon cleaner coal or at least a charge based upon the heat value and cleanness of coal, a method of storage so that the miners may find steadier work by reason of continuous output instead of seasonal output, are some of the most apparent and some of the most promising contributing factors to the permanent solution of the coal situation.

Sticking to Business

IN a recent article appearing in the ELECTRICAL REVIEW a statement was made by the author that no equipment of a certain variety was available that met all requirements as regards flexibility demanded by average central-station practice. In an almost consecutive issue appeared an article upon the same subject, this time the author being the president of a manufacturing company, in which it was pointed out that absolute flexibility of the apparatus under discussion was now existent, and that any central station had almost infinite choice when it came down to choosing its equipment.

Now the statements of these two men, the one an operating engineer having a large transmission system under his charge, the other an engineer who has specialized upon one phase of central-station engineering, are contradictory.

The reason is that the operating engineer was not conversant with all apparatus upon the market, but had used and was still using, equipment manufactured by his own company to meet the needs as he and his associates understood them. He had not made himself conversant with apparatus already available, the evolution of which had occurred gradually through many years of practical trial and survival of fittest.

However, the point which it is desired to emphasize here is that practically every branch of engineering, or any commercial line of endeavor so far as that goes, is a matter of specialization. Producing a turbine is a specialized piece of work, as is also designing a voltmeter, producing a sewing machine or what not. The many who specialize in producing an oil switch or a phonograph will succeed better than one who attempts to make everything he uses; for the days are gone when everyone can produce the necessities of life.

The central station devoting its effort to producing and supplying electrical energy by means of equipment upon the market or produced by manufacturers already in the game, will do better than the utility that tries to make its own transformers, its own circuit-breakers, etc. Central-station supply, just as manufacturing, is a specialized job these days. And it can be done the better by not dabbling in other work, for failure only means that "service" suffers and that the public must pay for the experiment.

Regarding Large Turbine Units

ELSEWHERE in this issue will be found very frank statements by two of the engineers of two of the largest manufacturers of steam turbines. These statements deal with the limitations of turbine outputs, and physical and economic aspects of the situation.

However, regardless of whether large turbine units are reasonably reliable and the physical limitations as to maximum capacity, another question enters, and one which probably concerns more central stations than does the question of what is the largest size that can be made. That question is the most desirable capacity of the individual turbine to the total station capacity. This question is important because it affects not only reliability and the factor of safety of operation, but operating economy. For most central stations, all except perhaps the largest, the question is of more concern than knowing the largest turbine that can be manufactured with reasonable assurance that it will be capable of being placed in and out of service and subjected repeatedly to the other uncertainties of service without danger.

For example, 50,000-kw. turbines may prove very economical and the best choice for a station containing 300,000 or even 250,000 kw. in generating capacity. Units of such size in a station of such size permit of economical operation, which means operating the individual units at loads corresponding to their highest efficiency and at high load-factor, thereby resulting in low water rate of the individual units and a further low over-all fuel consumption by reducing to a minimum coal used for stand-by service, starting and running lightly, banked fires, etc. At the same time, if one unit should become *hors de combat*, a possibility that must always be taken into consideration with any form of prime mover or apparatus in general, not so much because of the machine itself but because of the ancillary apparatus, condenser, boiler, stoker, etc., the remaining units should be able to carry the load of the unit not available without creating undue difficulties.

Reduce the station capacity to 200,000 kw., still retaining 50,000 kw. turbines, and the loss of one unit immediately becomes a very much more serious matter. Going further still, suppose a station contains only two or even three units, and one fails. It is probably true, if not axiomatical, that the larger the central station the greater the dependence placed upon it for power supply. To what extent is it advisable to put all the eggs in one basket—to use an old expression—or in other words place reliance upon one machine where two machines would give higher factor of safety of reliability with little loss of economy of floor space and initial cost?

And then, again, the ability to obtain efficient operation depends very largely upon the load-factor of the station, the manipulation of individual machines according to load, or the co-ordination of machines to load so as to operate each unit at its best efficiency and highest load-factor. The fewer the units in a station the less the flexibility; thus while the larger the size of unit the higher the efficiency, the higher efficiency may be balanced and even counteracted by lower operating economy because of inefficient operation imposed by the fact that the size of the individual units have not been correctly co-ordinated to the station load as a whole.

It thus seems that for turbogenerators of about 35,000 kw. and above, or even for 25,000 kw. and above, decision as to the choice of capacity of unit devolves not only upon whether units of such size are reliable but as to what is the most desirable size for a given station of a given number of units for serving a given load. Higher efficiency is of little real value when it does not work for higher operating economy, which is the condition obtaining when units too large and too few are chosen for a given plant, because the turbines have not been adopted to conditions to be met.

In other words, the choice of capacity of a turbine devolves, eventually, upon operating conditions, since these embrace reliability, individual efficiency and the co-ordination of load and machines for operating at the highest over-all economy.

Current Events

Turbo Units Discussed—Power Economy Conference Completing Organization — House Heating Studied in Idaho

LIMITATIONS OF STEAM TURBINES AND TURBOGENERATORS DISCUSSED BEFORE THE A. I. E. E.

New York Meeting Given Up to Problem of Construction and Operation of Large Turbine Generating Units.

Three papers of interest to engineers connected with plants having large turbogenerators were presented at the New York meeting of the American Institute of Electrical Engineers on Nov. 14. The papers were prepared at the request of the Power Station Committee in an effort to ascertain what, if any, limitations exist that will affect the size of large turbines and generators. The papers are the result of more than two years of work by the committee, of which Philip Torchio is chairman, and by the authors, Eskil Berg, of the General Electric Co., and F. D. Newbury and J. F. Johnson, both of the Westinghouse Electric & Manufacturing Co.

Mr. Berg's paper was entitled "Present Limits of Speed and Power of Single-Shaft Curtis Turbines." Mr. Johnson's paper had the similar title, "Present Limits of Speed and Power of Single-Shaft Turbines." These two papers are abstracted at considerable length in another part of this issue.

Mr. Newbury's paper, which is entitled "Present Limits of Speed and Output of Single-Shaft Turbogenerators," pointed out that output is determined broadly by rotor or stator dimensions. With speeds of 1200 r.p.m. and lower, the stator is the limiting member, while with higher speeds, the rotor is the limiting member. The most effective rotor diameter is not necessarily the largest diameter. To obtain maximum output at a given speed the rotor proportions must be chosen properly to balance mechanical stresses, rotor ampere-turns, and flux. American design practice has established 400 ft. per sec., approximately 4½ m.p.h., as an upper limit of rotor peripheral speed. The maximum length of core is determined by such factors as ventilation, bearing temperatures, critical speeds and limits to weight imposed by forging and transportation facilities.

Mr. Newbury presented a figure showing present limits to kilovolt-ampere rating at speeds from 3600 to 900 r.p.m. These limiting values are given as indicating present boundaries to knowledge and experience, rather than as real physical or other limits that cannot be exceeded. Mechanical forces due to short-circuit current and damage caused by armature winding failures are no greater in the very large generators indicated by the figure than in present-day 20,000 and 30,000-kv-a. units. No opinion is expressed as to the wisdom of installing very large single-shaft units. If operating engineers desire units of 50,000 to 100,000 kw., there is no question but that such generators can be conservatively designed and constructed.

Several engineers engaged in the discussion. Philip Torchio gave a short review of the progress of turbogenerator construction in this country. He said that the rotor is the limiting factor for speeds larger than 1800 r. p. m., whereas the stator is the limiting factor for speeds less than 1800. The development of this kind of machinery is indicated by the fact that a unit installed by the New York Edison Co. in 1895 was of 300 hp. capacity. One installed recently in the identical station was of 50,000 hp. The first American units were of a few hundred horsepower, but their capacities had increased to 5000 in 1906, 20,000 in 1912, 30,000 in 1913, and the large installations now being installed. Probably two-thirds or three-quarters of all central-station generating units are turbine units. Central stations supply only one-sixth of the total power generated in the country, of which 93% is developed by steam and 7% by water. An enormous saving of fuel can be effected by installing more turbogenerators.

B. A. Behrend called attention to the limitations imposed on the design of large rotating parts on account of the liability of metal to succumb to fatigue. The mechanics of the rotating parts of turbogenerators is not the same as that of members subjected to static conditions only. Since the stresses in rotors are alternating in a manner that cannot be ascertained accurately, the ordinary rules of the mechanics of static bodies do not apply to the problems met in the design of generators. Designers are coming to realize that the lessons in mechanics learned at school are not solutions of the problems of today. The fatigue of metal is a controlling element in motor sizes. Nonductile material must be avoided because ductility is a criterion of the ability of material to resist crystallographic deterioration. A turbine disk should be sufficiently ductile to bend flat on itself without cracking. It is incorrect, probably, to say that the limitation of capacity lies in the turbine. Machines cannot be increased in size indefinitely.

W. L. R. Emmet, consulting engineer for the General Electric Co., agreed with Mr. Behrend that there is a limit to the capacity of machines. There is a demand for large units, but there is no reason for them. He did not agree with Mr. Behrend, however, about the uncertainty and magnitude of stresses in moving bodies. Inelastic armatures on elastic shafts tend to produce dead running. By weighting bodies that vibrate excessively, the vibrations can be eliminated. In a series of experiments conducted recently by Mr. Emmet in which several hard rubber disks were mounted on shafts and revolved rapidly, the vibrations occurred in only one disk. This was the thinnest one. Vibrations could not be set up in the other disks by any speed. This experiment indicates that heavy disks should be employed in turbine runners.

W. J. Foster, discussing Mr. Newbury's paper, said that the rotor is the limiting part of a machine. There is no necessity for the occurrence of large eddy currents. It is entirely possible to build a 90,000-kv-a.

machine running at 1200 r. p. m. The matter of temperature control can be effected more successfully by radial than by axial ventilation. One thing worth considering is the advantage of 50 cycles. The construction of 50-cycle machinery will improve the opportunities of American manufacturers in foreign markets.

Among those who took part in the discussion besides those already mentioned were F. Hodgkinson, C. A. Adams and Farley Osgood.

SPECIAL MEETING OF OHIO ELECTRIC LIGHT ASSOCIATION CALLED.

One-Day Meeting to Be Held at Dayton on Dec. 3—Association Finances, Safety Code and Orders of Fire Marshal to Be Considered.

The Executive Committee of the Ohio Electric Light Association has called a special meeting of representatives of member companies to be held at the Miami Hotel, Dayton, Ohio, on Dec. 3. Three special subjects are to be taken up, the first being a change in the constitution relative to the payment of dues by active members. At present these contribute only about $1530 annually. Additional revenue is obtained through advertising in the association's monthly. It is proposed to increase the dues of member companies so as to secure about $6000 annually and permit the work of the association to go on unhampered because of increased costs.

Another matter to come up is in regard to the National Electrical Safety Code, especially Part II dealing with outdoor line construction. The present revision of the code, it is feared by many central-station interests, will increase the cost of line construction very much and a committee that has been considering this subject will report at this meeting regarding steps to be taken to protect the electric utility companies.

A third subject is to discuss action relative to the recent order sent out by the fire marshal of Ohio, requiring inspection of all buildings before central-station companies supply service thereto; the order also calls for installation of inclosed service switches and main line cutouts. As it is regarded by the central stations as an extremely sweeping order that will cause hardship, especially to the smaller companies, the subject will be given thorough consideration to secure uniform action.

MEETING OF EXECUTIVE COMMITTEE, INTERNATIONAL POWER ECONOMY CONFERENCE.

Plans for Permanent Organization to Be Carried Out Immediately by Executive Secretary Bolles.

A meeting of the Executive Committee of the International Power Economy Conference was called by Chairman C. A. Tupper for Nov. 17 for the purpose of formulating a plan of permanent organization. The chairman read communications from the only two members absent, expressing regret that important business engagements prevented their being present. Each, however, expressed great interest in the work and desired to be kept advised of progress made. One member made reference to interviews which he had with several important business men with reference to the work of the Conference and stated that all were deeply interested and desired to take an active part in the work at the proper time. These letters outlined ideas of organization which were thoroughly discussed by the members present.

It was reported by one member that in talks he had had with several local unions of the stationary engineers at Cedar Rapids, Ia., Milwaukee, Wis., and Louisville, Ky., with reference to the work contemplated by the Conference, the members invariably endorsed the idea and offered co-operation toward its success.

It was the consensus that the first work should embrace the formulation and printing of a statement of the objects sought, which should also give a tentative constitution, clearly point out the aims of the Conference, the general ideas of procedure to reach the goal aimed at and explain the organization necessary to accomplish the desired result.

A campaign should then be started to secure not less than 100 contributing members and more, if possible, to finance the greater work which must follow if success is to be achieved.

The executive secretary was directed to proceed immediately with this work as the situation with regard to fuel is already bad with absolutely no indications that conditions are likely to improve, at least in the near future. The success of such organizations as the International Power Economy Conference usually depends upon a few of its members who are willing to contribute considerable time and hard work. We believe that the Conference is fortunate in having the service of Col. F. G. Bolles, late of the War Department Claims Board, Washington, D. C., as executive secretary. Colonel Bolles is eminently well qualified for this work. His past experience in the national field of power development with such concerns as Westinghouse Electric & Manufacturing Co., Bullock Electric Manufacturing Co., Allis-Chalmers Co. and the Bucyrus Co., gives to him a firm grasp of the problem and its importance as a national conservation movement. Add to this his knowledge of foreign economic conditions gained through six years' travel in 14 European countries, also his wide personal acquaintanceship, and his value to this movement must be recognized as a most important factor in its success.

All the signs of the times point clearly to the great necessity for an organization such as is proposed to back up and co-operate with the Fuel Administration and, when it no longer functions, to continue the splendid work done by it during the war.

NATIONAL CO-OPERATIVE CAMPAIGN FOR MORE ADEQUATE OUTLETS.

Electrical Manufacturers, Central Stations and Others Urged to Bring Value of Convenient Outlets to Attention of Public by Advertising and Other Means.

In various discussions that have taken place among electrical contractors, central-station interests, manufacturers and others respecting the value of providing more wall and floor outlets in the average residence or apartment, there has been a general consensus of opinion that such outlets should be much more numerous, as liberal provision thereof will not only make the use of electrical appliances more convenient but more general. It has been pointed out that to bring this about the public will need to be educated to the convenience value of such outlets and away from the common and inconvenient method of attaching appliances to lighting fixtures with the resultant multiplicity of dangling cords, poor appearance and frequent interference with the use of the fixtures for lighting. This practice has come about largely through the custom of manufacturers of appliances and socket devices advertising various utensils connected to fixtures, the impression created in the public mind being that such connections are good practice.

One of the aims of the newly organized Advertising and Publicity Service Bureau of the National Electric Light Association, as set forth in the ELECTRICAL REVIEW of Oct. 4, is to stimulate interest in more outlets and for this purpose a special branch of the Bureau, known as the More Service Outlets Division, was organized. During the week of Oct. 20-25 several divisions of the Bureau met in Chicago coincidently with the Illuminating Engineering Society, among these being the More Service Outlets Division. The various means for most effectively reaching the public on the matter of convenient outlets were freely discussed and the conclusion reached that electrical manufacturers could doubtless offer the most important aid. The principal recommendations made on this and related phases of the problem were as follows:

> That this committee recommends that electrical manufacturers, in illustrating applications of their devices in advertising, show appliances connected with baseboard and chair-rail outlets rather than to lighting fixtures.
>
> That steps be taken to induce manufacturers of portable lamps to show their lamps connected to outlets in their illustrations in advertising.
>
> That it would be desirable for manufacturers of wire, wiring devices, etc., who do national advertising, to include in their copy an appeal to the public to use more outlets, and that such manufacturers who do no national publicity work, but carry on local newspaper advertising over the dealer's name, introduce the same argument into their copy.
>
> That central stations be urged to have some one man in each company cultivate the acquaintance of architects in their territory, and familiarize them with the advantages of specifying more outlets in their building plans.
>
> To recommend to central stations the desirability of frequently circularizing the public with direct-by-mail matter on the desirability of more outlets, and that the Society for Electrical Development be asked to consider the preparation of literature of this character.
>
> That the committee notify all manufacturers of outlets, wire, wiring devices, etc., of the desirability of having their printed matter, posters, folders, cartoons, etc., contrast the convenient outlet with the inconvenient one.

The committee also recommended that its name be changed to the Adequate Outlets Committee, this name being more descriptive of its work.

WORK OF THE SIGNAL CORPS OF THE ARMY.

Colonel Carty Explains Some Hitherto Secret Achievements of the Corps—Code-Deciphering Machine.

At a luncheon of the New York Electrical League at the Hotel McAlpin, New York City, on Nov. 12, Col. J. J. Carty, officer of the Legion of Honor and vice-president of the American Telephone & Telegraph Co., made the principal address, which dealt with the accomplishments of the American Signal Corps during the World War. Colonel Carty related some interesting incidents which had come to his notice during his time in the service.

One of the matters referred to was the danger that the Atlantic cables would be cut by submarines. As a matter of fact, two cables, one leading to Newfoundland and one to the south of Europe were cut at a point near New York. The means taken to combat this possibility were the construction of powerful radio stations at various points on the French and American coasts, the latter being connected by wire with Washington.

Colonel Carty also spoke of the desire of high army officers to devise a means whereby messages could be sent by cable and telegraph in plain English, thus eliminating the loss of time and uncertainty involved in using a code. This problem was solved by a device which the colonel spoke of as a cipher machine. By means of this device a message coming in from the printer telegraph could be run through this machine and the message obtained in plain English. This machine was in use on the lines between Hoboken and Washington and on those from Washington to Newport News. Colonel Carty paid a very sincere compliment to those whose duty kept them on this side and stated that their work was absolutely indispensable to the combat troops.

ELECTRICAL EXPORTS FOR SEPTEMBER BELOW AVERAGE.

Large Increase Shown Over a Year Ago, But Decrease From Preceding Month.

Decreases of approximately 20% are shown in the total of electrical exports of the United States for last September as compared with August and with the average of the first nine months of this year. As compared with September of last year, however, there was a gain of about 19%. The total of the nine months ended Sept. 30 last was $68,439,204, compared with $43,757,716 for the corresponding period in 1918, and $39,977,642 for the similar period in 1917.

These facts are disclosed in the monthly summary of the foreign and domestic commerce of the United States for last September published by the Bureau of Foreign and Domestic Commerce, Washington, D. C. The following classified figures, obtained from the same source, give the detailed data for September compared with the corresponding month last year.

Articles.	September 1919.	September 1918.
Batteries	$ 442,588	$ 250,037
Carbons	72,816	125,956
Dynamos or generators	525,040	269,276
Fans	49,768	26,396
Heating and cooking apparatus	91,881	48,552
Insulated wire and cables	301,315	548,640
Interior wiring supplies, including fixtures	146,729	88,139
Lamps—		
Arc	374	4,141
Carbon filament	10,861	6,369
Metal filament	358,396	282,518
Magnetos, spark plugs, etc.	226,843	206,160
Meters and measuring instruments	208,496	100,301
Motors	733,891	589,905
Rheostats and controllers	38,326	12,993
Switches and accessories	339,188	162,049
Telegraph apparatus, including wireless	31,262	42,289
Telephones	199,936	228,961
Transformers	153,508	392,026
All other	2,188,370	1,761,369
Total	$6,119,588	$5,146,077

The above figures do not include electric locomotives. During last September there were exported 11 of these locomotives valued at $502,200.

N. E. L. A. COMMITTEES ON ELECTRIFICATION AND RESOURCES OF NATION.

Two Committees to Undertake Important Studies for Next Annual Convention Organizing with Active Chairmen.

President R. H. Ballard of the National Electric Light Association reports that Frank M. Kerr, vice-president and general manager of the Montana Power Co., has accepted the chairmanship of the Committee on Steam Railroad Electrification. The Montana Power Co., of which Mr. Kerr is the operating executive, is now furnishing the power supply for the operation of 657 miles of track of the Chicago, Milwaukee & St. Paul Railroad in Montana and the Pacific Northwest, and consequently Mr. Kerr is in a position to speak with authority on the subject of railroad electrification from a practical standpoint. R. Beeuwkes, electrical engineer of the Chicago, Milwaukee & St. Paul Railroad, will act with Mr. Kerr on this committee, and the additional members will be from other power companies, manufacturers and banking institutions, so that every phase of this great subject will be intelligently handled in the report of the committee which will be submitted at the Pasadena, Cal., convention, May 18 to 21.

M. S. Sloan, president of the Brooklyn Edison Co., Brooklyn, N. Y., has accepted the appointment by President Ballard as chairman of the Committee on Electrical Resources of the Nation. Mr. Sloan is organizing a committee to handle this great subject representative of all branches of the industry. The committee's report to be presented at the next annual convention will be of inestimable value to the industry at large. It will be in the nature of a textbook of particular assistance to the small companies throughout the country. The present status of electrical development in the United States, both private and municipal, will be noted, and the comparisons, drawn between different sections of the country and between private and municipal operation, should prove to be very interesting.

IDAHO INVESTIGATION FINDS ELECTRIC HOUSE HEATING IMPRACTICABLE.

Public Utilities Commission Conducts Most Exhaustive Study of Practicability of Open-Air Heating From Hydroelectric Systems.

One of the most unique investigations ever conducted by a state utility commission was recently concluded in Idaho and its findings have just been made public. It was a study of the practicability of general house heating by electricity and remains the most thorough investigation of this subject yet undertaken. Hearings were held by the Public Utilities Commission of Idaho for nine days last December and a mass of expert testimony, data, charts, etc., presented which fills a large printed volume of 576 pages. Digest of this testimony and deliberation on the subject took many months; the final decision was entered on Oct. 17 and is now just off the printer's hands.

At various times articles had appeared in the Idaho newspapers calling attention to the abundant water powers of the state which were going to waste and which should be harnessed for heating homes throughout the state. The question of electrical development was also brought up in political campaigns and many speakers made such sweeping assertions relative to the possibility of using hydroelectric power that the public was liable to be misled and have hopes raised that could not be realized. In two districts in Idaho a certain amount of electric house heating had been carried out which gave the basis for this agitation. The Commission undertook this study so as to get the actual facts regarding the practicability of house heating in general.

It was generally conceded that it would not be practicable to use electricity generated by steam for house heating in competition with coal, because in the first case, there would be actually realized only about 13½% of the heat of the coal, while in using coal directly in the heating of the house from 40 to 50% of the heat is utilized. The common notion that hydroelectric energy is much cheaper than steam-electric energy is more or less a fallacy. In Idaho, hydroelectric energy is used almost exclusively.

For the basis of this study it was assumed that the average six-room house in the southern part of Idaho would require about seven tons of coal annually for heating and that this heating would be of an efficiency of about 50%; to obtain the equivalent heat electrically would take about 25,000 kw-hr. The average demand in such a house would be 9.3 kw., but to heat the house comfortably during the extremely cold weather would require much larger installation. This excess demand would in most instances be taken care of by some supplemental heat from stoves or furnaces. In 105 houses electrically heated in the city of Twin Falls all but six have provision for such supplemental heating during the very cold weather. The Idaho Power Co. serves a district with about 100,000 population or 20,000 homes. Allowing 25% for losses in transmission, distribution, etc., to heat these homes electrically would require an installation of 258,000 kw. The total installed capacity of all present hydroelectric plants in southern Idaho is about 75,000 kw. and it is estimated that it would take all of the water power feasible for development in the state to heat about 77,000 homes, which is much less than the present number of homes in the state. Similar studies in Spokane, Wash., and in Toronto, Ont., Canada, showed that an extraordinary capacity, greatly beyond the present hydroelectric development would be needed for house heating alone, and this would furnish a load only about seven months in the year, leaving an extremely large plant development idle during some five months.

To heat the average six-room house with seven tons of coal annually at $10 per ton costs $70 a year. The cost of electric heating would be, under the most favorable conditions at least four times greater and, by the testimony of Prof. H. V. Carpenter, this cost would be about $444 a year. Allowing for the fact that large additional installation would be required for proper heating, it is concluded that electric house heating would cost from six to nine times as much as coal in southern Idaho.

The favorable conditions under which electric house heating is carried on in cases where electric power is used for irrigation pumping during the summer, permit utilizing the capacity that otherwise would be idle in winter. The Minidoka government reclamation project now heats five towns at very low rates, averaging 66 cents per kw. per month during the heating season. These rates include practically no overhead expense and fixed charges and will be raised about 50%, effective next March, which will bring the cost to somewhat above that of coal for an equivalent amount of heat. Even under these conditions it has been found that the heating and irrigation load overlap during the early spring and the heating is then discontinued.

It was shown in the testimony that the heating of 15,000 homes in the district of the Idaho Power Co. would save about 100,000 tons of coal annually, whereas a smaller amount of electrical energy would serve to electrify the entire system of one of the trunk-line railroads in Idaho with a resulting saving of about 1,000,000 tons of coal annually.

The findings and conclusions of the Commission are substantially as follows: "Having made an earnest effort to secure all the light possible on the subject . . . we find no grounds for holding out to the people of Idaho a reasonable hope that electricity will ever be used generally for house heating in our state, and we are forced to the conclusion that the use of electric energy for house heating in Idaho in competition with coal is neither feasible nor practicable and would be unprofitable to any producers who might undertake to furnish the service, and further, that so long as there remains a field for the use of electric energy as motive power, its use for house heating is extravagant and wasteful." These conclusions were reached by Commissioners A. L. Freehafer and George E. Erb. They were concurred in by Commissioner E. M. Sweeley, who was not a member of the Commission when the investigation was begun.

PRINCIPLES OF RADIO COMMUNICATION WITH ANTENNA AND COIL AERIALS.

An extensive research on radio transmission and reception with various types of aerials has been in progress at the Bureau of Standards, Washington, D. C. One of the most interesting questions at the present time is as to the relative advantages of the antenna, or usual type of elevated aerial, and the smaller coil aerial. This question is answered by the studies of the Bureau.

As a result of this work it is possible to determine by simple calculation the distance at which a given receiving aerial will receive signals from any transmitting aerial when the current in the transmitting aerial, its dimensions, and the distance between the stations are known. The small coil aerial has many advantages, but is usually not as powerful a transmitting and receiving device as the antenna type of aerial. It may, however, have so much lower resistance than the antenna that it is equal to it in transmitting and receiving value.

Our knowledge of electric waves has been very incomplete. The work referred to has assisted in clarifying some of our ideas so that the way the two types of aerial operate can be better understood. It is shown that a special type of antenna, consisting of two large metal plates, has certain advantages. The fundamental principles of design of radio aerials have been developed. The investigation has opened up a large and most interesting field for further research and progress in the utilization of radio waves.

GERMAN USE OF SUBSTITUTES IN ELECTRICAL WORK.

In the course of some references to the effects of the war upon the German electrical industry, A. B. Gridley and A. H. Human state in the *Journal of the Institution of Electrical Engineers* that the Allgemeine Elektricitäts Gesellschaft and the Siemens-Schuckert group were the first to substitute aluminum for copper wire in machine windings, but it was soon found that the high cost and the growing scarcity of this metal necessitated recourse to the use of zinc wire. At first this wire was not successful owing to its brittle nature, but ultimately a more elastic and serviceable form was produced and firms commenced to manufacture motors with zinc wires which served their purpose more or less satisfactorily. The machines thus constructed were very nearly twice the size of the old type, and iron commutators were used. Transformers with zinc windings were also made, and the A. E. G. built transformers of this type of 7500 kv-a. capacity, which proved satisfactory.

At a later date, reversion was made partly to aluminum windings, and only in exceptional cases was the use of copper permitted in the construction of electrical machines. Conductors were made of iron, aluminum and zinc wires, little copper being permitted for this purpose.

Substitutes for rubber were adopted for the insulation of wires, the most satisfactory being impregnated paper. Resistances, controller contacts, etc., were made of iron. Switches, lamp bases, etc., were made of sherardized sheet iron. Iron was mostly employed in high-tension apparatus, current-carrying parts—except contacts—being made of zinc. Meters made of iron and zinc were produced.

Messrs. Gridley and Human report that, "Despite the restrictions and great difficulties which hampered them, the German manufacturing firms were far from nonprogressive, and while there are some in England who still have misgivings about using units of 25,000 kw. capacity, the A. E. G. manufactured during the war a 7000-volt turbo-alternator of 60,000 kv-a. capacity, the turbine blading of which was made of steel, without nickel, worked out of the solid. A second and similar machine has recently been constructed."

CHANGE IN EDITORSHIP OF LONDON ELECTRICIAN.

On Oct. 31, W. R. Cooper was presented by his colleagues of Benn Brothers with a silver rose bowl and Weston portable milliammeter, upon his retiring from the editorial chair of the *Electrician*, of London, after a period of thirteen years. Mr. Cooper has decided to devote the whole of his time to his consulting practice, the growth of which renders it impossible for him to continue his editorial duties at the same time. Mr. Cooper was appointed editor of the *Electrician* in 1906, and under his editorship the journal has made considerable progress.

His place will be taken by F. H. Masters who was chief assistant editor at the outbreak of the war in 1914. Mr. Masters received his technical training at King's College, London, and Finsbury Technical College, under the late Prof. S. P. Thompson. He was afterwards engaged in substation work on the Central London Railway, and in the Electrical Engineers' Department of the British Government Dockyard, Chatham. He joined the "Electrician" staff in 1906, and was subsequently appointed chief assistant to the editor. During the war he was engaged on coast defense electric lighting work and on searchlights used against enemy aircraft. He contributed considerably to the development of these defenses, and did very useful work in the training of the men engaged upon them. Mr. Masters was awarded the O. B. E. and was twice mentioned in dispatches.

Commercial Practice

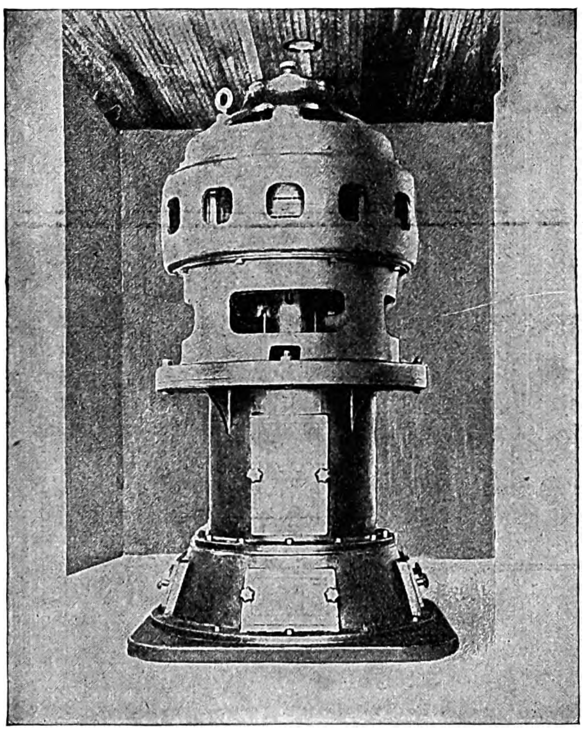
Electric Pumping Saves Money for City — Many Electric Elevators Being Installed — Dayton Flatiron Campaign

ELECTRIC PUMPING PROVES ECONOMICAL FOR CITY OF SAVANNAH.

First of Five Motor-Driven Centrifugal Water Pumps Shows Large Saving in First Cost and in Operation.

The city of Savannah, Ga., is now effecting a large saving every day on account of the installation of an electric motor-driven pump on an artesian well furnishing 4,000,000 gals. of water daily to the city. The plant from which the city formerly got its water supply cost $65 a day to pump a million gals. of water, while the new equipment pumps at the rate of $10 a million gals., or a saving of $55 for every million gals. pumped.

If the city decides to install electric pumps throughout, and the indications are that it will do so shortly, a saving of $57,500 a year will be effected in fuel and labor costs.



Centrifugal Water Pump Driven by 200-hp. Vertical Induction Motor at Savannah Water Works.

The artesian well is 519 ft. deep and was dug by the use of dynamite. A 24-in. casing was sunk to a depth of 110 ft. and from there to the bottom a 16-in. casing is used. The fact that this casing runs the full length of the well assures the city a supply of pure water. The pump is of the Layne & Bowler centrifugal type, is installed 100 ft. below the surface. It is driven by a 200-hp., two-phase, 60-cycle, 2200-volt, 1175-r. p. m., vertical induction motor which was built by the Westinghouse Electric & Manufacturing Co., and shipped to Savannah from the East Pittsburgh Works by express because of its urgent need by the city. Power for operation of the motor, is supplied to the city by the Savannah Electric Co.

Tests made on the water pumped from the well have proved its superiority over the water formerly pumped from the river station, and it is apparently much softer than any artesian water ever used in the city before. This softness is because it does not strike a strata of lime. The water is said to contain some sulphur, to lather fully, and to be unusually well adapted for all domestic as well as commercial uses.

A further evidence of the saving to be gained by the operation of the new outfit may be gained from the following figures submitted by the city officials. The original system with a capacity of 1,000,000 gals. was installed at an original cost of $750,000 and the operating cost amounted to $30 per million gals. To install the new system cost $10 a million gals., so that not only is there a large reduction in first cost, but the operating costs are reduced two-thirds. The pump was installed by P. D. Bowler, of the Layne & Bowler Corp., Memphis, Tenn., and the motor and control were supplied through W. C. Bryant & Co., Savannah.

The total number of wells completed, or for which contracts have been let is five, to be driven by motors of the following capacities: one 100-hp., two 200-hp., one 250-hp., and one 300-hp.

All of the motors are installed above ground on all these applications except one which is located under the street in a pit entirely inclosed and furnished with forced-draft ventilation.

The starting of the pump was the occasion of a large gathering of city officials, headed by Mayor Steward, and other prominent citizens. The mayor and other city officials express themselves as greatly pleased with the success which has already been attained in the operation of the new plant, and additional units will undoubtedly be installed at an early date.

ELECTRIC ELEVATORS IN DEMAND IN NEW YORK CITY.

Many Office Buildings Turn to Central-Station Service to Solve Problems of Elevator Operation.

One of the more recent elements of the tendency towards central-station electric supply in New York City is the increasing demand for electric elevators. The New York Edison Co. has compiled a list of 93 buildings that have done away with their old steam and hydraulic elevator equipment, changing over to electric, the estimated current consumption for this new elevator business being 2,000,000 kw-hrs. annually.

The cause for this renewed demand for electric elevators is two-fold. One is related to the building shortage, which is causing many old structures to be altered to suit some special industrial need; generally one of the desired features is better elevator facilities.

Another type included in this list is the good grade of office buildings, which have previously been equipped with hydraulic elevators. In these instances, the reason for the abandonment of the hydraulic machinery has been the greatly increased cost of operating it, the expense having mounted in some cases 100% in the last three years. Frequently, too, this situation is closely related to the private plant question, for where high-pressure steam is required to maintain elevator service, there is a tendency to operate electric generating apparatus as well. About half of the 63 office buildings that have changed over to electric elevators have closed down their generating plants at the same time.

VERY SUCCESSFUL FLATIRON CAMPAIGN CONDUCTED IN DAYTON.

In One Month 1500 Electric Irons Were Placed in Service —Excellent Results in Neighboring Towns Also.

The Dayton Power & Light Co. recently conducted an iron sale campaign in the city of Dayton, Ohio, which was unusually successful. Other towns served in the company's system were also covered. In Dayton, with a population of 165,000, there were sold 1206 irons. In Wilmington, with a population of 5000, the sales reached 145, while in Piqua, with a 15,000 population, 130 irons were sold. In Xenia, with a population of 10,000, the sales were 100 irons. In addition to the irons sold, there were found over 300 irons on customers' premises that were not in use, due to their needing some slight repair. These irons were brought in, repaired and put back into service, making approximately 1500 additional irons on the lines in Dayton over what existed before the campaign was begun. About the same proportion of irons were repaired in the other territories.

In addition to making direct sale of irons, lists of those who were interested in other appliances were made and turned over to the contractors, and it resulted in a large increase in the sale of sewing-machine motors, sweepers, toasters, etc. The campaign began on July 1 and ended August 1. General Electric irons were sold at the full retail price of $6.50 and as a premium a folding ironing board was given. The customer paid 50 cents on the order and $1 per month with his light bill until paid.

Another novel feature of this campaign was that it was carried out by the pupils in the company's cooperative school for high-school students. These students made a house-to-house canvass, each carrying a card which gave the name, number of the house and report whether the occupants had an electric iron, whether they were using it regularly, whether it was giving entire satisfaction, and whether it was in need of repairs, etc. With this information the company was able to get a very valuable line-up on what the customers had and what they needed. No great amount of advertising was done in laying the groundwork for the campaign, as it was found that the house-to-house canvass was in a measure all the publicity needed.

After the campaign was over, in checking up with the dealers all the prospects that were handed in, it was reported that in practically every case the prospect was sold. The campaign was the most successful one the company ever conducted.

FALL SALES PROVE NOTEWORTHY IN BROOKLYN, N. Y.

Electric Washers and Vacuum Cleaners Sold to the Amount of $100,000 in Two Months.

Sales of the Brooklyn Edison Company resulted in 325 orders for washing machines during September and 1173 orders for vacuum cleaners during October, making a gross sale of over $100,000 for the two campaigns.

The washing machine offered in September was of standard make, with a special galvanized iron body substituted for copper, which allowed for a special price during the month of $129.75, with payments extending over 12 months. The October sale of vacuum cleaners offered a well-known cleaner, with a special "Brooklyn Edison" set of attachments, for $49.50, with partial payments of $4.50 on delivery and $5 monthly.

The advertising procedure was the same in both sales. Special return post-card announcements were sent to residential customers and two-column newspaper advertisements in preferred position were used periodically to keep up the interest. Demonstrations in all of the display rooms of the company were made each week and a selected list of customers were invited to attend. The two campaigns surpassed the corresponding sales in 1918 by 219 washers in September and 427 vacuum cleaners in October.

CENTRAL STATION BUYS POWER TO SUPPLY DEMAND.

Mobile Electric Co. Secures Additional Capacity by Cooperating with Shipbuilding Concern.

A transmission line by means of which the Mobile (Ala.) Electric Co. will secure electrical energy from the Chickasaw Shipbuilding Co. has been completed and placed in operation. As a result of power demands made upon the company during the past two years it had become necessary to provide additional capacity involving a new power house at an outlay of $1,000,000 or more capital. Instead, Manager T. K. Jackson saw the possibility of purchasing additional power from the shipbuilding company and an agreement was entered into whereby the Mobile company is to receive one-half of its energy demand from the shipbuilding company on a 3000-kw. peak load basis.

The company is now serving a power demand nearly twice as great as in 1916, chiefly due to shipbuilding activity.

ELECTRIC LIGHT AND POWER INDUSTRY COMMENDED BY BANKERS.

Investment Bankers' Association Says Central Station Deserves Confidence of Public.

The public utility securities committee of the Investment Bankers Association of America makes the following statement in its annual report relative to the electric light and power industry:

"It should not be difficult to educate the public to renewed and increasing confidence in an industry which has proven itself, even in the crisis of war, so stable, resourceful, resilient and productive, and which offers convincing promise for safe and remunerative employment of enormous additional capital."

Operating Practice

Underground Steam Lines — Electrolysis of Cables in St. Louis—Boiler Efficiency and Gas Survey — Power-Factor

METHOD OF INSTALLING UNDERGROUND STEAM LINES IN WISCONSIN.

Recommendations Made by State Engineering Department for Steam and Hot-Water Lines.

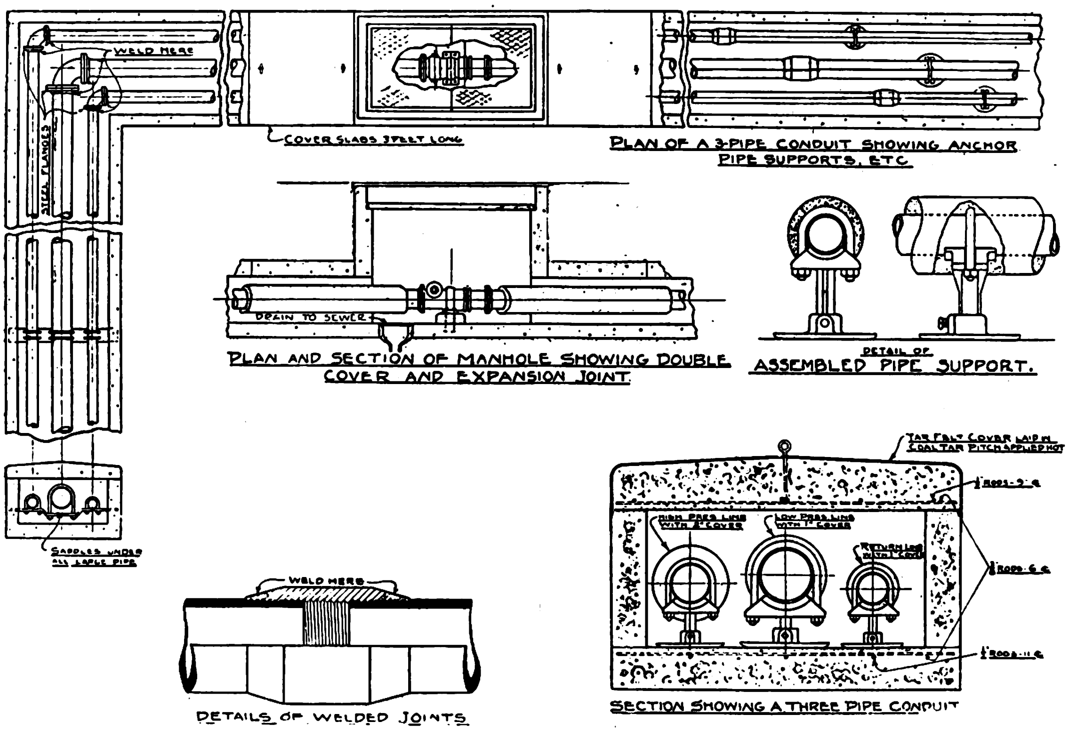
The state of Wisconsin has installations of almost every type of pipe conduit that has been devised and none of those as yet tried out has met the above requirements in a satisfactory manner. As a result of this experience the Department of Engineering worked out a method of installing such lines that has so far proven satisfactory, according to John C. White, state power plant engineer.

The conduit is made of concrete, of such size as may be required to accommodate the number of pipe lines and reinforced as necessary. The bottom slab is laid to grade for any section and is trowelled smooth. The sides are next poured and the work of installing the pipes may be started as soon as the forms may be safely removed. The cover slabs may be molded while the work of installing pipes is going on. These are generally made in 3-ft. lengths bedded in lime mortar. The top of the conduit is covered with a waterproof material such as tar felt before backfilling the trench.

Anchorage is so arranged that the pipes are permanently held in place at anchor points and expansion is taken either at the bends or by expansion joints. The supports are clamped to the pipes and move with them. They consist of a saddle clamp adapted to engage a round shoe which slides on the floor of the conduit as the pipes move under changes of temperature. Rollers are not used.

Insulation is applied as for exposed work and it is not subjected to mechanical injury nor to the action of water.

Drainage is provided for by making the conduit as nearly waterproof as possible and then conducting such water as does find its way into the conduit to drainage outlets at manholes or openings into the buildings. This water flows along the bottom of the conduit, each section of which is graded for that purpose, and by inspection at the drainage points the condition of the lines so far as water is concerned may be determined. Under-drains are not used.



Underground Pipe Line Arrangements Recommended by Wisconsin State Engineering Department.

By arranging the pipes in a horizontal plane either line can be removed and replaced by disconnecting at anchors and connecting points and uncovering a sufficient length of the trench to permit withdrawal of the section. A line should be attached to the section before it is withdrawn for use in pulling in the new pipe.

Where steel or wrought iron pipe is used, the joints are made up with couplings and the backs of the couplings are then welded up until the section of the pipe that has been cut away by the threading process is built up to the original section of the pipe. The joint is thus equal to the solid pipe in thickness and it is sealed against that form of leakage which is so persistent a cause of failure in the ordinary construction. Cast-iron flanged pipe may be used for low-pressure steam or hot-water lines. Lead joints cannot be used where temperatures change to an appreciable extent.

The accompanying illustrations clearly show the essential features of the method without further explanation. The first line was installed about two years ago for carrying high-pressure steam and so far has given no trouble whatsoever.

ELECTROLYSIS OF CONDUCTOR SHEATHS IN ST. LOUIS.

Use of Cambric Insulation Results in Time Lag Between Corrosion and Cable Failure.

The Bureau of Standards' investigation of electrolysis of underground cables in St. Louis has now practically been brought to a conclusion. The occasion of the work was a very serious case of corrosion of lead cable sheaths which appeared to be different in some respects from that ordinarily found. After extensive investigations regarding conditions both past and present under which these cables have been operated, and supplementary studies on the conditions under which lead is corroded, the conclusion has been reached that most of the burnouts now occurring are the result of electrolytic corrosion which occurred during the first few months after the cables were installed. The serious difficulty and large expense which are now being experienced are, therefore, the result of damage done several years ago. The long period which elapsed between the injury to the sheaths and the burning out of the cables is accounted for by the slowness with which moisture penetrated the varnished cambric insulation. As the insulation became moist, the dielectric losses increased and in many instances the immediate cause of failure of the cables has been overheating resulting from the large dielectric loss. A considerable number of failures were found to arise from surges of electric current resulting from other burnouts.

The peculiar appearance of the lead sheaths which gave rise to the belief that the failures were due to some hitherto unknown cause was found to be due to chemical action which had little to do with the failure of the cables.

In this case the damage has already occurred and can be repaired only by installation of new cables. Consequently, the Bureau's investigation of the problem has resulted in no saving to the company. The investigation has, however, been well worth while in that it has afforded a forcible object lesson of the importance of prompt attention to electrolysis conditions when new installations are made and it will, therefore, be of value in promoting careful consideration of electrolysis problems.

TEMPERATURE SURVEY AND GAS ANALYSIS IMPROVE BOILER EFFICIENCY.

Early in 1918 F. W. Dean, of the Emergency Fleet Corporation, made the request to the Bureau of Mines that it furnish the personnel and equipment to make determinations of the temperatures existing in the gases throughout the setting of a boiler. This was to be done in connection with the test of a boiler which the Corporation was conducting at Erie, Pa. O. P. Hood was in charge of the test and Henry Kreisinger, both of the Bureau of Mines, detailed to make the determination. The results obtained clearly indicated the necessity for further work on the problem of boiler efficiency, as was also forcibly brought out at the International Power Economy Conference held in Chicago recently.

The fact is not generally appreciated that sufficient air cannot be admitted through the fuel bed of a hand-fired furnace to provide for complete combustion. This fact is independent of the kind of fuel used or the rate at which air passes through it. Unless there are holes in the fuel bed through which the air can pass without coming in contact with the fuel, there is always 20 to 32% of combustible gases with no free oxygen to burn it. This important fact is generally overlooked, because in ordinary furnace practice there are so many holes in the fuel bed and so many leaks around the furnace doors and in the boiler setting that an excess of air commonly exists in the flue gases. In other words, two errors compensate for each other so that the existence of one is masked. The excess air which leaks into the furnace, however, does not usually serve the purpose of bringing about complete combustion of the fuel, because it is not properly mixed with the combustible gases, nor is it under control as to quantity. In other words, for proper combustion excess air should not leak through holes in the fuel bed, but should be introduced above the fuel bed in such a way as to bring about complete combustion of the gases.

Another point revealed by the temperature measurements was that changes in the design of the baffles were necessary in order to provide for proper absorption by the boiler surfaces of the heat in the gases. In boiler practice the design is commonly made from empirical data and not from exact determinations, so that the baffling of the gases to guide and retard their passage through the boiler setting until their heat is absorbed with maximum efficiency is not properly accomplished.

As a result of the information obtained from temperature measurements and gas analyses the design of the boiler was so modified that six tons of coal were enabled to do the work of seven.

USUAL ECONOMICAL LIMIT FOR POWER-FACTOR CORRECTION.

It has long been recognized that the additional amount of capacity required of a synchronous motor, to effect a given percentage increase of power-factor in the neighborhood of 100%, is several times that which would obttain at, say 60%. And this fact becomes more and more conspicuous as the power-factor comes nearer to unity or 100%.

While the lower the power-factor the more injurious the effect upon voltage regulation, investment, etc., it is also a fact that as the power-factor approaches toward unity the investment in corrective apparatus—a synchronous motor, for example—becomes so high that it does not pay to improve power-factor above a certain limit. In general, it may be stated it is usually not economical to correct above 90% and in most cases not beyond 85%. The chief reason for this is that most generators are able to maintain voltage sufficiently well at 90% power-factor and to release the 10% of generator capacity between 90 and 100% power-factor would require, on the part of the synchronous motor, about 40% of the capacity of the generator.

Contracting-Construction

Factory Lighting and the Contractors—New Construction Rules in Ohio—Connections Between Buildings Discussed

CO-OPERATION IN SELLING GOOD INDUSTRIAL LIGHTING.

Part That Contractors Can Play in Improving Lighting Conditions in Existing Factories and Planning for Good Lighting in New Factories.

Realizing that managers of industrial plants, as a general rule, have little knowledge of what constitutes good lighting and of increased production that results from it, the Committee on Illumination of the Ohio Electric Light Association has been conducting an investigation leading to methods for improving industrial lighting in that state. It is apparent that the electrical contractor is one of the most important factors in promoting good industrial lighting in existing plants as well as those under construction, and the following comments of the committee, which apply equally well to contractors in other states, should be well taken.

There seems to be a general appreciation on the part of the electrical industry that the industrial lighting field could profitably be given more attention. In this connection it is conceded that local electrical contractors must take a more active part in this work if it is to be very effective. It is obviously impossible for the contractor to undertake to bring existing lighting installations up to the high standards recognized today unless he pays particular attention to new aspects of the industrial lighting problem. It would seem, therefore, that the first step in any program that can be undertaken jointly by the contractors and central stations to encourage higher standards of industrial lighting would be for each contractor interested to delegate some one individual in his organization to make a special study of the subject and to acquaint himself with the latest lighting practice so that he can cooperate in selling industrial lighting.

While the work of laying out the lighting installation in existing plants according to the latest practice will fall in most cases upon the local electrical contractors, there is no question but that the central-station representative can approach a prospect for improved industrial lighting to better advantage than can a representative from an electrical contractor or manufacturer of lighting equipment. It would seem, therefore, that in the general plan of improving industrial lighting conditions the central station could undertake to make the initial call on its industrial customers with a view of discussing with the plant executive the general questions relating to the lighting service it is rendering the plants and to try to interest the plant managements in the value of good lighting to such an extent that they are willing to go into the question in detail. When the prospect is brought into this frame of mind he could be referred to local electrical contractors who are thoroughly conversant with what good industrial lighting work is and they could follow up the lead.

Other plans will have to be made, for the time being, to take care of lighting installations in buildings now in the process of construction, in which lighting layouts are made by construction engineers. However, buildings which will be put up next year and the years to follow will in most cases be occupied by industries now operating in old buildings and, if the managements of these industries really have been impressed with the value of lighting their plants properly, this will automatically insure good lighting in their new buildings.

OHIO FIRE MARSHAL REQUIRES INSPECTION OF ELECTRICAL INSTALLATIONS.

No Service to Be Connected Unless Installation Complies with National Electrical Code—Inclosed Safety Switches and Cutout Cabinets Also Required.

Electrical contractors and central stations in Ohio are much interested in, if not alarmed by, a recent ruling of the fire marshal of Ohio. By an order that was supposed to become effective Oct. 15 it is required that before making connection for light or power service all central stations are to make or cause to be made satisfactory inspection of the wiring on the premises to ascertain whether it is properly installed according to the requirements of the National Electrical Code; no service connection must be made until it is found that any changes required have been made.

It also was ordered that main service switches must be of the inclosed safety type and installed so as to be readily accessible, an exception being made if the switch is mounted on a switchboard under competent supervision. All other knife switches used for light, heat or power circuits, other than those used on switchboards or inclosed panelboards, must also be of approved safety inclosed type if installed within 7 ft. of the floor or elevated platforms. A further requirement of the order is that all automatic cutouts within 7 ft. of the floor or elevated platforms and in the vicinity of easily ignitable material must be inclosed in approved metal cabinets.

Furthermore, the order also provides that all alternating-current motors above 5 hp. must have approved starting devices; starters for direct-current motors must be equipped with no-voltage release attachment, and all motor starters having exposed contacts must be installed and placed so that accidental contact by person is reduced to a minimum.

No provision is made in the order for putting it into effect, since the state has no inspection department especially delegated for this purpose, and there are only a few municipal electrical inspection departments in the state.

This order is regarded as so important by Ohio central stations that it is one of the questions to be discussed at a special meeting of the Ohio Electric Light Association on Dec. 3.

Discussion of Code Rule on Inter-building Connections

Uncertainty of Intent of Rule 17*d*—Analysis of the Rule and Suggested Changes—Paper Presented to National Association of Electrical Inspectors

By H. S. WYNKOOP

THE existence of Rule 17*d* of the National Electrical Code is due to a desire to limit the indiscriminate ramification of electric light and power systems throughout private properties, where supervision and maintenance of equipment are difficult and where accidents may readily happen to workmen engaged in altering or tearing down buildings, through the unsuspected presence of these conductors. Municipal authorities, furthermore, object to the use of house mains instead of street mains because the former evade franchise charges. Neither the rule nor the reasons for its existence seem to be well understood, even by those who have most occasion to use it.

It is contended by some that the rule does not clearly convey its intent, by others that it does not say what its framers supposed it to say, and by still others that its requirements, under whatever interpretation may be assigned to them, are unreasonably severe, and perhaps altogether unnecessary. Rule 17*d* reads as follows:

> "No underground service from a subway to a building, and no service from a private generating plant, shall supply more than one building, except by special permission, unless the conductors are properly protected by fuses and are carried outside all the buildings but the one served. Conductors in conduit or duct under two inches of concrete under a building, or buried back of two inches of concrete or brick within a wall, are considered as lying outside of the building. These requirements do not apply to factory yards and factory buildings under single occupancy or management."

There are two corrections which it is generally agreed should be applied to the rule: (1) It should include overhead services and (2) "*one* served" should read "*ones* served."

An explicit definition of the term "factory yard" is difficult to find. Perhaps the following will suffice: "A factory yard is any group of buildings, with no street intervening, which is under one ownership or occupancy and which provides physical access between buildings without the necessity of going upon the street." A dwelling and its private garage on one plot would constitute a "factory yard," as would a group of buildings comprising a brewery. But if some of the brewery buildings were located across the street from the main group the former would be classed as one "factory yard" and the latter as another. This interpretation may not be necessary or even desirable in the smaller communities but in the larger cities it is of considerable importance.

Having divested Rule 17*d* of its non-essentials, the first difficulty in interpretation which we encounter lies in the word "building." What is a "building?" The Electrical Code of the City of New York says that a building is "any edifice, structure or enclosure, whether roofed or unroofed." I have been at considerable pains to call for definitions from electrical authorities throughout the country. Few replies have been received; and I cannot evade the conviction there exists a lack of appreciation of the importance of the subject and in some cases an inability to phrase an answer. These are all the definitions that have come to me:

> "A building, in the case of apartments in a row, is that part which is separated from other parts by standard fire walls; that is, 12-in. walls and double fire doors."

> "A building is a structure originally erected as one building by one owner and where the structural details are such as to plainly indicate this, and, further, where the building is so constructed that any one part of it could not be sold by itself. The same heating plant, ventilating system, janitor service or similar service would, as a general rule, indicate a 'building.' The fact that a building may be separated by partitions or even by solid fire walls does not alter the ruling of this department in regard to a structure being a 'Building'."

> "A building is a structure under one roof, the entire area of which is accessible from within."

> "A building is a property entirely separated from adjacent properties by fire walls or otherwise, and individually owned and controlled by a party or agent, as a business block which may contain a fire wall or other dividing member within its outer limits."

> "A building is that portion of a structure or succession of structures which is separated from every other portion by unpierced fire walls."

The last definition is the one employed in New York.

It will be observed that all these definitions convey more or less clearly the idea of detachment through non-intercommunication, showing most explicitly that all the authorities are generally in accord in the desire to limit the spreading of electric light and power systems throughout blocks, and are casting about for some happy phraseology which will properly describe the zones into which all the structures in the block are considered to be divided.

Some one has said that a row of buildings in a block is comparable to a pile of floors in a skyscraper which has been laid on its side, and that, if we allow risers to run unrestricted from basement to top floor, we should permit a horizontal main to run from the first building of the row straight through to the last building. The comparison is unfortunate; for in one case we have a number of floors not separated by unpierced fire barriers (and consequently, interaccessible) while in the other case each building is so separated from its neighbor.

But we must not dwell too long on what a building is. In the fullness of time—probably within six months—we shall have the answer. Let us now consider the rule with a view to determining just what it calls for and in an effort to agree upon the end to be accomplished by this rule or by some better substitute for it.

Discussion of the Rule.

Rule 17*d* says, in effect, that you cannot feed through from one building to another, whether the first building has a company service or an isolated plant *unless the conductors are properly protected by fuses*. If, then, fuses are provided you can run feeders all through the block, but you must not enter any building except "the ones served."

Did the framers of the rule mean to say this? Is anyone willing to subscribe to such a broad permission, with all its resultant disadvantages and dangers? Subcommittees of the Electrical Committee of the National Fire Protection Association are now grappling with this problem and it is expected that definite recommendations for an amended rule will be considered at the meeting in March, 1920.

With one more comment we shall dismiss the rule as it now stands. The requirement of concrete or brick over the conduit is only a means of securing the equivalent of a line carried outside. A short-circuit in a street main would introduce no hazard into the building. A short-circuit in a house main laid in a brick wall would introduce no hazard. But a short-circuit in a main run through a basement might cause a very serious fire. The man who replaces fuses on a line leading to some other fellow's building usually sees to it that they shall not readily blow again. In brief, he is very apt to adopt the time-honored central-station practice of "burning off the ground." If we have concrete or brick over the conduit a reasonable protection against this has been provided.

The ideal condition would exist if an isolated plant never had to serve other than its own building and if the electric light company always could provide a separate service for each building. But in practice we find that the continually improving economy of the incandescent lamp releases generator capacity which can be used next door, that the lighting company cannot open a new pavement which has just been laid, that some influential industry on a rear street where there is no main must be supplied, and that some person who has no franchise sets up a block lighting plant and schemes in every devious manner to evade Rule 17*d*. Manifestly, the line must be drawn somewhere—but where?

It seems that we shall have to make the answer hinge upon inter-accessibility. We cannot use the one roof or structural idea, for a business may expand from a three-story building into a four-story building next door, and the occupant may cut doors between the two premises and run both places as one establishment—one building. We cannot base our ruling upon the occupancy, as the occupant may control a number of adjoining warehouses which he prefers to keep separated from each other by unpierced fire walls in order to reduce the insurance rate. Nor can we be governed by the ownership, as one individual may own an entire row of apartment houses, each absolutely separate from each other, and each constituting a separate building.

Fortunately, the analysis leaves us on firm ground. The lighting company does not desire to have connected to its system any equipment over which it cannot exercise at least supervisory control. If its service enters a building it has such control. But if the feed is taken from another building instead of from a street main, the company may be unable to enter the premises with which it has no direct relation. This is a dangerous situation, for in one case at least, in the Middle West, the court has held the public utility company directly responsible for accidents occurring on equipment which it is supplying, on the theory that it is the company's duty to assure itself of the safety of these equipments. How such a theory would work out in a case where the company sold electricity in bulk to a customer who resold it at retail throughout the block, is hard to say.

Similarly, the electrician of an isolated plant prefers to serve only the equipment in his own building. Defects in the equipment next door blow his fuses and trip his circuit-breakers, keeping him continually on the jump. If he attempts to remove the cause of his troubles he is told to stay in his own building and run his plant. This is particularly exasperating to the man whose own equipment is always kept in first-class condition, and he sometimes yields to the temptation to "burn it off."

Municipal authorities, too, consider that it is well to limit the supply to the building directly served, as this offers the simplest control. In giving approvals of equipment, in listing defects, in disconnecting dangerous work, in controlling franchise rights, in setting under way legal action, the one-building-on-one-service plan establishes clean-cut conditions, which do not otherwise prevail.

Suggested Changes.

Undoubtedly it will be agreed, after this brief review of the situation, that Rule 17*d* should be rephrased in some manner which will satisfy the following principles:

(1) Only such equipment may be connected to a service as can be considered to be directly under the control, through ready access, of agents of the serving party—whether lighting company or isolated plant.

(2) Where it is necessary to serve a second building from a building having a service, instead of from a direct street main, the construction must be such as to give the equivalent in safety and control of that which would be provided by a direct service.

(3) No electrical energy shall be carried into a building which is not used in said building.

(4) The equivalent of a street main and a direct service may sometimes be secured by the use of conduit or duct covered by concrete or brick, where it is absolutely necessary to feed through from one building to another.

(5) A service which is split before entering a building and is carried along the exterior face of several buildings, either overhead or underground, does not come within the scope of this discussion.

(6) It is probably impracticable, at least in our larger cities to adhere absolutely to the rule of one-building-on-one-service.

I trust that I have succeeded in laying before you fairly one of our big-town problems. Do not, however, assume that the smaller cities are not concerned. Every electrical inspector, every lighting company, and every franchise-granting authority should be interested in amending Rule 17*d* so the laxness and uncertainty of the present rule will be eliminated. And to that end I look to the National Association of Electrical Inspectors and its friends to present that helpful discussion without which we cannot progress.

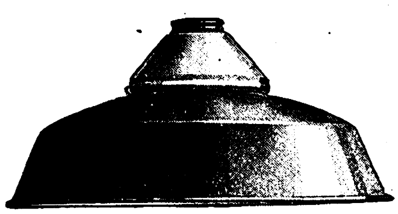
New Appliances

Steel Reflectors with Luminous Glass Tops — Portable Flood Lamp—Safety Motor Switch—Marine Lighting Set

Ivanhoe-Regent Works Announces Metal Reflectors with Glass Tops.

A decidedly new development in reflectors for industrial service, of both dome and bowl types, is announced by the Ivanhoe-Regent Works of General Electric Co., Cleveland, Ohio. The new reflectors afford all the advantages of porcelain-enameled reflectors while permitting the distribution of some light above the units, thus relieving the gloomy appearance often prevailing when no light is directed above the level of the lamps.

The metal part of the reflector is of



Dome Type Metal Reflector with Glass Top to Permit Some Light to Reach Ceiling and Upper Walls.

Bowl Type Metal Reflector with Glass Top to Remove the Customary Gloomy Contrast of Dark Upper Parts of Rooms with Bright Working Areas.

one compact piece, the form and the heel being connected by legs securely welded to each part. The contour of the metal part of the dome type approximates that of the Ivanhoe RLM standard reflectors of the same size.

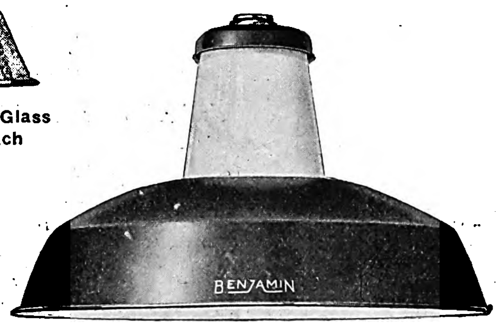
The glass top is in little danger of being broken as it is small and well protected. Well diffused light reaches the space above the lighting units through a small section of opal glass of good quality firmly fitted in the top of the reflector. This light gives the room a more cheerful appearance and assures better diffused lighting because of the light reflected from the upper part of the room, softening shadows and reducing reflected glare.

Possibility of eye strain because of the sharp contrast between the dark region above the lighting units and the bright region below them is eliminated.

Ivanhoe glass-top reflectors are of special advantage, both in rooms with light or dark walls and ceilings, because of the more uniform distribution of light over walls and ceilings than is possible with reflectors which permit no light to pass upward. The efficiency is not seriously affected because much of the light which reaches the upper parts of the room is thence reflected downward.

Benjamin Luminous-Top Reflector With Opal-Glass Hood.

It is known that the great contrast between an unlighted surface and an adjoining brightly illuminated one is very trying to the eyes. Formerly illuminating engineers used to pride themselves on industrial lighting installations in which opaque reflectors were used to cut off *all* of the light that otherwise would strike the ceilings and upper parts of the walls. The result was a high efficiency of utilization because practically no light was *wasted*



Benjamin Luminous-Top Reflector to Give Soft Light in Upper Part of Room and High-Efficiency Illumination on Working Plane.

in the upper part of the room. Nowadays, however, it is realized that if a moderate amount of light does reach the ceiling and upper parts of the walls it is *not* wasted, for it reduces the great contrast between the intensively bright sources and highly illuminated working surfaces on one hand and the otherwise dark and gloomy ceilings on the other.

This idea is being applied to certain enameled-steel reflectors made by the Benjamin Electric Manufacturing Co., Chicago. The neck or hood part of the reflector is made of opal glass, permitting a soft light to be projected to the upper part of the room. In factories with dark walls and ceilings, this unit through its luminous top diffuses a certain amount of light to the upper portions of the room, thus bringing out in detail the belting, pulleys, etc., occupying that space. The effective illumination of the area above the rim of the reflector also serves to increase the apparent height of the ceiling and thus produces a sense of greater freedom of action among the workmen. It also makes the room a more cheerful one by removing the gloomy and forbidding aspect of very dark ceilings.

In factories with white or light-colored walls and ceilings, this unit serves to increase the effectiveness of the illumination. Sharp contrasts are reduced and a better quality of illumination results. The light which otherwise would be lost in the recesses of the fixture is put to useful work. Where the walls and ceilings are light part of this light is reflected back upon the working plane and in this way increases the efficiency of the lighting system.

Benjamin luminous-top reflectors are built in the RLM standard dome shape and at present are made in the 14 and 16-in. sizes. The former is suitable for 100 and 150-watt Mazda type C lamps, whereas the larger size is suitable for 200-watt lamps. It is also possible to secure the opal glass hoods separately to allow for replacements of any broken parts, although the construction of the unit is such that the breakage should be very small.

Western Electric Portable Utility Light for Nearby Flood Lighting.

A new type of modified projector for highly localized lighting has recently been placed on the market by the Western Electric Co. This unit, which is to be known as the Western Electric portable utility light, is for use at close ranges where the light is to be located at distance not greater than 125 ft. of the object or surface to be illuminated.

With the light operating on a 100-ft. throw, a 100-ft. spread is obtained at an angle of 60°. The unit gives a smooth white light without serious gleam or glare. This is made possible by a new development—the hammered glass reflector. A 200-watt Mazda type C lamp is used. The unit is of especially rugged construction throughout and will withstand rough usage in service.

The hammered glass reflector is spring-suspended in a one-piece cast-iron housing. The housing is closed by a wire-glass front which is fitted into a recessed cast-iron ring. This forms a door which is hinged at the bottom and secured by a hand latch, thus affording easy access to the interior of the housing. The recessing in the ring makes the interior fully weatherproof.

This lighting unit can be furnished in either a black or gray weatherproof enamel finish. It is 19¼ ins. high and weighs approximately 30 lbs. This light weight makes the unit very easy to carry from place to place. The base is 9 ins. in diameter, giving the light stability when mounted on a flat horizontal surface. The unit can also be mounted on either vertical or flat surfaces such as walls, poles or roofs, by virtue of a heavy universal joint which fastens the housing to the base. All adjustments can be made by hand; no tools are necessary.

The Western Electric portable utility light has a wide range of applications. In railroad work it can be used for lighting transfer tables, coaling stations, inspection pits, loading platforms, cranes, roundhouses and drawbridges. On marine work it can be used for lighting docks, dredges, slips, loading operations, canal locks, dry docks and pile drivers. Its industrial applications cover even a wider variety of uses, such as lighting shop yards, material yards, coal yards, well drilling, coal tipples, erecting shops, machine shops, tramways and inclines, conveyors and all kinds of emergency work.

Other uses will be found in illuminating playgrounds, skating rinks, signs, street corners, alleyways, swimming pools, monuments, flags, building fronts and construction work in general. In other words, it can be used for general flood lighting of nearby areas for which the ordinary floodlight projector gives too concentrated a beam.

New Westinghouse Safety Motor-Starting Switch.

A new type of motor-starting switch, which is low in first cost but provides complete protection to both the operator and the motor, has just been placed on the market by the Westinghouse Electric & Manufacturing Co., East Pittsburgh, Pa. It is known as the type WK-100 switch and is designed for connecting single or polyphase alternating-current motors of from 1 to 10 hp., 250 and 550 volts, directly to the line without the use of autotransformers or resistance.

All of the mechanism with the exception of the operating handle is inclosed with a steel box. The protective devices are easily accessible on opening a door in the cover; but this door can not be opened except when the switch is in the off position (nor can the switch be closed when the door is open) and all parts accessible are then dead. Therefore it is impossible to receive injury from contact with live parts when either operating the switch or making ordinary adjustments.

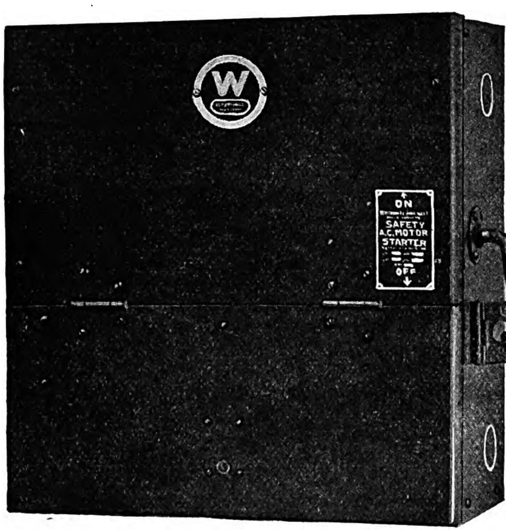
No-voltage protection to the motor is provided by a magnetic release which opens the switch automatically on a failure of voltage. Overload protection is provided by means of relays, resembling cartridge fuses in appearance, each of which contains a contact connected in series with the release magnet. Harmless momentary overloads have no effect on the relays, but as soon as the load on the motor becomes dangerous, the relay contacts open the magnet circuit and the switch automatically flies open. The relays then automatically reset themselves.

A New Marine Lighting Outfit.

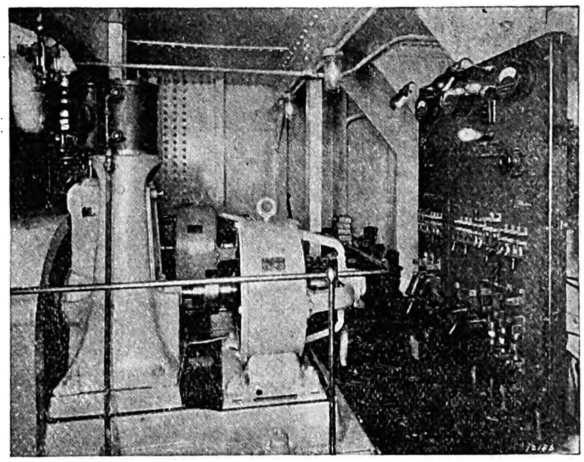
A new line of engine-driven marine lighting generators, designed especially to insure reliability of operation, has recently been developed by the Westinghouse Electric & Manufacturing Co., East Pittsburgh, Pa. The sets range in size from 2 to 50 kw., and each consists of a steam engine coupled to a generator, the whole being mounted on a bedplate so as to form a compact unit. The 15-kw. size, shown in the illustration, is 6 ft. long, 3 ft. wide, 5 ft. high and weighs about 3300 lbs.

The engine used in these sets is manufactured by the Clarage Fan Co. It is of the single-cylinder, vertical inclosed V-type with automatic lubrication. It can be supplied for operation on steam pressures of from 80 to 250 lbs. and is suitable for either condensing or noncondensing service.

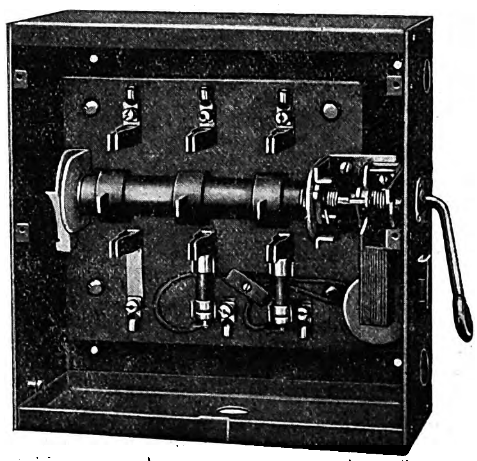
The generator, while in general of standard Westinghouse construction, is specially designed for marine service. The bearings are arranged so that perfect lubrication is assured regardless of the tossing of the vessel. The windings are specially insulated to protect them from salt and dampness. Metal parts subject to corrosion are made of noncorroding alloys. A special feature of these generators is their freedom from sparking at the commutator, even under heavy overloads. They are supplied for either 125 or 250 volts, direct current, and for either two or three-wire systems.



New Westinghouse Safety Inclosed Motor-Starting Switch With Switch Handle Locked in "Off" Position.


Two 15-kw. Westinghouse-Clarage Engine-Driven Lighting Generators on Steamer New Britton.

Inclosed Motor-Starting Switch in "Off" Position, Permitting Fuse Compartment to Be Opened.


Safety Motor-Starting Switch With Cover Entirely Removed, Which Can Be Done by an Authorized Person.

Trade Activities

Course in Production Methods Conducted for Crocker-Wheeler Foremen—Kallmerten & Warner Electric Formed

The C. Y. Engineering Co., Newark, N. J., of which C. W. Yerbury, a former Western Electric man, is manager, has taken over the business of the late C. McIntire, for many years a manufacturer of high-grade connectors and electrical specialties. The new firm aims to maintain the same high standard of production as was maintained by the C. McIntire Co.

Cooper Hewitt Electric Co., Hoboken, N. J., in order to secure more space for factory expansion, will remove several departments of the offices, on or about Dec. 1, to 95 River street. The departments affected are the executive, auditing, sales, purchasing and patent. The engineers' department will remain at the present location in the factory at Eighth and Grand streets.

Kallmerten & Warner Electric Co., 120 Lovell street, Charleston-Kanawha, W. Va., is the name of a recently incorporated concern, which will carry on a manufacturers' agency to sell and erect for mines such units as power plants, substations, ventilating fans, pumps, locomotives, etc. The company will also sell transformers, motors, small light plants, lamps, etc., and is equipping its shop with machinery to make armature coils, rewind and rebuild motors, armatures, field coils, transformers. The officers of the company are as follows: G. E. Warner, president and treasurer; O. W. Kallmerten, vice-president and general manager, and Ira W. Belcher, secretary.

General Electric Co., Schenectady, N. Y., has issued a handsome booklet entitled "The Electric Ship," which describes at some length the electric propulsion of the battleship *New Mexico*, which is considered one of the most remarkable engineering feats that has thus far been accomplished. How the electrical machinery looks, how it works, and why the electric drive is preferable to other forms of propulsion in terms understood by the average non-technical reader are described in Part I. Part II relates "what the experts say," and sets forth in their own words how America's leading experts regard electric ship propulsion and its economic and military advantages. A chapter on "The Electric Propulsion of Ships" is included by W. L. R. Emmet, consulting engineer of the General Electric Co., who in co-operation with the Bureau of Steam Engineering, U. S. Navy, developed electric drive for ships. Another chapter by Eskil Berg reviews the propelling equipment and operation of the *New Mexico*. The publication is profusely illustrated and contains considerable valuable data on the subject.

Webb Electric Furnace Corp. has established offices at 36 Church street, New York City, and has taken over the manufacture and sale of the furnace developed by the Old Dominion Iron & Steel Corp., Richmond, Va.

Jenkins & Knowles, with office and shop at 34 Wells street, Hartford, Conn., is the name of a new firm recently organized by H. E. Jenkins, Hartford, Conn., and Elmer J. Knowles, Worcester, Mass., which will specialize in power installation in factories and power plants. The firm will also do a general electrical business.

Westinghouse Electric & Manufacturing Co., East Pittsburgh, Pa., has completed negotiations for the sale of its holdings in the British Westinghouse Manufacturing Co. for a consideration said to exceed $5,000,000. The company has completed arrangements for taking over the East Springfield plant of the New England Westinghouse Co., Springfield, Mass., and is planning to commence operation at once on the production of industrial motors and automobile starting and lighting systems. This plant will be operated as an additional unit to the East Pittsburgh works of the company and will afford employment for about 5000 persons.

Pyroelectric Instrument Co., Trenton, N. J., has issued an illustrated catalog entitled "Pyrovolter Type Instruments." The catalog which is perforated contains 40 pages of text and illustrations that indicate the details of the instruments, the different types and sizes, wiring diagrams, prices, the uses to which instruments can be placed, and other information. The Pyrovolter, which is an instrument designed, as the name implies, to indicate and measure high temperatures, was placed on the market in 1916. It is distinguishable from ordinary pyrometers in that the former measures potential and the latter current. In effect, the Pyrovolter principle provides a means of operating a deflection instrument on the potentiometer principle wherein the accuracy and permanency of the instrument depend basically upon a permanent magnet rather than upon a standard cell. Operation of the instrument is effected by balancing a potential drop against an unknown c. e. m. f. and then changing the connections of the instrument suddenly and observing the drop across an accurately adjusted fixed resistance. The connection is changed by turning a button. The instrument does not require the use of a standard cell nor does it have any temperature resistance coefficient. It is applicable to all situations in which high temperatures or minute temperature changes are sought.

Pierce Fuse Corp. of Canada, Ltd., Bridgeburg, Ont., capitalized at $250,000, was recently incorporated to manufacture renewable electric fuses. Officers of the company are: President, W. N. Pierce; vice-president, F. A. Myer, and secretary, B. C. Candee.

C. & P. Electric Works, Springfield, Mass., is sending out catalog No. 1 dealing with barrier panels, barrier cabinets, type "S" cabinets and steel boxes and cabinets. This catalog comprises 15 pages and contains illustrated descriptions of each product. The barrier cutouts are made of white glazed porcelain, with a patent upturned end which, when the cutouts are placed together, forms a barrier around the wiring gutter, and is one of the most convenient arrangements devised for panel construction. The feature of having a barrier made a part of the block reduces the number of parts and simplifies the operation of making up a panel. One of the principal advantages of the barrier panel is a substantial barrier between the busbars so that accidental short circuits are impossible. These products are of the N. E. C. standard and have been approved by the Underwriters' Laboratories.

Crocker-Wheeler Co., Ampere, N. J., has just inaugurated a plan of training for its foremen and other factory supervisors which is of considerable interest. A group of 62 men has been formed to pursue a three months' course in modern production methods, which comprises the study of specially prepared text units, the solution of problems relating to the units and the discussion of this material at six biweekly meetings held after hours in the plant. These meetings will provide an opportunity to bring home the application of the work to the special problems of the Crocker-Wheeler Co.'s production. At each meeting a lecture will be delivered by an experienced production man and the lectures will be followed by a round table discussion. Included in the group aside from the foremen are the superintendent and three assistant superintendents, and insurance is given that the meetings will be highly beneficial to the members of the class. The subjects to be studied are: How to promote team work in the shop; handling men in a way to increase production and promote harmony; how production should be organized; efficient purchasing, scheduling, routing, repairing, etc.; keeping down the overhead by stricter cost keeping and major problems of management. The course is under the direction of the Business Training Corp. of New York City which supplies the study material and the class instruction.

Current News

Weekly Record of Construction Activities—Conventions

EASTERN STATES.

Medford, Mass.—American Radio Research Corp. has completed arrangements for the erection of a new one and two-story radio building, about 60x120 ft. and 60x140 ft. on College avenue. Alonzo D. Wright, 40 State street, Boston, is architect.

New Britain, Conn.—Landers, Frary & Clark will erect a building 96x289 ft. to cost $200,000, and a three-story tempering building 40x68 ft.

Pawtucket, R. I.—Potter & Johnstone Machine Co. will build a two-story 63x72 ft. foundry addition and will alter buildings Nos. 1 and 2 at a cost of $60,000.

Pawtucket, R. I.—James M. Carpenter Tap & Die Works has recently broken ground for the construction of a one-story brick boiler plant on Newell avenue, about 20x30 ft. Willmarth-Mackillop, Inc., Freeman street, is the contractor.

Woonsocket, R. I.—Harvey Electric Co. has filed notice of organization to operate at 19 Sayles street. Harvey Lamy, 100 Arnold street, heads the company.

Bath, N. Y.—The question of issuing $35,000 municipal light bonds will be submitted to vote. Address town clerk.

Brooklyn, N. Y.—Metal Hose & Tubing Co., 253 Tillory street, has under advisement the erection of a $75,000 plant. Plans call for a three-story structure, 80x100 ft.

New York, N. Y.—Plans are under consideration by the Commission of Water Supply, Gas and Electricity for extensions and improvements in the electric street-lighting system in sections of 42nd street, including a rearrangement of lighting units in the vicinity of the Grand Central Terminal.

New York, N. Y.—In connection with the proposed construction of the large new motion picture studio building, about 200x600 ft. to be erected by the Selznick Picture Corp., 729 Seventh avenue, large quantities of electrical equipment will be required. The structure will be of reinforced concrete, and is estimated to cost $2,000,000. Contract for erection has been awarded to the Thompson-Starrett Co., 49 Wall street.

Rochester, N. Y.—Notice has been filed with the Secretary of State by the North East Electric Co., 348 Whitney street, of an increase in its capitalization from $1,000,000 to $3,000,000, for business expansion.

Schenectady, N. Y.—General Electric Co. is having plans prepared for the construction of a new five-story brick administration building about 54x219 ft. The structure will cost in excess of $350,000. Harris & Richards, Drexel building, Philadelphia, Pa., are architects.

Schenectady, N. Y.—Mica Insulator Co., Villa road, manufacturer of insulation specialties, has awarded contract for the construction of a one-story plant on Villa road. The structure is estimated to cost about $15,000 and will be used for increased output. Hanrahan Brothers, Wendell avenue, Schenectady, are the contractors.

Solsville, N. Y. — Public Service Commission has approved the application of the Solsville Electric Light & Power Co., operating in Solsville, Madison county, to construct an addition to its local electric plant, to provide for increased capacity. The company will also arrange for the acquirement of the local hydro-electric plant for operation.

Utica, N. Y.—Held Electric Co., manufacturer of electrical goods, etc., has filed notice with the Secretary of State of an increase in its capital from $5000 to $10,000, to provide for general business expansion.

Wayland, N. Y.—Wayland Light & Power Co., Inc., has been granted permission by the Public Service Commission to construct an addition to its electric plant at Wayland, and to construct and operate a new plant at Conesus, Livingston county, for local service, franchise for the latter having been granted by the municipal authorities recently.

Califon, N. J. — Califon Electric Light & Power Co. is making rapid progress on the construction of an additional power line from Hackettstown to Long Valley, to provide increased capacity. The company purchases its electric energy from the Hackettstown Electric Light & Power Co., Hackettstown.

Freehold, N. J.—Board of Chosen Freeholders of Monmouth county is having plans prepared for the construction of a new power plant at the County Court House. Douglas Sprague, 39 Cortlandt street, New York, is architect.

Irvington, N. J.—Plans are under consideration for improvements in the municipal police signal system.

Jersey City, N. J.—Leeds Phonograph Co. has filed plans for the construction of a new one-story brick engine house, to be located at 143 Morgan street.

Newark, N. J.—In connection with the proposed new additions to the plant of the Duratex Co., 768 Frelinghuysen avenue, estimated to cost about $500,000, plans are being prepared for the construction of a one-story addition to the power plant, about 60x75 ft.

Newark, N. J. — Cowan Brothers have filed notice of organization to operate at 123 North Sixth street as a general electrical repairing establishment. Arthur G. Cowan heads the company.

Newark, N. J.—American Transformer Co., 178 Emmet street, has completed arrangements for the disposal of its plant at 484-86 New Jersey Railroad avenue, to new interests. The property consists of a one-story brick structure on a plot about 45x140 ft.

Trenton, N. J.—Trenton Malleable Iron Co. will erect a $20,000 power plant.

Trenton, N. J.—City commission is having new plans and specifications prepared covering the installation of the proposed steam, electric and hydraulic equipment at the municipal waterworks plant. A resolution was recently passed awarding the contract for the proposed work to Harry E. Stahl, the lowest bidder, and this resolution has been withdrawn. Under the new plans, the equipment is estimated to cost about $65,000.

Trenton, N. J. — Fay & Youngs, Inc., 75 Spring street, New York, is planning for the installation of new boiler equipment in the plant of the Fidelity Pottery Co., Trenton, N. J., recently acquired.

Bethlehem, Pa.—Traveler Tire & Rubber Co., 819 North Broad street, Philadelphia, Pa., has completed foundation work in connection with the construction of its proposed local plant, including large power house for works operation. The works will be one-story, about 90x332 ft. located at Traveler avenue and Auburn streets and estimated to cost $125,000.

Easton, Pa.—Easton Hospital Association has awarded a contract to Bechtel & Bechtel, Easton, for the construction of a new three-story hospital building, about 165x230 ft., to be supplemented by a power plant for general operation, the structures to be located at Lehigh, 20th and 22nd streets. The project is estimated to cost $150,000.

Erie, Pa.—Burke Electric Co. has recently completed negotiations for the purchase of the business of the C. & C. Electric & Manufacturing Co., Garwood, N. J., manufacturer of direct-current motors and generators, etc. It is understood that the equipment will be removed to Erie. James Burke is president.

Harrisburg, Pa.—Charles A. Fair, 128 Sylvan terrace, will build a two-story machine shop and auto repair works, 70x120 ft. This work will involve an expenditure of $20,000.

Philadelphia, Pa.—A boiler house involving an expenditure of $50,000 will be erected by the American Preserve Co.

Philadelphia, Pa.—Wicaco Screw & Machine Works, Seventh and Wood streets, is preparing plans for a plant to cost approximately $100,000.

Philadelphia, Pa.—H. O. Wilbur & Sons, Inc., 235 North Third street, has awarded a contract to the Turner Construction Co., 1713 Sansom street, for the construction of a new seven-story and basement brick and concrete power plant and warehouse building, about 80x92 ft.

Pittsburgh, Pa.—Follansbee Brothers Co., operating steel mills at Follansbee, W. Va., has completed arrangements for the construction of a new steel plant at Toronto, Ohio, estimated to cost approximately $5,000,000. The structures will include machine shop, open-hearth and hot mills, annealing departments, scrap shed, and power plant, about 60x100 ft., for general works operations, as well as auxiliary structures.

Pittsburgh, Pa.—Atlantic Refining Co. has filed plans for the erection of a new one-story concrete and steel pumping plant to be located at 57th and Butler streets. The structure is estimated to cost about $35,000.

Rittersville, Pa.—Hildebrand Knitting Co. is having plans prepared for the construction of a large new stack at the power plant at its mills located at Rittersville, near Allentown.

Scranton, Pa.—City is having plans prepared for the construction of a new municipal electric light plant. Frank Koester, 50 Church street, New York, is engineer; Robert W. Allen, City Hall, is director of public works.

Shepherdstown, Pa.—Plans are understood to be under consideration by local interests for the installation of electric service in the municipality. An electric plant will be installed.

York, Pa.—Read Machinery Co., 231 North George street, is having plans prepared for the construction of a one-story brick, concrete and steel boiler plant, about 40x50 ft. The structure will be located on Grantley street, and is estimated to cost $20,000. Gemmill & Billmeyer, 37 West Market street, architect.

Baltimore, Md.—In connection with the proposed improvements in the municipal water supply system, plans have been submitted before the city council covering the construction of a large tunnel from McCall's Ferry to Baltimore over the right of way of the Pennsylvania Water & Power Co., for the tapping of the Susquehanna river for the proposed supply. It is estimated that this project would cost approximately $50,000,000. Howard Bryant is president of the second branch of the city council.

Ehrhardt, S. C.—City will establish an electric light plant according to plans prepared by the Ryan Engineering Co., National Bank of Sumter building, Sumter, S. C.

Jacksonville, Fla.—Installation of a new 10,000-kw. generator will be effected at the municipal electric light and power plant about Jan. 1. This will give the plant a total generating capacity of 19,000 kw. per hour. Additional improvements are also contemplated in the municipal plant.

DATES AHEAD.

American Society of Mechanical Engineers. Annual meeting, New York City, Dec. 2-5. Secretary, Calvin W. Rice, 29 West 39th street, New York City.

American Institute of Chemical Engineers. Annual meeting, Savannah, Ga., Dec. 3-6. Secretary, J. C. Olsen, Brooklyn, N. Y.

Electric Power Club. Meeting, Hot Springs, Va., Dec. 11, 12 and 13. Headquarters, Homestead Hotel. Secretary, C. H. Roth, 1410 West Adams street, Chicago.

National Council of Lighting Fixture Manufacturers. Annual convention, Detroit, Mich., February, 1920. Secretary-treasurer, Charles H. Hofrichter, Cleveland, Ohio.

American Electrochemical Society. Annual convention, Boston, Mass., April 7-10, 1920. Friday, April 9, joint session with American Institute of Electrical Engineers on "Electrically Produced Alloys." Secretary, Joseph W. Richards, Bethlehem, Pa.

National Electric Light Association. Annual convention, Pasadena, Cal., May 18-21, 1920. Headquarters, Hotel Huntington. Acting secretary, S. A. Sewall, 29 West 39th street, New York City.

NORTH CENTRAL STATES.

Lima, Ohio.—Rates for boulevard and arc light service in Lima will be submitted to the joint committee of clubs and civic organizations by the Ohio Electric Co. The Ohio Electric Co. is to submit its figures for the boulevard in two ways, under one of which it will install and own the equipment, and under the other the city will install the posts and wires and buy only the current.

Oberlin, Ohio.—The city proposed to erect an electric power plant.

Evansville, Ind.—Evansville Metal Bed Co. has purchased two entire blocks adjoining its factory and a large addition will be built.

Brockton, Ill.—The council is planning ways and means to secure electric lighting. Address C. B. Miller.

Chicago, Ill.—Central Manufacturing Co. will erect a $900,000 six-story warehouse, 260x174 ft.

Chicago, Ill.—Central Bag Manufacturing Co. is erecting a new factory building to cost $350,000.

East St. Louis, Ill.—St. Louis Pressed Steel Co. will erect the first unit of a factory plant, the building to be a steel and brick structure, 200x100 ft., and the estimated cost $65,000. The Sutherland Building Construction Co., St. Louis, Mo., has the contract.

Elgin, Ill. — Donald Hubbell will erect two-story brick building to cost $28,000.

Monticello, Ill. — Township has voted to erect $200,000 community high school.

Sorento, Ill.—The sum of $5000 in bonds has been voted to secure electric lighting.

Bangor, Mich. — The village, after operating a municipal electric plant for about 15 years, has sold it and granted a franchise to the Benton-Harbor-St. Joe Railway & Light Co.

Detroit, Mich. — Notice has been filed with the Secretary of State by the Detroit Edison Co. of an increase in its capital stock from $35,000,000 to $60,000,000, to provide for general expansion.

Hartford, Mich.—The village has granted to Anderson Brothers a substantial increase in rates for electric current. In return for the higher rates, Anderson Brothers will install a new power plant with new waterwheels and vertical direct-connected generators. Orders for this machinery will be placed this year for delivery about next June.

Lawton, Mich. — A committee has been appointed to obtain information relative to the amount necessary to install a modern electric light plant. It is probable that a special election will be called this year. Address village clerk.

Muskegon, Mich. — Shaw Electric Crane Co. contemplates an addition to its plant which will double its capacity.

Westphalia, Mich.—The council has received an estimate for construction of a municipal lighting system. The expert figures will not exceed $15,000 to install the system and to build a suitable shelter for the dynamo and engine. The council will submit the question to the voters some time in December.

Manitowoc, Wis. — Chamber of Commerce is interested in ornamental lighting system on several streets. Arthur Zander, city clerk.

Waupaca, Wis.—Waupaca Electric Service & Railway Co. has under consideration the erection of a new electric plant.

Faribault, Minn.—The Faribault division of the Northern States Power Co. will shortly furnish 100-hp. of electrical energy for operation of a stone quarry on the outskirts of the city.

SOUTH CENTRAL STATES.

Gadsden, Ala. — City council has called a special election on Jan. 6 for the purpose of voting on a bond issue of $100,000 to cover the cost of the establishment of a municipal electric light plant. Ernest Smith is city engineer.

Huntsville, Ala.—The new transmission line of the Alabama Power Co., which will bring power from Goose river near Gadsden to Huntsville for distribution throughout northern Alabama, will be finished by the first of the year. Preparations are being made for the erection of two large steel towers on each side of the Tennessee river at Whitesburg, where the crossing will be effected. A line is being extended to Decatur and Albany, which will be completed about the same time.

Jackson, Miss—Plans are being arranged by the city for the installation of new equipment in the municipal electric plant. Bonds for $15,000 have been voted to cover the cost of the proposed work. F. M. Trussell, is clerk.

Hominy, Okla. — City considering plans for the installation of a new electric street lighting system. C. E. Lee is engineer.

Shattuck, Okla.—City Council, A. C. Oliver, Mayor, has taken bids for the installation of a quantity of new equipment in the municipal electric plant, including boilers, generating apparatus, lifting equipment, heater, pumping units, switchboard, and auxiliary apparatus. Improvements and extensions will also be made in the municipal water supply system, pole lines, etc. Burns & McDonnell, 402 Interstate building, Kansas City, Mo., are engineers.

Sapulpa, Okla. — The 66,000-volt transmission line of the Oklahoma Gas & Electric Co. connecting Drumright and Sapulpa has been completed and much needed additional capacity is now available for the Sapulpa division.

Abilene, Tex. — Work will begin Dec. 1 on the construction of a combined power and ice plant in Abilene to cost $700,000, according to an announcement made by A. Hardgrave, Dallas, vice-president and general manager of the American Public Service Corp. The building will be of reinforced concrete throughout. A turbine of 2600 hp. will generate power for the plant, which will supply electric current to seven towns in this section.

Brady, Tex.—City has let first contract for electric light plant. Address Mayor.

Houston, Tex.—It is planned by the Harbor Board and city council of Houston to take up for consideration soon the matter of extending the municipal belt railroad to Morgan's Point, situated on the south side of the Ship Channel, and to Goose Creek, situated on the north side and to convert the system into electric traction. It is also proposed that the lines be double-tracked and equipped to carry passenger as well as freight traffic. The plans also include the merging of the Municipal Belt railroad and the city's port properties at Port Houston into a terminal corporation for the issuing of bonds. It is stated by City Engineer McVea that these properties have a value of more than 2,500,000, including 465 acres of land on the Ship Channel. It is estimated that the cost of the main line extension to Morgan's Point and Goose Creek would be about $1,000,000.

Killeen, Tex. — Fire recently destroyed the plant of the City Light & Power Co., with loss estimated at $28,000. It is understood that plans will be arranged for immediate rebuilding.

WESTERN STATES.

Hardin, Mont.—Big Horn Canyon Irrigation Co. with a capital of $5,000,000 will build reservoir 60 miles long. About 1,500,000 yds. of concrete will be required for dam. Approximately 40,000 acres of land will be irrigated with the aid of pumps operated by power generated from the dam. Address secretary of company.

Chehalis, Wash. — City Engineer Bantz will report his complete specifications for the proposed new lighting system for Chehalis' streets at the next meeting of the city commission. The plan proposed a concrete or steel standard with a single globe and 400-watt lamps at reasonable intervals in the business center of the city and make Chehalis one of the best lighted Northwest cities.

Goldendale, Wash. — The power house is to be entirely overhauled. The flume and piping are to be repaired and replaced when necessary.

Bend, Ore.—At a recent meeting of the city council the mayor suggested that an adequate system of municipal lighting should be adopted.

Roseburg, Ore.—The question of issuing $500,000 electric light bonds is under consideration. Address Mayor Hamilton.

Modesto, Calif. — On Dec. 9, the question of issuing $20,000 bonds for street lighting equipment will be submitted to vote. Address city clerk.

CANADA.

Bala, Ont.—Bala Electric Light & Power Co., is constructing a 14-mile pole line, and also contemplates the construction of another line the same length.

Vancouver, B. C. — Canadian Marconi Wireless Co. contemplates the erection of a wireless station to cost $2,000,000 and is negotiating with the Government for license.

PROPOSALS

Transformers—Bids will be received by the Committee of Fire, Water, Light and Power, Winnipeg, Man., at the office of C. J. Brown, city clerk, until 3 p. m., Dec. 1, for the supply and installation of six 1000-kv-a. step-down, single-phase transformers for the city light and power department. Specifications may be obtained at the office of the city light and power department, 54 King street.

Fire Alarm Boxes.—Bids will be received by the commissioner of gas and electricity, Room 614, City Hall, Chicago, on Nov. 28, for furnishing and delivering to the city, 20 fire alarm boxes complete, in accordance with specifications on file in the office of the above official. William G. Keith, commissioner of gas and electricity.

Electric Elevators. — Bids will be opened in the office of the supervising architect, Treasury Department, Washington, D. C., at 3 p. m., Dec. 2, for remodeling the electric freight elevators in the United States Post Office, Court House and Custom House at Providence, R. I., in accordance with specifications, copies of which may be had at the above office, in the discretion of the supervising architect. James A. Wetmore, acting supervising architect.

Electrical Work.—Bids will be received at the supervising architect's office, Treasury Department, Washington, D. C., on Dec. 18, for furnishing materials for the construction of the United States Post Office at Thomasville, N. C., including millwork, painting, glazing, hardware, heating, electric work, etc., in accordance with drawings, specifications and bills of quantities attached thereto, copies of which may be obtained from the custodian of the site at Thomasville, N. C., or at the above office, in the discretion of the supervising architect. James A. Wetmore, acting supervising architect.

NEW PUBLICATIONS

Safe Practice in the Use of Wire Ropes in Mines.—The Bureau of Mines in the course of its investigations of safety in mining, the fuels and mechanical equipment has collected much information bearing on the use of wire rope. In this paper by R. H. Kudlich and O. P. Hood, the authors outline approved practice and the most important precautions to insure safety. It emphasizes the essentials of good practice and gives the reasons underlying such practice.

Abatement of Corrosion in Central Heating Systems is the title of technical paper No. 236 by F. N. Speller and issued by the Bureau of Mines, Department of the Interior, and serves as a guide to engineers in the design of heating systems. The author emphasizes the fact that whether hot water or steam is used as the medium for conveying heat to the consumer, a heavy toll in upkeep must be faced sooner or later if the corrosion of piping is not taken into account in the design of the plant. It has been found that the main source of corrosion has been traced to dissolved gases brought into the heating system either with the feed water for the boiler or through leaks in return lines under a pressure below that of the atmosphere. This publication discusses piping material, theory of corrosion and the engineering problem involved in heating systems. The price of this publication is 5 cts. and copies may be secured by addressing the Superintendent of Documents, Government Printing Office, Washington, D. C.

Photoelectric Spectrophotometry by Null Method.—The Bureau of Standards, Department of Commerce, has issued scientific paper No. 349 by K. S. Gibson, entitled "Photoelectric Spectrophotometry by the Null Method." In connection with the color-standardization work of the Bureau of Standards, it was found desirable to have available a number of independent methods of making spectrophotometric determinations, especially in the visible part of the spectrum; for it is generally admitted that the fundamental basis of color specification is spectrophotometry. To supplement the other methods at present in use at the Bureau, the author was given the problem of developing a method for accurate and convenient photoelectric spectrophotometry suitable for routine determinations, and the results of his study are described at length in this publication. It discusses the apparatus, method and errors and accuracy in spectral transmission, diffusion of spectral reflection and other applications of the apparatus. The price of this bulletin is 5 cts. and is sold by the Superintendent of Documents, Government Printing Office, Washington, D. C.

INCORPORATIONS

Holmesville, Neb. — Consolidated Electric Co. has incorporated with a capital of $10,000. Plans to build electric line from Holmesville, taking in towns of Rockford, Filley and Virginia.

Cylon, Wis.—Cylon-Forest Electric Co. has incorporated with a capital of $25,000. Herman Frey & John F. McNamara.

Carthage, Miss.—Carthage Light & Ice Co. has been incorporated with a capital of $30,000. R. L. Jordan and others.

Wenatchee, Wash.—Articles of the incorporation were filed by Columbia Railway Electric Co. for $5000 by W. L. Chrysler, and Edith F. Chrysler.

Chesterfield, Ill.—Chesterfield Electric Co. has been incorporated with a capital of $15,000 by W. J. Finch, D. Ambier and L. Ambier.

Indianapolis, Ind.—Adams-Coulter Manufacturing Co. has been incorporated with capital of $35,000 for the manufacture of machinery. L. P. Adams, A. L. Coulter and Walter G. Holt are the incorporators.

Muncie, Ind.—Star Storage Battery Co. has been incorporated with capital of $25,000 to manufacture electric storage batteries. Address W. O. Haymond, Muncie, Ind.

New York, N. Y.—Worth Lighting Fixture Co. Capital, $10,000. To manufacture electric and gas fixtures, etc. Incorporators: J. Pecker, B. Shapiro and B. Leavitt, 311 East Ninth street.

New York, N. Y.—Blair Reseater Co. Capital, $50,000. To manufacture engines, motors, and kindred equipment. Incorporators: A. Hall, F. R. Howe and D. M. Gerard, Huntington.

Brooklyn, N. Y.—Aws Manufacturing Co. Capital, $10,000. To manufacture electrical and gas appliances, etc. Incorporators: A. Schachne, I. Kantrowitz, and A. W. Schenker, 469 West 164th street.

Brooklyn, N. Y.—Art Fibre Productions, Inc. Capital, $20,000. To manufacture lighting fixtures, etc. Incorporators: M. Appelbaum and F. and H. Adlow, 37 Linden street.

Buffalo, N. Y.—Huron Electric Co. Capital, $10,000. To manufacture electrical goods, etc. Incorporators: E. A. Heller, S. Eckert and E. J. Hanks.

Danville, Pa.—Penns Creek Hydro Electric Co. Capital, $30,000. To operate a hydroelectric power plant. Incorporators: Miles A. Ziegler, New Berlin; F. Q. Hartman, and A. Pritchard, Danville.

Wilmington, Del. — Extemp-Fone Company. Capital, $125,000. To manufacture telephone attachments, equipment, etc. Incorporators: M. Butler, B. M. Barrett, and M. M. Lucey, Wilmington.

Charlotte, N. C.—Owen Light & Power Co. Capital, $100,000. To operate a local light and power plant. Incorporators: S. D. Bagwell, J. V. Simms, and H. C. Irvin.

Walnut Cove, N. C.—Dan Valley Power Co. Capital, $50,000. To operate a local electric light and power plant. Incorporators: O. N. Petree, H. L. Mitchell and J. W. Slate.

Gurdon, Ark.—Gurdon Light & Power Co. Capital, $20,000. To operate a plant for the generation and distribution of electric energy. T. Neely is president.

Albany, Tex. — Albany Light & Power Co. Capital, $30,000. To operate a local electric light and power plant. T. B. Wood is the principal incorporator.

Logan, W. Va.—Newman Electric Co. Capital, $10,000. To manufacture electrical goods. Incorporators: J. G. Biggs and L. Niederlenner, Jr., Huntington, and H. C. Newman, Logan.

Toledo, Ohio—Lucas Electric Co. has incorporated with a capital of $25,000. Frank L. Lucas and George I. Michener, incorporators.

Grand Rapids, Mich.—Grand Rapids Electric Service Co. has incorporated with a capital of $8000. Ora E. Richards, Grand Rapids, William J. Burns, and William W. Pennington, Detroit.

Washington, D. C.—Federal Battery Manufacturing Co. Incorporated under Delaware laws with a capital of $3,000,000. To manufacture electric batteries, etc. Incorporators: M. E. Jones, Richard B. Owen, and William H. Benjamin, Washington.

Tulsa, Okla.—W. H. Youse Electric & Supply Co. Capital, $25,000. To manufacture electrical supplies, etc. W. H. Youse is the principal incorporator.

New York, N. Y.—Rice & Ganey, Inc. Capital, $40,000. To engage in a general electrical contracting capacity. Incorporators: W. H. Schneider, O. L. Perrault, and H. T. Cooper, Albany.

New Rochelle, N. Y.—Ameritoy Co., Inc. Capital, $20,000. To manufacture electrically operated toys and novelties, etc.. Incorporators: A. M. Joslyn, J. O. Miller, and A. M. Nowell, New Rochelle.

Albany, N. Y.—Fine Wire Insulating Co. Capital, $10,000. To manufacture insulation specialties, wires, etc. Incorporators: M. D. Shiverick, and F. H. and D. H. Tyler, Albany.

Binghamton, N. Y.—Southern Tier Electrical Supply Co. Capital, $35,000. To manufacture electrical supplies, etc. Incorporators: E. A. and A. H. Hyde and E. C. Wehle.

Philadelphia, Pa.—Daynix Engineering & Power Co. Incorporated under Delaware laws with a capital of $200,000. To engage in general electrical engineering, etc. John C. and V. H. Daynix and H. Frances Taylor, Philadelphia, are the incorporators.

FOREIGN TRADE

[Addresses of firms referred to in these trade opportunities may be obtained by writing to the Bureau of Foreign and Domestic Commerce, Washington, D. C., or its branch and local co-operative offices. Request for each opportunity should be on a separate sheet and the file number given.]

Electrical Goods (31,158).—A commercial agent from Australia desires to purchase and secure agencies for the sale of hardware, draperies, electrical goods, tools, stoves, clothing, dry goods, knit goods, cosmetics and pumps. Reference.

Machine Tools, Etc. (31,223).—A business man in England desires to secure an agency or act as sales manager or representative of electrical and mechanical engineering firms, motor-car manufacturers, machine tools, automobile accessories; and also manufacturers of gas and chemicals, as he is familiar with these products. Payment, salary and commission basis. References.

Electrical Instruments (31,227).—An agency is desired by a commercial agent in Switzerland for the sale, of foodstuffs, machines, colonial products, iron articles, cotton, animal hair, electrical instruments and apparatus, typewriters, etc. Quotations should be given c. i. f. Genoa. Payment in Italian currency, account current, within 30 to 60 days. Correspondence should be in Italian, French or German. References.

Electrical Supplies (31,228). — A commercial agent in Spain desires to secure agencies for the sale of iron and steel sheets, hardware, electrical supplies, drugs and chemical products. Quotations should be given c. i. f. Spanish ports. Payment preferred 30 days from shipment. Correspondence should be in Spanish or French. References.

Electrical Material (31,269).—A firm in Spain desires to secure agencies for the sale of steel electrical material and supplies, copper, steel and iron wire, office supplies, cheap jewelry, rubber goods, etc. Correspondence should be in Spanish. References.

Turbines, Boiler Equipment (31,271).—An engineer in Belgium desires to purchase and secure an agency for the sale of industrial material and machines, turbines, boiler equipment, lathes, planers, shapers, etc. Quotations should be given c.i. f. Antwerp and Brussels. Terms, payment against documents or with bank credit. Correspondence should be in French. Reference.

Electric Light Plant (31,279).—The partner of a firm in Uruguay will shortly arrive in the United States and desires to secure agencies for the sale of textiles, industrial chemicals, medicinal and industrial oils, electric light plants for farms, automobiles, etc. Quotations should be given c. i. f. Montevideo. Correspondence may be in English. References.

Personals

Paul M. Lincoln Becomes Consulting Engineer of Lincoln Electric—G. T. Seely Joins Youngstown Utility—Changes

E. W. DOTY, formerly connected with Doty & Bienemann Public Utility Service, Columbus, Ohio, has become associated with Nau, Rusk & Swearingen, 901 American Trust building, Cleveland.

CHARLES S. HAMMOND, recently with Lockwood, Greene & Co., has joined the Georgia Railway & Power Co., Atlanta, Ga., in the capacity of power sales engineer, succeeding J. E. Mellett, resigned.

WILLIAM L. MOORHEAD, who recently resigned as vice-president of the Duquesne Electric Manufacturing Co., Pittsburgh, is now affiliated with Henry T. Parsons, who will conduct a general machinery business under the name of Parsons-Moorhead Machinery Co. at 237 Fourth avenue, Pittsburgh.

HAROLD H. SMITH, formerly electrical engineer with the Edison Storage Battery Co., has resigned to become chief engineer of the Transportation Engineering Corp., 200 Fifth avenue, New York. This company acts as railway distributor for Edison storage batteries, "Automatic" industrial trucks and tractors and accessories.

L. S. HORNER, vice-president of the Acme Wire Co., New Haven, Conn., has been honored with a special citation received from the Brtish Government, awarded in recognition of his war work as chief of the executive staff of the Bureau of Aircraft Production, engaged in the development and production of aircraft during the late war.

CAPT. C. E. GRUNSKY, JR., has resumed his engineering work in San Francisco with the C. E. Grunsky Co., a reorganization of the American Engineering Corp. Captain Grunsky had been with the U. S. Army for two years, during which time he saw active service at the front and supervised the valuation of war losses in French mines.

JOSEPH JACOBS, recently returned from overseas service with the U. S. Army, has resumed his engineering practice with offices at 1317-18 Smith building, Seattle, Wash. He will specialize, as heretofore, in diking, drainage irrigation and general water supply and land development projects, public utility valuations and engineering consultation in connection with cases before the courts.

CLIFTON R. HAYES, manager of the Fitchburg Gas & Electric Co., Fitchburg, Mass., has become associated with Charles H. Tenney & Co., Boston, engineers and managers of gas and electric light plants, as engineering manager of their system from Maine to New Jersey, with headquarters at Boston. Mr. Hayes is president of the New England Section of the National Electric Light Association.

PAUL M. LINCOLN, for many years commercial engineer of the Westinghouse Electric & Manufacturing Co., East Pittsburgh, has resigned from that organization to enter the consulting engineering field, and in that capacity will have active charge of motor application engineering for the Lincoln Electric Co., Cleveland, Ohio. Mr. Lincoln is well known in the electrical engineering profession and to him are accredited many notable pieces of engineering work, the following being perhaps the best known: The design and installation of the first hydroelectric power plant at Niagara Falls, the operation of which he subsequently directed for six years, and the development of the first high-voltage transmission lines. On this latter subject he is considered the best known authority in the world. He has also perfected many other notable inventions including the Lincoln synchronizer for paralleling large electric alternators for which he has received various medals and awards. He was elected president of the American Institute of Electrical Engineers in 1914 and has served for many years on the Board of Directors and on the Transmission Comittee of the Institute.

Paul M. Lincoln.

The work which Mr. Lincoln will take up with the Lincoln Electric Co. involves the entire problem of motor drive for machinery, and especially the determination of the proper type, characteristics and sizes of motors best adapted for direct connection to various sizes and types of machinery. After this problem has been worked out for each particular machine, the motor will then be direct-connected to the machine at the plant where the machine is made and delivered to the user as a complete, self-contained unit. The Lincoln company is indeed to be congratulated on securing the services of one who has had such extensive experience in the profession and unlimited ability to solve this very important problem in electrical and mechanical engineering; and it is expected that its solution will tremendously increase the efficiency of electric motor drive and will make for increased production and efficiency in general manufacturing work.

F. C. BIGGERT, JR., for a number of years chief engineer and second vice-president of the United Engineering & Foundry Co., Pittsburgh, has been made president of the company. He succeeds Isaac W. Frank, who recently resigned, but who will serve as chairman to the executive board. K. C. Gardner, former manager of sales of the rolls department, has been elected to succeed Mr Biggert as second vice-president.

C. J. COOPER, JR., who recently resigned as general manager of the Mineral Point Public Service Co., has become connected with the Chicago office of the Hoover Suction Sweeper Co., where he will engage in sales promotion work. Prior to his connection with the Mineral Point company, Mr. Cooper was superintendent of heating and assistant general manager of the Merchants Heat & Light Co., Indianapolis, Ind.

E. L. MILLIKEN, secretary and manager of the Houghton County Electric Light Co., Houghton, Mich., has resigned to become manager of the Houston Electric Co., Houston, Tex., and will handle street railway problems. Mr. Milliken is a native of Maine, and has spent the greater part of his business career with the Stone & Webster organization. While with the Houghton company, he had charge of both the street car system and extensive interurban lines and the lighting system, and the experience he has gained while engaged in this work eminently fits him for his new duties with the Houston company.

JOHN C. LYNCH, general superintendent of traffic of the Bell Telephone Co. of Pennsylvania, Philadelphia, has been promoted to the position of vice-president and general manager, succeeding L. H. Kinnard, now president of the company. He is a New Englander by birth, having been born Jan. 15, 1875, at Stockbridge, Mass. After attending Williams Academy he entered Cornell University, and was graduated from the latter institution with the degree of mechanical engineer in 1896. In the same year he entered the telephone business, his first position being traffic inspector for the New York Telephone Co. in Manhattan. A year later he was made assistant traffic manager of Franklin central office. After being transferred to other New York offices, he was made manager at Riverside in 1899, each of these positions being an advancement, carrying with it larger responsibilities. He was for six years traffic engineer of the New York Telephone Co., and later became division superintendent of traffic for the New York & New Jersey Telephone Co., which company was later consolidated with the New York Telephone Co. About 1909 when the organization of the New York "Up-State" Bell companies was effected, Mr. Lynch was largely instrumental in making the traffic force a highly efficient organization. In 1913 he removed to Philadelphia to accept the position of general superintendent of traffic, and continued in this capacity until his recent promotion.

GARRETT T. SEELY, for the last eight years assistant general manager of the consolidated system of Elevated Railroads of Chicago, has been elected vice-president and general manager of the Mahoning & Shenango Railway & Light Co., with general offices in Youngstown, Ohio. Mr. Seely, who is a native of Illinois, having been born in Oswego, is a graduate of Beloit College Academy (1895) and of the University of Illinois (1899). During his college days and after being graduated he did engineering work from 1896 to 1900 on the Atchison, Topeka & Santa Fe Railroad system in various parts of Kansas, Colorado and Oklahoma. In the latter year and until he became engineer of maintenance of the Chicago South Side Elevated Railroad in 1901, he was engaged in engineering on track elevation work in Chicago. He continued as engineer of maintenance till 1908, when he became assistant general manager of the South Side Elevated and in 1910 he was advanced to second vice-president and general manager of the same road. In 1911 he became assistant manager of the consolidated system of Elevated Railroads, a position which he relinquishes to become operating head of the combined railway, lighting and power system in northeastern Ohio and northwestern Pennsylvania with headquarters in Youngstown. Mr. Seely is a member of the Western Society of Engineers, the Chicago Engineers Club, the South Shore Country Club and the Flossmoor Country Club. He also has been active in the American Electric Railway Association and is third vice-president of the American Electric Railway Transportation and Traffic Association. Mr. Seely and his family will remove from Chicago to Youngstown about Dec. 1, when he will assume his new duties.

Garrett T. Seely.

RUSSELL W. STOVEL, who recently returned from France, where as lieutenant-colonel of engineers, he served as chief of the Terminal Facilities Division of the Army Transport Service, has been appointed a consulting engineer of Westinghouse, Church, Kerr & Co., Inc., New York City, and, as a member of that organization, will devote his entire time to the company's electrical and mechanical work. Mr. Stovel has had an unusually comprehensive experience in the electrical and mechanical problems connected with central power station and steam railroad electrification work, from the fundamental economics involved, to design, construction, equipment and operation, together with a most valuable experience in mechanical handling at docks and terminals. He was graduated from McGill University in 1897 with the degree of Electrical Engineer, and the following year entered the employ of Westinghouse, Church, Kerr & Co. He soon became an assistant engineer, then successively engineer-in-charge and mechanical engineer of the company, and finally a managing engineer.

Some of the important work handled by Mr. Stovel while with the Westinghouse, Church, Kerr company was the design and construction of the power plants of the Utah Light & Railway Co., Salt Lake City, Utah; Meriden Light & Railway Co., Meriden, Conn.; Edison Electric Illuminating Co., York, Pa.; the design and construction of passenger terminal and steamboat pier of the Canadian Pacific Railway, Vancouver, B. C.; the design of the proposed power station of the Pennsylvania Railroad at Harrison, N. J.; the design of extension to the power plant at Cos Cob, Conn., of the New York, New Haven & Hartford railroad; design and construction of the power plant of the Wabash-Pittsburgh Terminal, Pittsburgh, and the design and construction of the machine shop of the Chicago Railway Equipment Co., Chicago, Ill. In 1914 Mr. Stovel left the company to become managing engineer for Gibbs & Hill, consulting engineers, New York. For this company he had direct charge of the Paoli and Chestnut Hill electrifications of the Pennsylvania railroad, the Elkhorn Grade electrification of the Norfolk & Western railway, and the electrification of the New York Connecting railway.

Lieutenant-Colonel Stovel's work in France is well summarized in the following letter from his commanding officer: "Entering the service Oct. 6, 1917, and arriving in France on Nov. 8, 1917, this officer was assigned to duty with the chief engineer, Transportation Service, and in view of the excellent results obtained in his work in connection with the provision and installation of the electrical and mechanical equipment of the Transportation Service, was on Aug. 22, 1918, transferred to the office of the director, Army Transport Service, as electrical and mechanical engineer in charge of the Pier Utilities Branch of the Terminal Facilities Division. His grasp of the problems involved in providing adequate facilities to permit the discharge of 100,000 tons a day necessary to meet the proposed program of an army of 4,000,000 men in France was so complete that on Sept. 2, 1918, he was designated as chief of the Terminal Facilities Division and placed in charge of all matters relating to the procurement, maintenance and operation of all terminal facilities under the jurisdiction of the Army Transport Service, including all dock, wharf and warehouse structures, cranes, conveyors, tractors, and all other electrical and mechanical appliances and installations. His wide experience gained as an engineer in civil life, his high technical attainments, tact, energy and force brought immediate results, so that within a comparatively brief time he had reorganized the Terminal Facilities Division at the principal ports and had well in hand all matters pertaining to the provision, maintenance and operation of the required terminal equipment. To the untiring, farseeing work of this officer and to his splendid administrative abilities are due the excellent results obtained by the Terminal Facilities Division of the Army Transport Service." Mr. Stovel is a member of the American Institute of Electrical Engineers and the American Society of Mechanical Engineers.

Russell W. Stovel.

Obituary.

E. T. PARDEE, manager of the New York office of the Allis-Chalmers Manufacturing Co., passed away on Nov. 14 at the New York Hospital at the age of 50 years. He had been in poor health and had had a serious breakdown early this summer. On Thursday, Nov. 13, he was taken ill in his office and taken to the hospital where he died on Friday morning of cerebral hemorrhage. He was born at New Haven, Conn., May 28, 1869. He was with the old Fort Wayne Electric Co. in its early days as a salesman and for about the last 20 years had been connected with the Bullock Electric Manufacturing Co. and the Allis-Chalmers Manufacturing Co. He subsequently held the offices of manager of the Boston office, manager of the power and electrical department, manager of the Bullock Works, and since 1915 up to the time of his death served the company as manager of the New York office.

Financial News

Public Utility Companies Financing Extensions with Stock.

Despite adverse conditions affecting public utilities arising from war prices and fixed rates and fares, these corporations have been able to do considerable financing recently by means of stock issues sold to the public. Total amount of stock sold by public utilities corporations so far in 1919 is $53,601,490. This compares with $614,858,600 preferred and $514,948,500 common stock sold by industrial corporations.

Many utility corporations, particularly traction and gas companies, are in need of money for expansion purposes but owing to their curtailed earning power wherever they have been obliged to operate under rates and fares which prevailed before the war, financing cannot be successfully promoted at present time. The situation, however, is slowly but surely improving and through courts and public utility commissions many of the companies have been authorized to increase rates and fares to meet higher operating costs.

With improvement in the general situation it is expected that much new financing will be done by public utilities and their securities which have always as a class been regarded highly in peace times, will eventually work back to their former position.

Public Service Co. of New Jersey sold the largest amount of preferred stock during the year, $10,000,000 8% stock. This was offered to stockholders at par. Ohio Cities Gas Co. sold $9,187,500 of common stock which was the largest issue of that class floated.

Below is given a list of public utility corporations which have brought out preferred or common stock, from Jan. 1 to Oct. 31 this year, with rate and amount as compiled by Dow, Jones & Co.:

PREFERRED STOCK.

Corporation.	Rate.	Amount.
Public Service of New Jersey	8	$10,000,000
Pacific Gas & Electric 1st..	6	5,000,000
Cities Service N. Y. Class B...		3,000,000
Central Utilities Securities Co.	6	2,195,000
Hackensack Water Co.	7	2,000,000
Dixie Terminal Co.	6½	1,500,000
Gt. Western Power of Cal..	7	1,500,000
Dallas Power & Light Co...	7	1,000,000
Colorado Power Co.	7	1,000,000
Wash., Balt. & Annapolis Elec. Ry.	6	783,190
Erie Lighting Co.	7	500,000
Indiana Coke & Gas Co...	7	500,000
*Miscellaneous		1,349,200
Total preferred stock		$30,327,390

COMMON STOCK.

Ohio Cities Gas Co.	$9,187,500
Lone Star Gas Co.	4,000,000
Oklahoma Natural Gas Co.	3,000,000
Southern California Edison Co...	2,500,000
Turner Falls Power & Electric Co.	2,409,100
Hartford Electric Light. Co.	1,500,000
*Miscellaneous	677,500
Total common stock	$23,274,100
Total preferred and common stock	$53,601,490

*Aggregate of issues less than $500,000.

Rochester Railway & Light Changes Name.

At a recent meeting of the stockholders of the Rochester Railway & Light Co., it was voted to change the corporate name of the company to the Rochester Gas & Electric Corp. An increase in capitalization of $1,000,000 was also voted, making the authorized capital of the company $18,250,000.

E. G. Long & Co., 50 Church street, New York, manufacturer of electric railway metals, has filed notice with the Secretary of State of an increase in its capital from $50,000 to $100,000, to provide for proposed business expansion.

Foreign Finance Corporation Formed.

The Foreign Finance Corp., with an authorized stock capital of $10,000,000, has been formed primarily to invest funds in enterprises or securities which held forth promise of safe and satisfactory return.

This new corporation is backed by a powerful group of bankers. Arthur M. Anderson of the firm of J. P. Morgan & Co. will be president.

The board of directors will include J. P. Morgan, H. P. Davison, James S. Alexander, George F. Baker, Jr., George W. Davison, Harvey D. Gibson, Seward Prosser, Charles H. Sabin, James Stillman, Albert H. Wiggin and A. M. Anderson. The new corporation is incorporated under the laws of New York and will deal in securities of foreign countries and go into any field that looks safe and attractive.

General Gas & Electric Revenue Increase.

Preliminary statement of earnings of General Gas & Electric Co., comprising all subsidiaries acquired through recent reorganization, shows total operating revenue of $853,873 for October, 1919, which compared with $687,290 for October, 1918, is an increase of $166,583, or 24.2%.

The month of October indicated the largest kilowatt-hour output of any month since the new plant of the Binghamton Light, Heat & Power Co., a subsidiary, has been in operation. Total generation for the month was 1,726,960-kw-hr., while it is confidently expected that the 2,000,000-kw-hr. output mark will be reached before the end of the year.

According to advices from Columbus, Ohio, the Logan Natural Gas Co., one of the largest gas producing companies in the Middle West and which supplies the city of Sandusky through the Sandusky Gas & Electric Co., subsidiary of General Gas & Electric Co., has asked the State Public Utilities Commission to allow it to abandon its service in 50 towns and cities in the state of Ohio.

Standard Gas & Electric Balance on Common Stock.

Earnings of Standard Gas & Electric Co., subsidiaries, exclusive of oil properties, which are applicable to Standard Gas & Electric Co., compare as follows:

	12 mos. to Sept. 30.	6 mos. to June 30.
Gross earnings	$2,509,837	*
Net after taxes	2,434,030	$1,377,011
Surplus after charges	1,530,737	890,365
Balance after preferred dividends	662,355	446,404
Balance after mort. of disc.	607,355	*

*Not available.

The balance for the 12 months ended Sept. 30, 1919, is equal to approximately $2.40 a share, or 4.8% on the common, including the increased common stock issued in payment of 13% accumulated dividends on the preferred. In addition applicable net earnings from Shaffer Oil & Refining Co. for the first nine months of 1919 are estimated at $675,000 on the majority common stock in this company acquired by Standard Gas & Electric Co. as of Jan. 1, 1919.

On the basis of current earnings of Shaffer Oil & Refining Co., the Standard Gas & Electric Co.'s share for the full 12 months of 1919 should be approximately $900,000, while the electric light, power, traction and other departments should contribute approximately $890,000. The latter estimate is based on the showing for the first six months of 1919, during which period the earning power of the company showed improvement which has been steadily maintained since that time.

The total from all departments, including oil subsidiaries, should therefore show approximately $1,790,000 for the calendar year equal to about $7 a share, or 14% on the outstanding common stock, after payment of the regular 8% dividend on the cumulative preferred stock.

Arkansas Company to Issue Stock.

Permission has been granted by the Arkansas Corporation Commission to the Arkansas Light & Power Co. and the Pine Bluff Co., an auxiliary, to issue certain amounts of preferred stock and bonds. The Arkansas Light & Power Co. proposes to issue $150,000 of 7% preferred stock and $50,000 6% bonds, and the Pine Bluff Co. $25,000 7% preferred stock and $25,000 6% bonds.

DesChutes Falls Company to Operate in Oregon.

DesChutes Falls Power Co., capitalized at $5,000,000, has been granted permission by the State Corporation Commission to operate and will engage in a general business in the distribution of electricity for heat, power and light. The main offices of the company, which is organized under the laws of Nevada, are in Carson City, Nev. A. M. Wright, vice-president of the United States National Bank of Portland, is named as attorney in fact.

Pennsylvania Utilities Income Shows Increase.

Pennsylvania Utilities System, composed of the Pennsylvania Utilities Co., the Eastern Pennsylvania Power Co., and the Easton Gas Works, has issued a statement showing an increase of 33½% in operating income during the month of September, as compared with the corresponding month for the previous year. The operating income for this month in 1919 was $50,317.47, as against $37,696.73 in 1918. The operating revenues in this month for each respective year were $155,571.66 and $133,494.21. This is an increase of 16.5%.

Idaho Power Earnings Show Substantial Gain.

Earnings statement of Idaho Power Co., controlled by the National Securities Co., for the 12 months ended Sept. 30, 1919, shows surplus after interest charges and other deductions of $407,379, equivalent to $39.55 a share on the 10,300 shares of 7% cumulative preferred stock outstanding, which includes 320 shares held in the treasury.

This compares with $39.23 and $37.41 earned on outstanding stock for the 12 months ended August and July, respectively.

Earnings for September and 12 months ended Sept. 30 compares as follows:

	1919.	1918.
September gross	$ 191,544	$ 159,006
Net after taxes	107,528	88,601
Surplus after charges	73,491	49,786
12 months gross	1,700,189	1,483,375
Net after taxes	806,306	715,054
Surplus after charges	407,379	325,925

The company has a total installed generating capacity of 36,315 kw. in plants leased or owned. With one exception all plants are interconnected by a comprehensive system of transmission lines aggregating 1106 miles in length. The population served is estimated at 150,000.

Public Offered Louisville Gas & Electric Stock.

In order that consumers of gas and electric power in Louisville may become partners and share in the profits of the Louisville Gas & Electric Co., the company through its board of directors has authorized the sale to the public of $2,000,000 of preferred stock. The stock will have full voting power and the money thus raised will be used only for retirement of bonds and for additions and extensions.

J. W. Smiley is in charge of the sales, which will be made on the partial payment plan. There is no preferred stock outstanding at present as in the past the company has financed such improvements by bond issues. The object of the company, according to its announcement, is to make the largest possible number of householders, stockholders of the company and at the same time retain responsible and experienced management.

Business Increase of Pacific Gas & Electric.

Gross earnings of Pacific Gas & Electric increased from $8,947,162 for the year 1906 to $25,498,400 for the year ended Aug. 31, 1919. During the month of September no fewer than 4830 customers were added to the company's distribution lines, bringing the total number of customers served at Sept. 30, 1919, up to 500,994. This is exclusive of the 10,565 customers of the Northern California Power Co., Consolidated, who will be added to the line as an incident of the recent acquisition of the properties of that company.

The rapid growth of business in the Bay region is shown by the fact that the net gain in consumers during September was 1798 in the San Francisco district and 1471 in the Alameda County district.

An estimate of the use of gas in the shipyards of the Pacific Coast submitted at the convention of the Pacific Coast Gas Association, places the consumption at 78,000,000 cubic feet each month, bringing the producers an average revenue of $41,000. It is also estimated that from gas used in the preparation of various food products the revenues amounted to not less than 53½% of the total output, revenues from sales to the shipbuilding industry not exceeding 10%.

Dividends.

Nebraska Power Co. has declared the regular quarterly dividend of 1¾% on preferred stock, payable Dec. 1 to stock of record Nov. 20.

The regular quarterly dividend of 1¾% has been declared on preferred stock by the Colorado Power Co., payable Dec. 15 to stock of record Nov. 29. The regular quarterly dividend of ½ of 1% has also been declared on common stock, payable Jan. 15 to stock of record Dec. 31.

Southwestern Power & Light Co. has declared a quarterly dividend of 1¾% on preferred stock, payable Dec. 1 to stockholders of record Nov. 22.

A quarterly dividend of 1½% on preferred stock has been declared by the Northern Ohio Electric Co., payable Dec. 1 to stockholders of record Nov. 18.

Ohio Cities Gas Co. has declared a cash dividend of $1 per share, payable Dec. 1 to stock of record Nov. 29.

The Philadelphia Electric Co. has declared a quarterly dividend of 1¾%, payable Dec. 15 to stock of record Nov. 20.

Earnings.

NORTHERN STATES POWER CO.

Gross and net earnings of Northern States Power Co. of Delaware and subsidiaries for the month of September, 1919, and year ended Sept. 30, 1919, compared with corresponding previous periods, are reported as follows:

September:	1919.	1918.
Gross	$ 769,620	$ 656,774
Net	276,539	245,906
12 mos. ended Sept. 30:		
Gross	9,477,907	7,943,132
Net	4,053,820	3,286,316

WESTERN STATES GAS & ELECTRIC.

Comparative earnings of the Western States Gas & Electric Co. of Delaware and subsidiaries for the month of September and year ended Sept. 30, 1919, are reported as follows:

September:	1919.	1918.
Gross	$ 156,277	$ 131,749
Net	57,459	39,054
12 mos. ended Sept. 30:		
Gros	1,812,940	1,575,312
Net	750,775	624,945

KEYSTONE TELEPHONE CO.

(Combined earnings.)

	1919.	1918.
October gross	$ 142,548	$ 128,668
Net after taxes	44,789	49,731
Surplus after charges	15,338	21,175
10 months' gross	1,350,880	1,327,561
Net after taxes	442,129	544,758
Surplus after charges	148,678	257,891

CUMBERLAND CO. POWER & LIGHT.

	1919.	1918.
September gross	$ 250,318	$ 299,726
Net after taxes	95,391	107,643
Surplus after charges	39,780	36,401
12 months' gross	2,836,763	3,176,543
Net after taxes	833,871	950,328
Surplus after charges	113,066	97,044
Deficit after pfd. div.	24,934	40,956

HAVANA ELECTRIC RAILWAY, LIGHT & POWER.

	1919.	1918.
September gross	$ 792,317	$ 714,696
Net after taxes	401,597	391,455
Total income	409,848	406,918
Surplus after charges	263,853	228,464
9 months' gross	6,724,847	6,042,507
Net after taxes	3,402,232	3,277,160
Total income	3,481,842	3,385,117
Surplus after charges	2,119,243	1,914,155

NEBRASKA POWER CO.

This subsidiary of American Power & Light Co. reports earnings as follows:

	1919.	1918.
September gross	$ 200,548	$ 162,247
Net after taxes	67,754	59,143
Surplus after charges	38,617	33,975
12 months' gross	2,250,330	1,831,143
Net after taxes	771,338	689,401
Surplus after charges	503,380	458,180
Bal. after pfd. div...	258,380	213,180

PORTLAND RAILWAY, LIGHT & POWER.

	1919.	1918.
September gross	$ 706,479	$ 672,791
Net after taxes	239,917	196,306
Surplus after charges	50,786	8,173
12 months' gross	8,382,345	7,303,001
Net after taxes	2,803,412	2,658,809
Surplus after charges	536,263	467,428

ALABAMA TRACTION, LIGHT & POWER.

Earnings of Alabama Power Co., operating subsidiary of Alabama Traction, Light & Power Co., Ltd., compare as follows for September and 12 months ended Sept. 30:

	1919.	1918.
September gross	$ 258,552	$ 274,022
Net after taxes	125,690	110,142
12 months' gross	3,099,540	2,751,418
Net after taxes	1,711,054	1,519,219

TENNESSEE RAILWAY, LIGHT & POWER.

(Combined earnings.)

	1919.	1918.
September gross	$ 527,745	$ 557,768
Net after taxes	140,639	187,003
Surplus after charges	420	50,845
12 months' gross	6,345,136	5,808,198
Net after taxes	2,124,770	2,040,581
Surplus after charges	451,104	380,167

Above figures include operations of railway department of Chattanooga Railway & Light Co., for which receiver was appointed on April 18, 1919.

NASHVILLE RAILWAY, LIGHT & POWER CO.

This subsidiary of Tennessee Railway, Light & Power Co. reports earnings as follows:

	1919.	1918.
September gross	$ 274,181	$ 271,642
Net after taxes	69,125	97,564
Surplus after charges	30,021	57,339
12 months' gross	3,150,791	2,728,503
Net after taxes	802,174	983,493
Surplus after charges	329,200	496,935
Bal. after pfd. div....	204,200	371,935

CHATTANOOGA RAILWAY & LIGHT.

Earnings of this subsidiary of Tennessee Railway, Light & Power Co. compare as follows for September and 12 months ended Sept. 30. Earnings for the railway department, for which receiver was appointed on April 18, 1919, are included:

	1919.	1918.
September gross	$ 164,034	$ 173,242
Net after taxes	37,789	43,078
Surplus after charges	5,169	11,119
12 months' gross	1,872,329	1,677,838
Net after taxes	400,961	278,396
Surplus after charges	138,422	*50,684
Bal. after pfd. div...	6,734	*95,788

*Deficit.

BANGOR RAILWAY & ELECTRIC.

	1919.	1918.
September gross	$ 97,088	$ 83,952
Net after taxes	45,235	34,500
Surplus after charges	24,083	14,517
12 months' gross	1,018,697	924,778
Net after taxes	368,552	365,491
Surplus after charges	121,762	128,289
Bal. after pfd. div...	16,762	23,289

WEEKLY COMPARISON OF CLOSING-BID PRICES OF SECURITIES OF LEADING ELECTRICAL COMPANIES.

Quotations furnished by F. M. Zeller & Co., Rookery Bldg., Chicago.

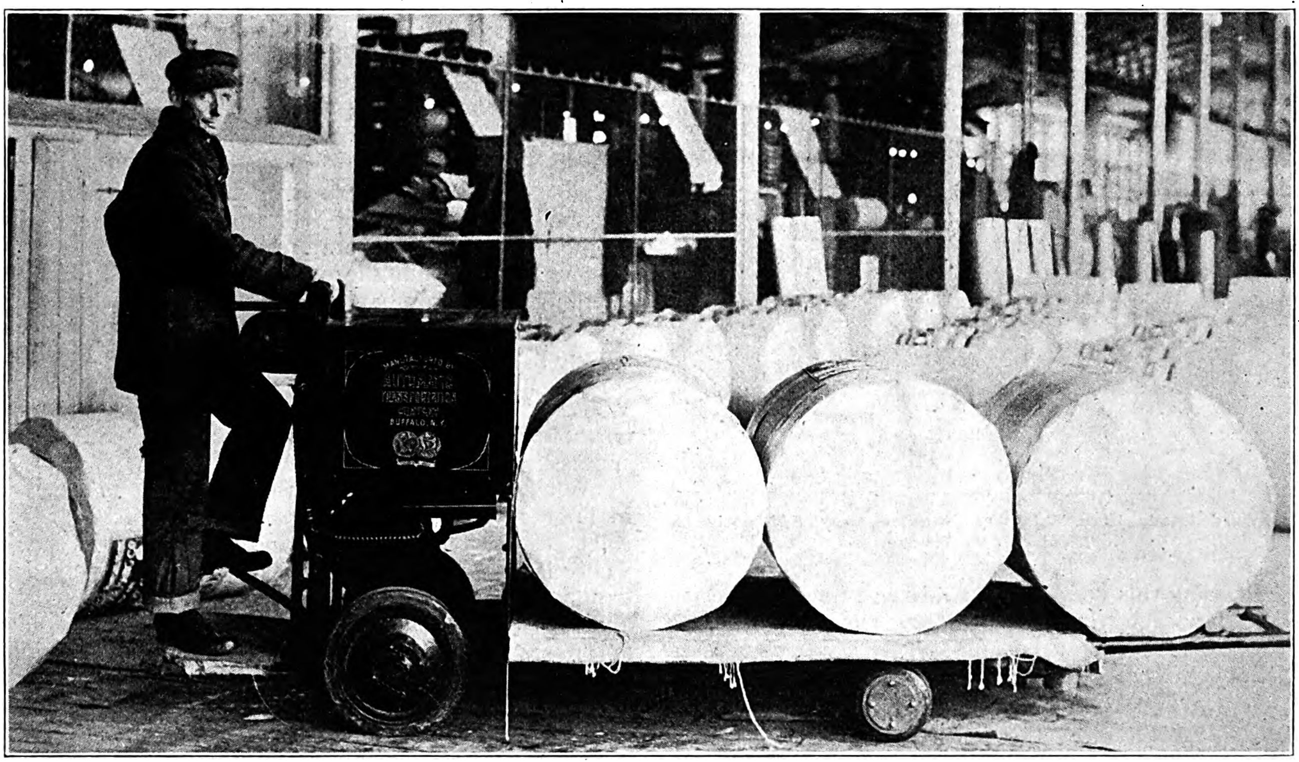
Public Utilities.	Div. rate. Per cent.	Bid Nov. 11.	Bid Nov. 18.
Adirondack Electric Power of Glens Falls, common	6	14	14
Adirondack Electric Power of Glens Falls, preferred	6	16	76
American Gas & Electric of New York, common	10+extra	126	125
American Gas & Electric of New York, preferred	6	40	39
American Light & Traction of New York, common	..	210	208
American Light & Traction of New York, preferred	6	93	93
American Power & Light of New York, common	4	54	59
American Power & Light of New York, preferred	6	72	71
American Public Utilities of Grand Rapids, common	..	8	8
American Public Utilities of Grand Rapids, preferred	7	25	23
American Telephone & Telegraph of New York	..	98⅝	100
American Water Works & Elec. of New York, common	..	5¼	5
American Water Works & Elec. of New York, particip	7	10	9
American Water Works & Elec. of New York, first preferred	..	53	50
Appalachian Power, common	..	4	4
Appalachian Power, preferred	7	20½	22
Cities Service of New York, common	+extra	455	437
Cities Service of New York, preferred	6	77½	76
Commonwealth Edison of Chicago	8	111	110¾
Comm. Power, Railway & Light of Jackson, common	..	23	23
Comm. Power, Railway & Light of Jackson, preferred	6	48	46
Federal Light & Traction of New York, common	..	9	7
Federal Light & Traction of New York, preferred	..	44	43
Illinois Northern Utilities of Dixon	6	..	..
Middle West Utilities of Chicago, common	2+extra	25	25
Middle West Utilities of Chicago, preferred	6	52	50
Northern States Power of Chicago, common	..	64	64
Northern States Power of Chicago, preferred	ex.div.7	90	90
Pacific Gas & Electric of San Francisco, common	..	62½	61
Pacific Gas & Electric of San Francisco, preferred	6	..	..
Public Service of Northern Illinois, Chicago, common	7	80	80
Public Service of Northern Illinois, Chicago, preferred	6	85	85
Republic Railway & Light of Youngstown, common	4	14	14
Republic Railway & Light of Youngstown, preferred	6	49	50
Standard Gas & Electric of Chicago, common	..	30½	30
Standard Gas & Electric of Chicago, preferred	6	41½	42
Tennessee Railway, Light & Power of Chattanooga, common	..	4	3
Tennessee Railway, Light & Power of Chattanooga, preferred	6	10	7
United Light & Railways of Grand Rapids, common	4	40	43
United Light & Railways of Grand Rapids, preferred	6	71	70
Western Power of San Francisco, common	..	22	21½
Western Union Telegraph of New York	extra	86	87¼
Industries.			
Electric Storage of Philadelphia, common	4	141	135
General Electric of Schenectady	8	170½	171½
Westinghouse Electric & Mfg. of Pittsburgh, common	7	55	54¾
Westinghouse Electric & Mfg. of Pittsburgh, preferred	7	..	..

Electrical Review

Vol. 75. No. 22. CHICAGO, NOVEMBER 29, 1919 Three Dollars a Year

Electrical Review
WITH WHICH IS CONSOLIDATED WESTERN ELECTRICIAN AND ELECTROCRAFT

VOL. 75—No. 22. CHICAGO, SATURDAY, NOVEMBER 29, 1919. PAGE 895.



Paper Rolls Are Difficult and Dangerous to Handle by Hand—The Electric Truck Handles Them Easily, Quickly and Safely.

Electric Trucks and Tractors in Printing Plants

Advantages of This Class of Apparatus in Printing Plants—Reasons for Its Special Consideration at This Time — Methods of Applying Electric Apparatus to the Handling Problems of Such Plants

By BERNARD J. DILLON

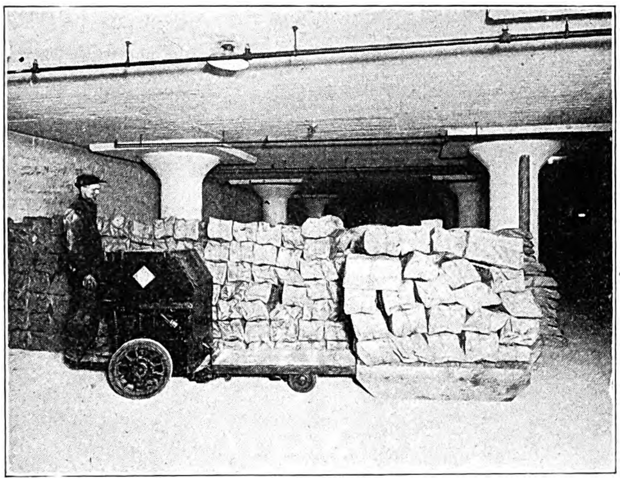
IN SOME respects the printing industry is among the most advanced along the lines of modern efficiency and in its adoption of mechanical methods as a substitute for hand labor. This is shown by the widespread adoption of modern typesetting and printing machinery of all kinds which is now in general use in the majority of plants and which represents a tremendous advance over the old-time manual methods and early crude machinery. It is also true that modern printing processes are a great improvement over the older processes not only with regard to efficiency of production but also in the quality of the results obtained.

Most of this advancement, except in a few of the later plants, however, can be partly attributed to outside influence. The adoption of modern printing machinery, for example, is as much, if not more, the result of the efforts of the manufacturers of such apparatus as it is of the printers.

From within the industry itself the advance in modern efficiency has been comparatively slow. This is shown by the poor lighting facilities usually found in print shops, despite the large amount of night work done, and by the layout of the machinery which is seldom arranged with a view toward securing the maximum of efficiency or production. In many other ways also the older practices still exist. When associated with modern machinery the inefficiency of such methods is even more apparent and complicated and, in addition, prevents realizing the advantages of the machinery to the fullest possible extent.

This latter condition applies particularly to the methods of handling employed in the great majority of printing plants at the present time. In all except a very few such plants the necessary handling of stock, type, forms and other materials is still accomplished by brute force and perseverance with manual labor that somehow is maintained in spite of its exorbitant cost and the difficulty of securing it.

In the majority of printing plants of any size it is safe to assume that the introduction of electric industrial trucks or tractors offers a valuable means of overcoming this condition. And right now is an especially favorable time to consider them. Competition in this field is very keen and largely on a price basis. Many new plants are being established wherein modern efficiency methods will prevail, and to meet this competition the older plants are being remodelled and enlarged and are adopting every possible means to improve their efficiency.



Awkward Loads Like This Are Handled Very Efficiently by Electric Lift-Trucks.

On account of the various types of printing establishments the real advantages of electric industrial handling apparatus can only be realized by a thorough investigation of the local conditions in each plant. However, it is worthy of careful consideration in every case for such apparatus offers one of the best means of reducing costs without making any expensive plant changes. Central-station men, contractors and others of the electrical field should also accept this opportunity of promoting the use of electric handling apparatus, for not only will it result profitably for them but in the majority of cases they will render a valuable service to the printers as well.

The principal advantages to be derived by the application of electric industrial trucks or tractors to the handling problems in the printing industry are: An actual dollars and cents saving in handling costs which can be easily determined; an opportunity for increased production and efficiency which is also especially desirable and which in many cases is even greater than the first; fewer and better workmen will suffice. These are more contented and satisfied with the result that the losses due to labor turnover are reduced.

The extent of the actual savings in labor will, of course, depend upon the amount of handling done and the conditions under which it is done. Modern printing machinery has eliminated handling to a great extent by multiplying the operations performed on one machine. In every establishment, however, there are usually performed several distinct operations frequently in different rooms or on different floors. Transferring materials for these various operations involves a considerable amount of hand labor that can be avoided by the use of an electric industrial truck or tractor.

The first handling operation in a printing establishment is the carrying of paper stock from the receiving platform to the storage space. Where flat-bed presses are used the paper stock is received in sheets of various sizes either in ream lots or in cases, according to weight. Usually the stock is uncrated and left to season and dry out before being used. The paper is then placed on skids or four-wheel trucks. Two-wheel hand trucks cannot be used generally due to the size of the sheets and because the possibilities of damaging the stock by such handling are very great. This operation, therefore, presents an ideal field for the elevating-platform truck or tractor. When used for such work either type will replace the labor of six or more hand-truck operators and perform the work quicker and without the confusion, crowding and rehandling that accompanies such operations when done by hand. In addition, it will often save further rehandling for enough stock can be piled on a truck or skid to make it unnecessary to unload and repile it. Where the stock must be piled very high, however, portable piling machines can be used with great success.

Where web presses are used the stock is received in huge rolls weighing up to 1800 lbs. each. These rolls are very difficult to handle or place in stock. There is also an element of serious danger involved in handling them by hand due to their tendency to slip and roll. As a rule, the rolls are placed on low dollies and pushed from place to place or rolled one at a time. In either case their transfer is a slow, tiresome process usually requiring two men to a roll. In an accompanying illustration an electric truck is shown carrying three such rolls. This does not overtax the truck's capacity and the rolls can be carried at a rate of about six miles per hour with ease and safety. It can also carry them up grades as high as 30% which will permit piling the rolls if a runway is available.

Only a very few printing houses, however, are in a position to use an electric truck profitably for this receiving operation alone. They must also be used to transfer the paper from the stockroom to the presses and usually for further operations as well. The first of these operations—that of carrying stock from the stockroom to the presses—involves practically the same conditions as those of receiving except that the length of haul is usually greater and elevators must be used more often. In many cases it will be found that the elevator capacity is not sufficient to accommodate the electric and its load at the same time. This condition can usually be met by carrying the electric and the stock separately or by using separate electrics on the various floors. For carrying directly to the press the electric offers the advantage that the stock can be placed in the most convenient position for the operator and the aisles and floor spaces in the vicinity of the machines can be kept clear.

After leaving the presses the number of operations through which the stock must be taken depends entirely upon the nature of the work. Usually there are several which include stuffing or gathering, binding, etc. Careful handling is essential in all these operations and the stock is usually very awkward to handle in this semi-finished condition. The greater power of the electric is, of course, a very desirable feature for such handling. Huge loads of stock can be carried quickly and smoothly without any jerking or jarring and the operator can easily avoid any obstacles or rough places without exerting himself in the least. He will, therefore, take greater pains to transfer the load without danger.

In transferring the finished product to the mailing and shipping rooms the electric is also very useful and efficient. Its advantages are especially desirable when facilities for such operations are limited, for the product can be kept in motion continually and overcrowding avoided.

The principal objection to the use of electric industrial trucks or tractors offered by printers is that common to all industries but is especially apparent in this —that is, that the aisles and passageways are too narrow and crowded to permit the use of the electric. This condition is usually exaggerated. The modern electric industrial handling equipment is so flexible in respect to steering and control that there are very few places where a hand truck is used that an electric cannot be used also. The majority of electrics can be turned around in a very short radius and their ability to go in either direction enables them to get into and out of very cramped quarters quickly and without endangering the adjacent walls or materials. Moreover, with electrics the materials can be handled more efficiently with fewer trucks which, in a large measure, will relieve crowding and congestion in the aisles and passageways.

In addition to the handling of paper stock there are many other materials to be handled in printing plants for which an electric is desirable, principally the handling of type and forms. These are composed chiefly of lead and are very heavy, an average 16-page trade magazine form weighing about 400 lbs. They are also bulky and difficult to handle by hand. Furthermore, they must be handled carefully for the type metal is soft and any marring or scratching will ruin it. For this, as well as for the other handling problems, the electric not only offers a more efficient and practical method of handling but reduces the possibilities of personal injury to the employes to a considerable extent.

There are also many other advantages to be obtained by the use of an electric industrial truck or tractor in printing houses, chiefly of a general utility nature, such as the moving of exceptionally heavy machinery or large parts. Very few such plants are equipped with cranes or other means of power handling and this work is usually accomplished by utilizing all the man power available. When an electric is used a little ingenuity on the part of the operator will often permit of such unusual operations being conducted quickly and without drawing on the strength of workmen who should be employed in other and more essential duties.

It is not to be expected that many printing plants can use a separate truck or tractor for each of these operations or for any one of them alone. When the amount of handling operations is considered, however, and the advantages of the electric applied to all or part of them, the possibilities of this apparatus in this field can readily be seen. The majority of electric industrial trucks or tractors on the market now are very sturdy, reliable, durable and efficient. Under ordinary conditions they will save the labor of six or eight men for a small portion of the present cost of hand labor. The operators, however, should be carefully chosen; they should be competent and careful and should be given complete charge of the equipment.

Nor is it to be expected that in every case the saving in labor alone will suffice to provide for an electric. In many cases the increase in efficiency or production or the maintenance of labor is the deciding factor.

One of the greatest advantages which the electric industrial truck or tractor offers for use in printing plants is that it eliminates a large amount of rehandling. Almost every time paper is handled a certain proportion of it is lost due to the fact that it is soiled in the operation. In large establishments the amount lost in this way is considerable and rehandling is avoided wherever possible. Where an electric is used this rehandling is reduced to a minimum, for the stock can be loaded in large quantities on skids or trucks and left to be transferred by the electric without any loading or unloading.

Another decided advantage is the ability of the electric to keep the stock moving and keep the machines supplied with work. It is not necessary for the operator to stop his machine to wait for supplies or go after them himself. This provides a maximum of production efficiency with a minimum of lost time. The printers are also better satisfied for they are not called upon to do any extra hard work and they can keep at the work for which they are specially employed.

As a means of solving the labor problem the electric also offers many advantages. Labor nowadays is not only high in cost but very hard to maintain. It will not perform the strenuous work it formerly would. In addition to relieving the workmen of the harder and more difficult tasks the introduction of an electric also has a certain moral effect that causes the men to be more contented and satisfied; for it is an indication from the management that it endeavors to relieve them of the hard work and its dangers of developing hernia and causing accidents. Those that are employed can also be paid higher wages without increasing the handling expense to any extent. As a result a better and more efficient class of workmen can be maintained which will do away with many of the labor troubles encountered and the losses due to excessive labor turnover.

Crowded and Congested Aisles Are Typical of Printing Establishments—This One Is Exceptionally Clear—They Can Be Kept Even More Clear Where Electric Handling Equipment Is Used.

Central-Station Rates in Theory and Practice

Twenty-First Article—Geometrical Analysis of Rate Schedules—Principles of Three-Dimensional Representation of Rates—Typical Examples Using Solid Models

By H. E. EISENMENGER

This series of articles, of which the present is the twenty-first, was begun in the issue of July 12. Part I consisted of seven articles on the cost of electric service. Part II included six articles on the general principles governing the choice of a rate system. Part III contained six articles describing various rate systems. In Part IV, of which this is the second half, it is shown how rate systems can be analyzed. The remaining four articles will constitute Parts V and VI, dealing respectively with accuracy of rates and the current practice of rate regulation by utility commissions.

PART IV—RATE ANALYSIS—Continued.

II. Geometrical Rate Analysis.*

SECTION 164. A rate system is nothing but a statement of the way in which the amount to be paid by the customer varies with his maximum demand and with his energy consumption.[1] We have therefore three variable amounts: the maximum demand *d*, the energy consumption *e* and the amount of the bill *a*. Some rate systems do not take cognizance either of the demand or of the energy consumption (pure meter rates and flat demand rates, respectively). In those cases we have therefore only two variables and we can demonstrate the way in which one of the two variables depends on the other one, by a graphic representation in a plane (see Figs. 4 and 5). If we want to extend the graphic representation to rates that are based on both demand and energy consumption we must add a third dimension. The rate will be represented by a surface in space or in other words by a solid model.

To explain this more fully: In Figs. 4 and 5 we stepped off the energy consumption to a certain scale in horizontal direction and the amount of the bill in vertical direction. We had, as it is termed, two *axes* standing normal upon one another. Now we will have to add the demand in another horizontal direction (assuming this page to be held vertically in front of the reader) normal to the direction in which the energy consumption has been stepped off, that is normal to the plane of the paper. We thus get three axes *OA*, *OD* and *OE*, of which each one stands normal to the two others, like three edges of a cube which meet in one point (Fig. 9). Given now a customer with a certain demand *d* and a certain energy consumption *e*, we choose a scale for the demand, for instance we say that every inch shall represent 10 kw. We then measure off the number of inches which corresponds to the given demand *d* from *o* in the direction towards *D*. Let this length be *Od* and we thus arrive at the point *d*. From this point we draw a parallel to *OE*, shown as *DE'* in Fig. 9. In the same manner as above we choose a scale for the energy consumption and step off on the parallel *dE'* the length *dP* corresponding to the energy consumption of the customer. We thus reach the point *P*.

Point *P* is called the characteristic point of the customer. As soon as the customer changes either his demand or his energy consumption, or both, his characteristic point will shift to another position. Fig. 10 shows the bottom plane *ODE* viewed vertically downwards from above. If we connect *P* with the origin *O* by a straight line all customers whose characteristic points are situated anywhere on this line (or its production beyond *P*) evidently have the same load-factor e/d as the customer with the point *P*. The smaller the angle λ is the smaller is the load-factor of all the customers whose characteristic points lie on that line. For the load-factor $l = e/d = 0$ the angle $\lambda = 0$, but for $l = 100\%$ the angle λ is not 90° as might be expected on superficial observation, but it reaches a certain maximum value λ_{max} which is smaller than 90°. Just how large it is depends on the scales which have been chosen from *d* and *e*, but it must of necessity always be smaller than 90°.

If we step off now in the vertical direction from the characteristic point of a certain customer the amount *a* (to a certain scale which we are free to choose) we get a point in space above the plane (*Q* in Fig. 9). The position of this point in space determines the customer's demand, his energy consumption, and the amount he has to pay for both, under the system of rates under investigation.

*The principles of geometrical rate analysis were first brought out by the author in the 1911 report of the National Electric Light Association Rate Research Committee.

[1]Engineers and other readers who are more familiar with mathematics may skip Section 164, and substitute the following briefer statement in lieu of the same: Mathematically expressed a rate system is nothing but the function $a = f(d, e)$. This function contains three variables *a*, *d*, and *e* so that three dimensions are necessary for a graphical representation. Demand *d* and energy consumption *e* are used for the horizontal axes of an orthogonal system of axes in space and the amount *a* is stepped off in the vertical direction. We thus get a surface in space representing the function $a = f(d, e)$. The surface and the rate determine each other.

Every customer is characterized by his "characteristic point" *P* on the bottom plane. The co-ordinates of this point are the customer's demand and energy consumption. The locus of the characteristic points of all customers with the same load-factor is a straight line drawn from the origin at an angle λ with the axis of *d*, where $\tan \lambda$ is proportional to the load-factor *l*. Consequently where $l = 0$ this line is identical with the *d*-axis, whereas for $l = 100\%$ it is not identical with the *e*-axis, but includes a certain angle λ_{max} with the *d*-axis. The size of λ_{max} depends on the relation of the scales for *d* and *e*. Any portion of the bottom plane as well as of the surface in space for which $\lambda > \lambda_{max}$ has no meaning in practice.

Now all rate systems, with practically no exception, are of such a nature that the function $a = f(d, e)$ is of the first order so that the surface representing the rate is a plane, at least for all customers within a certain range of demand and energy consumption. For other ranges we get another function for $f(d, e)$ which also, however, is of the first order so that the surface for all customers is a combination of planes.

If we now do the same thing as just described for every point on the bottom plane the upper ends of all the vertical lines will form a surface in space which determines and represents the demand-energy rate in the same manner as the plane curves of Fig. 4 or 5, for instance, represent pure meter rates. Instead of the surface we can also speak of the total space between the surface and the bottom plane, that is of a solid or of a solid model, always meaning, of course, in this case the upper surface of the model.

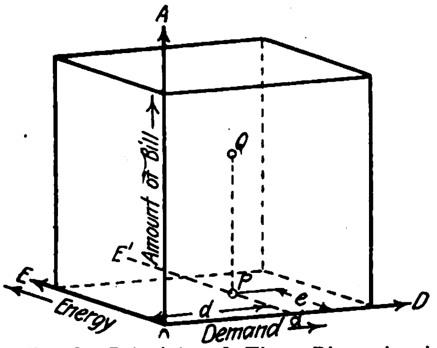


Fig. 9.—Principle of Three-Dimensional Rate Representation.

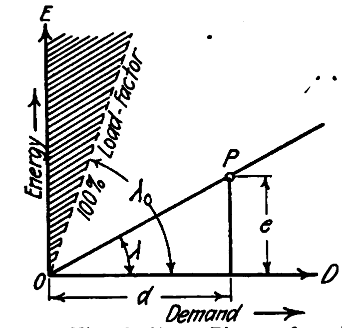


Fig. 10.—The Bottom Plane of a Rate Model.

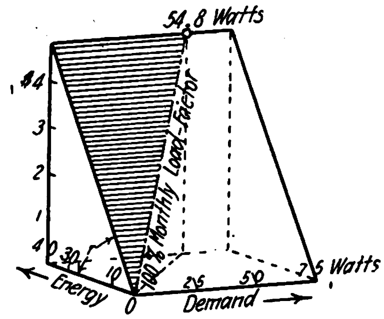


Fig. 11.—Straight Meter Rate.

A few examples will make this clearer.

165. One of the simplest cases is the straight meter rate. The charge is proportional to the energy consumption and independent of the demand. This rate is obviously represented by a plane passing through the demand axis and sloping at a certain angle r from the bottom plane upwards. Fig. 11 is, for instance, the model of a 12-cent per kw-hr. rate.

In designing a model of a rate we have first to decide over what portion of the bottom plane the model is to extend. Fig. 11, for instance, extends over the range from 0 to 75 watts demand and from 0 to 40 kw-hr. energy consumption. At $e = 40$ kw-hr., that is, at the rear end of the model the amount to be paid is $12 \times 40 = 480$ cents ($4.80) for any demand d.[2] The part of the solid which corresponds to load-factors of more than 100%, and which therefore has no practical meaning, is shaded in the drawing of this and the following models. It is found in the following manner: For 40 kw-hr., for instance (rear plane of the model) we have 100% load-factor (730 hours' use per month) at $d = 40{,}000$ watt-hours/730 hours $= 54.8$ watts. Place a vertical plane through this point and the origin O; the line of intersection of this plane with the surface of the model is the 100% load-factor line.

A similar surface or solid would represent a flat demand rate except that this model would have to be turned around by 90° with respect to the former, see Fig. 12.[3]

Supposing now that we have a Hopkinson rate, then it becomes clear that we will get a combination of the planes shown in Figs. 11 and 12. The plane will be in such a position in space that the angle r corresponds to the energy charge and the angle s to the demand charge (Fig. 13). A large energy charge will result in a large angle r and vice versa. The same applies to the relation between the demand charge and the angle s.[4]

The next example is logically the Doherty three-charge rate. The difference from the Hopkinson system is that a customer charge of constant size (to be called x) is added to the charges of the Hopkinson system.[5] This means that the plane of the Hopkinson system will simply have to be lifted up parallel to itself over a distance corresponding to the amount x (to the scale previously chosen) and if the demand and the energy charges are to be lowered the angles r and s will have to be made smaller. The plane or model will assume the general shape of Fig. 14.

166. Without going into theoretical details[6] we will investigate now how the plain Wright demand rate looks in this space representation, for instance a rate charging 10 cents per kw-hr. for the first 30 hours of use and 5 cents per kw-hr. for the balance. Assuming first a customer with a fixed demand of 1 kw. it is evident that the quoted Wright rate will be

[2]By mathematics: $a = f(d, e) = ze$, that is the equation of a plane passing through the axis of d and sloping at an angle r from the bottom plane, where $\tan r = z$.

[3]Mathematics: $a = f(d, e) = yd$, that is the equation of a plane passing through the axis of e and sloping at an angle s from the bottom plane, where $\tan s = y$.

[4]Mathematics: The equation of the plane in space is $a = yd + ze$. (It should be remembered that the co-ordinates are here not called x, y and z, as usually, but d, e and a, respectively, whereas x, y and z are co-efficients). The trace on the a-d plane of co-ordinates is found by setting $e = 0$ in this equation, resulting in $a = yd$. Likewise the trace on the a-e plane is found as $a = ze$. These two traces rise therefore at angles r and s from the horizontal which are determined by $\tan r = z$ and $\tan s = y$. The traces determine the position of the plane in space.

[5]Of course, if this shall not simply mean making the rates simply so much higher to every customer, the kilowatt-hour charges or the kilowatt charges, or both, will have to be lowered, just as the kilowatt-hour charges of a straight meter rate have to be lowered if we change over to a Hopkinson rate by adding a demand charge.

[6]For these see the author's article on "Space Representation of Central-Station Rates," *Electrical World*, Nov. 4, 1911.

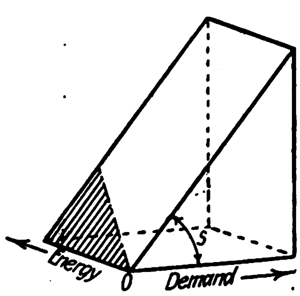


Fig. 12.—Flat Demand Rate.

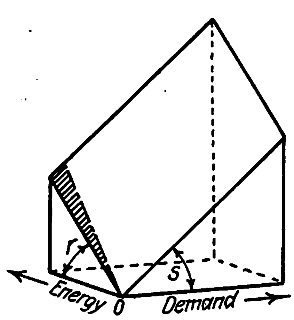


Fig. 13.—Hopkinson Rate.

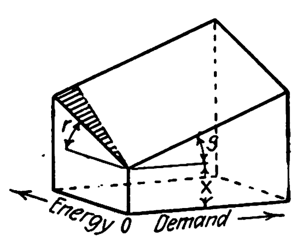
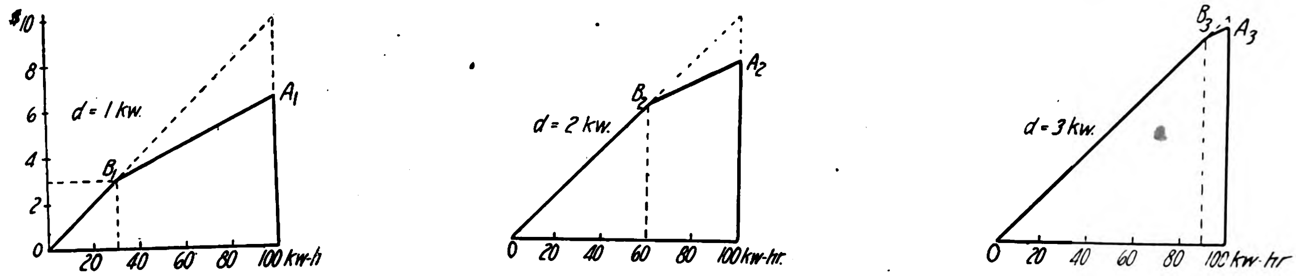


Fig. 14.—Doherty Rate.

a block meter rate for all such customers (demand 1 kw.) charging 10 cents per kw-hr. for the first 30 kw-hr. and 5 cents per kw-hr. for the excess (See Fig. 15a, also Insert XII). For every customer with 2 kw. demand the Wright rate is the equivalent of another block meter rate, viz., 10 cents per kw-hr. for the first 60 kw-hr. and 5 cents per kw-hr. for the excess (Fig. 15b). For 3 kw. demand we get Fig. 15c, etc.



Figs. 15a, 15b and 15c.—Wright Demand Rate—Monthly Bills for Various Customers with Various Maximum Demands.

Supposing now that we cut these diagrams Fig. 15a, 15b, 15c, etc., out of stiff cardboard and arrange them behind one another in proper order and at distances from each other corresponding to 1 kw., as shown in Fig. 16. The interstices between these cardboards are then filled in by more cardboard diagrams representing the rate for customers with fractional-kilowatt demands, for instance 1½ kw., then 1¼ and 1¾ kw., etc., at the proper spacing, until we finally get a solid block of cardboards (Fig. 17). Then this block evidently represents the space model of the rate. Every point on the bottom plane is determined by the customer's demand and energy consumption and the vertical distance from there to the upper surface is the amount paid by the customer.

This surface consists of two planes ODB and $OBAF$ which intersect in the straight line OB. Plane ODB represents a straight meter rate. $OBAF$ is a Hopkinson plane (compare Fig. 13), as can be easily seen if we produce that plane until it intersects the vertical plane passing through axis OD (point E and dot-and-dash lines in Fig. 17). The line of intersection OB between the two planes where the 5-cent charge begins, corresponds of course to the 30-hour load-factor, this means that if we project it down on the bottom plane we get the 30-hours load-factor line.[7]

To construct this model the simplest way will be to proceed in the manner indicated above by the cardboard diagrams. We would place the last cardboard $D_3B_3A_3$ at the proper distance from the origin O (Fig. 17) and pass the plane ODB through DB and the point O (primary plane) and then pass $OBAF$ (secondary plane) through O and AB, or through O and AF. A check of the correctness will hardly be necessary in this simple case, but we could check whether the secondary plane $OBAF$ actually is identical with the Hopkinson plane as computed.

167. Turning now to a somewhat more complicated example, that of the St. Louis Residence Lighting rate, described and partly discussed in Section 161, we have in range 1 (see Fig. 8) a straight meter rate, of course. Ranges $2a$ and $3a$ have been found by the algebraical analysis to be represented by Hopkinson planes. The rate schedule is therefore equivalent to a simple three-block Wright demand system for all customers whose demand element does not exceed 4 rooms. If the demand is greater than 4 rooms, we have in range $2b$ a Doherty plane (see the inscription in range 2b of Fig. 8). This plane may be constructed in several different ways, one of which is this: The point of the rate surface corresponding to point A in Fig. 8 must be a point of the plane under construction. It belongs to range 1 as well as to range $2b$ (and incidentally to $2a$). The number of rooms corresponding to this point is 4, consequently the number of kilowatt-hours is 4×4 because the point lies on the dividing line. The amount to be paid is $4 \times 4 \times 12 = 192$ cents,[8] computed from range 1. We have thus located one point of the plane for the range $2b$ and in an entirely analogous way we can determine two more points of the plane, for instance those corresponding to B and M_1 of Fig. 8. Points on the dividing lines are of course preferable because they can be used for the determination of more than one plane and thus the work is simplified.

The whole model of the St. Louis residence rate (modified as per footnote 8) looks like Fig. 18.

168. The stipulation of a minimum bill in a rate schedule means that, whatever the rate surface may

[7]The mathematics of the case is as follows: Call p the primary charge in cents per kw-hr. and s the secondary charge and let l be the load-factor up to which the primary charge applies. Then we have in the primary range $a = pe$ and in the secondary range $a = p\,l\,d + s(e - ld) = (p - s)ld + es$. This means, in the secondary range we have a demand charge of $(p - s)l$ and the energy charge is s cents per kw-hr. We will therefore have in the primary range a straight meter plane and in the secondary range a Hopkinson plane with $\tan r = s$ (secondary energy charge) and $\tan s = (p - s)l$.

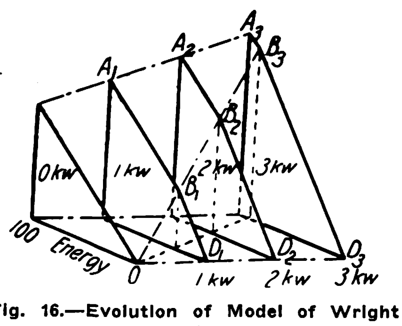


Fig. 16.—Evolution of Model of Wright Demand Rate.

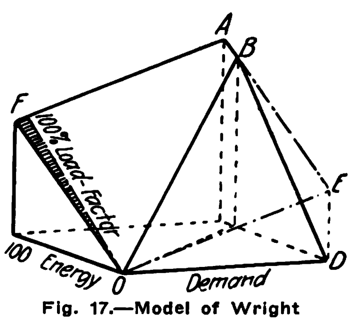


Fig. 17.—Model of Wright Demand Rate.

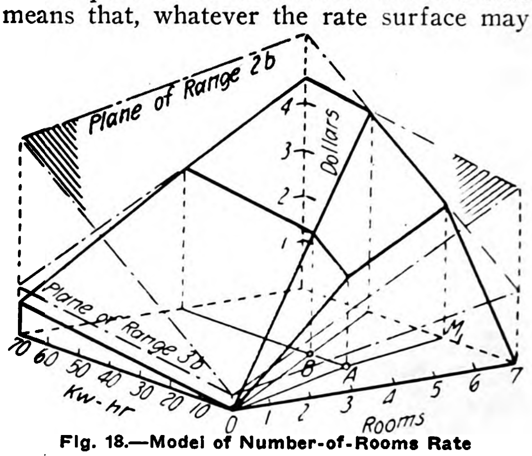


Fig. 18.—Model of Number-of-Rooms Rate (12-6-1c/kw-hr.).

be, no parts of it shall be considered which are nearer to the bottom plane than the distance corresponding to the amount of the minimum bill. We therefore draw a horizontal plane at that distance above the bottom plane and wherever that plane is higher than the surface of the model it replaces the latter. To demonstrate how this works out, Fig. 19 shows a model of a Wright demand rate[9] with a minimum charge (of $1), indicating also in the ground plane Fig. 19a in which range the minimum bill applies.[10]

Fig. 20 is the same Wright rate with the stipulation of a certain minimum number of kilowatt-hours instead of a minimum bill. Suppose, for instance, the rate would say that, whenever the actual energy consumption is less than 20 kw-hr. it shall be figured as being 20 kw-hr. for billing purposes. Then we have to draw a vertical plane *PQQ'20* normal to the axis of energy and at a distance from the origin *O* which is equal to the stipulated minimum number of kilowatt-hours (20 kw-hr. in our example). From every point of the line of intersection between this vertical plane and the rate surface we draw a horizontal line parallel to the energy axis. All these horizontal lines together then form a set of planes *pp'q'q*, *qq'r'r* and *rr's's* (Fig. 20) which determine the minimum charge. Fig. 20a shows the range of the minimum charge in this case.

We see from this at once the difference between a minimum bill and a minimum number of kilowatt-hours for billing purposes (see end of Section 108).

The stipulation of a minimum demand which is also sometimes found in practice results in an analogous set of planes to those shown in Fig. 20, but on the kilowatt-hour side of the model instead of on the kilowatt (or watt) side.

The stipulation of a minimum load-factor to be taken into account for billing purposes results (with the same simple Wright demand schedule) in a model like Fig. 21 (no load-factor considered for billing purposes smaller than 20 hours' use per month).

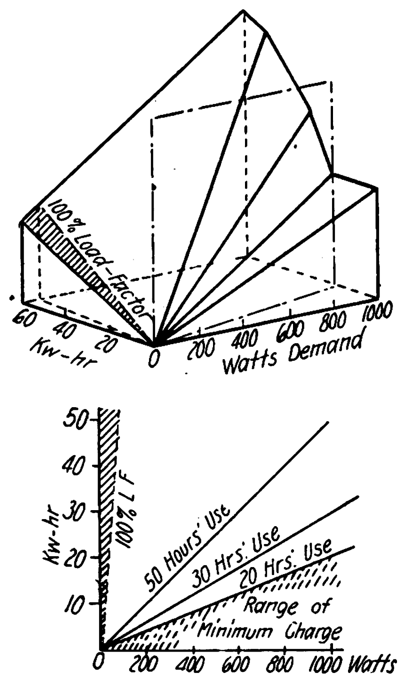


Fig. 19.—Minimum Charge.
Fig. 19a.—Plan of Fig. 19.

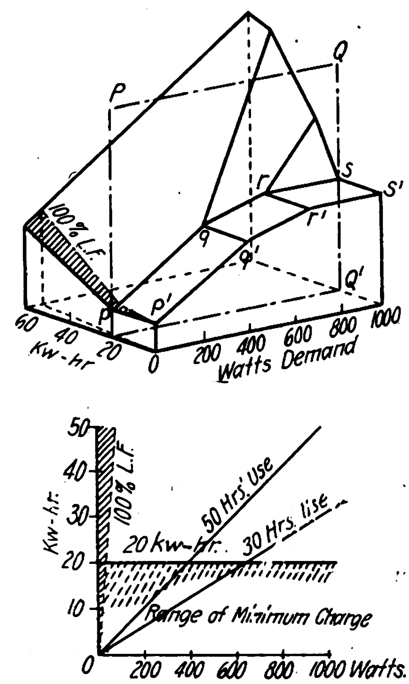


Fig. 20.—Minimum Energy Consumption.
Fig. 20a.—Plan of Fig. 20.

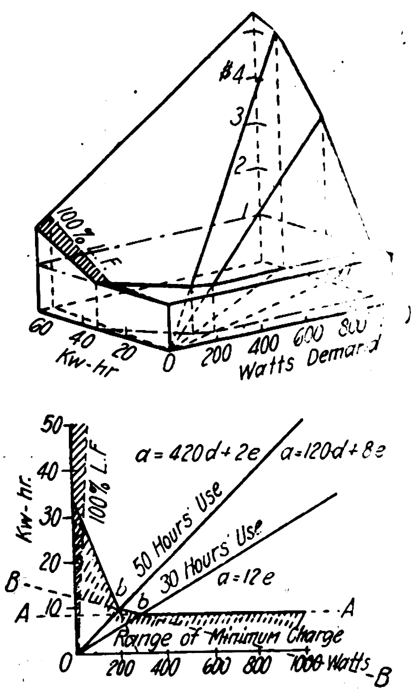


Fig. 21.—Minimum Load-Factor.
Fig. 21a.—Plan of Fig. 21.

It requires no further detailed explanation to show how a combination of minimum charges expresses itself in space representation. For instance, it may be stipulated that under the Wright schedule just discussed (Figs. 19 to 21) the minimum number of kilowatt-hours to be paid must correspond to a monthly use of the maximum demand of at least 20 hours, and that moreover no bill shall be made out at less than $1. The two minimum-charge steps of Fig. 19 and Fig. 21 will then combine in such a manner that that step applies which is the higher one of the two at the respective point of the bottom plane, in other words on the left portion of the model (small demands) the $1 minimum step (Fig. 19) will apply and for larger demands the load-factor-minimum applies. The demand at which the two "minimum" steps intersect one another can be found either graphically or by computation as

$$d_1 = \frac{\text{100 cents per month}}{\text{12-c/kw-hr.} \times \text{20 hours per month}} = 0.4166 \text{ kw.} = 416\ 2/3 \text{ watts.}$$

169. Fig. 22 shows a model of the rate referred

[8]To exhibit more plainly the characteristic qualities of this type of rate, the St. Louis rate has been arbitrarily modified for the construction of the model Fig. 18 from a 8-6-3-cent rate to a 12-6-1-cent rate which makes the angles between the various planes greater. The ground plane is unchanged.

[9]Assumed charges are 12 cents per kw-hr. for the first 30 hours' use, 8 cents per kw-hr. for the next 20 hours' use and 2 cents per kw-hr. for the excess.

[10]This range in which the minimum bill applies can be found either graphically from the tracing of the model itself or, if greater accuracy or a check would be required, it can also be computed, in the following way:

In the primary range where $a = 12e$ we get by setting $a = 100$ cents, $12e = 100$ and $e = 100/12 = 8\ 1/3$ kw-hr.; this means a straight line *AA* (Fig. 19a), normal to the axis of energy consumption (kw-hr.) and at the distance 8 1/3 kw-hr. from the origin. In the secondary range we have the equation of the rate surface $a = (12 \times 30d) + 8(e - 30d) = 120d + 8e$ and setting this = 100 cents we get $120d + 8e = 100$. This is the equation of the straight line *BB* in Fig. 19a. The portion *bb* between the 30-hour and the 50-hour load-factor lines determines the range of the minimum charge in the secondary range of the rate. To construct this line $120d + 8e = 100$ we find its intersection points with the axes of abscissae (watts) and of ordinates (kw-hr.) by setting first $e = 0$ and then $d = 0$. $e = 0$ gives $120d_0 = 100$ or $d_0 = 100/120 = 0.8333$ kw. = 833 1/3 watts on the axis of demand. $d = 0$ results in $e_0 = 100/8 = 12\ 1/2$ kw-hr. on the axis of energy consumption. In analogous manner we can find the range of the minimum charges in the tertiary range of the rate.

to and analyzed in Section 163. It demonstrates clearly how the plane for load-factors above 300 hours (plane *OST*) slopes in the wrong direction so that a negative angle *s* (that is, a negative demand charge) results.

170. Only simple rates have been dealt with here as far as their space representation is concerned. The more complex a rate system is the greater is the

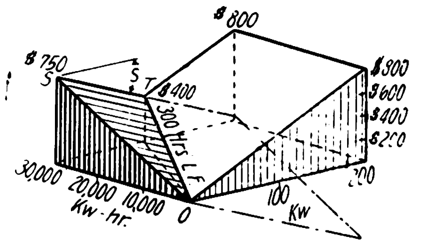


Fig. 22.—Negative Demand Charge.

advantage of a graphic representation for a clear insight into the meaning and the character of the rate.

More about this system of rate representation is contained in the author's article on "Space Representation of Central-States Rates" in the *Electrical World* of Nov. 4, 1911, which also contains many examples of various kinds of rates and numerous photographs of a large number of actual models of rates as had been made for the purpose of investigating these rates. It is, of course, not strictly necessary to have the models actually made in three dimensions. A good axonometric drawing, of the type of Figs. 17 to 22, or even pure imagination how the model looks, will also prove very helpful.

(To be continued.)

PROPOSED ELECTRIFICATION OF SOUTH AFRICAN RAILWAYS.

Experts Report to Union Government on Advantages of Conversion and Estimated Financial Results.

A London firm of consulting electrical engineers (Merz & McLellan) has submitted a report to the Union Government of South Africa on the possibilities and advantages of the electrification of certain sections of the South African railways. The sections of the railways considered for electrification are confined to four divisions.

The first comprises the main line from Cape Town to Touws river and suburban lines in the peninsula. A tabular statement, giving the cost of electrification and the profit, shows an estimated return on the net capital outlay of 1½% on the main line section, 10% on the Simonstown branch, 8.1% on the Sea Point line, 30.5% on the Docks branch, and 9.7% in the Docks area.

The second section comprises the Natal main line from Durban to Glencoe, on which a return of 40.3% is anticipated, and the Glencoe-Vryheid East branch with a return of 12.5%.

The third section is the Witbank-Germiston-Randfontein line, on which the return is estimated at 10.8%; while the fourth section is the Delagoa Bay line between Witbank and Komatipoort, and here the return is expected to be 5.6%.

Thus the conversion of the main line in Natal is by far the most profitable. This is to be expected on account of the density of the traffic and the very severe nature of the line, both of which tend to make operation of the line very difficult. The introduction of electric traction would avert the necessity for double-tracking the line, the traffic on which is approaching the limit of capacity for a single track.

This scheme embraces a route mileage of approximately 650 miles, a single-track mileage of nearly 1015 miles, with certain additions for sidings, etc.

A number of the advantages to be derived from the conversion are enumerated. They include:

(1) A higher average speed for long-distance passenger trains.

(2) An increase in the weight and a reduction in the number of freight trains, with a consequent improvement in the handling of traffic.

(3) Postponement of the necessity for doubling the track.

(4) Reduction of wear and tear on the permanent way.

(5) Elimination of the costs connected with the supply of water and coal for locomotives.

(6) Increased comfort for passengers and train crews.

(7) Abolition of expenditure in compensating farmers for fires caused by engine sparks.

As it is out of the question to take in hand simultaneously the whole scheme of electrification, the report recommends that steps for the conversion of the line between Durban and Glencoe be started immediately, then successively the Rand line, the Vryheid East branch, the Cape lines, and finally the Witbank-Komatipoort section should be electrified. The direct-current system and overhead transmission are recommended.

For main-line traffic it is proposed to use freight locomotives with a tractive effort of 48,000 lbs., compared with 53,750 lbs. of the present Mallet articulated type, and passenger locomotives with a tractive effort of about 30,000 lbs., which would be capable of hauling a 600-ton load up a gradient of 1 in 60.

In view of the fact that with electric working the most economical condition is obtained when the train travels at the highest possible speed, it is proposed to increase very substantially the general speed of the freight traffic. Provision would be made for a speed of 20 to 23 m.p.h. up the ruling gradients by freight trains, and 28 to 29 m.p.h. for passenger trains, as tending to the most economical working, while for level parts provision would be made for an express passenger locomotive to haul 15 main-line coaches at not less than 55 m.p.h.

A comparison is made with a test made with a locomotive of the 12th class on a run from Witbank to Germiston, which covered the distance in 3 hrs. 45 min., exclusive of stops, whereas an electric locomotive would take 2 hrs. 40 min.

The report does not anticipate any substantial gain from the utilization of water power for the generation of energy. It suggests for the Natal lines the erection of power stations at Durban and Tayside, near Glencoe. For the Rand line power might be taken partly from a station on the Great Olifant's River and partly from the existing network of the Victoria Falls Co. For the eastern line a power station should be provided at Komatipoort, and for lines radiating from Cape Town there should be a power station near Cape Town and another at Touws River. At Cape Town a combined station is suggested capable of developing power for railways, tramways and municipal requirements.

The proposed new service provides for an increase of 66% in train mileage on the ordinary week day.

Effect of Strike Upon Central-Station Supply to Coal Mines

Consensus of Opinion Foretells Higher Demand, Greater Energy Consumption and Increased Electrification — Central-Station Supply to be Encouraged—Other Effects

ELECTRIFICATION of coal mines has progressed steadily for many years, the rate being accelerated from time to time by such factors as high market value of coal, high cost of labor or its scarcity, and increasing necessity for efficient mining of coal. Many central stations have found the supplying of power to coal mines a profitable form of load. The coal operators have found central-station service equally profitable. The plan is mutually profitable.

Under these circumstances there has been every reason to expect that more and more coal mines would go over to central-station service in preference to operating their own isolated and inefficient plants. The conditions that may be created by the cessation of the bituminous coal miners' strike, which will be brought to a cessation by a compromise the details of which are not yet known, immediately cause one to ask as to the effect of the new conditions upon the central stations already serving coal mines and those that purpose to do so.

The miners originally demanded a 60% increase in wages, a 6-hour working day, the working day being considered as commencing from the time they started down the mine shaft to the time at which they emerged, and a 5-day week. There is every reason to believe, however, that a compromise will be made by increasing wages 30% or so, the coal operators guaranteeing more regular work, but insistence being made that an 8-hour day be retained. The question then that central stations already supplying coal mines are asking themselves is, whatever be the result of the strike, how will that result affect them? Likewise, utilities that have been looking to the coal mines as a potential load are concerned as to whether the new conditions soon to come about will help them or hinder them in taking on coal mines. There is every reason to believe, and this belief is backed by the opinions of a large number of central stations, that whatever the outcome, whatever the compromise between the striking bituminous miners and the coal operators, there will be added incentives for the coal operators to purchase central-station service.

The Penn Central Light & Power Co., located at Altoona, Pa., serves a territory where coal mining constitutes an active and extensive industry. The company operates two steam plants of its own and also purchases considerable energy from an interconnected hydroelectric system. Considerable energy is supplied for coal-mining operations, hence this company is closely interested and well versed in this phase of central-station supply.

Speaking of the result to be expected, should the bituminous coal miners gain their demands for a 6-hour day and a 5-day week, and not taking into cognizance the aspect of higher rate of remuneration, J. H. Shearer, general superintendent of the company, points out that the consideration of the immediate effect of capitulation to the miners' demands should be divided into two catagories; the first of these embraces haulage, the second ventilation.

"The country cannot get along on any less production than it is at present, in fact, we need considerably greater production," says Mr. Shearer. "The 6-hour day would, of course, mean a reduction in tonnage and, in order that the coal operators could maintain sufficient tonnage to meet the demand, they will undoubtedly resort to the electric mining machine in mines where the seam is so arranged that mining machines can successfully be applied. By maintaining the tonnage in this manner, the annual kilowatt-hours used for haulage will, in our opinion, remain practically constant, since a given tonnage can be hauled over a certain distance under a certain number of kilowatt-hours used.

"It will require heavier trips under a 6-hour day than under the 8-hour day, which will mean a higher demand on the machines handling the haulage which reduces the load-factor of the installation, thus producing a greater income from the kilowatt-hour to the power company selling the service on a load-factor basis.

"In connection with the ventilation of the mine, we see that the kilowatt-hours will be reduced, since the fans in many mines could be slowed down to half speed two hours earlier than at the present; this will also reduce the load-factor with corresponding effect on power cost. We believe, however, that the kilowatt-hours used by additional mining machines will go a long way to overcome the reduction in the kilowatt-hours required for ventilation, if not exceeding them. Should a mine be a gaseous one where it is necessary to keep the fans running 24 hours a day at full speed, there will be no reduction in kilowatt-hours used in ventilation due to the 6-hour day, and the additional kilowatt-hours used for mining machines will increase the present kilowatt-hours.

"Power for pumping could not be taken into consideration as to working hours as this function is necessary according to weather and water conditions.

"We, therefore, feel that a 6-hour day would ultimately mean an increase in the use of power over the present requirements, but there would be a period of reduced production and kilowatt-hours used immediately after the mines would go on 6-hour shift, and this condition would continue until the mining companies installed the mining machines and the production increased."

The Appalachian Power Co., Bluefield, W. Va., is located in proximity to the Pocahontas, Clinch Valley, Tug River, Winding Gulf coal fields and finds in them a good customer for power. The company has a total generating capacity of about 25,000 kw. and a connected power load of 70,000 kw., indicating a comparatively large power load. The coal fields supplied by the company are non-union fields, hence their load has been favorably affected since the strike in union coal fields, partly because of the greater effort put forward by the miners and partly because the supply of railroad cars has enabled a much higher rate of coal production to be maintained. However, if the striking miners win in their demand the company expects conditions in the non-union coal fields to gradually approach those of the unionized fields so that if the latter obtain shorter working hours, the former will eventually also.

The effect of shorter working hours, points out Herbert Markle, general manager, Appalachian Power Co., will be similar in effect to the conditions created during the war by a shortage of labor. In both cases there will be greater incentive for the installation of "machinery of all kinds, and this tendency seems to be increasing." The result is "an increased consumption of electrical power as well as resulting in decreased cost of mining coal, as electrical power is cheaper than man power. As yet coal loading machines are not commercially in use, but some mines are experimenting with this type of equipment, and when perfected, there is no question but what they will be quite generally adopted, as they will go a long way toward solving the labor difficulty."

Practically every one of the large number of central stations expressing an opinion is convinced that the demand per mine will be higher for the reason that effort will be made to maintain production. More tipple and mine working will necessarily be installed, resulting in lower load-factor and higher peak demand. As one power company states, the fact that the men will lose time in getting to work and getting to the surface again after their work, creating in effect a shorter day, taken in conjunction with the fact that effort will be made by the coal operators to maintain production, will tend to cause mine operation to be more regular, and forced cessation such as has occurred so frequently in the past because of inability to obtain railroad cars, will be less a factor in limiting coal production and forced idleness of the men than in the past. Another factor tending toward this is the fact that public opinion and the attention of federal and other bodies has been brought to bear upon this phase of the coal situation.

G. M. Gadsby, vice-president, West Penn Power Co., whose company supplies considerable power to the bituminous coal fields of Pennsylvania, looks for somewhat lower load-factor, higher peak demand and increased consumption of kilowatt-hours if the miners obtain concessions in the way of shorter hours. In part, he says:

"The consensus of opinion is that every possible effort will have to be made to maintain production. This will mean the installation of more tipple and mine working capacity, with the resultant higher peak demand on the central stations and a very much poorer load-factor. The kilowatt-hour output would be changed but little, the result of the 6-hour day being to do in 6 hours what is now done in 8.

"Investment cost of coal produced would necessarily be higher, and since most power rates are based either directly or indirectly on load-factor, the cost of power per ton of coal mined would also be higher.

"It might be of interest here to note that during the shortage in central-station power which prevailed in this district in the war time, all the various agencies who investigated the situation agreed that if the operation of the mines could be spread over a longer period there would have been adequate capacity to serve all desiring this service."

Isolated Plant to Give Way to Central-Station Supply.

Electric power is cheaper than man power, can be more easily controlled and readily changed according to the needs of the situation. While man power is costing more and more and becoming more and more difficult to handle, electric power is of fixed cost, tending toward somewhat decreasing cost, and gives less trouble the larger the quantity handled (because of better provision for its distribution and maintenance for equipment). Higher wages for man power, regardless of any possibility or probability of a shorter effective working day, means increased electrification. The above is the sum-total of the expressions of several public service companies supplying coal-mining regions with electric power.

If the miners' demand for a shorter working day materializes, it is not difficult to see what will be the result. Whatever happens, every effort will be made on the part of the coal operators to maintain the production of coal according to the demand. The shorter working day means that there will be a greater number of hours out of the 24 when the mines will not be actively engaged in mining coal. Coal-cutting machines, locomotives, drills, tipples, etc., will be shut down and only a quota of the fans for ventilation and the pumps for caring for the seepage, etc., will operate. The working load will be heavier than previously while it lasts. There will be a relatively light load for a relatively longer portion of the 24 hours. The influence of the promised load curve upon plant performance and choice of equipment is of interest, as is emphasized by one utility.

Plant efficiency depends upon the load and the load-factor. The operators of coal mines have always in most cases favored central-station supply exclusively. A shorter working day only makes the purchase of service by the mine from the central station even more advantageous for the former, notwithstanding the lower load-factor, as already foretold above by many public utilities. Coal wasted at the mine represents a loss to the mine operator since that same coal has a market value—a value considerably enhanced during the last year or two; therefore, power plant economy becomes of importance. The lower load-factor that will come with the miners' shorter working day means more inefficient operation than ever of the coal operators' isolated plants. The higher peak or demand means a greater investment than was necessary before the strike, another factor favoring the use of central-station service in preference to enlarging the existing isolated plants.

Many coal mine operators have found it profitable in the past to purchase their electric power. Higher wages coupled with a shorter effective working day will mean many more operators will go over to central-station service. One utility manager voices the opinion that there will be almost a stampede in the endeavor to connect up to the transmission line in preference to making isolated plant extensions to meet conditions that are at best inefficient.

The shorter the time in use, the fewer the hours out of the 24 that equipment is in use, the more important it becomes to keep to a minimum the investment in plant. This means, according to the manager of a utility in the Middle West serving many coal mines scattered over a large territory, that the outdoor substation will receive unprecedented attention in preference to any other type. Moreover, the flexibility of certain types of the outdoor station, which enables them to be expanded according to the needs of the mine in the way of power requirements, will solve many difficult problems that will arise if the coal operators capitulate to the demands of the miners for a shorter effective working day.

The consensus of opinion of the central stations supplying mines in the bituminous coal fields, as learned from a large number of replies received in reply to a questionnaire sent out by the ELECTRICAL REVIEW is that the load-factor of the individual mine will be lower; the maximum demand and kilowatt-hours consumed higher; that many coal mines now producing their own power will be forced to go over to central-station supply; and that very many mines will find it necessary to increase their consumption, hence additional electrical equipment for below as well as above ground will have to be purchased. The central stations in general look for increased revenue from coal mines, whatever capitulation be made to the striking miners, whatever the compromise. This will not accrue immediately upon the resumption of work because of a time lag until new equipment can be obtained to counteract the new conditions. But it will come eventually.

CENTRAL STATION'S APPEAL FOR VOLUNTARY COAL SAVING.

Commonwealth Edison Co. Asks Its Patrons to Forego Needless Use of Light and Power—Coal Pile Dwindling.

As the strike of bituminous coal miners drags on, the nation is consuming the supplies of coal on hand. The coal pile of the industrial plant, of the railroads and of the central stations is the buffer that stands between operation and shutdown. Every day the coal piles become smaller. Every day that the coal strike lasts the visible supplies of coal become less.

The central stations have always been great believers in the coal pile. Coal is such an important factor in the business of producing electrical energy that the average central station located any distance from the coal mines has felt it incumbent upon it to store coal in fairly close proximity to its power plants so that should strikes of miners or railroadmen, inclement weather and similar unforeseen emergencies arise, there would be a supply of coal from which to draw until the emergency had passed. Usually the emergency has consisted of bad weather, blockage of traffic, inability to obtain railroad cars and similar occurrences of short duration. Many companies have never found it necessary to use their coal in storage because of necessity. But they maintained coal piles because the possibility of something happening convinced them that to do so was a wise precaution.

The Commonwealth Edison Co. has always kept a very large amount of coal in storage, the coal piles being located at their Fisk and Quarry street stations and Northwest station, with other piles at Clearing and along railroad tracks. These coal piles, comprising nearly 400,000 tons, have been maintained for vears but until the present strike occurred the company had never been called upon seriously to fall back upon the supply of coal in storage because there was no alternative. They felt, notwithstanding, that the coal pile was a necessary precaution, a safeguard against something that might occur some time, however remote the possibility. That time has come and the 380,000 and more tons stored in readiness are now being used up at the rate of some 5000 tons a day. The coal pile is the factor that makes it possible to continue service to more than 400,000 customers. At the present rate of consumption the company's coal piles will be depleted in 30 days.

With no compromise yet reached between the coal operators and the miners, the company has taken steps to conserve its coal lest the delay in producing coal again is more protracted than is generally expected. The company has already refused to furnish peak-load service to some customers and it is appealing to its patrons in general to help save its coal supply by not using more power and light than is actually necessary. The accompanying advertisement is being published in the Chicago daily papers in the effort of the company to bring realization as to the seriousness of the situation.

An Appeal to the Public to Help Us Save Coal

Because of its great responsibility to the public and to the business interests of Chicago, the Commonwealth Edison Company feels that it should, at this time, make to the people an exact statement as to its coal supply. The Company supplies electric current in 400,000 Chicago homes and business institutions for lighting, power and elevator service and, moreover, the Company's current is absolutely essential to the operation of many of the food producing and distributing institutions of the city. The inability of the Company to supply current would seriously affect the city's water system, the telephone, telegraph and U. S. mail service, and would stop the operation of all surface and elevated lines.

Realizing this great rosponsibility, the Company long ago adopted the policy of maintaining a large reserve supply of coal to meet such emergency as the present coal strike. As a result, on November 1st, when the miners struck, the Company's reserve supply of coal in and near Chicago was in excess of 380,000 tons, enough to meet its normal requirements for 50 or 60 days. The Company obtains its coal from Illinois mines, all of which are affected by the strike. This is the twenty-fifth day of the period of non-production from these mines, and during this period the Company has been obliged to draw on its reserve supply. At the present rate of consumption the Company's reserve supply will be exhausted in thirty days.

In the hope of deferring as long as possible, and perhaps avoiding entirely, the drastic curtailment of the use of electricity which has been found necessary in many of the cities of the middle west, the Company feels obliged to ask the people of the city to economize in the use of electricity, and to stop using it where its use is not absolutely necessary. This means a direct saving of coal. Even if a settlement of the coal strike be made immediately, it will not prevent Chicago's coal situation from continuing to be bad throughout the winter, due to exhaustion of the usual winter stock of coal and inadequate railroad transportation, snow storms, blockades, and general conditions that may be expected in cold weather

To help in this emergency the surface and elevated lines have agreed, so far as possible, to stop the use of electricity in heating cars. It is believed that this will cause slight, if any, discomfort to the public at this time of the year, and will not affect the general health. It will save hundreds of tons of coal daily.

In the interests of the entire community the Company respectfully requests the co-operation of the citizens of Chicago in this crisis, and especially asks that they stop, as far as possible, the use of electrical energy for display lighting of every kind, and curtail the use of light and power, so that there will be no waste and the present coal reserve of the Company may be made to last as long as possible.

COMMONWEALTH EDISON COMPANY

Commonwealth Edison Co.'s Appeal to Its Patrons to Assist in Saving Coal by Eliminating All Non-essential Consumption of Light and Power.

SHIP LAUNCHED UNDER ELECTRIC LIGHT.

It is interesting to note that the American International Shipbuilding Corp., of Philadelphia, Pa., recently effected the launching of the new 7825-ton capacity steel cargo carrier *City of St. Joseph* at night at its big Hog Island shipyards. The company had installed powerful electric projector lamps to light the path of the steamer. It is said that this is the first night launching which has taken place in this country.

Present Limits of Speed and Output of Single-Shaft Turbogenerators

Importance of Rotor Dimensions—Influence of Ventilation, Temperature, Speed and Mechanical Forces Upon Capacity—A.I.E.E. Paper

By F. D. NEWBURY

Westinghouse Electric & Manufacturing Co.

REDUCED to the simplest terms, maximum output at any speed is attained when slot space is provided for the maximum possible ampere-turns (in either stator or rotor), and core cross-section is provided for maximum possible flux. These conditions require the most effective rotor diameter (or stator bore) and the maximum rotor and stator core length. All factors that limit rotor diameter (or stator bore) or core length have a possible bearing on limiting outputs.

The most effective rotor diameter for a given speed is not necessarily the largest diameter. For maximum output, the rotor should have maximum space for winding and maximum tooth and core section for flux. Obviously, these requirements are antagonistic and the actual design is a balance between slot area and tooth and polar area. Again, as the diameter is increased (with a given speed) there is more room for both winding and flux, but with increase in diameter each pound of copper exerts an increasing centrifugal force and the ratio of slot area to tooth cross section must be decreased in order to keep within desired stresses. Beyond a certain peripheral velocity, ampere-turns must be decreased, in spite of the increase in available space, and the most effective diameter has been passed. It is seen, therefore, that in order to obtain maximum output at a given speed, the rotor proportions must be chosen to properly balance mechanical stresses, rotor ampere-turns and flux.

Turbogenerator design has settled down to one type of rotor, so far as form is concerned. This is the so-called radial slot type, in which the ends of the winding project beyond the core body. This construction is shown in Fig. 1, indicating the slot arrangement. This type of design requires solid rings of very good material for holding these projecting coil ends. The hoop-stress in the coil retaining rings is an important limit to output and is, in fact, a more important limit than the tooth stress in the main rotor body.

In a large-diameter low-speed turbogenerator (1200 r.p.m. and below) it is generally possible to employ a larger rotor diameter and more rotor ampere-turns than can be properly balanced by stator ampere-turns. The density of stator ampere-turns is limited by the ability to dissipate heat (with permissible temperature differences) and by the permissible concentration of ampere-turns in a single slot. Obviously, there is no such rigid limit to weight or depth of copper in a single slot in the stator as is imposed by centrifugal stresses in the rotor, but there is a limit to the depth of stator slots determined by the rapid increase in eddy current losses with deep slots and by the ability to construct and insulate long coils having a very large ratio of depth to width.

Thus, in certain cases the rotor is the limiting member and in other cases the stator is the limiting member. In general, the rotor first reaches its limit in ratings of 1500 r.p.m. and higher speeds, and the stator first reaches its limiting output in ratings of 1200 r.p.m. and lower, considering commercial frequencies.

It is apparent that unless the ratio of rotor ampere-turns to stator ampere-turns is a fixed design relation, all generators could be designed for the maximum possible output as determined by the stator, and the rotor need never be the limit. As a matter of fact, there is a tendency in this direction, the restraining fact being that as the field is weakened, relatively to the armature, the increase in field current and exciting voltage as the load is increased becomes greater. A reasonable limit to increase in excitation with load is desirable from the standpoint of voltage regulator operation. Regulators can readily handle a range of one to two or one to two and a half and large generators are proportioned to meet this ratio of no-load to full-load excitation. Voltage regulation has ceased to be a limit to output. These field and armature proportions result in regulations of roughly 25% at 100% power-factor, and 40% at 80% power-factor. Obviously, such regulations could not be tolerated if regulation were a factor in operation.

A fundamental difficulty in laying down definite limiting outputs is the difficulty in arbitrarily stating limiting stresses. The two principal stresses in the radial slot rotor are the tooth stresses in the main rotor body and the hoop stress in the coil retaining rings. Soft carbon steel is employed for the main rotor body and a good quality ductile alloy steel (usually chrome-nickel or chrome-vanadium) is used for the coil retaining rings. Turbogenerators are designed for a maximum speed 20% above the running speed. At this over-speed, the tooth stresses should be approximately one-fourth the ultimate strength of the carbon steel and the coil-retaining ring stress should be approximately one-third the ultimate strength. This results in working stresses, in both cases, approximately half the yield point. It is important that the material be ductile: carbon steel with proper working can readily be obtained with 22% elongation and 35% reduction in area and the alloy steel should have 22% elongation and 50% reduction. These figures refer to standard 2-in. test pieces under tension.

American design practice has established 400 ft. per sec. as an upper limit of peripheral speed for maximum ampere-turns and output for rotational speeds of 1500 r.p.m. and higher. This, of course, assumes existing rotor materials and factors of safety.

It is apparent that having increased the rotor diameter to the most effective value, output will be proportional to the length of the rotor and stator cores and maximum output will be secured when the length is increased to its limiting value. This limit to length is even more a matter of opinion and judgment than is the limit to rotor or stator diameter. It is determined mainly by cooling air requirements, by bearing proportions, by limits to weight imposed by transportation facilities and the ability to secure forgings of necessary diameter and weight.

Ventilation.

The generator losses, and consequently the required volume of cooling air increase almost in proportion to the core length. In the simple radial or air gap system of ventilation, shown diagrammatically in Fig. 2, all of the cooling air must pass through the air gap entering the annular openings between stator and rotor at the two ends of the generator. The radial dimension of the air gap is constant with constant rotor diameter, consequently volume of cooling air can only be increased as core length is increased by increasing the air pressure. Also, as core length is increased, the diameter of the shaft extension of the rotor body must be increased and the fan intake becomes restricted. In the axial system of ventilation, illustrated in Fig. 3, the stator ventilation is taken care of independently of the air gap and the requirements as to cooling air become less important from the standpoint of limiting output. But with either system of ventilation, designers are already finding it

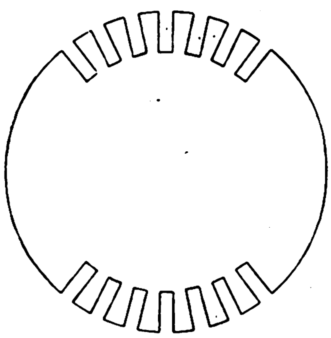


Fig. 1.

necessary to devise more complicated systems in order to take care of 3600 and 1800-r.p.m. ratings now in prospect.

Rotor Deflection.

As the core length is increased, necessitating an increased distance between bearings, the rotor deflection increases. This increases the reversing stress in the shaft material at the journals and reduces the value of critical speed. As the core length is increased the journal and bearing sizes must be increased in order to keep the shaft stress and the critical speed within desired limits and a limit may be imposed by bearing losses and temperatures.

Winding Temperatures.

The limiting ratings given in this paper are based on 150 deg. total rotor winding temperature and from 125 deg. to 150 deg. total stator winding temperatures. It is not probable that ratings will be increased by increasing these temperature limits. Higher temperatures would be of most value in connection with the rotor winding since the rotor limits rating in the two and four-pole designs commonly used. But temperatures higher than 150 deg. result in relatively little gain in rotor ampere-turns on account of the rapid increase in resistance of the winding. If the rotor winding temperature rise is assumed proportional to the loss, an increase in operating temperature from 150 deg. to 250 deg. (an increase in measured rise from 100 deg. to 200 deg.) results in an increase in ampere-turns of only 25%. Thus doubling the tem-

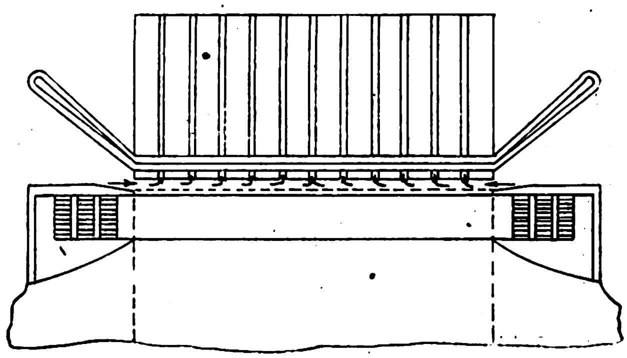


Fig. 2.

perature rise and rotor loss results in a gain of only 25% in output.

Temperatures much above 150 deg. in connection with very long rotors are not considered favorably on account of the danger of trouble from "creeping" of the winding caused by linear expansion.

Transportation Facilities.

Transportation facilities may impose a limit to size in the case of six and eight-pole, 60-cycle generators. With the larger two-pole, 25-cycle and four-pole, 60-cycle generators now being built, the stators are now too heavy for convenient handling and transportation, and they are assembled in place at the power station. Rotors, from the special nature of their design and the special skill and equipment required for winding and assembling, should be completed at the builder's factory and shipped as a unit. The weight of the complete rotor of a four-pole, 1800-r.p.m. generator of 40,000 kv-a. capacity will be roughly 90,000 lbs. This can be transported without difficulty, but the largest possible 1200-r.p.m. rotor would weigh more than 200,000 lbs. and would require rolling stock and trackage (in some cases) not now available.

Another general limitation to output that applies to the larger diameter rotors is that imposed by the forging facilities of the country. At the present time

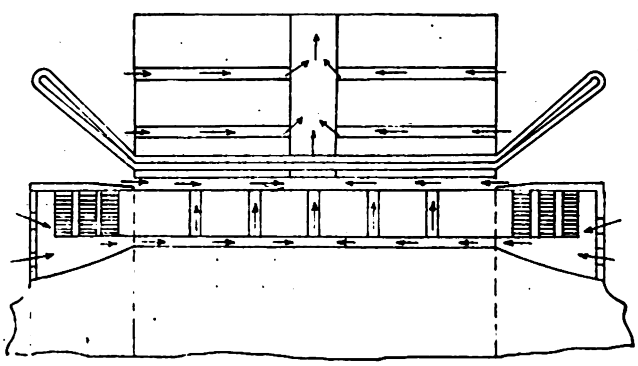


Fig. 3.

it is not possible to obtain forgings of suitable physical characteristics weighing more than 50 to 60 tons nor much larger than 50 ins. (assuming a minimum amount of working down from a 72-in. ingot). This limits the rotor, made from a single forging, to an output of roughly 50,000 kv-a. at 1500 r.p.m. and a proportionately decreasing kv-a. at lower speeds, assuming a solid rotor. By adopting the rotor construction involving 2 or 3-in. plates and up-set flanged shaft ends, the limiting diameter may be increased sufficiently for the largest 1500 and 1200-r.p.m. outputs, shown by Fig. 4. The design of 1200 and 900-r.p.m. generators for maximum output will be governed by questions of forging and shipping facilities, rather than by more strictly design matters.

Fig. 4 shows in curve form limiting generator capacities at various speeds. At 1500 r.p.m. and higher, the capacity is determined by the rotor and is inversely proportional to the revolutions per minute squared. At lower speeds, the capacity is limited by the stator and falls somewhat below the corresponding rotor limiting capacity as indicated by the dotted extension of the rotor curve. This curve is actually based on constant core length, when, as a matter of fact, the length can, with reason, be increased as the diameter is increased. The curve ratings, however, represent maximum lengths of core so far employed and material extensions in core length involve questions of linear expansion that must be very carefully considered. This limiting capacity curve represents capacities that can be obtained with existing commercial materials and without radical changes in stresses

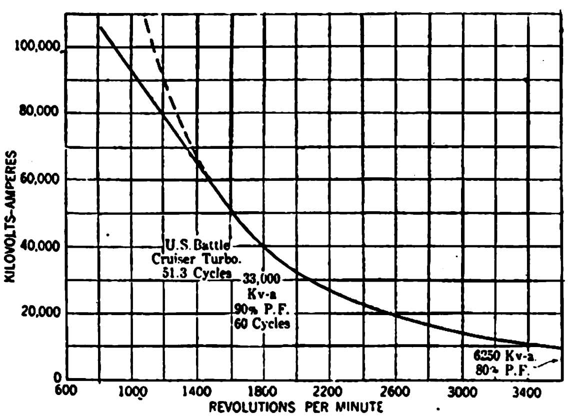


Fig. 4.

and bearing proportions. The curve does not represent limits that may not be exceeded in the future. It is, more properly, an indication of present boundaries—boundaries that will be extended as our knowledge and experience are increased. Its represents also the present judgment of designers, a judgment influenced greatly by the economic and operating advantages of still larger ratings.

The capacities shown by the curve are somewhat in advance of accomplished results. Ratings of several turbogenerators that are the largest that have been placed in operation or are under construction by the Westinghouse Electric & Manufacturing Co. have been added to Fig. 4 with self-explanatory comment.

As previously explained, the limiting capacities given for speeds below 1500 r.p.m. can only be attained by exceeding present transportation facilities if present design types are adhered to.

Incidentally it is interesting to note the advantage in limits gained by the use of 50 cycles as compared with 60 cycles. An increase of nearly 50% in rating is made possible by the 20% decrease in two-pole and four-pole speeds. This is of interest mainly when European and American maximum ratings are being compared.

The bare mention of ratings larger than 50,000 kv-a. raises the question of limits to size of individual generating units imposed by operating considerations, such as the relation between unit and station rating, the extent of the damage in case of winding failures, ability to withstand sudden short circuits, and so on.

While the detailed discussion of these questions is beyond the scope of the present paper, some design information affecting operating questions may be of interest. There is no reason for considering the larger low-speed generators less reliable than the high-speed generators indicated by limiting curve of Fig. 4. As a matter of fact, the lower speed ratings can usually be designed, both in stresses and in electrical factors, with more margin.

Mechanical forces developed by short circuits are determined by the short-circuit ampere-turns of the armature winding per inch of armature circumference, and, to a limited extent, by the density of the magnetic field set up by the rotor winding. Both the distribution of ampere-turns and the density of the air gap magnetic field are substantially constant for all limiting ratings of a given frequency. While the forces developed in a 25-cycle generator will be greater than in a 60-cycle generator—due mainly to lower reactance and the resulting greater values of ampere-turns—all 60-cycle ratings indicated by the limiting curve will have substantially equal forces developed on sudden short circuit. The stresses in the coil ends will be determined by these forces and by those factors determining the rigidity of the winding. Except possibly in the maximum size 1500-r.p.m., 25-cycle generator, with its long coil-end extension, there need be no material difference in the rigidity of the winding. Thus a 50,000-kv-a., 25-cycle, 1500-r.p.m. generator represents the most difficult design from the standpoint of short-circuit stresses. However, such a generator would not differ materially in short-circuit stress conditions from 30,000-kv-a., two-pole generators that have been in successful operation for three years. It can be stated with confidence that the danger of winding failure due to sudden short circuit, with generators of the indicated limiting outputs, will be no greater than 20,000 and 30,000-kv-a. generators that have been placed in operation in large numbers during the past six years.

Another question of interest to those responsible for the operation of large generating units is the extent of damage to winding in case of internal short circuits caused by failure of insulation between turns of the same coil or failure of insulation from copper to ground. Experience with large units now in operation has shown that, in the event of a winding failure that results in the flow of abnormal power current, the chances are that the entire winding will be destroyed and that a hole of considerable size may be burned in the core laminations. Generating units are already of such size that a winding failure usually results in the loss of output from the unit for several months. The results of failures in still larger generators will be of the same degree and will be no more serious except, of course, in that loss in kv-a. output will be greater. In this connection, it is pertinent to point out that the fusing of metal and other local effects of an internal generator failure is a function of station capacity rather than of individual unit capacity. The volume of metal fused at the point of failure is determined largely by the impedance of the generating circuits feeding into the vault. Therefore, the only difference between a failure in one of two 30,000-kva. units and a failure in a single 60,000-kv-a.

unit is in the impedance of the leads buses and other connecting circuits between the two 30,000-kv-a. units. The two 30,000-kv-a. unit installation has the obvious advantages that protective reactance may be installed between the units and the trouble is usually confined to half the station capacity.

The author has not intended to express an opinion as to the wisdom of installing very large single-shaft units. The only purpose has been to point out from the design standpoint the feasibility of certain ratings. Whether it is desirable or even wise to install very large units—above 50,000 kv-a.—will depend very largely on the growth and size of generating stations. When stations double in size—when stations of 300,000 kv-a. and 500,000 kv-a. become typical of American practice—there will undoubtedly be a demand of considerable volume for units of 50,000 kw., 75,000 kw. and 100,000 kw., and if single-shaft units are justified from the turbine standpoint, there is no question but that such generators can be conservatively designed and constructed.

REPORT ON HYDROELECTRIC POWER IN INDIA.

Government Investigation on the Available Water Power Resources and the Cost of Their Development.

The preliminary report of the systematic investigation by government engineers of the water power resources of India has recently been issued and is outlined in the British Government publication (*Board of Trade Journal*). While the data collected are admittedly incomplete, the facts gathered give a striking impression of the enormous potentialities of the development of hydroelectric power and the great benefits which the country must derive by a systematic exploitation of this national asset.

The report gives the following figures of known and probable sites where there is a reasonable prospect of obtaining power, and further states that a round estimate of 1,774,000 electrical horsepower in sight is vastly below the actual power which the final results of the survey will show:

Name of Province.	Continuous electrical horsepower.
Assam	51,200
Bengal	203,600
Bihar and Orissa	12,800
Bombay	258,300
Burma	439,000
Central Provinces	153,000
Cochin	25,000
Kashmir	30,000
Madras	106,000
Northwest Frontier Province	20,000
Punjab	260,900
United Provinces and Benares	32,200
Total	1,592,000

It is estimated that the capital cost of developing the water power of Burma and of the Punjab would be not less than $97,000,000 and $48,500,000, respectively. Of these sums there should be available for the hydroelectric departments $480,000 and $240,000, respectively, which, it is thought, should be sufficient to maintain staffs for the work.

Under the heading "Permissible Cost of Hydroelectric Development" the report deals very fully with and justifies the variations in capital expenditure necessary for different localities and under different conditions. The immediate detailed investigation of works estimated to produce up to 1,000,000 electrical horsepower is recommended and, assuming that only half of this to be ready for immediate development, an expenditure of about $162,000,000 would be necessitated. Prominent engineering authorities, however, are urging for more comprehensive and thorough investigation than the government seems willing to entertain.

The question of the control of water rights and the financing of works is also gone into, and extracts are quoted from the reports of both the British Water Power Committee and the Water Power Resources Committee of the Board of Trade. Both these authorities favor state control, to protect and serve public interests in the development of water power. At the same time, direct government control of a power scheme, once established, beyond that required for the purpose of finance, is generally deprecated.

AMBITIOUS POWER SCHEME PLANNED BY BRITISH MUNICIPALITIES.

Area of 2000 Square Miles to Be Covered at Cost Exceeding $60,000,000 on Proposed Linking Up of British Municipalities.

Plans are being prepared for the erection of a new generating station on the banks of the River Trent, to supply an area of 2000 square miles, 50 miles from north to south, and 40 miles from east to west. The area includes parts of Nottinghamshire, Derbyshire, Staffs, and Leicestershire. The first section of the station would cost £5,260,000, but supply authorities from Chesterfield to Leicester, on the one hand, and Burton-on-Trent to Newark on the other, would co-operate and bear a proportion of the cost.

It is estimated that the whole scheme will require about £14,000,000 to carry through, but it means much cheaper power, and would result in a saving of £40,000 per annum to the Nottingham Tramways alone. At the station, which would occupy at least 100 acres of land, many advantages are offered—an ample supply of condensing water, facilities for bringing coal by water and rail, for the disposal of ashes and coal storage, and, what was very important in future, a carbonization plant. The capacity of the station would be 200,000 kw., and it would require 580,000 tons of coal per annum (or 1500 tons daily) and 14,000,000 gallons of river water per hour.

The scheme outlined above is at present under consideration by the engineers and representatives of the various authorities concerned, but progress cannot be made until the Electricity Supply Bill becomes law, when no doubt the schemes will be submitted to the Government Department concerned and to the authorities which will be set up for dealing with electricity supply generally.

ELECTRICAL DEVELOPMENT IN FINNISH DISTRICT.

A stock company has been organized in the communities of Middle Osterbotten, Finland, for the development of the water power of Korpela Falls on the Lestijoki river. The cost of the development is estimated as follows: Dam and water division, 1,160,000 Finnish marks; power station, 380,000 marks; machinery, 650,000 marks; total, 2,190,000 marks (about $423,000 at the normal rate of 5.18 marks to the dollar; at the current rate, about $110,000).

Editorial Comment

The Burning Question of the Hour

WITH the strike of bituminous coal miners now in its twenty-sixth day, the coal situation assumes a vastly more serious aspect than it has assumed heretofore. The fact remains that the strike could have been settled by compromise the first day, just as well as on the twenty-seventh or the thirtieth day or whenever it is that the production of bituminous coal upon a national scale commences again. Meanwhile the visible supplies of coal on hand are diminishing and hardship and suffering and curtailment of industry come nearer.

A number of industrial plants have shut down completely and many more have curtailed production because of inability to obtain coal to keep going or because of limitations imposed by transportation or other factors arising directly out of the coal quandary. Public utilities, steam and electric railroads, especially, have curtailed their service by taking off trains and reducing schedules. Elimination of needless consumption of electrical energy as for sign lighting and advertising purposes has been made mandatory in some cities and in others the customers have been asked to voluntarily refrain from consuming needless light and power.

The strike of the bituminous coal miners will eventually be settled by a compromise. The pity is that that compromise could not have been made before, before such loss of coal production had occurred, before a strike was called at all. The reason why a compromise has not yet been made we cannot tell, a reason known only to those closest in touch with the stalemate—the coal operators and the miners' union managers. We want the strike settled, but we want it settled justly, which means not merely raising the price of coal and passing on that price increase to the ultimate consumer, but finding a solution at once equitable and sound.

The miners worked an average of 30 hours a week last year, a condition better than previous years, but a condition that needs remedying. The remedy appears to be to create a more steady demand for coal the year round instead of a seasonal demand as exists now; and ability to transport the coal when the demand for it occurs. If a demand can be created the question of railroad cars available at the mine to pick up coal mined as it is mined will tend to be answered, for the car situation is one that very largely determines how many hours the miners are able to work. It might be pointed out here that the domestic consumer is such a comparatively small consumer that his failure to purchase coal during the summer in readiness for the approaching winter is hardly a factor in giving the miners steady work. It is the public utilities, the industrial plants and the other large users of coal that must be made to distribute their purchase of coal throughout the year, and preferably during the summer months.

It is the coal pile that has saved the country from capitulation to the demands of the miners and saved the country from the mercy of the coal operators. It is the coal pile—the coal in storage—that has saved the day for the American public and American industries. "Store your coal now" is the advice that has been given the coal consumer during the summer and early fall in these columns, not once but repeatedly. That advice was sound and circumstances are now bringing home the wisdom of that advice in a vivid manner. But that advice to store coal during the months when it is not needed in readiness for when it will be needed holds for every year. To do so tends to give the miners steady work the year round—their due; it tends to lessen railroad congestion and difficulties that always come with the cold weather; it tends to create a more favorable price for the coal, since price tends to vary with demand; and favors the delivery of a better grade of coal.

The purchaser that buys his coal at the time when the mines are comparatively slack, when the nationwide demand for coal is below the normal, is likely to obtain a better price for his coal, likewise a better grade of coal. He is helping the country's railroads, helping the miners find steady work and helping the country as a whole. Those that bought their coal and stored it see now the wisdom of their act. The thing we wish to emphasize is the desirability of keeping up the practice year by year.

Relations Between Jobbers and Contractor-Dealers

ONE of the significant features of the convention of the Electrical Supply Jobbers Association held last week in Cleveland was the changed aspect from which the jobber viewed the contractor-dealer. Everyone seemed to agree that it was desirable to keep the merchandising of electrical products within the industry and likewise it seemed to be recognized that the most satisfactory way of doing this was to utilize existing channels of distribution, namely electrical contractor-dealers. This was not simply the view of one or two jobbers, but represented the consensus of opinion among all who attended and certainly was borne out by experiences recounted at a meeting of the Atlantic Division on Tuesday.

What this change of attitude implies can only be appreciated by those who are familiar with the sentiments expressed by many jobbers when the Goodwin plan was first launched. It was true that the contractor of old was a poor business man with anything but a bright outlook. But Mr. Goodwin in advocating his platform of co-operation held no brief for the contractor-dealer. He simply said that if we in the industry were to put our house in order we must begin somewhere and the contractor was the logical starting point, for obvious reasons.

The start was made—an organization was perfected and the contractor-dealer was "sold" on his own future. The work has just started, however. No one realizes this better than the contractor-dealer himself. But to carry on involves the co-operation of all branches of the industry, particularly of the jobbers. And at the Cleveland convention many jobbers publicly announced that they had co-operated and found that it paid and paid handsomely.

This sentiment in favor of greater recognition of the contractor-dealer, which was crystallized at the convention, should permeate the entire jobbing industry. What the contractor-dealer needs is a sympathetic understanding of his problems and his response will be rapid and complete. When all is said and done, all that the contractor-dealer asks is a fair opportunity to take his place as an economic factor in the distribution of things electrical to the great American public.

Coal Mining With Central-Station Service

CENTRAL-STATION service instead of power produced by isolated plant has so many advantages over the latter uneconomical and often unreliable source of power that coal mines have steadily been going over to the transmission lines of the public service company. There is every reason to believe that this movement will go on at an even more rapid rate in the near future, following the reaching of a compromise in the strike of the bituminous coal miners.

It appears almost certain that the miners will obtain a definite promise for a radical wage increase. It seems not unlikely that they will also be given what amounts virtually to a guarantee that they shall have opportunity to work more steadily, a condition that will be brought about through a more steady demand for coal and a greater availability of railroad cars. Again, there is every reason to believe that the eight-hour day will remain, the six-hour day being taboo in every quarter. The effective working day may, however, be reduced in that the working day will commence and terminate from the time the men reach the mine above ground instead of from the time they commence work below ground. These things mean a higher labor cost per ton of coal and a somewhat shorter working day, therefore curtailed production.

The country needs coal. Other countries are looking to our coal resources to an increasing extent. Therefore coal production must be maintained, and the most direct and perhaps only way of accomplishing this is to resort more to mechanical methods of mining, which means electrification entirely or in part. Central-station service will thus be called upon to reduce the cost of mining and to increase the rate of coal production, to counteract the higher wages on the one hand and the shorter effective working day on the other. Mines now producing their own power will find added incentives to go over to central-station service, while those already having done so will in all probability find it desirable to increase their connected load and thereby their demand, a condition that must obtain in any case in the endeavor to maintain coal output in face of a shorter working day. The fact that coal will increase in price will make it more and more advantageous for the isolated plant to shut down and take to central-station service, for after all, the fuel used has a market value, so that even the coal operators cannot afford to waste coal that could be sold otherwise.

Central stations that are already supplying coal fields expect that when the bituminous coal miners go back to work that the mines will make a greater demand upon their lines in the way of higher peak load and increased kilowatt-hour consumption per ton of coal mined. These things will not mature immediately, there being a time lag, of course, during which additional machinery will be installed and the movement for replacing man power by electrical power gets under way. During the interim coal production may be expected to decrease. Meanwhile many mines will prepare to go over to central-station supply, because there will be little alternative to do otherwise.

Giving Electrical Christmas Gifts

RESTRICTED spending, just as much as increased production of staples and necessities, is needed now to bring about more healthy conditions, such as are needed to bring the country back to a more normal state. The fact that America is the world's creditor has brought prosperity as it has never been known before.

However, bankers, captains of industry and economists are sounding a warning to save, to spend less upon non-essentials, to call a stop to the extravagances that now seem to have become our national habit. While a prosperous industrial future lies ahead, it is also a fact that the high cost of living, existing high wages and the incessant and limitless demand for higher wages to meet higher rates of expenditure on luxuries as well as for living are a source of danger.

It is fitting that the coming Christmas should be a typical American Christmas, a fitting Christmas following a victorious war. But let it be a thrifty Christmas, a Christmas in which the electrical gift—practical, eminently useful and economical—reigns supreme.

Current Events

Jobbers Discuss Relations with Contractor-Dealers—S.E.D. Elects New President—N.E.L.A. and S.E.D. Co-operate

ELECTRICAL JOBBERS SHOW FAITH IN CONTRACTOR-DEALERS.

Discussions at Cleveland Convention Indicate Evolution in Distribution of Electrical Supplies.

Increasing tendency on the part of electrical jobbers to recognize the contractor-dealer as a legitimate outlet for electrical supplies was strikingly demonstrated in the discussion at the convention of the Electrical Supply Jobbers Association at Cleveland, O., Nov. 18, 19 and 20. Numerous prominent jobbers who have made a genuine effort to cultivate and help in the development of the contractor-dealer reported results beyond the most sanguine expectations, indicating the tremendous possibilities in this direction. At least one jobber stated that since inaugurating a policy of co-operation with the contractor-dealer the ratio of sales has been reversed as between contractor-dealer and industrial plant, sales to the former averaging 75% of the total as compared to 25% in the past.

From every aspect the Cleveland convention was one of the most successful in the history of the association. There was a large attendance of jobbers and an unusually large delegation of manufacturers and their representatives, all of whom were invited to attend the sessions.

Meetings of the Atlantic and Central Divisions were held Tuesday morning and afternoon and general sessions were held the morning and afternoon of Wednesday, with a session at 8 p. m. The Central Division gave most of its attention to the subject of compensation of employees, particularly with respect to a possible reduction in the volume of sales and of corresponding reduction in profits.

The Atlantic Division held a very interesting meeting at which the contractor-dealer situation was ably discussed. The feature of the meeting was an address by W. G. Kennedy, of the Sibley-Pitman Corp., of New York, outlining the astonishing results secured by adopting a policy of close co-operation with the contractor-dealer. Other speakers recounted similar results following the development of a contractor-dealer policy. C. W. Peet, national chairman of the National Association of Electrical Contractors and Dealers, indorsed the new policy of the jobbers and bade them be patient. He outlined briefly the work that was being done to improve conditions in the industry.

At the general sessions addresses were made by W. L. Goodwin and Samuel Chase, both speakers expressing implicit faith in the future of the contractor-dealer. A resolution was unanimously adopted pledging support of the jobbers individually to the Bureau of Research of the National Association of Electrical Contractors and Dealers.

A resolution was also adopted requesting members of the jobbers association who conduct allied businesses to divorce these from the strictly jobbing end under a separately incorporated company.

The executive sessions were held on Thursday morning and Thursday afternoon. Resolutions regarding methods of billing goods for future delivery were discussed, and the report of the lamp committee taken up in detail with representatives of the lamp manufacturers. Various changes in methods of compensation were explained, and the report of the lamp committee of the Electrical Supply Jobbers Association adopted.

The action of the Hot Springs meeting in voting to hold the next convention at Del Monte, Cal., was re-affirmed, and Franklin Overbagh, general secretary of the Electrical Supply Jobbers Association, was unanimously elected chairman of transportation.

Ross G. Holabird explained the preparations which were being made to entertain the convention in California, and aroused great enthusiasm, the members present voting practically unanimously to attend.

At the afternoon session the report of the publicity committee was received, and the session was closed with an address by J. M. Wakeman, of the Society for Electrical Development, who explained the function of the society and the very considerable growth which had come about in its work and influence.

W. W. FREEMAN PRESIDENT OF SOCIETY FOR ELECTRICAL DEVELOPMENT.

Other Prominent Men Make Up New List of Officers—Brief Report of Society's Activities and Plans.

At a meeting of the Board of Directors of the Society for Electrical Development held at the society's offices, in the Engineering Societies building, New York City, on Nov. 11, W. W. Freeman was unanimously elected president of the organization succeeding Henry L. Doherty, who has held that office since the founding of the society nearly six years ago.

As president of the Union Gas & Electric Co. of Cincinnati, Mr. Freeman is well known to all branches of the electrical industry. Being vice-chairman of the Public Policy Committee of the National Electric Light Association, of which committee Mr. Freeman was chairman for a number of years, the new president brings to the society a broad experience in dealing with matters pertaining to the relations between the great electricity consuming public and the people who produce and market the energy and the devices through which it is used.

Under his leadership the society will continue its excellent work of co-ordinating and assisting all branches of the electrical industry to bigger and better business as well as carrying to the public the message "Do It Electrically."

Under the guidance of Mr. Doherty, its past president, the society has done a big work in getting the various branches of the electrical industry together and advancing their united interests. The extent of this work is made evident by a few extracts from the annual report of the society's general manager, James M. Wakeman.

This report emphasizes the fact that in spite of the handicap of the war, the society was able to continue its regular work of supplying articles on electrical subjects to newspapers, trade journals and popular magazines. A great deal of extremely valuable publicity for the electrical industry was thus obtained. Particular attention has been paid to developing the demand for household appliances and motors for industrial purposes. The society has under way a campaign for better industrial illumination.

When one realizes the effort that was previously required to sell washing machines, electrical ranges, vacuum cleaners or even irons, it is possible to appreciate in some measure the tremendous effect of the educational work the society has carried on during the past six years. The industry is reaping the benefit today, but as the effect is accumulative, still greater business is assured for the future.

The electrical range handbook prepared by the society has been pronounced by range manufacturers, dealers and salesmen the greatest help ever supplied to them in their work of selling the "idea of cooking electrically."

The *Monthly Sales Service* has been regularly issued and its general character not only maintained but greatly improved. The electrical men in all sections of the country are continually expressing their appreciation of the great help this publication is in carrying on their business.

Now that members have become familiar with the character of special services which they can receive from the society, requests for this sort of help are coming in daily. These requests range all the way from information wanted on voltages of lighting circuits in foreign cities, heating and cooking rates in American cities, numerous uses of electricity in the various industries, down to the names and addresses of manufacturers of this or that electrical device or the preparation of advertising copy and the outlining of a special sales campaign.

The staff of the society has always co-operated with other electrical organizations in every way possible. While there have been at times apparent duplications of the work of the society, it is believed that with a better understanding of the work of this organization there will be a better spirit of co-operation.

It is not only interesting, but extremely significant how the society has attracted the attention of other countries. Great Britain has started an "Electrical Development Association" patterned upon the Society for Electrical Development. This new organization has studied the literature, the aims and achievements of the American society and has decided to carry on the same kind of work to develop the industry in Great Britain. A member of that association has visited the society's offices and spent several days going over its files carefully.

Other visitors have come from Switzerland, from France and from Japan, all with the object of studying the methods of the society and with a view of inaugurating similar organizations in their own countries.

The society is now conducting another of its national campaigns. Through the drive for "An Electrical Christmas" the public is learning of the appropriateness of electrical devices as Christmas gifts. Reports from members and nonmembers alike indicate that the society is again doing the right thing at the right time.

In addition to the election of Mr. Freeman as president, two new vice-presidents were also unanimously elected. Fred Bissell, of the F. Bissell Co., of Toledo, is widely known as a progressive member of the electrical jobbers' fraternity. James R. Strong, of the Tucker Electrical Construction Co., of New York, stands high in the estimation of electrical contractors and dealers.

Charles L. Edgar, president of the Edison Electric Illuminating Co., of Boston, was appointed a director representing central-station interests in place of E. N. Sanderson, resigned.

Arthur J. Binz, of Houston, Texas, newly elected Jupiter of the Jovian Order, was appointed to the board in place of L. O. Ripley.

J. E. Montague was elected chairman of the new Executive Committee. The other members being: W. W. Freeman, L. P. Sawyer, W. D. Steele, E. W. Rockafellow, J. R. Strong, Fred B. Adam and J. Robert Crouse.

N. E. L. A. AND S. E. D. TO CO-OPERATE IN PUBLICITY WORK.

Meeting of Advertising and Publicity Service Bureau, N. E. L. A., Favors Eliminating Duplication of Work.

At a meeting of the Advertising and Publicity Service Bureau of the Commercial Section, National Electric Light Association, held recently in Chicago, important steps were taken to secure co-operation in electrical publicity work. In calling the meeting to order Chairman Gibbs stated that the Society for Electrical Development recently received the support of many large central-station and manufacturing organizations and that plans were being formulated to greatly expand its activities. It was desirable to so conduct the activities of both the society and the Commercial Section as to avoid duplication of effort. According to Mr. Gibbs, the Advertising and Publicity Service Bureau would function executively instead of handling in a production or mechanical way the work involved—that is, the Bureau's activities would be largely of an advisory and suggestive character. Mr. Gibbs outlined the organization of the Bureau, with particular reference to its relations with geographic sections of the association and with other bureaus and committees of the Commercial Section; also relations with other associations and various branches of the electrical industry, as indicated in the Bureau's organization chart.

No report was presented by the Division on Coordinate Advertising and Sales Campaigns, but in the discussion which ensued it was the consensus of opinion that this subject, originated by the Co-ordinate Advertising and Sales Campaigns Committee, now embraced in the Advertising and Publicity Service Bureau, was worthy of continuation and that a special effort should be made to obtain the co-operation of all related elements, particularly the manufacturers and central stations.

P. B. Zimmerman, chairman of the Division on Illuminating Engineering (nontechnical applications), stated that the work of this division would be largely that of effecting close co-operation with the Illuminating Engineering Society, Society for Electrical Development and the Lighting Sales Bureau, Commercial

Section, N. E. L. A., to the end that the electrical industry in general, as well as the public, would be informed regarding progress in the lighting art, as well as making understandable the technical phases of the work which were susceptible to commonplace translations.

Mr. Gibbs outlined the purpose of the Adequate Outlets Division, which was amplified by Chairman John G. Learned of the Commercial Section, the "father" of the general idea, which was to promote in every possible manner the installation of more electrical outlets, thus making it possible to use more extensively electrical appliances, portable lamps, etc.

For the Motion Picture Films Division Mr. Gibbs stated that Chairman Chas. H. Pierson, being located in Los Angeles, close to the center of motion-picture production activities, would be in a position to have consideration given to electrical applications in many films that could employ successfully material of such character.

In the absence of the chairman of the National Commodity Advertisers Division, Mr. Gibbs outlined the work of this division, which in general was to get in touch with advertisers, advertising agencies and others in an effort to have electrical appliances and their applications featured in advertising "copy" generally. It was the consensus of opinion that there was opportunity to do much educational work in this line which would react favorably on the electrical industry.

Mathias Turner, chairman of the Newspaper Advertising Compaign Division, referred to the general development of co-operative electrical pages, with particular reference to what had been accomplished in Cleveland. Frank H. Gale reviewed the general subject of advertising and publicity, dwelling on the rapidly increasing interest in electrical subjects and indicating that the time was now right to get before the public the electrical industry's message, especially as magazines and newspapers are carrying a considerable amount of electrical advertising and publishers are keenly alive to the future of the electrical industry, thus offering a big opportunity to travel on this wave of interest. J. M. Wakeman stated that 172 newspapers used regularly material furnished by the Society for Electrical Development. He reviewed the work of the society. Mr. Gibbs referred to possible co-operation of value with the American Newspaper Publishers Association.

Frank B. Rae, Jr., chairman of the News Syndicates and Magazine Writers' Division, emphasized the importance of central stations and others offering to the members stories of live interest written in an entertaining and informative manner necessary to justify and assure publication. Frank Kivel suggested development of "questions and answers" pages in magazines and newspapers, through which electrical information could be disseminated. Mr. Wakeman stated that the Society of Electrical Development was conducting work of a similar character at this time.

Cyril Nast, chairman of the Publications Division, advised that no program of activities had been outlined as he was awaiting specific instructions from Chairman Gibbs as to the scope of activities of this division.

O. H. Simonds urged that special consideration be given to co-operation with small central stations, indicating that one-half and full-page co-operative electrical advertising pages had been run successfully in Dubuque, Iowa, in close co-operation with electrical contractors and dealers.

R. S. Hale, chairman of the Wiring Committee, reviewed briefly the work of this committee, with special reference to standardization activities, all of which were calculated to help the public to use electric service conveniently and economically.

Clarence L. Law, chairman of the Lighting Sales Bureau, indicated his desire to co-operate with the Advertising and Publicity Service Bureau in every way possible.

John W. Meyer spoke of the work of the Power Sales Bureau and the opportunity afforded by the Advertising and Publicity Service Bureau for acquainting the electrical industry and the public of the advantages of central-station power applications.

Chairman John G. Learned of the Commercial Section referred to the desire of this section to co-operate closely with the Society for Electrical Development to the end that maximum results could be obtained with minimum duplication of effort and expense. He indicated that the prime object was to see that essential work was accomplished. Mr. Learned referred to the meeting of a special committee to consider co-operation between the two organizations and presented informally the following resolution, which was later to be presented before the Commercial Section's Executive Committee to form a part of the special committee's report on this subject to the National Executive Committee. The resolution follows:

> "Whereas, it is desirable that the activities of the Commercial Section of the National Electric Light Association and the Society for Electrical Development, Inc., be conducted to obtain maximum results and to avoid duplication of effort, and
>
> "Whereas, the Society for Electrical Development, Inc., has a trained and experienced staff with facilities for the general promotion of the use of electricity, electrical merchandise and other translating devices;
>
> "Be It Resolved That, A conference be held each month, or more often, if necessary, at the headquarters of the Society for Electrical Development, Inc., or the National Electric Light Association, to be composed of representatives of the National Electric Light Association and the Society for Electrical Development, Inc., as follows:
>
> "For the National Electric Light Association—Chairman (or authorized representative) of each National Special Section; chairman (or authorized representative) of each National Special Committee, and such other members of the respective Sections and Special Committees as desired;
>
> "For the Society for Electrical Development, Inc.—Such members of the Executive Committee (representing contractors, jobbers, manufacturers and central stations) as desire to attend; the general manager and such members of his staff as desired;
>
> "The conference to decide upon plans for producing, and publishing newspaper articles, publications, special campaigns and all related matters for the promotion of the use of electricity.

"The Society for Electrical Development, Inc., shall produce and distribute publications and related matter as authorized by the conference, with or without the imprint of either or both the National Electric Light Association and the Society for Electrical Development, Inc., as desired.

"For the purpose of assimilation, chairmen of the sections shall transmit to the conference information pertaining to the general activities of their respective sections.

"The sections shall issue publications as they are deemed advisable. Such publications, however, shall not be duplications of the printed matter heretofore referred to and they may be produced and distributed by the Society for Electrical Development under the direction of the section interested. Publications so produced and distributed shall be charged to the section interested at the invoice cost plus cost of distribution."

After extended discussion the resolution was unanimously adopted.

BYLLESBY UTILITIES TO BUILD THREE NEW POWER STATIONS.

Three Central Stations to Install 33,500 Hp. in New Power Plants in 1920—Additions Will Bring New Work to 100,000 Hp.

Rapidly increasing business in territories served by Byllesby electric properties has made imperative additional generating capacity. Three new power stations with a total initial capacity of 33,500 hp. have been planned for immediate construction and further necessary additions and extensions are receiving attention.

One of the new stations will be located in southern Minnesota, where demands of the southwestern districts served by the Northern States Power Co. have exceeded the capacities of the several divisions concerned. A new steam station will be constructed at this point and one 13,500-hp. steam turbine will be installed. Provision will be made for a second unit of 20,000 hp. to be installed later. Condensing water will be obtained from the Minnesota river and present equipment will include three 1165-hp. boilers with coal and ash-handling machinery, etc. The improvement is expected to be completed within a year.

A new station with an initial capacity of 10,000 hp. will be constructed in western Oklahoma to take care of the growing demands upon the Muskogee, Sapulpa and Drumright divisions of the Oklahoma Gas & Electric Co. Condensing water will be obtained from the Arkansas river.

The third station will be constructed at Pueblo, Colo., on the present power-house site of the Arkansas Valley Railway, Light & Power Co. The present power station with a capacity of 7500 hp. will be maintained and the new station with an initial capacity of 10,000 hp. will be constructed adjacent to it. This improvement, like the others, is necessary because of increasing business in the present territory and not because of expansion of territory.

With the new 40,000-hp. unit at Riverside station at Minneapolis (now under construction) and other enlargements or extensions at the properties either being built or contemplated, the combined properties of H. M. Byllesby & Co. will have available an additional 100,000 hp. of generating capacity before the end of 1920.

COLONEL ARNOLD NARRATES AIRCRAFT EXPERIENCES OF THE WAR.

Intensely Interesting Address Before the Electric Club of Chicago Explains Much of the Development Work.

The far reaching importance of much of the war work done by engineers and scientists who did not get to the battlefront or even overseas was explained by Col. Bion J. Arnold, the well known consulting engineer, in an address before the Electric Club of Chicago on Nov. 25. He spoke almost entirely of such work that he came personally in contact with, first as a member of the Naval Consulting Board and later when in active service as an engineer officer of the aircraft division of the Army and Navy.

Before we entered the war the Naval Consulting Board began studying inventions dealing with solution of the submarine menace and other weapons of warfare. Later the National Research Council and Council of National Defense took this over. Several thousand inventions were analyzed and all promising ones tried out. Out of this, for instance, came the submarine detector or listening device built on a simple principle. Colonel Arnold had long been interested in aeronautics and was chosen to make a comprehensive investigation and recommendation on speeding up of all aircraft production facilities, both for the Army and Navy. Subsequently he conducted the Congressional Committee investigating this matter to the various plants engaged on the work. Although there was considerable waste in this and other branches of our feverish war preparations, it was unavoidable and no more proportionally than would have occurred under private jurisdiction. An extraordinary amount of work was accomplished on a much bigger scale than was generally understood by the public.

Colonel Arnold also spoke of an extended investigation he made of our aluminum resources which showed these were ample for our war needs and those of our Allies, if conservation in miscellaneous consumption were affected. In the last months of the war he was engaged in co-ordinating and speeding up production of a special and very ingenious aerial offensive weapon of gigantic deadliness which was practically ready when the armistice was signed. During these months he had some thrilling flying experiences.

CONTRACTS FOR SEATTLE PLANT UNIT AWARDED.

The Seattle Board of Public Works, Seattle, Wash., has awarded contracts to furnish and install the equipment for the new steam-electric unit at its Lake Union auxiliary plant, for which bids were opened recently. The bid of Chas. C. Moore & Co., of San Francisco, was accepted on six watertube boilers of 825 hp. each, superheaters and stacks, oil heaters, oil pumps, feed-water heaters and piping system; also boiler-feed pumps and service pumps, high-vacuum jet condensers, with air and water pumps having both motor and turbine drive. This bid was $415,707.

To the Allis-Chalmers Mfg. Co. was awarded the contract for furnishing the 10,000-kw. steam turbogenerator with both steam and motor-driven exciter and all accessories at $195,500.

Commercial Practice

Electricity for Oil-Well Drilling—Explaining Increasing Light Bills—Louisville Company Sells Stock to Customers

OIL-WELL DRILLING BY ELECTRICITY PROVES ECONOMICAL.

Advantages of Electricity for Drilling Includes Savings in Cost, Small Depreciation, Simplicity and Flexibility of Operation.

It is stated that when the extensions of the high-tension transmission lines now under construction in north Central Texas are completed, most of the well drilling operators will discard the steam motive equipment on their drilling rigs for electric power. Many wells in the Burkburnett field are being pumped with electric power, and it is asserted substantial savings have been effected in the cost of drilling as well as pumping.

In one well in the El Dorado (Kansas) field engineers of the Empire Gas & Fuel Co. claim a saving of $3655.20 by using electric power instead of steam power. S. B. Severson, chief of the electrical engineering department of the company, in a report says that this well was the first one drilled in that field by electricity, although hundreds of the company's wells are being pumped by electric power.

"Attempts have been made in recent years to use electric motor equipment for drilling deep wells," says Mr. Severson, "but it has been only within the last year or two that much success has been attained. A number of wells have been drilled with electric motor in various parts of the world. The question of motor has been readily solved, but the perfect control necessary to satisfy all conditions in the drilling operation has been difficult to obtain. Results obtained in the drilling of the well in the El Dorado field and a subsequent well show conclusively that a combination of motor and control apparatus has been perfected to a degree that causes even experienced drillers to say electric drilling equipment is superior to steam. Reports from operation give ample proof that the trial was satisfactory and successful."

The veteran driller, it was believed, would not take kindly to the new method, but this did not prove to be the case. In a short time both crews became so familiar with the electric apparatus that the services of an electrician hardly were needed. This was the experience of J. G. Dickinson, electrical engineer, who was stationed at the well and who made a general report, which said:

"The maintenance of the electrical drilling equipment consisted principally of attention to the contact fingers and segments in the main controller due to the fact that these parts become pitted by the arcing caused in reversing the motor and prevent the fingers from making a good contact. This condition would not require the constant attention of an electrician, but could be handled by the regular inspector on his daily visit, and in the event of more serious trouble, the trouble-man of the electrical department could be summoned.

"The driller and tool dresser became familiar enough with the electrical equipment during the test to be particularly independent of outside assistance, so that electrical drilling equipment will not require the services of an extra man. On two or three occasions fuses were replaced, but at no time was there any serious electrical trouble. The principal delays incurred during the test were caused by rig equipment.

"While the operation during the test covered a period of 60 days, the actual drilling was accomplished in 34 drilling days, and the only water required for the test was water used in the hole for mixing the drillings.

"The controllers were so arranged that they provided 80 different speed variations. The controllers were operated by steel cable lines from levers on the 'headache' post. The weight of the motor was approximately two tons.

"The ammeter was located in the derrick close to the 'headache' post, and showed the driller the amount of power he was using. During drilling operations in hard lime, where the tools got a good rebound, it required 50 to 60 amperes, or from 30 to 35 hp. For drilling in shale, where the bit muddled up, the ammeter showed about 60 to 70 amperes, or about 35 to 41 hp. In pulling the tools out and in bailing water is usually required about 100 to 125 amperes, or about 57 to 75 hp. As the motor was 75 hp. and would stand a load of 100% continuously, a 25% overload for two hours and a 100% overload for two or three minutes there was ample reserve power for any emergency that might occur. By changing the taps in the transformer bank the voltage was raised so that while drilling it would be about 440 volts. In that way the motor received the rated voltage during the operation, which was nearly continuous.

"During the test, tachometer readings were taken while drilling in order to determine the 'kick' on the line when using a motor as compared with a neighboring steam drilling outfit, but there was not enough difference to be noticed, so the 'kick' on the line may be taken as identical on the two outfits.

"A perusal of the daily report will show that this well had more to contend with than the average well. There was much more bailing than usual, and this, in turn, caused considerable rig trouble. The bull-wheel, band-wheel and the sand-reel had to be replaced. This, with other difficulties, caused many delays that otherwise would have been avoided. Water and caving increased the cost per foot drilled more than the average for electric drilling in California.

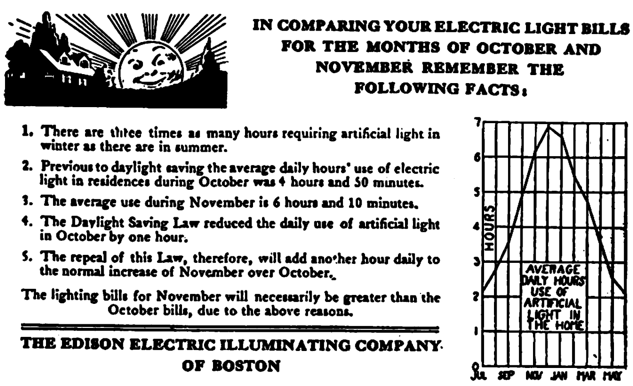
"The many advantages of electricity for drilling were realized on this well from the start. The saving in cost includes the building of one house that will suffice for both drilling and pumping without motor and control is less than the cost of boiler and engine. The cost per day for drilling by electric power is less than with steam. The water consumption is smaller. There is almost no fire risk, and it is not necessary to move the motor away from the rig if gas is encountered. The depreciation of the electric equipment is very small and repair parts are interchangeable. The motor used for drilling is supplied with screws at the bottom of the end shields, so that reasonable wear in the bearings may be taken up and thus the air gap may be kept balanced on all sides. With good oil for the bearings, it should not be necessary to do this more than once in eight months."

BUILDING UP THE CUSTOMER'S CONFIDENCE IN THE METER.

How Boston Edison Co. Explains Increasing Bills Due Shortening Days.

In spite of the fact that watt-hour meters have been proven uniformly accurate measuring instruments, that central-station companies have been continually decreasing their rates, and that electric service is practically indispensable to users, it is difficult to reconcile customers to the amounts of their monthly lighting bills. Central stations can generate electrical energy, but it is not so easy to generate the customer's faith in a device that measures the amount of money he has to pay for service.

The majority of complaints that come from customers are in the nature of claims for overcharges, meters "running fast" or "creeping." And just at this



Card Sent to Customers to Explain Increase In Lighting Bill.

time of year, when lighting service demands are increasing, the complaints come the most frequent. The difference between October and November bills is the most noticeable, due to the shortening of the days and to the change back to standard time.

In order to let customers know of these conditions affecting their lighting bill, the Boston Edison Co. prepared a card, reproduction of which is given, explaining the reasons for increased bills and mailed one to each customer. The explanations are frank and convincing, and serve to build up the customers' faith in the meter and the company.

INDIANA COMPANY ASKS CO-OPERATION OF PUBLIC.

Co-operation with the public has been the object of some excellent publicity work recently done by the Northern Indiana Gas & Electric Co., Ft. Wayne, Ind. The company addressed an open letter to the public, in advertising display type, showing the public what the company is anxious and willing to do in regard to good service. The company, in the same letter, addressed an appeal to its employes for greater harmony as relating to the company's interests and the rights of the public.

LOUISVILLE COMPANY STARTS CUSTOMER-OWNERSHIP PLAN.

The customer-ownership plan of distributing electric securities among the citizens served by Byllesby companies has been extended to the Louisville Gas & Electric Co. Within a few days after the announcement of the plan in the newspapers 520 inquiries had been received and nearly 100 residents of Louisville, Ky., had become preferred shareholders.

Customers and the public generally were invited to become profit-sharing partners in the Louisville Gas & Electric Co. in accordance with the new financing policy announced by the company. To make this possible, preferred stock will be issued and offered with a view of giving people of small as well as large means an opportunity to acquire part ownership. Investment on the partial payment plan will be a feature, and the company will henceforth maintain an investment department at its office, where citizens may purchase its securities direct. The new department will be in charge of J. W. Smiley.

The company has no preferred stock outstanding at present. Recent amended articles of incorporation were filed, authorizing the issue of 7% preferred stock, and the board of directors authorized the sale of $2,000,000 of such stock to the public. Proceeds of the stock must be used for the retirement of outstanding bonds or the construction of additions and extensions to the property which would otherwise require the issue of bonds. The new stock will have full voting rights.

In the past the funds required for construction purposes to serve the increasing demands of a growing city and business have been obtained by the company through the usual investment channels. The new plan marks the inauguration of a definite step toward the building up of a large number of customer-shareholders among citizens in all walks of life. The object of the company, according to the announcement, is to make the largest possible number of home shareholders by offering them an attractive security, so that eventually the utilities will be popularly owned, and at the same time retain responsible, experienced and economical management.

DETERMINING CARBON CONTENT OF STEEL ELECTROLYTICALLY.

The carbon content of steels may be determined rapidly and quite rapidly by absorbing the carbon dioxide resulting from direct combustion of the metal in oxygen in a solution of barium hydroxide. The carbon content is decided by measuring the electrical resistance of the barium hydroxide solution. Further particulars as to the method employed and the apparatus used will be found in Technologic Paper No. 141, by J. R. Cain and L. C. Maxwell, Bureau of Standards.

CLOSE MUNICIPAL PLANT.

Voters of Eldon, Ia., have ratified a contract between the municipality and the Ottumwa Railway & Light Co. for the purchase of the community's electrical energy requirements from the company. The municipally owned steam plant, which has up to this time generated electricity for street lighting and business and residential use, will be abandoned. The company is building an extension of its transmission lines to serve the town.

Operating Practice

Sealing Up Blown-Out Concrete Dam — Carbon Dioxide and Fuel Saving—Reducing Corrosion of Turbine Blading

INTERESTING MODE OF SEALING UP BLOW-OUT IN CONCRETE DAM.

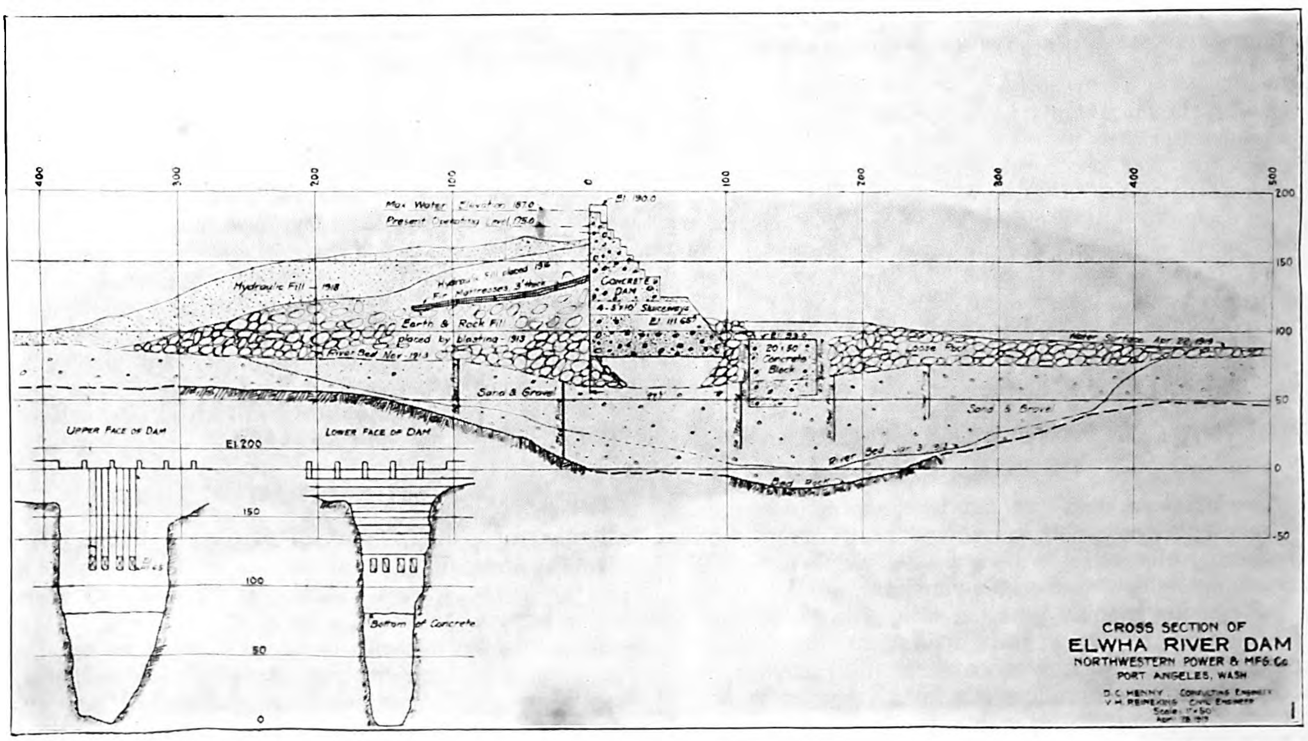
Outline of Measures Adopted to Stop Flow and Seepage Through Dam.

The blow-out which occurred under the Elwha river dam of the Northwestern Power & Manufacturing Co., in the vicinity of Port Angeles, Wash., about three years ago, created for that company the difficulty problem of building up a substructure that would make the dam available for the purpose for which it was originally built. The blow-out extended to a depth of 90 ft. below the base of the concrete dam and to a level about 10 ft. above bedrock in the canyon proper.

It was considered not practicable to unwater the stream sufficiently to allow the concrete to be extended down to bedrock, and the first step taken was to drive sheet-steel piling both above and below the dam and to run a heavy concrete block at a point just below the lower toe of the dam. Then, the canyon walls both above and below the dam were blasted in for the purpose of choking the flow of the river. This resulted in stopping about one-half of the normal flow of the stream. The next step was to fix in place a fir mattress upon the blasted-in portion of the dam and fill in on top of it 30,000 cu. yds. of material by hydraulic work. The result of this was to reduce the flow through the structure to 160 cu. ft. per sec.

At the conclusion of the work above described, the Puget Sound Bridge & Dredging Co., Seattle, was engaged to continue the hydraulic work, which has been continued and 180,000 cu. yds. of material have been filled in above the concrete dam, making about a 1 to 3 side slope. When this work was completed it was ascertained that the seepage loss had been reduced to 80 cu. ft. per sec. at the water elevation of 185.

It was decided that the hydraulic method of sealing, which had been adopted, would not in itself prove sufficient to entirely stop the seepage loss. Following this a plan was devised which it is believed will prove effectual, and the work of carrying it out is well along toward completion. First, a cofferdam was constructed of material previously sluiced in by using a drag-line scraper. The cofferdam served to cut off the portion of the basin immediately in front of and next to the concrete dam. The plan was that if, when the cofferdam was completed, a marked decrease in seepage loss was observed, a flexible copper joint would be set into the upstream face of the dam and joined to a reinforced concrete slab, 4 ft. wide and 12 ins. thick. The purpose of the flexible copper joint was to provide for possible settlement of the hydraulic fill against the face of the dam. Inasmuch as the anticipated reduction in seepage was in evidence after the completion of the cofferdam, the concrete slab with flexible copper joint was put in place. That phase of the work is being followed by a method of asphaltic sealing, to consist of joining onto the re-



Cross-Section of Elwha River Dam.

inforced concrete an asphaltic composition of such consistency as will not harden under cold water and which is to be extended over the entire area behind the cofferdam. The asphaltic sealing is to be covered with boulders and cobblestones to hold it in place. At the conclusion of this work observations will be made as to seepage loss, and if the entire method shall prove efficient, the other areas above to the dam will be treated in a similar manner.

CARBON DIOXIDE AND FUEL SAVING.

By F. A. Uehling.

I was greatly interested in reading your editorial article entitled "Air Supply to the Boiler Room" because it touches a somewhat neglected subject, yet one of prime importance to every steam power plant because it has an important influence on the amount spent for fuel. Every statement in the article is true and to the point, and still I fear it will leave the reader with the thought that too many plants suffer from an insufficiency of air for the furnace, whereas, exactly the reverse condition is true. In fact, I believe that for every boiler furnace that uses too little air there are at least a hundred that use too much.

For example, you state "Too many power plants suffer from insufficient air; too many stacks are taxed because of closed doors and windows during the cold weather. The fires in too many boiler rooms are partly asphyxiated because no proper provision for incoming air has been made. And the reason for these things is not because it has been overlooked that air is one of the three raw materials required in steam making by fuel, but because the vast volume and heavy weight involved are not fully appreciated."

By far the largest single loss in the steam power plant is found in the heat carried away up the chimney. The principal factor contributing to this loss is the excess air which enters the furnace through the ashpit door or through leaks in the boiler or furnace setting.

All air in excess of that actually required to support combustion increases the volume of gases passing up the chimney, thus supplying a greater vehicle to carry away the precious heat units. Likewise excess air mixes with the gaseous products of combustion, lowering their temperature alarmingly. It is obvious that the heat misappropriated in this way leaves fewer heat units to enter the boiler and evaporate water.

It is fortunate that there is a simple and accurate means of measuring this excess air so that it may be regulated. It is based on the fact that the percentage of carbon dioxide (CO_2) in the flue gases bears a definite relation to the percentage of excess air. The accompanying table shows how the percentage of Co_2 falls as the amount of air per pound of fuel is increased. The third column of the table shows how excess air lowers furnace temperature and the fourth column gives some idea as to the magnitude of the heat losses occuring with lower percentages of CO_2. Even slight increases in CO_2 percentages represent worth while fuel savings. For instance, an increase in CO_2 from 6.2 to 7.3% reduces the loss due to excess air from 35.7 to 30.5%. By maintaining even such a slight improvement as this the coal expense would be reduced 5.2%, not to mention other advantages.

As a matter of fact many plants are reducing their coal expense from 10 to 20% per annum by the intelligent use of CO_2 recorders. The cost of installing and operating such instruments fades into insignificance compared with the saving effected. The sixth column of the table enables the reader to estimate his actual losses up the chimney in dollars and cents. No better means could be found of driving home the fact that excess air costs money.

HEAT CARRIED AWAY UP CHIMNEY.

Based on data in "Steam Power Plant Eineering" by Prof. Geo. F. Gebhardt. Based on carbon of 14,540 B. t. u. calorific value as fuel, on dry chimney gases and 600 deg. F. chimney temperature and 60 deg. F. atmospheric temperature.

Percentages of CO_2 in flue gas.	Pounds of air per pound of fuel.	Fire temperature deg. F.	Heat wasted up chimney in B. t. u. per pound of fuel.	Percent of heat of fuel wasted up chimney.	Money wasted up chimney for every thousand dollars spent for fuel.
20	12	3,910	1,683	11.6	$116.00
16	15	3,190	2,072	14.3	143.00
13.4	18	2,700	2,460	17	170.00
11.4	21	2,340	2,846	19.5	195.00
10	24	2,060	3,240	22.4	224.00
8.9	27	1,850	3,628	25	250.00
8	30	1,680	4,016	27.8	278.00
7.3	33	1,535	4,405	30.5	305.00
6.7	36	1,415	4,798	33	330.00
6.2	39	1,315	5,180	35.7	357.00
5.8	42	1,225	5,570	39.4	394.00
5.0	48	1,085	6,350	43.7	437.00
4.0	60	880	7,910	54.4	544.00
3.0	80	680	10,500	72.2	722.00

DUQUESNE LIGHT CO. USES KEROSENE FOR REMOVING TURBINE SCALE.

It is well known that the piping of heating systems become corroded in course of time, the corrosion being due to dissolved gases taken into the system either with the feed water or through leaks in return lines at a pressure below atmospheric. One of the chief aims in reducing corrosion is to eliminate the oxygen in the water, because when this is done water ceases to be a corrosive agent in the manner here understood. Carbon dioxide causes acidity, of course, but indications are that with oxygen absent water has little tendency to cause corrosion.

Open type heaters offer one solution to reducing corrosion of pipes, oil treatment another. The Duquesne Light Co. applied the use of oil-kerosene, actually—in one case of corrosion, and with very successful results. In one of its stations, this company had a steam turbine that was corroding seriously around the blades. This turbine had to be shut down about six hours per day, because of operating conditions, during which time condensation upon the blading occurred. Oxygen entered the turbine casing through leaks and with the steam, and this in the presence of the condensate, started corrosion. This continued more or less intermittently for some two years at which time the corrosion had become a serious matter.

At the suggestion of F. N. Speller, a pure heavy mineral oil with a paraffin base was dropped into the steam ahead of the throttle at a regular rate, the purpose being to cause a thin oil film to form upon the blading and casing. This treatment proved so effectual in stopping corrosion, by protecting the surfaces, that the practice has been continued. About one and one-half gallons of kerosene are applied every day at the time of shutting down, and five gallons are applied every Saturday before the weekly shutdown. The application of kerosene in this way cleans out whatever scale exists and lessens the likelihood of any more adhering. Corrosion is, likewise, reduced.

Contractor-Dealer

Potential Field for Fan Sales—Electric Reading Lamps as Suitable Christmas Gifts—Good Example of Dealer Helps

MAKING A MARKET FOR A MILLION ELECTRIC FANS.

Opening Up a Field That Is Rife with Possibilities for the Sale of Enormous Quantities of Fans in 1921.

By D. H. Colcord.

I am no more interested in electrical dealers marketing a million electric fans in the summer of 1921 than I am in yesterday's weather report, except that as an outsider not in the business I can see merchandising possibilities to which merchants may be blind. I can see clearly and logically how dealers in and salesmen of electric fans can create a potential market for the summer of 1921 that will tax every electrical manufacturer to the capacity of their plant. Why 1921 and not 1920? There hangs the tale.

I know nearly a million places where humanity swelters without the cool breezes of an electric fan—rooms where the occupants are doing the hardest kind of mental labor—studying when they don't want to. These folks have never dreamed of a fan and once they start in there will be a riot. They will rise up and demand fans. I know, because I spent seven years in one of those rooms—in April, May, June, September and October—close to the Mason and Dixon line—trying to pound a little knowledge into their hot heads. Why isn't every school child in the United States, especially in the South, entitled to the same comfort at his work during the warm days of the spring and fall that their fathers enjoy at the office? There is the proposition: *Every school room should be equipped with electric fans.*

You have already thought of the obvious objection: that there is no school during the hot months of the year, that fans for the few hot days at the beginning and close of the term are unnecessary.

I am writing this in Pittsburgh on the last day of October with a 14-inch electric fan stirring up a room full of sultriness and warm stagnant air. I'll bet that there are a thousand fans running now within five miles of my desk; and that at the same time a squad of instructors are leaving the high school in the next block, exhausted after a "blue Monday"—blue, because it's hot and muggy and rainy, and the youngsters were "dead" all day. But their dads are not; they snapped on the fan!

I'll grant that it would be foolish to install fans in Dawson or Halifax—but not in Austin or Tampa or even St. Louis. Even if electric fans were needed only two months a year, between the Mason and Dixon line and the Canadian border, they would pay in health and happiness for the kiddies. They are not costing anything when not in use. As a matter of fact anybody knows who has "passed" geography that the two most important months in the school year are the first and the last—and these are the hottest. In September it is hard for a child to get a good start, so essential for a successful year, with the thermometer at 90 deg. June is examination time and many of us "flunked" the final exams. because it was too gol-durned-hot to think. Am I right?

Are you convinced, Mr. Dealer? If not, put the idea up to your own youngsters. Take one to your office on a hot day in June when he comes home "all tired out" from school. Tell him to sit down at your desk and get out his "problems" for tomorrow. Then slip over and snap on your fan, placing it so he will get the full benefit of the breeze. If he isn't sold, I miss my guess. He will sell you, too. I know; I tried it. He will sell your board of education eventually if you work it right.

How are you going to start the campaign? I'm not a professional agitator, nor do I believe in making young Bolsheviks out of the coming generation, but I'd say, "Start with the kids themselves."

Understand I'm not selling fans nor do I intend to, but here's the way I'd begin if I were: Double-page spread in a national magazine with four contrasting pictures—father at his desk working, enjoying the cool breeze of a Wesgen fan; opposite, a school room full of exhausted youngsters with no fan; again, same youngsters, straightened up, bright, industrious, bombarded with the breezes of a couple of fans; again, the teacher, smiling at her desk, with a little 8-in. Whizzer to the right.

Of course the electrical dealer is not interested in this phase of the publicity effort, which is up to the manufacturer, but a little pressure brought to bear on the latter would start the big idea. I don't believe I would attempt to realize on the advertising until after about two years of publicity wisely conducted, until the youngsters arise and demand that boards of education provide electric fans for the school room. Then cash in!

THE UNWRITTEN GUARANTEE ON ELECTRICAL DEVICES.

"One thing that we have found," says George J. Beattie, proprietor of the Electric Shop, Toronto, Canada, "is that it pays to sell only a quality device and at the right price, and to stand behind it. Not over a year ago, we sold a device for $500 to a customer. After four months' use it developed defects and we replaced it with a new unit. As a direct result of this stand-behind-the-goods policy direct we have since received from this customer $1500 additional business, and from a personal friend of his over $2000—a total of $3500.

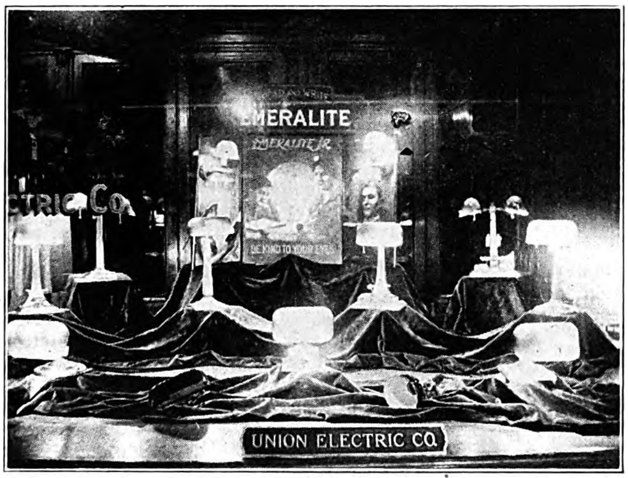
"All dealers should tie up with goods made by reputable manufacturers backed up by national advertising.

"Our policy is that our interest in the sale does not end when the goods are delivered and paid for, but extends as long as may be necessary. We not only demonstrate an article but we have a trained man who goes around to each customer about once a month to see that the device is operating satisfactorily."

MERCHANDISING READING LAMPS FOR ELECTRICAL CHRISTMAS GIFTS.

How a Progressive Pittsburgh Dealer Is Disposing of Many Lamps for Students as Well as General Household Reading and Similar Uses.

As an electrical Christmas gift for the college student or the professional man or woman nothing could be more appropriate than a reading lamp, and the old adage that "goods well displayed are half sold" applies with special force to this class of merchandise. The Union Electric Co., Pittsburgh, Pa., getting into the running at an early date, sent out cards to its patrons, explaining the advantage of good



Window Display Featuring Reading Lamps.

light, and especially recommending a reading lamp as a birthday or holiday gift to students. Quotations were made on a number of different styles, and an invitation made to inspect its full line of electric lamps and secure expert advice as to the kind best adapted to their particular use.

Backing up the publicity campaign was an excellent window display, advantage being taken of the manufacturer's aids to give force to the window advertising. In the background, on a long low platform covered with green velvet, was a three-panel cutout showing men, women and children reading by electric lamps fastened in different positions. Set on mounds of velvet throughout the window were many types of study lamps with brass standards and green shades. One of them, particularly adapted to the professional man, has incorporated into its base a complete writing set—ink stand, pen rack, etc.

LIGHTING FIXTURE MANUFACTURERS TO HOLD SHOW.

The first annual lighting fixture market and chandelier show is announced to be held Feb. 9-13 in Detroit by the National Council of Lighting Fixture Manufacturers. Conventions of the Lighting Fixture Dealers' Society of America and of the Illuminating Glassware Guild will also be held at the same time.

The demand for exhibit space indicates that such an exhibition is very desirable and assures that the show will be a success. C. H. Hofrichter is secretary-treasurer of the National Council of Lighting Fixture Manufacturers and is in charge of arrangements for the show. His address is 8410 Lake avenue, Cleveland.

DEALERS' HELPS DO A GOOD SHARE OF SELLING.

Appliances are easier to sell when suggestions as to the necessity and convenience afforded by them are pointed out. For instance, a feed-through switch casually displayed in window space or show case doesn't mean much to the layman who has never used one unless a demonstration of its usefulness is made to him. It is physically impossible for the dealer to show everyone just how useful each and all of the many electrical devices are, and, realizing this, the manufacturers step in and provide sales helps that simplify the problem.

A good illustration of this is given by the line of dealers' helps prepared by the Cutler-Hammer Manufacturing Co. in connection with its "70-50" feed-through switch. The handling of these switches by dealers as accessories and as part of flatiron and toaster equipments has become so standardized that a piece of permanent advertising seemed warranted. A large lithographed metal sign was the result and to accompany this selling suggestions, folders and lantern slides were prepared to convey the message to the uninitiated of the usefulness of such a device.

A Good Example of the Many Dealers' Helps Prepared by Electrical Manufacturers.

These helps relieve the dealer of much of the educational work that are part of the sales of electrical appliances and do much to increase the total volume of sales.

ELECTRICAL SHOW TO BE HELD AT WORCESTER, MASS.

During the week from Nov. 29 to Dec. 6 an electrical show will be held at Worcester, Mass., the electrical interests of that city combining to make an exhibition to stimulate holiday sales.

On Dec. 3 the Massachusetts State Association of Electrical Contractors and Dealers will hold its annual meeting at Worcester. Officers for the coming year will be elected and other business matters will come up before the association, after which J. A. Corcoran, of General Electric Co., will give an address on "The Merchandising of Electrical Products."

New Appliances

Westinghouse Safety Inclosed Service Entrance Switch—Washing Machine with All the Mechanism Safely Inclosed

New Electric Washer Combines Safety With Economy.

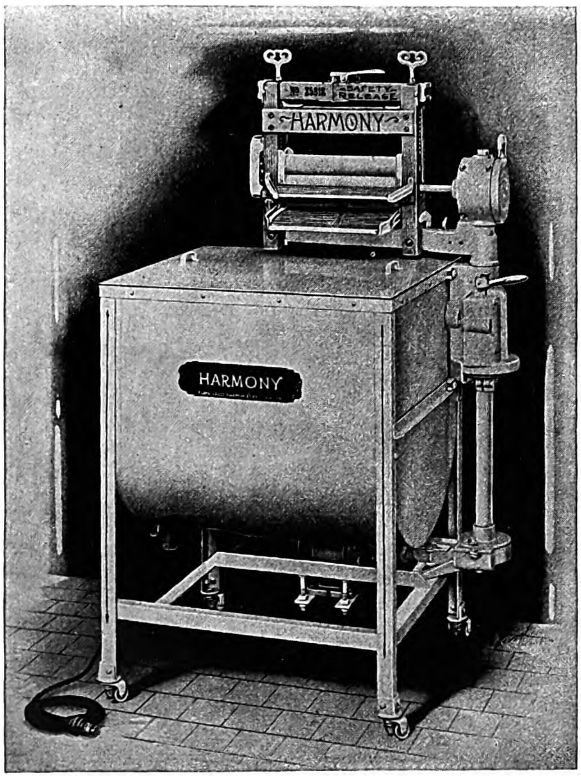
Equipped with devices which prevent accidental starting, and incorporating improvements resulting from many years of experience with washing problems, an electrically driven washing machine known as the "Harmony" and lately placed on the market by the Clark-Cadle-Harmon Corp., Rochester, N. Y., is becoming popular as a labor-saver in the home.

One of the safety devices consists of a lever which must be depressed before the machine can be started. This is especially advantageous in preventing the mischievous or accidental starting by children. Another safety device comprises a stop which prevents the wringer from being started under any conditions unless locked in position and ready for work. The wringer also has a safety release at the top to relieve the load if the clothes become clogged in the rolls. All working parts are inclosed so that there is no danger of fingers or clothes being caught in them.

The machine is driven by a ¼-hp. Westinghouse splashproof motor, which under test has proved durable and efficient.

It is noteworthy that the washing cylinder is made of selected white cork pine, a light, clear wood which absorbs little water and is easy to clean. An advantage of using wood is that it causes less wear on the clothes because of its elasticity and lack of thin sharp edges.

The frame is electrically welded into practically one piece, and is mounted on large ball-bearing, double casters which enable the machine to be easily rolled in any direction.



Electric Washer With Special Safety Features.

A New House-Entrance Safety Switch.

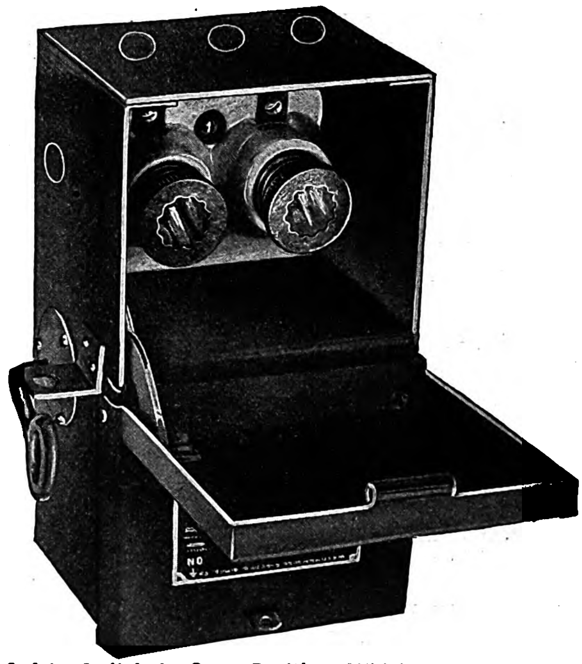
It is now becoming generally recognized that the unprotected knife switch is too dangerous to be used in places where it can be handled by careless and ignorant persons, especially in the home where it can be reached by children. The best modern wiring practice therefore demands the use of safety switches in such locations.

The new Westinghouse type WK-53 switch has been designed to meet this demand. It is perfectly safe to operate, the fuses can be renewed only when they are dead, unauthorized persons can not reach live parts, and the switch can be locked open if desired. At the same time its construction is simple and its cost very low. It is suplied in a 30-ampere, 125-volt size and is especially adapted for house-entrance service; but it can also be used to advantage in place of an open knife switch for any purpose within its capacity.

The switch, which is of knife type, is mounted together with two plug fuses on a porcelain base and is inclosed within a steel box. It is operated by a projecting handle and opens with a quick break, no matter how slowly the handle may be operated.

The cover of the box consists of two parts, hinged together. The upper part, which covers the knife switch, is held in place by screws. The lower part forms a door, which gives access to the fuses. It is, however, impossible to open this door unless the switch is in the off position when the fuses are dead; if the switch is closed when the door is open, the door closes also; and a barrier prevents access to the switch and terminals from the fuse compartment. Hence there is no possible way (short of damaging the switch) of getting a shock when renewing the fuses.

The upper part of the cover can be protected by a seal and the handle can be locked in the off position by a padlock. Unauthorized persons can therefore be prevented from getting at the live parts and also closing the switch. These features are valuable safeguards in any service, but appeal especially to central stations as they prevent theft of current.



Safety Switch in Open Position, Which Enables Access to Be Obtained to Fuse Compartment.

Lately Approved Appliances

The electrical fittings listed and described in this department have been approved by the Underwriters' Laboratories, Incorporated, after examination and tests conducted under standards of the National Electrical Code as recommended by the National Fire Protection Association.

Armored Cable.—Arrow Flexible Conduit Co., Inc., 212 Canal street, New York.
Marking: Letter "A" in circle stamped in armor at intervals of about 3 in.
Listed June 2, 1919.

Cabinets and Cutout Boxes, Sheet-Metal.—United Metal Box Co., 49 Sixth avenue, New York, N. Y.
Listed Sept. 10, 1919.

Connection Block.—Benjamin Electric Manufacturing Co., 120 South Sangamon street, Chicago.
Consisting of two or more terminal plates, each with two binding screws, mounted on base of insulating material. Designed for mounting in conduit box to facilitate making connections. "Benjamin," Catalog Nos. 6912 to 15 inclusive, 6936, 6937, 6952.
Listed Aug. 21, 1919.

Cutout Bases, Plug-Fuse. — The Gordon Electric Manufacturing Co., Waterville, Conn.
"Gordon," 0-30 amperes, 125 volts. Catalog Nos. 1935, 2135.
Listed Sept. 8, 1919.

Cutout Bases, Plug-Fuse.—Ward Electric Co., 1411 Walnut street, Philadelphia, Pa.
"Ward." 0-30 amperes, 125 volts, Catalog Nos. 1935, 2135, 2165, 2199, 2965, 8042.
Listed Aug. 29, 1919.

Dental Equipment Stand.—The S. S. White Dental Manufacturing Co., 211 South 12th street, Philadelphia, Pa.
Consisting of pedestal designed to stand by dentist's chair and upon which are mounted an extensive line of electric, gas, air and water attachments, suitable for use in performing a great variety of dental operations. Catalog No. 5.
Listed July 2, 1919.

Fixtures, Vaporproof.—The Adapti Co., 919-25 West street, Cleveland, Ohio.
"Adapti." Catalog Nos 9100, 9101, 9110-12 inclusive, 9120-22, 9130-32, 9140-42, 9150-52; 9200, 9201, 9210-12, 9220-22, 9230-32, 9240-42, 9250-52, 9500-02, 9510-12, 9520-22, 9530-32, 9540-42, 9550-52, 9600-02, 9610-12, 9620-22, 9630-32, 9640-42, 9650-52.
Listed Oct. 10, 1919.

Fuses, Cartridge.—Ward Electric Co., 1411 Walnut street, Philadelphia, Pa.
"Ward." Cartridge inclosed fuses. 0-600 amperes, 250 volts, 0-200 amperes, 600 volts.
Listed Aug. 29, 1919.

Fuses, Plug.—Whitman Electric Manufacturing Co., 352 South avenue, Whitman, Mass.
"Blue Ribbon." Edison plug fuses, 0-30 amperes, 125 volts.
Listed Sept. 6, 1919.

Ground Clamps.—Emil C. Zisterer, 4701 West 12th place, Cicero, Ill.
"Zisterer." Continuous copper strip for bonding and grounding pipes and conduits 2 in. size or less.
When distance between pipes and conduits is not so great as to require insulated connecting ground wire, continuous strip installation reduces number of joints and connections to minimum.
Listed Aug. 22, 1919.

Heating Appliances, Liquid.—Hot-Flo Faucet Corp., 1400 Broadway, New York.
Electric faucet, consisting of electric heater and switch combined with water faucet; switch spindle controls both electric current and water.
"Hot-Flo." 14 amperes, 125 volts; 7 amperes, 250 volts, a.c.
Listed Aug. 12, 1919.

Insulating Supports.—Line Material Co., South Milwaukee, Wis.
Stamped bases, or malleable-iron hooks or brackets, galvanized, to which petticoated porcelain insulators are secured.
Catalog Nos. 1818-G, 1919-G, 2001-G, 2051, 2201, 2231, 2261, 2324-G, 2332-G, 2341-G, 2352-G, 2355-G, 2411-G, 2413, 2417, 2421, 2423, 2433-G, 2473, 2681, 2951-G, 2959-G, 2961-G, 2969-G, 2973-G, 2977-G, 2989-G, 2995-G, 3205-G, 3219-CG, 3233-G, 3237-G, 3247-G, 3305-G, 3309-G, 3319-CG, 3323-G, 3333-G, 3337-G, 3347-G, 5050-G, 11529, 11538.
For low-potential conductors No. 8 B. & S. gauge or smaller, when installed in manner acceptable to inspection department having jurisdiction.
Listed July 15, 1919.

Outlet Bushings, Service-Entrance.—Cap-Swivel-Let Co., Warren, R. I.
"Johnson's." Porcelain fittings having separate openings for wires and secured in cast-iron caps attached by threaded swivel bushing to rigid conduit. ½-in. to 2-in. sizes included. Types AW, BW.F.
Listed Oct. 6, 1919.

Pump.—The Vaile-Kimes Co., 35 St. Clair street, Dayton, Ohio.
Electrically operated pump for domestic water supply automatically controlled by switches, pressure or float-operated.
"V-K." 250 volts or less, 1½ hp. or less. Fig. 120, sizes 0, 1; Fig. 130, sizes 3, 5, 7; Fig. 140, sizes 0, 1; Fig. 150, sizes 3, 5, 7; Fig. 173, size 203; Fig. 177; Fig. 178; Fig. 183; Fig. 185; Fig. 266, sizes J, K, L, M; Fig. 267, sizes E-2, E-4, F-4, F-6, F-8, G-8, G-10.
This rating is to be understood as indicating that in construction the electrical hazard has been reduced to an acceptable degree. It is not to be construed as approval of device for use in connection with automatic sprinkler or other fire-protective equipments, for which services their merits have not been investigated.
Listed Aug. 13, 1919.

Receptacle for Attachment Plugs, and Plug.—Oliver Electric & Manufacturing Co., 4221 Forest Park boulevard, St. Louis, Mo.
"Oliver." For use in series with switch and not for opening or closing circuit under load.
3-pole, 60 amperes, 550 volts. Type S.P.R.
Listed July 19, 1919.

Receptacles for Attachment Plugs, and Plugs.—Ward Electric Co., 1411 Walnut street, Philadelphia, Pa.
"Ward." 660 watts, 250 volts. Catalog Nos. 4000-01.
12 amperes, 250 volts. Catalog Nos. 4500-02 inclusive.
Listed Aug. 29, 1919.

Receptacles for Attachment Plugs.—John I. Paulding, Inc., New Bedford, Mass.
"Paulding." 660 watts, 250 volts. Catalog No. 8010.
Listed Sept. 22, 1919.

Receptacles for Attachment Plugs, and Plugs, Vaporproof.—The Adapti Co., 919-25 West street, Cleveland, Ohio.
"Adapti." Catalog Nos. 9410-12 inclusive, 9420-22, 9430-32, 9440-42, 9450-52.
Listed Oct. 10, 1919.

Receptacles, Medium-Base.—Kirkman Engineering Corp., 237 Lafayette street, New York, N. Y.
"Kirkman." Porcelain receptacles. Keyless. Catalog No. 50715.
Listed Sept. 5, 1919.

Rectifiers.—Mills Novelty Co., Jackson boulevard and Green street, Chicago.
Dynamotor type rectifiers for charging small-capacity storage batteries. A.c., 110 volts, 60 cycles. D.c., 15 volts, 18 amperes; 30 volts, 9 amperes; 45 volts, 5 amperes or 110 volts, 2 amperes.
Standard when dynamotor and its wiring up to storage battery are installed according to Class C specifi-

cations of National Electrical Code. Listed July 28, 1919.

Rectifier. — St. Louis Electrical Works, 4060 Forest Park boulevard, St. Louis, Mo.

Vibrating rectifier for charging small storage batteries from a.-c. supply lines. 110 volts, 60 cycles, a.c.; 6 volts, 6 amperes d. c. Type MU.

Vibrating contacts in operation are capable of producing arcs which may, under certain conditions, ignite flammable vapors. Devices having such contacts should preferably be placed outside rooms likely to contain such vapors, or if in such rooms, must be installed in accordance with requirements of inspection department having jurisdiction.

Listed Aug. 8, 1919.

Rosettes, Fused, Link Type.—John I. Paulding, New Bedford, Mass.

"Paulding." For use only in large mills in accordance with Rule 23d of the National Electrical Code. 2 amperes, 125 volts. Catalog No. 14203.

Listed Sept. 22, 1919.

Sewing-Machine Motor and Control Rheostat.—Hamilton-Beach Manufacturing Co., Racine, Wis.

Portable motor for operating domestic sewing machines together with foot-operated control rheostat, and separable attachment plug, separable cord connector and portable flexible cord for attachment to supply circuit. 115 volts, d.c. or a.c.

Listed July 18, 1919.

Signal Appliance, Miscellaneous.—Charles J. Dorrance, 5247 Ravenswood avenue, Chicago, Ill.

Device on principle of induction coil designed to take current from direct-current lighting circuit at 125 or 250 volts and to supply current at approximately 10 volts to signaling circuit. Primary wiring to be in accord with Class C requirements, National Electrical Code.

"Dorrance D. C. Voltage Reducer, Type D.C.-A."

Listed Oct. 1, 1919.

Signaling Systems.—The Holtzer-Cabot Electric Co., Roxbury, Boston, Mass.

"Plug Type Relay Unit System." Hospital signal system composed of push-button calling stations on flexible cords and signal lamps at calling stations, corridors and annunciators, together with buzzers for audible signals; a.c. or d.c., 125 volts or less.

Standard when all wiring is installed in accordance with Class C rules, National Electrical Code.

Listed Aug. 5, 1919.

Signs.—A. & W. Electric Sign Co., Prospect and West Third streets, Cleveland, Ohio.

Electrically illuminated display signs for general use.

Listed Aug. 2, 1919.

Sockets, Mogul-Base.—Benjamin Electric Manufacturing Co., 120 South Sangamon street, Chicago, Ill.

"Benjamin." Porcelain shell.

Keyless, socket extension. Catalog Nos. 4396, 4397.

Listed Aug. 22, 1919.

Stand for Flatiron.—Mrs. Catherine V. Wilson, 2591 Broadway, Toledo, Ohio.

"Wilson Iron Rest." Corrugated steel stand to be secured by screws to end of ironing board, for pressing irons consuming 660 watts or less.

Listed Sept. 17, 1919.

Sockets, Medium-Base. — Henry Cole & Co., 54 Old Colony avenue, Boston, Mass.

"Cole." Weatherproof sockets. Porcelain. Catalog No. 9366.

Listed Sept. 18, 1919.

Supports for Switch Boxes.—E. & B. Manufacturing Co., 965 Woodward avenue, Detroit, Mich.

"E. & B." Formed, sheet-steel supports in single and gang types having flanged edges for mounting on studs and notches for screws securing switch boxes.

Listed Sept. 11, 1919.

Switches, Inclosed.—Square D Co., Detroit, Mich.

"Square D." Two, three or four-pole knife switches and cutout bases for standard plug or cartridge inclosed fuses. Inclosed in metal cases and designed for manual operation without opening cases.

30 amperes, 250 volts or less. Catalog Nos. 57311, 78211, 78311, 96211, 96311, 97311.

Listed July 3, 1919.

Switches, Oil-Break.—Electric Service Corp., 511 Sutter street, San Francisco, Cal.

"Adler." Two or three-pole, oil-immersed switches designed for manual operation without opening case, provided with no-voltage release coils and in sizes up to and including 30 amperes with overload release.

440 volts or less, 100 amperes or less.

Listed July 8, 1919.

Switches, Knife. — Ward Electric Co., 1411 Walnut street, Philadelphia, Pa.

"Ward." 30 amperes, 125 volts. Catalog Nos. 801, 1000, 1001, 1002, 1003, 1004, 1005, 1006, 1007.

30 amperes, 250 volts. Catalog Nos. 802, 803, 2030, 2031.

Listed Aug. 29, 1919.

Switches, Miscellaneous — Oven-Door.—J. F. Hoenninger, Jr., 322-24 West King street, Lancaster, Pa.

Single-pole knife switch in cast-iron case with spring-actuated push rod arranged to engage with door of bake ovens to illuminate lamps in oven when door is open. For use on branch lighting circuits. 660 watts, 250 volts.

Listed Aug. 8, 1919.

Switches, Oil-Break.—W. E. Mushet Co., 502 Mission street, San Francisco, Calif.

"WEMCO." Three-pole, oil-immersed switches designed for manual operation without opening case, provided with no-voltage and overload release coils. 10 hp., 440 volts or less.

Listed Aug. 6, 1919.

Switches, Rotary Flush, Vapor-proof.—The Adapti Co., 919-25 West street, Cleveland, Ohio.

"Adapti." Vaporproof box complete with standard labeled snap switch.

Catalog Nos. 9300-02 inclusive, 9320-22, 9340-42, 9350-52.

Listed Oct. 10, 1919.

Switches, Surface. — The Chelten Electric Co., 4859-65 Stenton avenue, Philadelphia, Pa.

"Chelten." Single-pole. Catalog No. 1200.

Listed Sept. 10, 1919.

Transformers, Bell-Ringing.—Killark Electric Manufacturing Co., 3940 Easton avenue, St. Louis, Mo.

"Killark." Air-cooled transformers designed to supply current at following voltages: For use only in ringing bells or for similar signaling work when primary wiring is installed in accordance with Class C rules, National Electrical Code.

25 or 60 cycles, primary 110 or 220 volts, secondary 10 volts or 6, 12 and 18 volts.

Listed June 20, 1919.

Wire Connectors.—The French Manufacturing Co., Grandview avenue and Robbins street, Waterbury, Conn.

Copper lugs of stamped tubing for making electrical connection to wires and cables. Each lug is marked with equilateral triangle on top of barrel. 0-30, 31-60, 61-100, 101-200-ampere ratings.

Listed June 27, 1919.

Wire Connectors.—H. B. Sherman Manufacturing Co., Battle Creek, Mich.

Solderless splicing device, consisting of brass sleeve and brass clamping screws for tightening on conductors.

For use in joining wires No. 12 B. & S. gauge or smaller, where such joints are accessible for inspection at all times.

Laboratory tests indicate this connector will not hold more than two No. 12 B. & S. gauge conductors, more than three No. 14 B. & S. gauge conductors, nor conductors of different size at same end.

Note: Joint must be insulated as required for soldered joints.

Listed June 26, 1919.

Wire—Flexible Cord.—The Whitney Blake Co., New Haven, Conn.

Marking: One uncolored cotton thread running parallel with conductor between insulation and braid.

Listed July 18, 1919.

Wire — Flexible Cord. — Flexible Woven Cable Co., 170 Purchase street, Boston, Mass.

Marking: One red, one yellow and one green thread between outer covering and rubber jacket or one red and one green thread between braid and rubber insulation on each conductor.

Listed Aug. 13, 1919.

Wire, Portable Flexible Cord for Electric Heaters.—The Whitney Blake Co., New Haven, Conn.

Marking: One uncolored cotton thread running parallel between insulation and braid.

Tag on coil to read "National Electrical Code Standard."

Listed Aug. 6, 1919.

Trade Activities

Crystal Washing Machine Co. Holds Successful Convention —Doehler Die Casting Co. to Erect New Plant—Literature

Wellman-Seaver-Morgan Co., Cleveland, has issued Bulletin No. 38, dealing with its dock cranes installed at the U. S. Army Supply Base, Boston. An extensive description of these crane installations was given in ELECTRICAL REVIEW, Nov. 8.

American Machinery Equipment Co., Detroit, Mich., was recently organized as a clearing department for cranes, boilers, power plant equipment, new and second-hand machinery, etc., with headquarters at 1246 Penobscot building. The company's operations will cover the entire east and central western sections of the country with branch offices in all the largest cities, according to W. R. Gard, general manager.

Voss Brothers Manufacturing Co., Davenport, Iowa, manufacturer of hand and power washing machines, is erecting a new factory, which will be joined to the old building with a tunnel and an overhead bridge. The new building will be a four-story structure, 150x75 ft., and of brick and concrete construction. It will be modern in every respect and will be used for assembling a new type of machine which the company is manufacturing.

Edison Electric Appliance Co., Inc., 5660 West Taylor street, Chicago, has issued a handsome bulletin, introducing its new line of "Hotpoint" 1847 Rogers Brothers silver plated ware. It contains two full page illustrations of the silver plated tea set and percolating coffee urn set and gives some idea of the remarkable beauty of this electric hollow-ware which has been added to the Hotpoint line of appliances. It is of the Adam period style, artistically designed, and lends an atmosphere of wealth wherever seen.

Doehler Die Casting Co., manufacturer of die-castings in white metal, aluminum and brass alloys, and bronze back and aluminum back babbitt-lined bearings, with main office and eastern plant at Brooklyn, N. Y., and branch plant at Toledo, Ohio, has just closed the purchase of a seven-acre tract in Chicago, on which the company will erect a modern one-story concrete steel and brick structure for the manufacture of die castings and bearings, in order to respond to the increasingly large demand for its product. Contract for the new building has already been let and operation started. The building is to be completed and ready for occupancy and operation on or about Jan. 1, 1920. This enterprising concern, one of the world's largest manufacturers in its particular line, has been influenced in this move by a policy for which it has long been noted—service to its customers.

Westinghouse Electric & Manufacturing Co., East Pittsburgh, Pa., has issued, effective Nov. 1, a new retail price list on electric ware, which includes iron, percolators, toasters, hot plates, chafing dish vessels, warming pads, luminous radiators, air heaters, etc.

Allis-Chalmers Manufacturing Co., Portland branch, has received an order from the Pelican Bay Lumber Co., Klamath Falls, Ore., for a 1000-kw. turbine. This unit will be complete with condenser, exciter and centrifugal injection pump. The machinery is for 480-volt, 60-cycle, 3-phase service, and has a capacity of 1500 amperes per terminal at full load.

American Wiremold Co., with general office and factory at Hartford, Conn., is sending out a new discount sheet (No. 5) to contractors, applying to doubling of all list prices published prior to Nov. 1. This action was taken in deference to the wishes of many thousand contractors, who are using Wiremold and have asked that the list prices of Wiremold and of Wiremold fittings be increased in order that they might have a basis for figuring wider margins of profit on this line of material which is meeting with increasing popularity.

McCarter & Cooper is the name of a new firm of consulting engineers formed by Robert D. McCarter and William L. Cooper, with offices at 165 Broadway, New York. Prior to 1902 Mr. McCarter was connected with the General Electric Co. in London as chief engineer and from that time until 1914 he maintained a consulting engineering office in London. He was also consulting engineer for all the European Westinghouse companies and president and managing director of the Russian Westinghouse Co., and in 1914 opened his office in New York. Mr. Cooper was for 15 years European manager and chief engineer for Robert W. Hunt & Co., prior to the establishment of his office in New York in 1917. The purchasing department of this firm will be located at 50 Church street.

Harvey Hubbell, Inc., Bridgeport, Conn., is sending out two new pieces of literature to the trade dealing with industrial illumination, and are a part of the extensive publicity campaign which the company is now conducting. One of these circulars illustrates and describes various types of Hubbell lamp guards, which protect lamps from breakage in shops or warehouses or wherever the lamp is exposed. Hubbell locking lamp guards are provided with lock and key and can be supplied to fit any type of socket. The other circular (No. 184) points out the essentials of efficient industrial lighting and the part that reflectors play in the distribution of light. Various types of reflectors with their respective distribution curves are illustrated, as is also a typical factory installation showing the type of reflector used and the effectiveness of this particular design. Both of these circulars, with any desired imprint and in any quantity, are offered gratis to the dealer of Hubbell electrical specialties for distribution to his customers.

Crystal Washing Machine Sales Convention.—That the electric washing machine has received the endorsement of the entire American household was borne out by the distributors and salesmen of the Crystal Washing Machine Co., who held their annual convention in Detroit, Mich., the week of Nov. 10-15. Among those who attended the convention aside from representatives from all parts of the country were Phillip R. Mallory, president of the Mallory Industries, Inc., manufacturer of household appliances, of which the Crystal company has just been made a subsidiary; Frank E. Seeley, vice-president in charge of production; C. A. Magee, vice-president in charge of sales, and F. C. Sebulske, secretary, who has been made general manager of the Crystal company and directed the convention program.

Many interesting facts were brought out at this convention, but probably the most striking was the remarkable growth of the electric washing machine industry, and the optimistic view held of the future was further evidenced by the demand of the distributors that the production figures for next year be set at 120,000 machines. These figures, Mr. Seeley said, would tax to the utmost the four large plants operated by the company throughout the country, but he lent assurance that material has already been purchased to exceed this demand. Mr. Mallory outlined the policies and activities of the company for the coming year, and laid great emphasis upon the coming year as a record breaker in the washing machine industry. Another important part of the convention was that brought out by Mr. Magee in his talk on territorial quotas, and a wider distribution of the washing machines. He pointed out that under the new distributing plans and with the co-operation of trade publication and newspaper advertising the company hoped to put the washing machine within the reach of every household, no matter how remote may be the section in which they live. To further the widespread plan of distributing the washing machine, Mr. Sebulske outlined the plan of dealer co-operation that this company plans to give every distributor and dealer.

Current News

Weekly Record of Construction Activities—Conventions

EASTERN STATES.

Manchester, N. H.—Manchester Traction Light & Power Co. has completed arrangements for the issuance of notes for $1,750,000, the proceeds to be used for general business expansion.

Cambridge, Mass.—Palmer Electric Manufacturing Co. has started work on a plant, 50x200 ft.

Bridgeport, Conn.—United Illuminating Co. will erect a power house of 75,000-hp. capacity, generator house, boiler house, switchboard and screen house. The plant will be equipped with automatic stokers and ash removers.

Elmwood, Conn.—New Departure Manufacturing Co., Bristol, will erect a three and four-story reinforced concrete building. Extensive improvements in its plant at Bristol are also being considered. The work will take seven months and will involve an expenditure of several million dollars.

Bristol, Conn.—In connection with the construction of the proposed additions at the plant of the New Departure Manufacturing Co., to comprise four-story building, about 110x 220 ft.; one-story structure, 100x200 ft.; two-story transformer house, 41x 133 ft.; boiler plant, 45x58 ft.; machine shop, 70x263 ft.; administration building, printing plant, and auxiliary structures.

New Haven, Conn.—Seamless Rubber Co. has had plans prepared for the construction of a new power plant to be used in connection with the new plant of the company now in course of construction on Hallock avenue.

West Haven, Conn.—Kelly Tire & Rubber Co., 262 Chapel street, New Haven, is having preliminary plans prepared for the construction of a new three-story plant and one-story power house, about 75x260 ft., and 25x 260 ft., respectively, to be located at West Haven. The project is estimated to cost $500,000. Westcott & Mapes, Inc., 207 Orange street, New Haven, is architect for the company.

Providence, R. I.—Robbio Electric Co., 753 Eddy street, has filed notice of organization to engage in the production of electrical goods. Benjamin Robbio, 23 Barclay street, heads this company.

Brooklyn, N. Y.—Metropolitan Engineering Co., 1250 Atlantic avenue, manufacturer of protective devices, will erect a two-story plant addition, 100x148 ft.

Churchville, N. Y.—F. S. Tracy, electrical engineer, of Middleport, was retained to make an exact estimate of the cost of the installation of an electric lighting system for the village.

Endicott City, N. Y.—In connection with the construction of the proposed plant of the International Time Recording Co., North street, now under consideration, estimated to cost $150,000, considerable electrical equipment will be required.

Middleport, N. Y.—Niagara Sprayer Co., manufacturer of spraying machines, will build a one-story machine shop, works, power plant and chemical plant.

New York, N. Y.—Alberger Pump & Condenser Co., 140 Cedar street, has been reorganized with a capital of $499,250, to manufacture pumping equipment, condensers, etc.

New York, N. Y.—Ohio Utilities Co., 115 Broadway, a Delaware incorporation, has filed notice with the Secretary of State of an increase in its capitalization from $5,000,000 to $7,750,000, for general business expansion.

New York, N. Y.—New York Edison Co., Irving place and 15th street, has completed plans for the construction of a new three-story transformer station, about 42x75 ft., to be located at 421-23 East Sixth street. The structure will be of brick construction, and is estimated to cost $60,000.

New York, N. Y.—Vitreous Enameling & Stamping Co., 11 East 147th street, is having plans prepared for a one-story, 95x172 ft., plant.

Port Chester, N. Y.—P. R. Mallory, Inc., manufacturer of tungsten products, has awarded a contract to George Mertz & Sons, Port Chester, for the construction of the proposed two-story and basement plant, about 40x112 ft., to be used for increased capacity. The structure is estimated to cost $60,000.

Rochester, N. Y.—City has awarded a contract to W. F. Martens, 244 Cutler building, for the erection of a new one-story boiler plant and laundry building on Woodman road. The structure will be about 46x167 ft., and is estimated to cost $35,000.

Pulaski, N. Y.—In the early spring ornamental lights will be planned in the business section of the city. Address Frank L. Burdick, cashier of Pacific National Bank.

Annandale, N. J.—Plans are under consideration by borough officials for the installation of a new electric street-lighting system. It is understood that electric service will be furnished by the Jersey Electric Co., High Bridge.

Bloomingdale, N. J.—Borough Council is understood to be arranging plans for the installation of a new electric street-lighting system, service to be furnished by the municipal electric plant at Butler, N. J.

Hoboken, N. J.—Button Machinery Co. has filed plans for a three-story reinforced concrete plant at 401-15 11th street, to cost about $100,000. A boiler plant and other construction work will cost $70,000.

Newark, N. J.—Roth & Co. has had plans prepared for the construction of a large new cold storage plant to be located in Plane street, near Orange street. The structure will be two-story, about 60x150 ft., and will include a heating plant, refrigerating apparatus, electrically operated elevators, etc.

Nutley, N. J.—Board of commissioners is understood to be considering plans for the installation of a new street-lighting system on Park avenue, between Washington avenue and the Passaic river bridge.

Rosenhayn, N. J.—The committee is planning to secure electric lighting. Address Samuel Vinie.

Wharton, N. J.—New Jersey Power & Light Co. is arranging for the installation of new electrically operated pumping equipment on the Rockaway river to have a capacity of 500,000 gal. per day, to be used by the Borough of Wharton.

Whitehouse, N. J. — Readington township committee is considering plans for the installation of a new street-lighting system in the Whitehouse and East Whitehouse districts.

Wrightstown, N. J.—Hanover Water Co., which operates in Wrightstown and vicinity, has been ordered by the Board of Public Utility Commissioners to make extensive improvements in its plant, to provide increased and improved service. The proposed work includes the installation of new plant equipment.

Allentown, Pa.—Slate Belt Street Railway Co. is understood to be considering plans to increase its capital from $360,000 to $585,000, and the indebtedness of the company from $402,000 to $500,000. The company will also change its corporate name to the Slate Belt Transit Co.

Allentown, Pa.—A number of electric utility companies recently incorporated, are planning for extensive operations in this vicinity, including the production and distribution of electric energy for light and power service. These companies are Danville Borough Electric Co., East Chillisquaque Township Northumberland Electric Co., West Chillisquaque Township Northumberland Electric Co., Turbot Township Northumberland Electric Co., Milton Borough Electric Co., Rush Township Northumberland Electric Co., Mahoning Township Electric Co., Valley Township Montour Electric Co., and Liberty Township Montour Electric Co. H. R. Fehr, C. M. Walter (treasurer), and J. S. Wise, Jr., head the companies.

Bethlehem, Pa.—City council has passed a bill authorizing a bond issue for $80,000 to cover the cost of the installation of a new ornamental electric street-lighting system. It is proposed to commence the work at the earliest possible moment, and the city is arranging for the preparation of plans and specifications at once.

Chester, Pa.—Board of managers of Chester Hospital, 16th and Parker streets, has commenced work on the construction of the proposed three-story laundry building and boiler plant at the institution at Ninth and Halley streets. The work, including equipment installation, is estimated to cost about $300,000. The Ward Building Co., Crozer building, Chester, is the contractor.

Gettysburg, Pa.—A special election has been called by the Borough Council for the purpose of voting on the issuance of bonds for $20,000, the proceeds to be used for the construction of a new municipal electric light plant and the erection of the necessary lines for street-lighting purposes.

Marcus Hook, Pa.—Union Petroleum Co. is considering the construction of a new pumping plant in connection with its local government contracts, including the installation of new boilers and other equipment.

Philadelphia, Pa. — In connection with the construction of new extensions and additions to the Philadelphia Hospital for Contagious Diseases by the Department of Health and Charities, contract has been awarded to the Electro Construction Co., Commercial Trust building, for all electrical work, at $7125.

Pittsburgh, Pa.—General Electric Co. has completed negotiations for the purchase of a portion of the property of the Eiler Lumber & Mill Co., 23rd and Wharton streets, in the south side district, for a consideration of about $75,000. The property is about 120x214 ft., and it is understood that the company is arranging plans for the construction of a large new building, to be used in part for warehouse purposes.

Stroudsburg, Pa. — International Boiler Works has acquired a 40-acre tract of land on which it proposes to build a modern plant.

Tullytown, Pa.—Tullytown Electric Co., recently organized, is considering plans for the operation of a local electric light, heat and power plant. The company has made application at the state capitol for a charter of incorporation.

York Haven, Pa.—York Haven Power Co. is making rapid progress on the construction of an addition to its electric substation on South Wood street. It is understood that the company is planning to commence the installation of machinery and equipment immediately upon completion of construction work.

Baltimore, Md.—Consolidated Gas, Electric Light & Power Co. has completed arrangements for alterations and improvements in its building at Lexington and Liberty streets, to facilitate operations.

DATES AHEAD.

American Society of Mechanical Engineers. Annual meeting, New York City, Dec. 2-5. Secretary, Calvin W. Rice, 29 West 39th street, New York City.

Massachusetts State Association of Electrical Contractors and Dealers. Annual meeting, Worcester, Mass., Dec. 3. Headquarters, Bancroft Hotel. Secretary, J. E. Wilson, Boston.

American Institute of Chemical Engineers. Annual meeting, Savannah, Ga., Dec. 3-6. Secretary, J. C. Olsen, Brooklyn, N. Y.

Electric Power Club. Meeting, Hot Springs, Va., Dec. 11, 12 and 13. Headquarters, Homestead Hotel. Secretary, C. H. Roth, 1410 West Adams street, Chicago.

National Council of Lighting Fixture Manufacturers. Annual convention, Detroit, Mich., February, 1920. Secretary-treasurer, Charles H. Hofrichter, Cleveland, Ohio.

American Electrochemical Society. Annual convention, Boston, Mass., April 7-10, 1920. Friday, April 9, joint session with American Institute of Electrical Engineers on "Electrically Produced Alloys." Secretary, Joseph W. Richards, Bethlehem, Pa.

National Electric Light Association. Annual convention, Pasadena, Cal., May 18-21, 1920. Headquarters, Hotel Huntington. Acting secretary, S. A. Sewall, 29 West 39th street, New York City.

Winchester, Va.—Northern Virginia Power Co. is understood to be considering plans for the extension of its electric lighting system to Strasburg, Shenandoah county. The company was recently acquired by the Potomac Light & Power Co., Baltimore, Md.

Wilmington, N. C.—Notice has been filed with the Secretary of State by the Tidewater Power Co. of an increase in its capitalization of $2,600,000, to provide for general business expansion.

Greenville, S. C.—Thomas N. Walker Co. will establish electric lighting and power plant in connection with the development of Oakville, a residential suburb five miles from Greenville.

Greer, S. C.—The power house at plant of the Greer Water & Light Co. was destroyed by fire. C. C. McGowan, manager.

Chipley, Ga.—Plans are under consideration by the city officials for the construction of a new municipal electric light plant. S. A. Goodman is mayor.

Columbus, Ga.—In connection with the proposed additions to the plant of the Columbus Manufacturing Co., contracts for which have been awarded, estimated to cost, including equipment, $1,000,000, it is planned to install a total of about 1000 looms, to be operated by individual motor drive. Contract for electric motors for this purpose has been awarded to the General Electric Co.

Dawson, Ga.—A white way lighting system is proposed. The electric wires may be laid underground. Address mayor.

Talbotton, Ga.—City is having plans prepared for the construction of a new municipal power plant, including the establishment of an electric light system.

Tifton, Ga.—Southern Bell Telephone & Telegraph Co. will erect a new telephone exchange at a cost of $450,000. Chief engineer, Atlanta, Ga.

Jacksonville, Fla.—Additional improvements of municipal electric light plant are contemplated. John S. Bond, chairman of city commission.

Jacksonville, Fla.—Acceptance by the Navy Department of the offer of the city commission of Jacksonville of a tract of land and other facilities at the municipal docks and terminals for the erection of a high-powered radio station was announced in a letter to the commission from Secretary Daniels. Plans and specifications for the station will be prepared immediately.

NORTH CENTRAL STATES.

Akron, Ohio. — Ground has been broken for the erection of Plant No. 2 by the Firestone Tire & Rubber Co. The building will be three stories high and is designed to accommodate the electrical, machine, pipe, carpenter, pattern and tin shops. It will coordinate under one roof all the labor of this nature done in the various buildings of the tire factory. The structure will be modern in every respect and all mechanical equipment will be strictly up-to-date. Electric traveling cranes will be employed to carry heavy machinery. The cost of construction is said to exceed $400,000.

Dover, Ohio.—About $100,000 will be expended to improve the city power plant. W. H. Scheu, mayor.

Lima, Ohio.—Lake Erie & Western Co. will erect a power plant. Address Superintendent Peters.

Toledo, Ohio.—Toledo Railways & Light Co. has proposed to the city a $2,000,000 10-year street-lighting contract.

Auburn, Ind.—Auburn Water & Electric Light Co. will install a 480 hp. boiler, build a brick stack 135 ft. high, 6½ ft. in diameter at the top; equip the plant with an automatic coal conveyor; install an automatic underfeed stoker under three boilers and make other improvements. To this end the company has asked approval of the Indiana Public Service Commission for the issuance of $40,000 in bonds.

Decatur, Ind.—General Electric Co. has announced that it will erect a new branch factory in Decatur. The new plant will be a one-story building, 200x300 ft., brick and steel. It is planned to have the factory start operations March 1, 1920, and employment will be given to 500 persons. The new plant will have trackage connections with the Grand Rapids & Indiana railway.

Marquette, Mich.—Houghton County Electric Light Co. is making improvements in its lines from Laurium and Dollar Bay, at an estimated cost of $12,000. The installation of a substation at Lake Linden is also contemplated.

Chicago, Ill.—A. M. Castle & Co., 715 North Morgan street, have purchased property, 219x561 ft., at the northwest corner of Blackhawk street and Cherry avenue, on which they will erect a building with floor space of approximately 200,000 sq. ft.

Chicago, Ill.—Fairbanks, Morse & Co., manufacturers of electrical and railroad equipment, gasoline and oil engines, etc., will erect a big warehouse at 38th street and Loomis place, in the central manufacturing district. The lot has a frontage of 300 ft. and a depth of 150 ft. The building will be a three-story structure of brick and reinforced concrete construction, 150x 210 ft., and will cost about $315,000.

Chicago, Ill.—H. M. Byllesby & Co., public utility operators, plan immediate construction of three new power stations, one in southern Minnesota for the Northern States Power Co., one in western Oklahoma for the Oklahoma Gas & Electric Co., and one at Pueblo on the present power site of the Arkansas Valley Railway, Light & Power Co., with combined initial capacity of 33,500 hp. at an estimated cost of about $3,000,000. These and other projected improvements, including a new 40,000-hp. unit under construction at Minneapolis, will add 100,000 hp. to Byllesby properties during 1920.

East St. Louis, Ill.—The machine shops of the St. Louis, Troy & Eastern Railroad Co. have been destroyed by fire.

Evansville, Ind.—Schroeder Headlight & Generator Co. will erect a new addition to its plant.

Fort Wayne, Ind.—Fort Wayne Battery Manufacturing Co. will on Jan. 1, 1920, begin the manufacture of storage batteries for automobiles and lighting systems. The company is completing a two-story building, 54x 196 ft., and a boiler house, 50x57 ft. The company has taken options on several vacant lots surrounding the plant for future expansion. Among the directors are S. A. Lehman, J. C. Sherer and George Houser.

Indianapolis, Ind.—H. C. S. Motor Car Co. will erect two four-story factory buildings, brick and concrete, each building 80 by 205 ft.

Marion, Ind.—Board of education plans erection of $80,000 school building to replace one destroyed by fire Nov. 19.

Marion, Ind.—Marion Insulated Wire & Rubber Co. has increased its capital stock from $100,000 to $500,000.

Portland, Ind.—Jesse E. Poting has the contract to erect an electric light plant at a cost of $16,441.

East St. Louis, Ill.—Erco Amusement Co. will erect a fireproof theater, 120x120 ft., to cost $200,000.

Marseilles, Ill.—National Biscuit Co. will erect combination warehouse and manufacturing plant as addition to present mill buildings. The new structure will be an addition to the main plant and will occupy the site of the old paper mill which was destroyed by fire a few years ago.

Peoria, Ill.—Western Structural & Machine Works has taken over the plant and business of the J. C. Armstrong Machine Co. The company handles machine, pattern, tool and die work, power plant work, engine boring and rebuilding, and general machine work of all kinds.

Taylorville, Ill.—Taylorville Utility Co., dealer in light, heat and power, has increased its capital to $100,000. H. M. Hallock, president; Walter M. Provins, secretary.

Sorento, Ill.—The sum of $5000 in electric light bonds has been authorized. Address village clerk.

Urbana, Ill.—University of Illinois will install two new boilers, each of 500 hp., Jan. 1. This will increase the present capacity of 3000 hp. 50%.

Colfax, Wis.—Colfax Light & Power Co., Amery, Wis., will erect a power house and dam here. Work will start in the spring. Engineer J. C. Jacobson, 53 Metropolitan Bank building, Minneapolis, Minn.

Marinette, Wis.—Wisconsin Service Co. contemplates a reserve dam at High Falls on the Peshtigo river.

Rutland, Wis. (P. O. Stoughton)—East Rutland Electric Co. will construct a power plant to furnish power to the towns of Dunkirk and Rutland. Ole H. Eddingsaas, W. J. Richardson and Bennie Oxrude are interested.

Stanley, Wis.—A new line is to be constructed between Chippewa Falls and Stanley to carry the current from Wissota dam to the consumers along the Soo. The work will be completed by next May.

Sturgeon Bay, Wis.—High Falls Power Co. contemplates the erection of transmission lines from High Falls to Sturgeon Bay. J. C. Langemack, city clerk.

Tomah, Wis.—The local plant of the Wisconsin-Minnesota Light & Power Co. has been purchased by Messrs. Louis Barnes and Philip Bennett, who will continue its operation under the name of the Tomah Electric & Power Co.

Union Grove, Wis.—The trustees of Union Grove have granted permission to the Milwaukee Electric Railway & Light Co. to establish a new electric lighting system in that village.

Waupaca, Wis.—Waupaca Electric Service & Railway Co. will erect a new electric plant. Truman Hibbard, president.

Albert Lea, Minn.—Minnesota Gas & Electric Co. has purchased capital stock owned by G. C. Edwards, president of the H. L. Nichols Co., and contemplates furnishing electric energy to communities outside of Freeborn county. Improvements will be made at an estimated cost of $50,000.

Clearbrook, Minn. — Clearbrook Electric Co. will construct electric light plant and install white way. E. T. Evenson, village recorder.

Crosby, Minn.—The city contemplates the purchase of poles, wires, and other holdings of Cuyuna Range Power Co. H. L. Nicholson, village recorder.

Glyndon, Minn.—The village will install electric light plant and extend lines from Dilworth. R. S. Brown, village recorder.

Perley, Minn.—The city will erect an electric light plant. Engineer W. E. Skinner, 15 South 5th street, Minneapolis. B. I. Hoglun, clerk.

Clinton, Iowa.—Low Moore Light & Power Co. and Clinton, Davenport & Muscatine Interurban Co. have been granted franchise for constructing power, heat and light line from Shafton to Low Moore.

Dubuque, Iowa.—The building of the International Harvester Co. has been destroyed by fire with $260,000 loss.

Sioux City, Iowa.—Harger & Blish will erect factory building, 50x100 ft., to cost $80,000.

Kansas City, Mo. — Sherwin-Williams Co., Cleveland, Ohio, will build a $500,000 factory, comprising an initial unit equipped for the manufacture of paint.

Marceline, Mo.—The city contemplates bond issue for an electric light plant. Address mayor.

Memphis, Mo.—The city will vote Dec. 5 on $10,000 bonds for extending the electric light plant. Address the mayor.

St. Louis, Mo.—Emerson Electric Manufacturing Co. contemplates the erection of a large new factory building, immediately adjoining the present extensive plant, to provide adequate facilities for meeting the increased demand for its products. The plant with machinery and other equipment installed will cost approximately $750,000.

Spivey, Kans.—The sum of $10,000 in bonds have been voted to install an electric light plant. W. B. Rollins & Co., 209 Railway Exchange building, Kansas City, Mo., engineers.

Wichita, Kans. — Extensive improvements in the electric light and power system will be made. Bids are being received on new machinery and engines which are to be installed in the power and water plants.

Chancellor, S. D.—Plans are being made whereby power lines will be extended from the electric light and power plant at Hartford to Chancellor.

Yankton, S. D.—Yankton is enjoying such a substantial growth that the enlargement of the local light and power system has become necessary. Extensive improvements are planned. The company recently was reorganized, with ample capital to make the contemplated improvements. It is further planned to have the power plant of such capacity that power wires can be extended from Yankton to adjoining towns, so they can be provided with electricity for lighting and power purposes from the central plant here.

Ellendale, N. D.—Ellendale Electric Co. will enlarge its plant and install another engine. It also contemplates the erection of transmission lines to Menango and Fullerton.

Grand Forks, N. D.—The new state-owned elevator and flour mill to be located in Grand Forks will have a capacity of 3000 bbls. of flour per day. Standard Oil Co. has taken out permits for $250,000 worth of construction in Grand Forks covering a distributing station and office.

SOUTH CENTRAL STATES.

Hazard, Ky.—Hazard Coal Co. is planning for the immediate installation of new power plant equipment at its works, to cost about $10,000.

Hazard, Ky.—Kentucky & West Virginia Power Co., with headquarters at 30 Church street, New York, which recently filed articles of incorporation with a capital of $6,000,000, is understood to be arranging plans for the construction of a new addition to its local power plant for increased operations. F. R. Weller, Hibbs building, Washington, D. C., is consulting engineer; R. E. Breeb is president.

Mayking, Ky.—Pine Creek Coal Co. is arranging plans for the construction of a new power plant at its local coal mining properties, to provide for increased capacity.

Parsons, Ky.—Plans are being prepared by the Elkhorn By-Product Coal Co. for the installation of a quantity of new power equipment at its plant in the Fleming district.

Chattanooga, Tenn.—International Harvester Co., Chicago, plans to double the capacity of the plant of the Chattanooga Plow Co. by the erection of an addition to its main plant. Plans are also being made for a $10,000 building containing club rooms, cafeteria, locker rooms and gymnasium.

Sequatchee, Tenn.—Crossville will have electric lights, a company composed of M. F. Reed, J. S. Reed and B. A. Smith having been formed to install a plant. A franchise to use the streets for the erection of poles will be granted by the city.

Gadsden, Ala.—An election will be held Jan. 6 to vote on a $100,000 municipal light plant and $90,000 sanitary sewer bonds. Address mayor.

Rolling Rock, Miss.—City has approved a bond issue of $60,000 the proceeds to be used to cover the cost of the construction of a new municipal electric light and waterworks plant. Xavier A. Kramer, Magnolia, Miss., is consulting engineer.

Little Rock, Ark. — Little Rock Railway & Electric Co. will sell $376,500 bonds to finance extensive improvements in its plant, extend its electric transmission on lines and improve its service generally. Many improvements in the plant are contemplated, including a giant smokestack, new boilers and other machinery and will install fuel saving devices to cost $60,000, which will effect a large saving in fuel for the power plant. The company expects to extend its lines to North Little Rock which, in case of emergency, may be tied in with the lines of the Arkansas Light & Power Co.

Drumright, Okla.—The Drumright division of the Oklahoma Gas & Electric Co. has completed extension of its transmission lines to the No-co-Che lease of the Shaffer Oil & Refining Co. where a number of wells will be pumped electrically.

Miami, Okla.—A loss of $75,000 was sustained when fire visited the power plant of the Miami Traction Co.

Thomas, Okla.—Plans are being prepared by the city for improvements and alterations in the municipal electric light plant, including the installation of a new Diesel engine, for increased service.

Electra, Tex.—The city council has under consideration the construction of a municipal electric light and power plant for that city.

Lubbock, Tex.—City is having plans made for extensions in the municipal electric light system. It is proposed to issue bonds for $15,000 to cover the cost of work.

Snyder, Tex.—G. I. Wilcox of Snyder has sold the local electric light plant to Messrs. Yoder and McCormick of Crowell. The new owners will install new machinery and make other improvements to the plant.

WESTERN STATES.

Pueblo, Colo.—A new tract of 1000 acres of land north of Fowler, Colo., will be irrigated by electric power next year, if plans under way mature. This will give the Arkansas Valley Railway, Light & Power Co. an additional 150 hp. of irrigation business. The company's output is running 15% ahead of last year.

Boise, Ida.—Utah Power & Light Co. has filed application with the Public Utilities Commission for permission to extend its lines to Clifton, Oxford and Dayton, and neighboring districts, for the furnishing of electric energy for light and power service.

Everett, Wash.—Plans are under consideration for improvements in the electric street-lighting system, including the installation of a new cluster type lighting system in the downtown district.

Holson, Wash.—The city will estimate its own public utilities, particularly light and water.

Vancouver, Wash.—City council is understood to be considering plans for the installation of a new modern electric street-lighting system throughout the municipality.

Portland, Ore.—A new lighting system will be installed by Northwestern Electric Co. Estimated cost, $20,000 to $25,000.

Young's Bay, Ore.—Pacific Power & Light Co. has recently completed arrangements for the construction of a large new power and gas plant on local property acquired comprising approximately 15 acres. It is said that the proposed works will cost in excess of $750,000, including equipment installation.

Los Angeles, Cal.—Board of Public Works has taken bids for the immediate installation of the proposed new ornamental electric street-lighting system on Westmoreland avenue, to extend from Wilshire to Seventh street. Marbelite lighting standards will be utilized in connection with the work.

Orange, Cal.—City trustees have recently taken bids for the installation of a new ornamental electric street-lighting system on Chapman and Glassel streets, located in the business section of the city. The work is estimated to cost $15,000.

Richmond, Cal.—City council is having plans prepared for the immediate installation of a new ornamental electric street-lighting system throughout the business district of the municipality. Service will be furnished by the Western States Gas & Electric Co.

Richmond, Cal.—Pacific Sanitary Manufacturing Co. will shortly install an additional 50 hp. in motors, and the Metals Atomizing Co. (a new concern) will start operations with one 100-hp. unit. Both will be served by the Richmond division of the Western States Gas & Electric Co. The second named company will add other units later. A new oil tank company building at Point Orient will require 25 hp. in motors.

Rio Vista, Cal.—Great Western Power Co. is having plans prepared for the immediate construction of a new power line extending from the company's pumping works in Reclamation District 999 to the Elkhorn Slough section of the property of the Holland Land Co., a distance of about five miles.

San Francisco, Cal.—Great Western Power Co. has completed plans for the construction of a new power line to extend to Franklin, near Sacramento, for the furnishing of electric service, the proposed line to cover a distance of about 12 miles; it is estimated to cost approximately $20,000. In connection with this work, plans are being arranged for the construction of a new substation at Hood, Cal., at which point a power line of 22,000-volt capacity will also be constructed.

Vallejo, Cal.—Plans are being arranged by the United States government for the construction of a new radio station, to be located in the Mare Island district. The work includes the construction of three large radio towers, and is estimated to cost $150,000.

FOREIGN TRADE

[Addresses of firms referred to in these trade opportunities may be obtained by writing to the Bureau of Foreign and Domestic Commerce, Washington, D. C., or its branch and local co-operative offices. Request for each opportunity should be on a separate sheet and the file number given.]

Telephone and Telegraph Apparatus (31,297).—A firm in Spain desires to secure the representation of a manufacturer of telephone and telegraph apparatus and supplies. It guarantees deposit on consignment of models manufactured in the United States. Quotations should be given c. i. f. Spanish ports, if possible, or f. o. b. New York. Correspondence should be in Spanish. References.

Electrically Operated Pianos (31,299). — Catalogs, quoting prices and terms of payment, of all kinds of musical instruments, and especially electric coin-operated pianos, are described by a firm in Norway. Reference.

Personals

M. S. Sloan Chairman Committee on Electrical Resources N.E.L.A.—F. R. Slater Resigns—S. A. Rhodes Promoted

J. F. CANFIELD, formerly auditor of the Ottumwa Railway & Light Co., Ottumwa, has been appointed auditor of the Union Light, Heat & Power Co., Fargo, N. D.

DON H. BLANKS has been appointed manager of railways for the Monongahela Valley Traction Co., at Fairmont, W. Va. He succeeds W. C. Callaghan, who resigned.

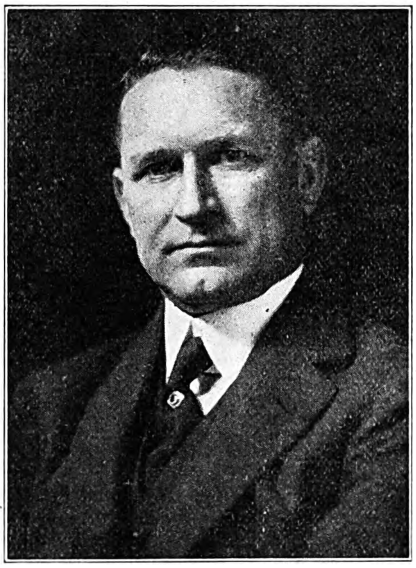
RALPH J. FOGG, who has been a member of the civil engineering department at Lehigh University during the last 11 years, has been appointed professor of civil engineering and head of the department. He takes the place vacated by Professor McKibben, who went to Union College at Schenectady.

R. F. PALMBLADE, general superintendent of the Jefferson City Bridge Transit Co., Jefferson City, Mo., will succeed Rufus W. Bailey as general superintendent of the Peoria Railway Co., Peoria, Ill. Mr. Palmblade is well acquainted with rolling stock, general equipment and conditions of operation of the Peoria Railway Co., as he was formerly operating engineer of that company.

W. L. R. EMMET, consulting engineer with the General Electric Co., Schenectady, N. Y., and one of the world's foremost experts on steam turbine design, delivered a paper on "Electric Propulsion of Ships" before the Society of Naval Architects and Marine Engineers at its twenty-seventh general meeting held in New York recently. He has made an extensive study of electric propulsion of ships and in co-operation with the Bureau of Steam Engineering, U. S. Navy, applied electric drive to the battleship *New Mexico*.

FRED R. SLATER has resigned as vice-president and general manager of the Texas Power & Light Co., Dallas, Tex., to take up another line of business and will remain in Dallas. Before joining the company about five years ago as general superintendent, Mr. Slater was engaged as an electrical and construction engineer in New York City. He was connected with William G. McAdoo in the building of the Hudson tubes under the East river. Mr. Slater is well known in the public utility field in the Southwest, and has been prominently identified with various organizations, having served as president of both the Southwestern Electrical and Gas Association and the Dallas Jovian League.

M. S. SLOAN, president of the Brooklyn Edison Co., Brooklyn, N. Y., has been appointed chairman of the recently organized Committee on Electrical Resources of the Nation, National Electric Light Association. Mr. Sloan is a graduate of the Alabama Polytechnic Institute and entered the utility business in 1906 with the Birmingham Railway, Light & Power Co., Birmingham, Ala. During the six years with which he was associated with the Birmingham utility, he rose from the position of chief engineer to assistant to the president, with supervision over all departments. In 1913 he left Birmingham for New Orleans, La., where he held the position of vice-president and general manager of the New Orleans Railway & Light Co. In the latter part of 1917 he became operating manager of the New York Edison Co. and on Aug. 1 of this year was elected to the presidency of the Brooklyn Edison Co., Inc.



M. S. Sloan.

Mr. Sloan is a firm believer in giving prompt and satisfactory service to the community and in effecting harmony and efficiency in all departments of his organization, so treating his employes as to make them happy and contented. It is his belief that in carrying out such a policy, he is performing the best and highest service to the stockholders of the company. His previous career has demonstrated that he has the strength and skill to accomplish such a program. Mr. Sloan is vice-president of the Association of Edison Illuminating Companies, treasurer of the Electrical Testing Laboratories and is identified with other organizations.

B. J. GRIGSBY, vice-president of the Anderson Electric Specialty Co., Chicago, is visiting London and Paris in connection with the distribution of the company's products in Great Britain and France. Mr. Grigsby is particularly acquainted with those markets, having been managing director of the Benjamin Electric, Ltd., in London, for nearly ten years, manufacturing electrical and automobile accessories.

CHARLES F. SCRIBNER, formerly industrial engineer with the Colt's Patent Fire Arms Manufacturing Co., Hartford, Conn., and more recently consulting engineer for L. V. Estes, Inc., Chicago, has become associated with the Business Service Corp. of America, Chicago, in the capacity of vice-president and chief engineer.

S. A. RHODES, acting chief engineer of the central group of Bell Telephone Companies, has been promoted to the position of chief engineer. Mr. Rhodes, who is an associate member of the American Institute of Electrical Engineers, was graduated from the Lehigh University in 1892. Shortly thereafter he established himself in Chicago, and his first association with active telephone work was on some inspections in connection with cable and conduit construction for the Chicago Telephone Co. He has ever since continued in the engineering department of the Chicago Telephone Co. and the engineering department of the central group of Bell Telephone Companies. About 1895, when the use of common-battery equipment was inaugurated, the Chicago company carried on considerable development work in connection with subscribers' station equipment and central office equipment for common-battery operation, and in this work Mr. Rhodes took a very active part. After the common-battery equipment became standardized, he became chiefly engaged in engineering in connection with outside plant and substation equipment. When the central group was formed in 1911 he continued work of a similar nature for the group under the title of material engineer. About this time the matter of providing adequate transmission over trunks and toll lines assumed much importance, and Mr. Rhodes was assigned transmission problems handled by the central engineering department, later being given the title of transmission engineer. In this capacity he continued until he became acting chief engineer of the central group in February of this year.

Obituary.

PERCY H. ASHMEAD, 52 years old, a consulting engineer, who was head of the Costa Rica-Nicaragua boundary dispute arbitration commission, died of pneumonia on Nov. 11 in New York. He was born in Philadelphia and was graduated from Lehigh University. He planned a railroad for the Chinese Government many years ago and also worked on the Madeira-Mamore railroad in Brazil. At one time Mr. Ashmead was in charge of the construction of railroads in the Philippine Islands, and for many years he was chief engineer of J. G. White & Co., of New York City. He was a major in charge of the supplies for the Engineer Corps at Washington during the war.

For the Readjustment Period—What?

LVIX.

Trade Advisors of Other Nations Coming to San Francisco

America's first world conference of American Foreign Traders, with special trade advisors from the Far East, Australasia, and South America, appointed by the various foreign governments, will be one of the important features of the Seventh National Trade Convention to be held at San Francisco, May 12-15, 1920, according to the preliminary plans of the Convention just announced at the Annual Meeting of the National Foreign Trade Council.

The bringing of special trade representatives from the foreign nations to San Francisco so that they may be consulted by American business men is something that should appeal to every manufacturer, merchant and trade organization in the country, says Secretary O. K. Davis, in commenting on this feature of the program. For the purpose of meeting these foreign trade advisors as well as the large number of Americans who are now doing business in foreign countries, who have been invited to attend, the Council is taking steps to have the San Francisco Convention one of the largest ever held in this country.

Chairman Frederick J. Koster, of the Pacific Coast Committee, announces that elaborate preparations for the Convention are being made on the Pacific Coast. The Seattle, Portland, San Francisco and Los Angeles Chambers of Commerce are co-operating in plans to make the journey to the Pacific Coast atttractive for those who attend the convention. Seattle is arranging an exhibition of products of the Far East, San Francisco an exhibition of Pacific Coast products, and Los Angeles an exhibition of the products of South America and Australasia.

Arrangements have been completed for two special steamers from the Far East and one from Valparaiso up the west coast of South America to bring the delegates to the Convention. A special steamer will be provided to take delegates from the East through the Panama Canal to San Francisco. This ship will sail from New York about April 20.

The Convention program will consider chiefly the effect upon American foreign trade of the fact that the United States has become a creditor nation during the war. The discussion at the Annual Meeting of the Foreign Trade Council showed that the members of the Council are giving careful study to the increase of imports that is bound to come to this country in satisfaction of the annual interest upon the huge loans that have been extended to Europe. This question will be threshed out from every angle at the San Francisco convention.

Extensive plans are under way for the entertainment of delegates to the convention and their families and in every way preparations are being made to care for the large attendance which is anticipated.

Special transcontinental trains are announced for the convenience of delegates in the United States. These trains will be made up of special cars from various cities, for reservations in which applications should be made to O. K. Davis, Secretary, National Foreign Trade Council, 1 Hanover Square, New York City.

C. A. TUPPER, President : International Trade Press, Inc., Chicago

Financial News

Warfare on Public Investors.

In a recent issue of Wall Street Journal there appears an article by William L. Ransom, former counsel for the Public Service Commission of the First District, New York, in which he discusses the essentials of a sound regulatory policy in respect to the investor. This is briefly quoted as follows:

"We have had in the United States nearly ten years of deliberate, well-planned warfare to intimidate investors from furnishing the needed new capital for railway and other public service projects. In some instances, this crusade has been the by-product of a narrow but zealous view of public rights as to franchise-holding companies, but it much more generally has been the work of men who believed that manifestations of extreme hostility to the owners of these enterprises would be so popular as to lead naturally to political preferment, and, in many instances, the campaign of terrorism and affrightment of investors has been inspired by those who realized that if private funds would not furnish the requisite capital for new construction and new financing, the treasury of government would of necessity be resorted to, and that the most effective step towards the governmental acquisition of all basic utilities would be to force existing properties into the bankruptcy court or upon the bargain counter.

"In the discussions which have taken place in the National Congress, and in much of the more recent discussion as to the plight of utilities in our states and cities, there has been discernible what may be termed a new realization of the relationship of the investor to the whole problem of the public service. If we are to avoid and withstand the wholesale socialization of the railway, light, heat, power and traction enterprises of the country, conditions must be restored which will attract private capital freely, normally and adequately, under proper safeguards and guarantees, again into this important field. Investors and the general public may well grasp the situation and join hands in dealing with it. The insidious campaign which has made private capital unwilling to risk further outlays in the railway and public utility field has had for its conscious objective the compelling of resort to governmental funds instead, and the clubbing of the present owners into willingness to sell outright on a bargain basis."

Thomas W. Hulme, vice-chairman of Railway President Committee on Valuation, speaking on relation of valuation to investment, said the courts have held true valuation is not original cost, but present value. The determining factors of present value are investments, cost of reproduction, condition of property and earning power. Even in rate decisions not merely physical value, but "going concern value," or good will have received consideration. These principles will be brought to the attention of the Interstate Commerce Commission in a conference to be held in January.

Cities Service Earnings Show Substantial Increase.

Earnings of Cities Service Co. for October, 1919, show a fair increase over the preceding month, indicating that the improvement in earnings noted in the September statement is still continuing. Gross earnings of Cities Service Co. for October, 1919, were larger by $37,756 than for September, while the amount available for payment of dividends on the preferred stock for the month increased $40,451. The balance available for reserves, dividends on the common stock and surplus for October showed a gain of $38,987 over the preceding month, and an increase of $195,820 over the balance for August, 1919.

In conformity with the policy announced in May, 1916, the directors at their November meeting increased the rate of stock dividends being paid on the common stock from 12% annually to 15% annually by declaring a monthly dividend of 1¼% on the common stock, payable in common stock at par on Feb. 1, 1920, to stock of record Jan. 15, 1920. The board also declared the regular monthly dividends, payable in cash, of one-half of 1% on the preferred stock and one-half of 1% on common stock, both payable Feb. 1, 1920, to stock of record Jan. 15, 1920.

In 1916 and 1917 Cities Service Co. paid 6% in stock dividends on the common stock, in 1918 9% was paid on the common stock in stock dividends, and the present rate of payment of these dividends is 12%. The directors at the meeting also approved the issue and sale of the $3,000,000 par value preference B shares recently offered to stockholders of Cities Service Co., which offering was heavily oversubscribed, and declared the initial monthly dividend on the 6% cumulative preference B shares of one-half of 1% payable Jan. 1, 1920, to shares of record Dec. 15, 1919.

Indiana Power Acquires Power & Water Company.

The Indiana Public Service Commission has granted permission to the Indiana Power Co. to issue bonds and stock to take over the property of the Indiana Power & Water Co. The commission authorized the company to sell at not less than 90% of par $750,000 of its first and refunding mortgage 25-year 6% bonds and $500,000 of its 7% cumulative preferred stock and to issue at not less than par $300,000 of its common stock, the proceeds to be used to cover the costs of extensions and betterments and property acquisitions; also to issue to its stockholders at par $150,000 of common stock to reimburse them for the loss of dividends incurred through increasing their equities in the property.

Dividends.

A quarterly dividend of $1.50 per share on preferred stock has been declared by the Connecticut Power Co., payable Dec. 1 to stock of record Nov. 20.

The American Power & Light Co. has declared a quarterly dividend of 1%, payable Dec. 1 to stock of record Nov. 21.

The Fairbanks-Morse Co. has declared a quarterly dividend of 1½% on preferred stock, payable Dec. 1 to stock of record Nov. 20.

Key West Electric Co. has declared a quarterly dividend of $1.50 on preferred stock, payable Dec. 1 to stock of record Nov. 18.

Northern Texas Electric Co. has declared a dividend of $2 per share, payable Dec. 1 to stockholders of record Nov. 21.

Wisconsin-Minnesota Light & Power Co. has declared a quarterly dividend of 1¾%, payable Dec. 1 to stock of record Nov. 20.

Eastern Wisconsin Electric Co. has declared a quarterly dividend of 1¾%, payable Dec. 1 to stock of record Nov. 20.

Marconi Co. of America has declared a dividend of 5%, payable Jan. 2 to stock of record Dec. 10.

Baton Rouge Electric Co. has declared a semi-annual dividend of $4 per share, also a semi-annual dividend of $3 per share on preferred stock, both payable Dec. 1 to stock of record Nov. 25.

Canadian General Electric Co. has declared a quarterly dividend of 2%, payable Jan. 2 to stock of record Dec. 11.

WEEKLY COMPARISON OF CLOSING-BID PRICES OF SECURITIES OF LEADING ELECTRICAL COMPANIES.

Quotations furnished by F. M. Zeiler & Co., Rookery Bldg., Chicago.

Public Utilities.	Div. rate. Per cent.	Bid Nov. 18.	Bid Nov. 25.
Adirondack Electric Power of Glens Falls, common	6	14	12
Adirondack Electric Power of Glens Falls, preferred	6	76	76
American Gas & Electric of New York, common	10+extra	125	120
American Gas & Electric of New York, preferred	6	39	39½
American Light & Traction of New York, common	..	208	210
American Light & Traction of New York, preferred	6	93	93
American Power & Light of New York, common	4	59	57
American Power & Light of New York, preferred	6	71	70
American Public Utilities of Grand Rapids, common	..	8	8
American Public Utilities of Grand Rapids, preferred	7	23	24
American Telephone & Telegraph of New York	..	100	100
American Water Works & Elec. of New York, common	..	5	5
American Water Works & Elec. of New York, particip	7	9	9
American Water Works & Elec. of New York, first preferred	..	50	50
Appalachian Power, common	..	4	4
Appalachian Power, preferred	7	22	21
Cities Service of New York, common	+extra	437	437
Cities Service of New York, preferred	6	76	75
Commonwealth Edison of Chicago	8	110¾	110¼
Comm. Power, Railway & Light of Jackson, common	..	23	21
Comm. Power, Railway & Light of Jackson, preferred	6	46	46
Federal Light & Traction of New York, common	..	7	8
Federal Light & Traction of New York, preferred	..	43	43
Illinois Northern Utilities of Dixon	6	..	..
Middle West Utilities of Chicago, common	2+extra	25	25
Middle West Utilities of Chicago, preferred	6	50	49½
Northern States Power of Chicago, common	..	64	65
Northern States Power of Chicago, preferred	ex.div.7	90	90
Pacific Gas & Electric of San Francisco, common	..	61	62
Pacific Gas & Electric of San Francisco, preferred	6	..	..
Public Service of Northern Illinois, Chicago, common	7	80	83
Public Service of Northern Illinois, Chicago, preferred	6	85	86
Republic Railway & Light of Youngstown, common	4	14	14
Republic Railway & Light of Youngstown, preferred	6	50	50
Standard Gas & Electric of Chicago, common	..	30	28
Standard Gas & Electric of Chicago, preferred	6	42	42
Tennessee Railway, Light & Power of Chattanooga, common	..	3	3
Tennessee Railway, Light & Power of Chattanooga, preferred	6	7	5
United Light & Railways of Grand Rapids, common	4	43	43
United Light & Railways of Grand Rapids, preferred	6	70	70
Western Power of San Francisco, common	..	21½	20
Western Union Telegraph of New York	extra	87¼	88
Industries.			
Electric Storage of Philadelphia, common	4	135	141
General Electric of Schenectady	8	171½	169½
Westinghouse Electric & Mfg. of Pittsburgh, common	7	54¾	53¾
Westinghouse Electric & Mfg. of Pittsburgh, preferred	7	..	..

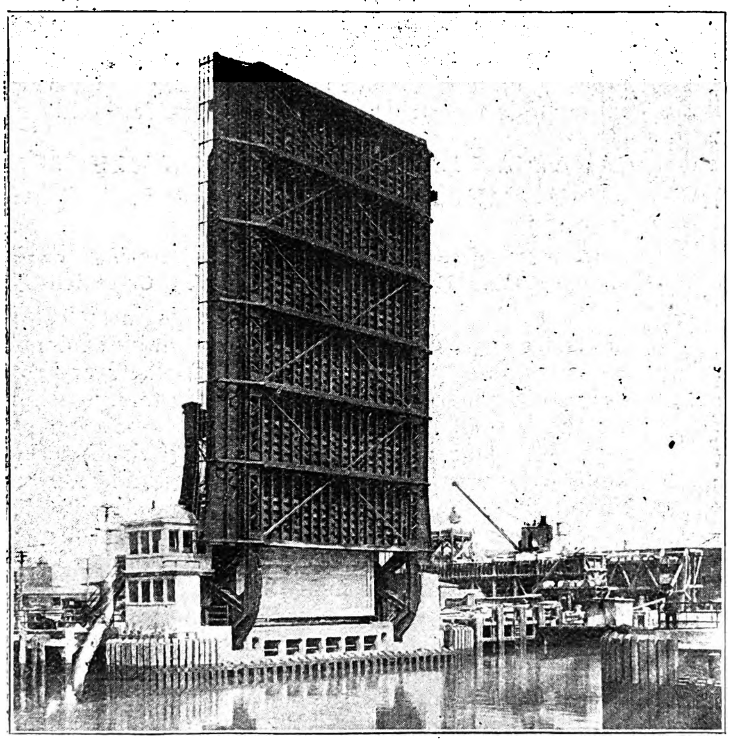
Electrical Review

l. 75. No. 23. CHICAGO, DECEMBER 6, 1919 Three Dollars a Year

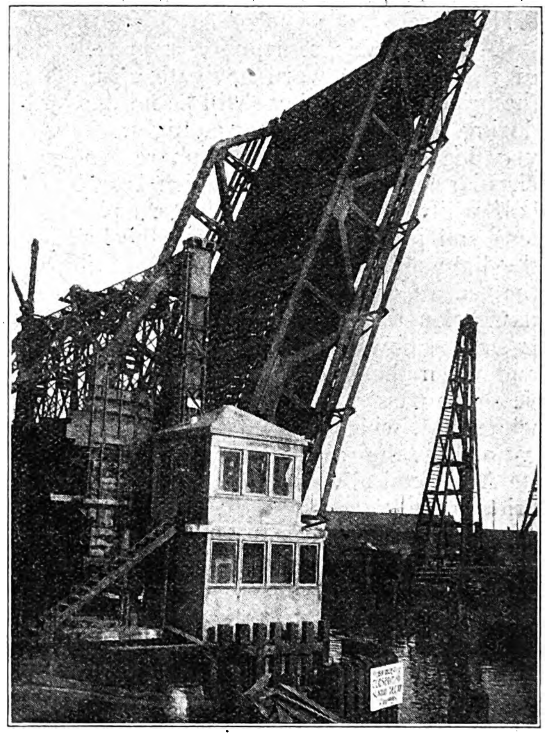
Electrical Review

WITH WHICH IS CONSOLIDATED WESTERN ELECTRICIAN AND ELECTROCRAFT

VOL. 75—No. 23. CHICAGO, SATURDAY, DECEMBER 6, 1919. PAGE 933.



San Francisco Single-Leaf Lift Bridge Raised to Its Highest Position—Entire Operation of Bridge Is by Electrical Apparatus, Most of Which Is Automatic.



Electrically Operated Lift Bridge During Construction—View of Tower Which Contains Control and Motive Equipment.

An Electrically Operated Bridge in San Francisco

Features of Motive, Control and Safety Electrical Equipment Installed on Novel Single-Leaf Lift Bridge in Golden Gate City

THERE are three drawbridges operated by the city of San Francisco, the electrical installations for all of which were designed by the engineers of the Department of Public Works of that city. The most novel of these bridges is that at Fourth street.

The bridge in question is of single-leaf construction, with a span of 94 feet. It is counterweighted on the north side with a 700-ton overhead concrete weight spanning the roadway, the weight of the bridge being slightly overcome by the weight of the concrete.

The bridge is raised and lowered by two 25-hp. electric motors, series wound, with reversing controller and magnetic brake lock, the latter being operated by a 0.2-hp. motor.

The switchboard and all controls are housed in an observation tower with glass sides, enabling the operator to obtain an unobstructed view of the river in all directions as well as a view of Fourth street. The switchboard is equipped for the control of lock motors, lift motor and brakes, gates, alarm auxiliary lights, and also with the necessary voltmeters and ammeters.

When the bridge is about to be raised, an alarm bell is sounded at both ends of the bridge to warn all vehicles and pedestrians. The safety gates are then lowered and the bridge unlocked. It is impossible to unlock the bridge until both safety gates have been lowered. It is also impossible to start the motors that raise the bridge until the safety gates are properly lowered and the bridge unlocked. Energy for operating the motors that raise and lower the gates on the south side of the river is carried over a cable that is carried on the bridge, and the instant the bridge starts to raise the contact is broken, so that it is impossible to raise the south safety gates until the bridge is again lowered.

When the bridge is raised to a nearly upright position, the upward movement is automatically stopped, a short-circuiting device shutting off the motor and applying the brakes. By means of hand control of the motors and brakes provision is made to raise the bridge still farther to enable vessels of extraordinary large sails to pass. On lowering the bridge it is automatically stopped just before reaching the final resting position, and it is then necessary for the operator to take charge of the controller and complete the lowering of the bridge. After the bridge has been lowered into its final position and then locked, a contact is made which permits the raising of the safety gates.

In the tower there are tell-tale lights which tell the position of the bridge, such as locked, open, bridge nearly raised, bridge fully raised, bridge nearly closed, bridge free.

An automatic semaphore is placed on both sides of the bridge to warn navigation of the position of the bridge, so that there will be no danger of collision during foggy weather or at night. This is operated very ingeniously. The semaphore consists of a semicircular lens, one-half of which is red and the other half white, and an electric lantern placed back of the lens and pivoted so that when the bridge is lowered the light shines through the red section of the lens; the red, of course, being the danger sign, indicates to navigation that the way is not clear. As the bridge is started upward the position of the lantern changes and when the bridge is raised sufficient to permit a vessel to pass the lantern is in a position back of the white lens, which gives a white light informing navigation that the way is clear.

An electrically operated bell is installed at all three bridges, and is connected with the central fire alarm station in Jefferson Park. When a fire is in a locality that will necessitate the fire department apparatus using any of the bridges a warning is sent out from the central fire alarm station by means of these bells. If a bridge is open it is closed as soon as possible, and if it is in a lowered position it is not raised under any consideration until after all fire department equipment has passed over the bridge.

NEW ZEALAND GOVERNMENT PURCHASES HYDROELECTRIC PLANT.

Another Plant Added to the Government System Which in Few Years Will Cover Both Islands.

The New Zealand Government has purchased the Horahora hydroelectric system from the Waihi Gold Mining Co. for $1,034,131, with the view of distributing electricity to the company's properties, other industrial enterprises, and homes in the Auckland province south of Auckland, New Zealand.

The Horahora electric power works, situated on the Waikato river a few miles beyond Cambridge, were erected by the Waihi Gold Mining Co. a few years ago at an expense of about $1,000,000. The present plant is capable of developing 9000 hp., and with the addition of two units at a cost of about $250,000, which it is expected will be constructed, soon will total 12,000 hp. for the hydroelectric works. The maximum demand of the Waihi company is 4000 hp., thus leaving 8000 available for distribution in the Waikato and adjacent districts as far north as Auckland, a distance of over 100 miles.

It may be a few years before the city of Auckland receives much power from Horahora, but with the construction of the additional two units it is estimated that 5000 or 6000 hp. would be available for that city. The present consumption in Auckland is between 12,000 and 13,000 hp., and whatever is obtained from Horahora will be in addition to the two local generating plants now operating in that city. The cost of the electricity from this plant is not fully determined, but it probably will be the same as that from the Lake Coleridge government plant in the South Island.

Horahora is only one step in the general hydroelectric development plan for New Zealand, and in the course of a few years the proposed Arapuni plant will be erected, which will be the main supply for the North Island, with several generators capable of producing 13,000 hp. each. In the face of the present critical coal shortage and the unpromising outlook for the future supplies of coal in New Zealand, it looks as though the hydroelectric developments in general will make great strides during the next few years.

CANADIAN EXPRESS RATES ON ELECTRIC INCANDESCENT LAMPS.

Protest by Manufacturers' Association Against Excessively High Rates Not Warranted by Conditions.

As the law in Canada now stands incandescent lamps are carried by the express companies at double first-class rates. The Canadian Manufacturers' Association, acting on behalf of the importers, is asking for the normal first-class rate. The association has recently submitted evidence showing that electric lamps were carried in the United States and from the United States into Canada at the first-class rate. It was further shown that 22% of the metal-filament bulbs and 70% of the carbon-filament bulbs exported from the United States in 1918 came to Canada.

The attitude of the express companies was that incandescent lamps were very bulky and light in proportion to other goods, the result being that cars were often loaded with electric bulbs to the exclusion of more profitable goods. To the contention of the importers that lighter articles, such as musical instruments, wicker furniture, tins, and wire goods, were carried at normal rates, the companies replied that these articles were not sent in such large quantities.

No decision was given by the board at the time of the hearing, and importers state that no judgment has yet been received by them as to the attitude of the board in the matter. The claim of the importer is that the only justification the express companies would have for charging such a rate would be the percentage of breakages being very high, and this was not shown by the companies in the case which they presented to the board.

COPPER PRODUCTION MORE THAN DOUBLED.

During the past four years the cost of producing copper has more than doubled, according to reports of producers. They show that the cost per pound in 1915 varied from 6 to 10 cents, while in 1919 this cost varied from 12 to 22 cents. Costs today are calculated on a somewhat different basis than in 1915 in that formerly no charge was made for depletion, and credits were allowed for gold and silver recoveries not now so treated; but these two items do not affect the comparison by more than 1 cent per pound.

Recent set-backs in the copper market have been due to the failure of export demand to materialize as expected. War-devastated Europe was counted on to absorb enormous tonnages of American copper in reconstruction, but to date foreign purchases have been small and until credits to foreign customers are forthcoming it is stated that it is needless to look for a correction of present conditions.

Central-Station Rates in Theory and Practice

Twenty-second Article—Importance of Accuracy of Rates—Inaccurate Rates Reduce the Profit and Impair the Service—Growth and Scope of Public Utility Regulation by Commissions

By H. E. EISENMENGER

This series of articles, of which this is the twenty-second, was begun in the issue of July 12. The first seven articles constituted Part I and dealt with the cost of electric service. Part II contained six articles on the policies governing selection of a rate system. Part III included six articles describing the various systems of rates in common use. Two articles formed Part IV on rate analysis. The present article includes Part V and the first portion of Part VI, the remaining portions of which will be continued in the last three articles of the series.

PART V—ACCURACY OF RATES.

SECTION 171. We have seen that, regardless of whether we make the prices on the basis of the cost-of-service principle or the maximum-earnings principle or the value-of-service principle, there are always certain prices for every particle or for every class of service. These prices vary with the class of service according to the variation of the cost and, except in case of the cost-of-service principle, according to the variation of the profit.

Referring to the system of graphical rate representation explained in the preceding Sections (164-170) we can say that the *cost* of the various consumers (at least within one certain class of service) is roughly a Doherty plane. If the percentage of profit were to be constant for all sizes of customers this would result in another Doherty plane for the *prices* (rates) which is everywhere higher than the cost plane by just that percentage.

According to Sections 97-99 it will be of advantage for the producers as well as for the consuming public if the small consumers and the large ones get prices which are based on smaller profits than those charged to the consumers of medium size. Then the price (rate) surface will become curved, with the convex side pointing upwards.

We cannot follow this ideal surface exactly by the rate schedule, in the first place because we do not know the surface exactly and secondly because we do not want the rate system to become too complicated. The surfaces of most rate systems show a more or less close approximation to this vault-like curvature of the ideal surface by a substitution of a combination of planes in lieu of the curved surface. We see this approximation to the curvature for instance in the Wright demand rates, especially in those with a greater number of blocks, and still better in the double-block Hopkinson rate. (For photographs and drawings of models of this system, see H. E. Eisenmenger, "Space Representation of Central-Station Rates," *Electrical World,* Nov. 4, 1911, Figs. 13 and 14.)

The very fact that we have only an approximation to the ideal rate surface implies that we have certain inaccuracies of the rate. The rate will be just at its ideal or theoretical value at certain points of the bottom plane, that is for certain combinations of demand and energy consumption, but it will be higher than it ought to be at other points, and again lower at others. The smaller these inaccuracies are (with reasonable simplicity of the rate schedule) the better for the consumer and the producer.

172. The reason why every inaccuracy of rates is of disadvantage to both the consumer and the producer is this: Suppose certain customers (to be called Class A) are charged more than what is intended and would be theoretically correct, that is, more than what is to the best interest of all parties concerned (see Part II, Section 78 *et seq.,* "The Value-of-Service Principle"); other customers (Class B) are charged less than their proper amounts. The result will be that some of the customers of Class A will drop out or change the character of the service they require, in such a manner that they become Class B customers or approach to Class B customers. An inaccuracy of rates has therefore the following effect: Whatever class (or classes) of customers or service is affected in such a way by the inaccuracy that its rates and therefore its profitableness is reduced below the theoretical and intended amount, it will always be just that class which is increased in number and volume, and conversely just that class whose profitableness would be increased by the inaccuracy will—at least partly—disappear. Therefore every inaccuracy of the rate will of necessity reduce the profits and thus create a tendency towards raising the prices.

173. A separate and frequent case of rate inaccuracy is the case where one or two of the three charges (customer, demand, energy) are left out. In fact, as has been shown (Section 10) even rates which embody all three charges are necessarily inaccurate because an accurate rate would require an indefinite number of charges.

If, for instance, we suppress the demand charge (as in pure meter rates) the customers will get the use of the demand for nothing and consequently they will not care how large their demand is; they will be wasteful with their demand, so to speak. A customer using, for instance, 50 kw-hr. per month under a pure meter rate will have a larger maximum demand than a customer using 50 kw-hr. under a rate system where a charge is made for the demand. The consequence will be a smaller load-factor. For a given kilowatt-hour consumption the central station has to keep in readiness a large generating capacity, etc., which reacts unfavorably on the cost and therefore on the price per kilowatt-hour.

On the other hand, if no energy charge is made (flat demand rate) the customers will be careful to keep down their maximum demand, or its rating-equivalent, respectively (capacity connected or connected load). In any case they will be far less careful about their number of kilowatt-hours (burning hours) than under a system of charging which makes a charge for every additional kilowatt-hour actually consumed. The only check which remains against absolute extravagance (outside of a feeling of fairness towards the central station on the part of a portion of the customers) is the cost of lamp renewals where these must be borne by the customer. The result will be that the load-factor of customers with a flat demand rate will be large.[1] A superficial observer who has accustomed himself to think in terms of average cost per kilowatt-hour may consider this an advantage because he knows that a large load-factor results in a low cost per kilowatt-hour. It must not be forgotten, however, that just in this case (flat demand rate) the central station is not paid for the additional kilowatt-hours furnished. The element that builds up the revenue is in this case exclusively the maximum demand and the larger the load-factor is for a given maximum demand the larger is the energy consumption for which the central station has to provide without getting any return.

Again, taking the case where the customer charge (and its substitute, the minimum charge) is left out of the rate schedule, this means that the very small customers will pay less than it costs to serve them; they can be carried only at a loss and, on the other hand, we have to give them service if they demand it. A customer charge or a minimum charge will either keep these unprofitable customers away or else raise their bills high enough so that they are turned into profitable customers. We can, in case of a suppression of the customer charge, not say that the *individual* customer is wasting anything, as in the case of the pure meter rate and of the flat demand rate, but the general average of the customers is wasteful, so to speak, without the customer cost, inasmuch as the small customers (whose customer cost would be a large percentage of their total cost) are unduly attracted.

It is always the element which is offered gratuitously or excessively cheaply with which the customer will be extravagant and in this manner the public service company will suffer damage from an inaccuracy of the rates and as the losses must, at least to a certain degree, ultimately be paid out of the customers' pockets the customers will suffer also.

174. It must not be overlooked, however, that the inaccuracies of the rate weigh differently in different places of the bottom plane. For illustration, if we have a residence rate it is necessary that it be accurate for small consumers but it does not matter if there is even a large inaccuracy for a residential customer of, say, 10 kw. demand and of some 2000 kw-hr. energy consumption per month because there will be very few, if any, residential customers who have a demand of that size and certainly none with a load-factor of that magnitude. A retail power rate, on the other hand, must be accurate for just that type of customers and its accuracy for the very small customers is not of such importance.

Fig. 23 shows a model constructed by the author several years ago in the course of an investigation of the rates of a company operating in a large city on the Pacific Coast. This model refers to the distribution of the residential customers of that company with reference to the size of the customers. The two horizontal axes of this model are kilowatts and kilowatt-hours, the same as in the rate models, but the vertical dimension is used for stepping off the number of residential customers. The ground plane (bottom plane) has been divided into squares (or rectangles) by using certain steps for the kilowatts as well as for the kilowatt-hours and then the number of residential customers to be found in each square in the territory of the company has been stepped off as vertical ordinate. The model shows that in one of the "squares" the number of customers in existence is very much larger than in any other square and it further shows that practically all residential customers are crowded together—so to speak—in a very few, perhaps six, of the squares so that anything outside of these six squares is of little or no importance and the accuracy of the rate outside of these six squares is of no great consequence. A similar model has also been constructed, showing in the same manner the income from the various sizes of customers instead of their numbers in each group. The shape of this model which has a still greater bearing on the accuracy of the rates is, of course, in general similar to the one shown in Fig. 18 except that the maximum is moved a little further away from the origin.

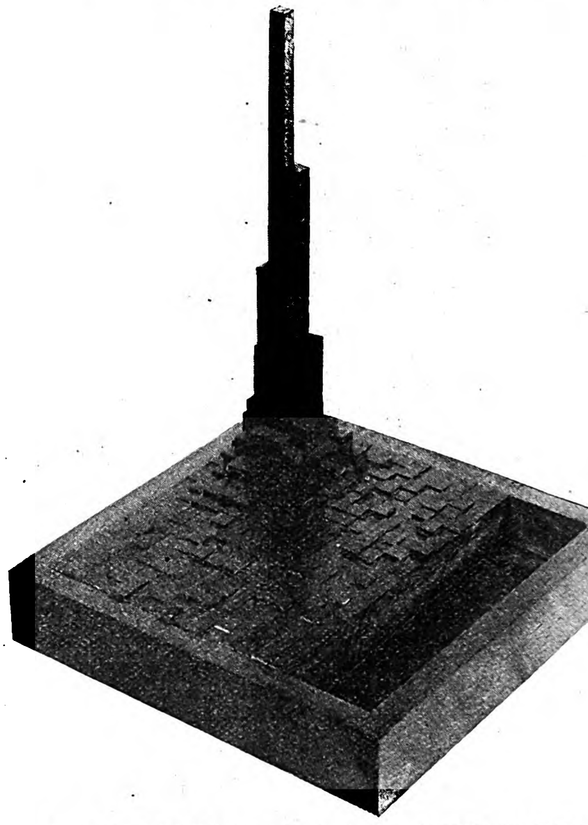


Fig. 23.—Distribution of Consumers of Different Sizes.

[1]According to the information obtained by S. E. Doane and the author in Milan, Italy, it has been found in that city by using check meters that the average load-factor for small flat-rate customers was 2270 hours per year. The demand charge must therefore be large enough to cover the cost of this waste of kilowatt-hours, but as the increment energy cost per kilowatt-hour is very small the large reduction in the customer cost (see Section 128) and the other advantages make this system economical in spite of the waste of kilowatt-hours.

PART VI—PUBLIC UTILITIES AND PUBLIC REGULATION.

CONTRIBUTED BY S. F. WALKER,
Formerly Associate Editor of Rate Research.

I. PUBLIC UTILITIES AND THE PUBLIC INTEREST.

WHAT ARE PUBLIC UTILITIES?

There is no generally accepted or legal definition of a public utility, or, looking at it another way, there is no generally accepted authority showing just what business enterprises may be brought into the program of public utility regulation and what industries may not be subjected to public service regulation as it has been set up in the various states.

In practically all of the state laws, public utilities have been defined by enumeration, the law stating, for example, that railways, electric, gas, telephone and water companies are to be subject to the regulatory powers vested in the commission. The policy of state regulation of public utilities has had a rapid extension. It has gone from state to state until every state, except Delaware, has some form of a railroad or public utility commission, and in various states the law has been amended year after year to include additional business enterprises. The question is, just where must this extension stop because the remaining unregulated businesses are not public utilities or are not subject to public regulation.

Franchise Companies.—Some authorities have held that public utilities are those companies which hold franchises to use the public streets. But regulation has gone beyond that limit.

Noncompetitive Enterprises.—Franchise companies were protected from competition, more or less. At least the field was not easily accessible to every one willing to come in and compete for business. On this basis some authorities have said that public utilities were subject to regulation because competition did not regulate their rates. But there are many monopolistic enterprises able to nullify the effect of competition in naming their prices that are not thought of in the same breath with public utilities. And, on the other hand, competition is a factor, often a ruling factor, in the rates of public utilities. There have been rate wars between public utilities that have driven rates lower than any commission would feel justified in imposing upon the companies, and it has often been one of the first tasks of a commission to bring such rate wars to a close and raise the rates to enable the companies to operate properly. The public utility rates are also affected by competition with other products. For example, electric companies are in competition with gas companies and with private plants for certain classes of service.

Commissions that have adhered strictly to the cost-of-service theory and have recorded their disapproval of "value of service" and "what the traffic will bear" methods, have often encountered situations where the theory cannot be followed, but where the rates for certain classes of the service are determined by the competition of other sources of fuel, light, power or whatever it may be.

Public Interest.—Taking refuge in a broader definition, public utilities are those companies whose business is clothed with a public interest.

The principle of public regulation was applied in early times to innkeepers, ferries, turnpikes, blacksmiths, and surgeons, because public welfare at that time was dependent upon obtaining these services at reasonable rates. This power to regulate in the interest of the public is held to be one of the inherent powers of the state, so much so in fact that the states cannot bargain this power away. It has been held that contracts, special charters and franchises granted a company or institution cannot debar the state from later imposing regulations contrary to the terms of such special grant, if it is in the interest of the public so to do.

EXTENSION OF PUBLIC REGULATION.

The state of Massachusetts established a Railroad Commission as early as 1869, and before 1890 there were railroad commissions in California, New York, and Iowa. The Interstate Commerce Commission was established in 1887.

Commission control of public utilities as it is known today may be said to have started with the Wisconsin and New York laws passed in 1907. Wisconsin established its Railroad Commission in 1905, and extended its power by the public utilities act of 1907. The New York law passed in the same year provided similar regulations of public utilities and other states have followed rapidly, keeping in general to the regulation of electric, gas, water, telephone, street railway, railroad, telegraph, and express companies, until the idea of public utility has been associated with these industries in a peculiar degree.

These industries might well ask, "Why is it so particular with us?" The business of furnishing food and clothing is certainly "clothed with public interest," and in fact, during the war period especially, has been subjected to regulation by administrative commissions in the interest of the public.

Commission regulation is not limited to natural monopolies and companies holding franchises, but may be extended at any time to such industries as public interest may dictate. There is no legal holding to the contrary.

In Oklahoma the Corporation Commission, provided for in the constitution of that state, was given general powers of regulation over all industries clothed with a public interest.

The provision of the Oklahoma constitution and the statute laws of that state relating to the establishment of the Corporation Commission and defining the powers of that body, while mentioning particularly railroad and transmission companies, include the following section going beyond any attempt at enumeration of public utilities subject to regulation.

Chapter 38, Article I, Section 13, Oklahoma Statute Law (1908): "Inevitable monopolies declared subject to price regulation by the state. Whenever any business, by reason of its nature, extent, or the existence of a virtual monopoly therein, is such that the public must use the same, or its services, or the consideration by it given or taken or offered or the commodities bought or sold therein are offered or taken by purchase in such manner as to make it of public consequence or to affect the community at large as to supply, demand or price or rate thereof, or said business is conducted in violation of the first section of this act (restricting combination in form of trust or conspiracy in restraint of trade or commerce within the state), said business is a public utility and subject to be controlled by the State, by the Corporation Commission or by an action in any district court of the State, as to all of its practices, prices, rates and charges. And it is hereby declared to be the duty of any person, firm or corporation engaged in any public business to render its services and offer its commodities, or either, upon reasonable terms without discrimination and adequately to the needs of the public considering the facilities of said business."

An enumeration of industries in the different state laws has led to a more artificial idea of public utility regulation. While in one city or town the people are in need of having their electric company or street-railway company regulated, perhaps in other towns the people are more in need of having a meat market, a grocery, a warehouse, stockyard or perhaps even the dentist, the doctor or the lawyer regulated than the so-called public utilities.

Sometimes the commission regulation planned for companies known as natural monopolies has been extended to other classes of business under the same law—warehouses and cotton gins, for example, while other methods of regulation have appeared as anti-trust laws, food and drug acts, and special laws regulating the rates of insurance companies.

Just what the future limits of public utility regulation by commission will be cannot be foretold, but the tendency appears to be toward extension of the regulatory policy rather than toward restriction.

PURPOSE OF REGULATION.

The main purpose of regulation may be briefly stated as the securing of adequate service at reasonable rates, without unjust discrimination in either the furnishing of service or in the rates charged.

Proper regulation is concerned with the protection of the company, on the one hand, as well as the protection of the public, on the other.

Service.—The commission may determine what extensions and improvements in service are required to serve the best interests of the public and is given the power to order such extensions and improvements where the company has failed to make them of its own initiative.

However, the company is protected from unreasonable demands which would increase the investment in its property out of proportion to the public benefit secured.

The protection of the company against unreasonable service demands to the benefit of the general public has been most marked during the period of the war. Service improvements have been postponed, further extensions discontinued, requirements lightened, all at a time when the high cost of materials and labor would have imposed a high investment as a permanent burden upon the utility service.

Rates.—The public is entitled to service at reasonable rates, and the utility is entitled to a fair return on its investment and to compensation for good management. Rate regulation is only one of the phases of regulation, although it has been given the first place in public attention. Poor service at low rates may not be as good a bargain for the public as good service at high rates. The rates must be such as to afford proper inducement to capital and managing ability and to secure the benefits of new inventions and improvements in the industries concerned.

Rate Reductions.—The introduction of regulation was followed by a period of rate reductions. The public expected this of the commissions established. There were many factors making it possible, perhaps, for the various utilities regulated to withstand these rate reductions without harm. Under regulation the rights and duties of these companies were more clearly defined, thus giving them a more stable position. The stocks and bonds of the companies issued under commission approval had a ready market. The experimental period of development was over and the companies were entering upon a period of regular development. The companies were in many instances freed from losses from free service and discriminatory rates held over from the days of bargaining. And finally, a most important factor, rate reductions brought increases in business.

Increasing Rates.—During the period of rising prices, under war conditions, the commissions have found it necessary to grant increases in public utility rates. While there have been disappointments and delays in granting what companies have considered justifiable increases in some cases, it is undoubtedly true that increases in the emergency were secured more generally under commission regulation than could have been secured by bargaining with local authorities.

Reasonable Rates.—It is the duty of a commission to determine reasonable rates—not just nonconfiscatory rates. The courts had the power to prevent the exaction of a confiscatory rate, but the commission must go further and prescribe reasonable rates affording a fair profit to the company above all legitimate expenses of operation.

(To be continued.)

NEW SOURCE OF ALUMINUM.

Metallic aluminum can be obtained by electrolytic methods from its oxide; the oxide, however, must be free from iron and silica. The ore most commonly used is bauxite, after it has been purified by the costly Baeyer process. There being no bauxite in Norway, Prof. V. M. Goldschmidt, of the Mineralogical Institute, Christiania, in 1917, conceived the idea of using Labrador stone as a source of aluminum. By Goldschmidt's process, the Labrador stone is extracted from the plagioclase felspar by means of 30% nitric acid (the first raw product of the electrical air industry). The silica and the greater portion of the iron minerals remain insoluble, while aluminum, calcium and sodium go into solution, together with a little iron. After removal of this iron the solution is evaporated down to dryness, and the residue heated to a certain temperature at which the aluminum salt alone is decomposed, the nitric acid driven off being collected as a valuable concentrate. By washing with water the nitrates of calcium and sodium are removed, to be recovered and used in agriculture, whilst the aluminum remains. Since there are abundant supplies of the white, marble-like rock or plagioclase felspar, containing about 30% aluminum, in the southwestern part of Norway, this process seems full of promise for that country.

EFFECT OF AUTOMOBILES ON STREET-RAILWAY REVENUES.

A committee of the Massachusetts Legislature, which made a study of the street-car situation, has estimated that private automobiles, exclusive of "jitneys," reduced the income of the traction lines in that state 12%, and that, if this reduction were applied to the whole country in proportion to population, the total reduction in street-car earnings would amount to about $70,000,000 per year.

Electric Automechanical Handling of Freight Shipments

How Electrical Equipment Can and Is Already Solving the Freight Terminal Problem — The Gattie System in London—Cincinnati's Experience—Paper Before New York Railroad Club

By ZENAS W. CARTER

Secretary-Manager, The Material Handling Machinery Manufacturers' Association

THE railroads are to go back into private hands. The first problem executives and managing heads of all departments of railroading must face and work to solve is that of costs—both costs for materials and costs for manual service. The second problem is labor shortage. The third problem is lack of equipment. The fourth problem is condition of equipment. And last, but not least, is attitude and productiveness of the entire personnel from the section hand to the directing chief.

Unfortunately, under government ownership and especially on account of the war reaction which is influencing men so strangely, there has been little serious attempt on the part of the operating and working forces to keep down costs.

Further, man-power shortage is the natural result of the war. This same cause may be given as the reason for lack of railroad equipment and condition of equipment.

Depreciation in productiveness is partly psychological and partly the result of the sudden increase in the distribution and rotation of money among the masses. Rotation of money tends to develop a sense of luxuriousness which directly results in a slackening of effort.

Knowing the problem and the factors of the problem is half the solution, however, and the real work for the railroad executive is the application of methods which will change the factors into a co-ordinated unit.

It is possible, therefore, to visualize electric automechanical freight handling as a very important method which may be used to change the factors of high costs, labor shortage, lack of equipment, etc. We may even conceive that used thus, electricity may be the colloidal to improve both the attitude of the individual toward his labor and to increase his productiveness.

To visualize this it is only necessary to consider the changes electricity has already made in our daily life. And to make the application specific, as it relates to the use of electricity in new ways in railroad progress, it is only necessary to check over the present activity at some few points.

Proposed Central Freight Station for London Using the Gattie System.

For instance, few men in this country, even in the railroad lists, are familiar with the fact that the British Government is right now considering very seriously the elimination of every one of the 74 freight yards and stations in the city of London.

The idea is to combine the entire interchange of all freight, both carload and l.c.l. into one immense central freight station and distributing point. This would be absolutely impossible without electricity as the all-powerful, infinitely flexible force with which to operate.

When such an idea is even mentioned the average man simply must smile to himself and look to assure himself the man who makes the statement is not a victim of shell shock.

Nevertheless, this scheme, known as the "Gattie System," has received the consideration of the governmental and financial and business interests and is not at all an impractical proposition. Mr. Gattie has worked out every detail from planning an immense depressed area of 30 acres to be known as the "Crypt" to the detail of the floor sections and stalls on each of the planned nine stories of a gigantic 15-acre freight station. The "Crypt" will be used for all incoming trains and in making up trains to travel over all lines radiating in and out of London.

Of course the use of gondola cars in England—much smaller cars than in America—has made his plan workable, and he is to utilize the flexibility of electricity throughout to operate 196 powerful overhead electric traveling cranes, supplemented by a system of conveyors, the entire plant being planned to handle heavy loads in bulk. The cranes will lift uniform containers bodily from the platform of a car on the London & Northwestern, say, and take it over and place it on the platform of a car on the Great Eastern. This will eliminate the present need for that car to pass through dozens of switches and suffer from four to ten days' delay in its transfer across London.

In the handling of l.c.l. freight the containers are lifted bodily and taken to one of the four distributing floors. All goods, as they term freight in England, will then be handled from these central distributing floors to every part of that tremendous station by electrically operated conveying systems, escalators, elevators, chutes and electric trucks and trailers. Each lot goes from the central distributing floors directly to stalls where are particular containers for each railroad station or group of small stations.

These containers filled with goods for one particular town will be lifted bodily from the car platforms by local cranes when the train reaches that town. The car platform, then empty, may be at once utilized for a local container which has been previously loaded at that station just as we now load a boxcar with l.c.l., and the local traveling crane will place the container on the empty car platform and the train may then proceed towards its destination.

It will take just a little reflection to completely bring to your mind's view just what is necessary in the way of electric automechanical freight-handling equipment to completely handle a system of this kind.

Certain it is, however, that it is all possible through the use of electrically operated shuttle cars, electric traveling cranes, electrically operated conveyors of both the overhead trolley and the belt and apron and gravity types, and automatic elevators, and electric trucks and trailers.

The result of using such a system will be great economy, the release of the great spaces now used for yards and switch storage tracks and freight stations and it is figured that the value of the 74 stations will be much greater than the entire cost of the proposed gigantic central station.

This would also solve much of the problem of reducing freight-handling costs, labor shortage and equipment shortage. In addition, the psychological effect upon groups of men operating machinery under sanitary and healthful conditions in all kinds of weather, and with a minimum of physical effort, is certain to be such as to change their very attitude toward this work, while the synchronization of the whole would automatically speed up the productivity of each worker.

What is still more important, it would tend to give both regularity of hours of toil and continuity of employment, with a resultant uplift in the mental caliber of the men employed which would be incalculable.

Terminal System to Be Used in Cincinnati.

And just to prove that electricity right here in the United States is going to help solve the coming problem of the railroad executives and managers and employes of the railroads in the United States, all the railroads of Cincinnati, O., have made arrangements with a private operating company for the installation of a patented system of terminal operation.

This company has almost completed all the installation of the electrically operated machinery necessary to carry out its method of handling l.c.l. freight at Cincinnati, and it is my opinion this, or a similar system, is going to revolutionize the transfer-point interchange of l.c.l. freight all over the United States.

Starting from the results which will accrue at Cincinnati and working back to the principles of operation, the facts seem almost as revolutionary at first as the "Gattie System" will be in England.

For instance, this Cincinnati plan to handle freight by automechanical methods, using electric and gas motor trucks and machines instead of steam coal, switch engines, engine and switch train crews, and switches, is estimated to release 66,000 freight cars previously used exclusively in "spotting," transfer, trap or ferry service in the Cincinnati terminal territory.

There are problems one, two, three and four met in a way which at first tends to stagger even our American imagination. Cost is reduced, equipment both released and saved from deterioration, and labor shortage overcome.

But that is only part of the saving. The complete motorization of Cincinnati l.c.l. will save the railroads entering that city just about 300,000 switch cut movements per year and also will extend existing terminal facilities over 30% and make a reduction of 25 cents per ton in handling costs—all at the insignificant cost to the railroads of approximately $150,000.

Furthermore, to date over 140,000 tons of general classification merchandise freight have been moved without a single loss or damage claim resulting, and the current movement of all connecting line and substation freight has been greatly facilitated. Thus electricity functions tremendously as a force to help overcome these five problems of railroad management at Cincinnati.

The detail of the operation at Cincinnati is not a new untried scheme, as it has been under practical every-day test for almost two years between main and substations of the "big Four" railroad. The actual figures resulting from the tests were used in making the estimates for the complete plants now being installed.

Details of the Equipment and Method of Operation.

The system is a combination of motor truck, overhead electric traveling cranes and uniform containers, with which will ultimately be combined many forms of mechanical handling machinery, such as industrial electric trucks, stacking and tiering machines, portable conveyors and other electrically operated devices which reduce physical labor and tend to improve the morale of the men who serve in the handling of freight.

It is the combination which is the essential element of saving, as all of these devices and machines are now daily reducing manufacturing costs in most of our American industries and most of them will soon be in service at terminal and transfer points handling ocean and river cargoes as well as freight.

The handling of l.c.l. interchange at Cincinnati is as follows, bearing in mind that at the present time the railroads are not making any attempt at store-door delivery, although this also is undoubtedly going to be the outgrowth of the use of this system. At Cincinnati only railroad freight is being handled.

The cars are spotted alongside the freight station in the usual manner. Doors are opened and hand trucks or electric trucks receive the goods in the usual manner. They are then conveyed to the uniform containers and packed into the container identically as you pack a freight car.

These containers are placed in rows in the freight station, each container being plainly marked for one of the seven railroads entering Cincinnati. The containers are wood and steel boxes, 17½ ft. long, 8 ft. wide, 7 ft. high, and are usually loaded not to exceed 4 tons. The containers each have wide side doors and wide end doors so they may be easily loaded with miscellaneous freight of all kinds. Also each container (at least most of them) is fitted with large substantial casters so that it may be rolled across the station floor or rolled along the platform alongside a car.

When the container is filled or loaded it is lifted by a traveling electric crane, swung from its position and transported by the crane to the point where a motor truck chassis stands ready to receive the container as the complete body of the motor truck. Clamps are set and tightened, and the motor truck dashes off to the station of the railroad over which the goods in that particular container are routed.

At some stations the traveling crane delivers the container to the motor truck sidewise and at others the delivery to the chassis is endwise. In most cases where endwise delivery is made, and in cases where crane operation is not necessary on account of the few containers per day to be handled, the containers are set on a type of skid, which is just high enough and wide enough between its supports to permit the truck chassis to be backed underneath the container, and the lifting and lowering is then done through the use of electrically driven chain hoists. Where this latter method is in use, the skids are in bays extending into the station shed.

When the truck reaches the destined station, the traveling crane immediately relieves the chassis of the container and then places a return container on the chassis, effecting a minimum of delay for the motor truck. A central dispatcher handles the operation of all of the motor trucks, insuring their operation for a maximum percentage of the day.

The electric traveling crane of course carries the container with its load to the point nearest the spotted car of the connecting line and it is unloaded direct from the container into the car of the connecting line; or, if the goods in the container are for various small stations along the line, they are placed in proper cars in the usual manner, remaining in the container until cars are spotted for that particular freight division on which the station is located.

It is entirely practicable to haul the containers about by means of a winch or an electric tractor truck although they are not yet equipped for movement by electric tractor.

Of course, it is but a step from the development of this system into an electrically operated unit for the complete system of freight service, including delivery and receipt of freight from store door, which will be a very simple step ahead—involving merely the use of the same type of trucks and containers for the door-to-door service as is now employed in the inter-railroad service.

It is almost necessary for similar plans to be put into use throughout the country in order to meet the demands of the economic situation of costs, manual service need and equipment shortage.

Because of this engineers and railroad operatives are making exhaustive studies of these different machines and their co-ordination into handling systems.

With its adoption will also come a fuller appreciation by the railroads of the value of all types of mechanical handling machinery. In our manufacturing plants, men are given the benefit of every conceivable type of machine or device which will save physical effort and conserve time and energy, or speed up production, but as yet little use has been made of these electrically operated machines in freight and ocean cargo handling.

An automobile plant is equipped with numerous systems of conveyors, cranes, etc., all electrically operated. And in all large plants coal is handled by crane, belt conveyor or trolley with grab bucket, oftentimes without manual labor service from coal car to furnace grate bars, and even the ashes are automechanically carried to refuse piles.

Endless instances of the use of mechanical handling machines could be given where savings have resulted sufficient to pay for equipment in one or two months after installation, and it is logical to believe that the very first moves on the part of the actual owners of the railroads after Jan. 1 will be to purchase and install electric automechanical handling machinery of many kinds.

VALUE OF ELECTRIC COAL CUTTERS IN MINING.

British Mining Electrical Engineer Explains How They Can Increase Output of Collieries.

The use of electric coal cutters in collieries as a means of securing efficiency of production came in for consideration in the address of E. P. Hollis delivered at Birmingham, England, in November to members of a branch of the Association of Mining Electrical Engineers. He said that the electric coal cutter had won its spurs and was a most potent factor for increasing production; in fact, it was now realized that it was the only method of getting maximum production contingent, of course, upon the circumstances being favorable for its use. The introduction of a few of these machines in a casual way had to be guarded against very strongly, as it was not a proper test of their effect upon production.

Maximum production could only be obtained by machine mining on an intensive scale and that did not mean merely putting a few coal cutters into a mine. It meant very much more than that. If the maximum output was to be obtained from a mine it was necessary to provide for a mining scheme with the application of a maximum number of machines and after that to see that the hoisting plant was large enough to handle the output expeditiously, and that the various tunnels and passages about the mine were never congested. It is also necessary to see that the best hoisting and haulage systems available were installed. Properly equipped repair shops for all kinds of machinery must be provided. There must be sufficient spare units and it is necessary to standardize the plant throughout. More particularly was it necessary to make sure that adequate protection against breakdown was provided so that it was never possible for a section of the mine to be shut down through a breakdown of the plant serving it.

The care with which the plant in the mine was attended had also a bearing upon production. If through inefficient or inadequate care the plant broke down, the whole working of the mine might be disorganized, the scheme put out of gear, and in consequence there would likely be a big slump in output which could not be made up for a considerable period. That would be avoided if the authorities put in properly skilled attendants.

There was no industry into which the same degree of skill in electrical engineering was put as in the mining industry. Mr. Hollis said that from his own knowledge he was quite certain that the mining electrical engineer was not sufficiently consulted and therefore did not apply himself as closely as he might to the problems of production. If it were known to the mining electrical engineer that his experience was valued, and if it were appreciated that he could give most valuable advice and that his experience fitted him for grappling with the problems involved in increasing production, then he would be given incentive to apply his knowledge intensively to increasing production.

BRITISH MARKET FOR ELECTRIC WASHING MACHINES.

From investigation it is evident that the sale of imported electric washing machines for domestic use in Great Britain is confined to two or three large firms. The sale so far is not extensive and the prices are in the neighborhood of $200 to $250. In the opinion of several of the large distributors of electric power in the London area, there should be a considerable market for these machines in England, provided a machine could be offered at a price which would bring it within the reach of the average middle-class householder, who would be the type of citizen to whom the machine would most readily appeal. The servant problem and high laundry prices greatly assist in the demand for such labor-saving devices.

Co-operation of Central Station and Lumber Mills

Mill Refuse Utilized to Good Advantage Through Co-operative Arrangement in Three Cities in Gray's Harbor District of Washington — Steam and Electric Drive in Typical Mills and Shops

By W. A. SCOTT

THE three small cities of Aberdeen, Hoquiam and Cosmopolis on Grays Harbor, Wash., have become important centers of lumber manufacturing and other industries subsidiary thereto. In the operation of saw mills, planing and shingle mills, stave and box factories, machine shops and fish-packing plants in these communities there is a considerable consumption of power. Steam is the basic power, and this will continue to be so indefinitely by reason of the abundance of lumber-mill refuse available for fuel. While a number of mills are operated from steam-driven lineshafts, several others are operated either partly or entirely by electric motors. In the latter cases the electrical energy is produced by steam-driven generators, there being no hydroelectric power produced on Grays Harbor. In developing this energy there has been worked out an interesting case of co-operation between the central-station and lumber-mill interests.

Demands for electric power are increasing, and of all the electrical energy produced by the central-station company and at the lumber mills there appears to be practically no surplus. Among the mills in which direct steam drive is applied there is undoubtedly a tendency to change to electric power except for certain purposes. As the lumber demands are becoming heavy, and as the mills are running well up to capacity, the situation would seem to invite an increase in the production of electric power, and there are indications that some new generating equipment will be installed in 1920.

Central-Station and Street-Railway Service Co-operating with the Lumber Mills.

The Grays Harbor Railway & Light Co., of Aberdeen, Wash., is the public utility concern that serves light, power and local passenger transportation in these harbor towns. Its central generating station is situated about half way between Aberdeen and Hoquiam, which are about six miles apart. Its power plant equipment has a present capacity of 2400 kw. The steam plant comprises four Babcock & Wilcox boilers of 400 hp. each, which require about 35 cords per day of "hog" or lumber-refuse fuel, procured from the mill of Wilson Bros., in Aberdeen. A supply of 700 cords of this kind of fuel is kept on hand. To prepare this fuel requires the operation of a "hog" machine by a 125-hp. motor.

In the generating room there are two 1000-kw., 3-phase, 2300-volt turbogenerators operating at 3600 r. p. m., and another similar unit of the capacity of 400 kw. In addition to the above, there are two rotary converters of 500 kw. and 300 kw., for producing the 550-volt direct-current energy required for the company's street-car system. These cars are operated between Aberdeen and Hoquiam, and between Aberdeen and Cosmopolis.

The power company's output of electrical energy is considerably augmented by a co-operative arrangement that it has with the Anderson & Middleton Lumber Co., of Aberdeen. There is installed in the mill of this lumber company a General Electric 1000-kw. turbogenerator, belonging to the power company, but which is operated by the lumber concern. The output of this generator is divided, Anderson & Middleton commonly using about 300 kw., and 700 kw. is tied in on the power company's system.

Further, the power company also buys about 700 to 1000 kw. of surplus power produced in the mill of the Grays Harbor Lumber Co. at Hoquiam. Thus, the public utility concern, counting what is generated in its own plant and that which is secured from the lumber mills, is able to deliver nearly 4500 kw. of power for its own use and to its customers. It has 5714 light consumers in the towns on the harbor, and 190 power customers. In meeting these demands, the company serves energy at voltages of 2300, 440, 220 and 110, as single, two and three phase. Practically no direct-current power is required except for operating the street cars.

The important economic aspect of the situation is that waste fuel at the lumber mills is being converted into electrical energy, and that development along this line may be carried to the point of producing as much power as may be needed for all purposes.

Installations in Typical Lumber Mills.

The Grays Harbor Lumber Co., operating a large lumber mill at Hoquiam, uses both steam and electric drive, and has a surplus of 1000 kw. of electric power which is sold. The boiler capacity of this plant is rated at 1050 hp. Steam is required for the dry kilns, and for operating the log carriage, and some other machines, besides for driving the generators. Even though an abundance of electric power is available in this mill, it is stated that for a few machines steam has superior adaptability. The plant is equipped with three steam-turbine-driven generators as follows: A Westinghouse 1000-kw., and a General Electric 750-kw., both equipped with Wheeler surface condensers; also, a General Electric 500-kw. generator, equipped with a Worthington barometric condenser. The first two are 2300-volt units, the third producing current at 440 volts.

All motors of 50 hp. and higher are operated at 2300 volts, those below 50 hp. being operated at 440 volts. The 440-volt bus and the 2300-volt bus are tied together through three 200-kv-a. General Electric transformers. In the connected motor load of about 2000 hp. in this mill there are the usual features of power transmission. The 11-ft. single-cut headsaw is driven at 10,000 ft. per min. by a 300-hp., 2300-volt, wound-rotor motor, of a speed of 600 r. p. m.; this is a belt drive on 13-ft. centers. The 14 by 72-in. Allis edger is operated by a direct-connected 400-hp. squirrel-cage motor, at 900 r. p. m. The trimmer, of 22 saws, is driven by a direct-coupled 100-hp. motor, at 600 r. p. m. Each of the three resaws is belt-connected to a motor.

In the planing mill there are five planers, including matchers and sizers, each machine being direct-connected to a motor of 50 to 75 hp. The refuse from the planing mill is handled by two motor-driven fans—a double 55-in. and a single 70-in. unit.

This lumber company supplies the city of Hoquiam with the electric power necessary to operate its pumping plant for delivering water to the city reservoir.

The Anderson & Middleton lumber mill at Aberdeen, which has a combination of steam and electric drive, is one of the plants in which electric energy may be greatly increased. There are here four Stirling boilers of a capacity of 2000 hp. The operation in this plant of a 1000-kw. generator, belonging to the Grays Harbor Railway & Light Co., has already been explained above. It was a case of installing the generator at a plant where the boiler fuel was produced. The electric drives in this mill are applied to the log-haul, resaws, planing-mill machines, two 84-in. refuse fans, circulation and hot-well pumps, and all conveyors and elevators. The transformer equipment consists of two 185-kv-a. transformers and two of 37½-kv-a., by which 2300-volt, three-phase energy is transformed to 480 volts, for the 440-volt motors; also one 25-kv-a. and two 10-kv-a. to step down to 110 volts for plant and yard lighting. The motor capacity in the plant amounts to 810 hp.

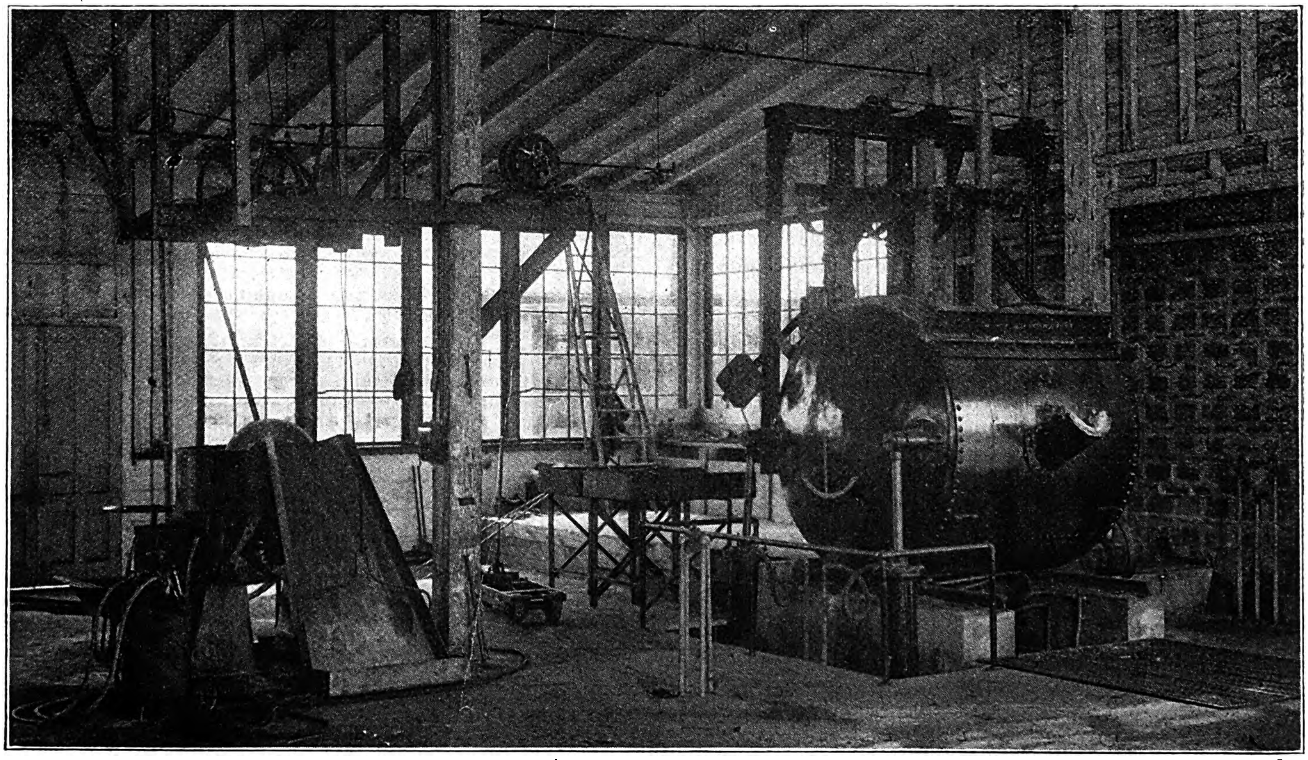
Steam drive is by means of a 24 by 48-in. Hamilton Corliss twin engine, connected to a main 350-ft. lineshaft by a 52-in. three-ply, waterproof leather belt, 110 ft. long. The 11-ft. bandsaw, with a 30-in. pulley, is driven from the main lineshaft through a Graton & Knight, two-ply, 26-in. leather belt, 90 ft. long, in which there is application of the plan of reverse drive. The bandsaw has a speed of about 10,000 ft. per min. The two "hog" machines, having a combined capacity of 60 cords of "hog" fuel per hour, are also driven from the main lineshaft through leather belts having a speed of 8200 ft. per min. The edgers and trimmer saws are also engine-driven through belt connection with the main lineshaft. It is understood that the Anderson & Middleton Lumber Co. has plans for installing a 1500-kv-a. generating unit, whereby practically the entire mill may be electrically operated.

The Grays Harbor Commercial Co., operating a plant at Cosmopolis, has a 750-kw. generating unit, and contemplates the early installation of another unit of like capacity to meet its power requirements. This company manufactures wood staves for pipe, silos and tanks, and makes boxes. It appears to have sufficient boiler capacity to furnish steam for the proposed new unit.

Bay City Lumber Co., of Aberdeen, and other concerns in this locality operate good-sized mills in which the principal drives are steam, but the facts above given serve to show the methods which are typical in this district. Storage-battery trucks and Ross Lumber carriers, also operated by storage batteries, are much used in the mill yards of this region.

The Lamb Machine Co., one of the electric-power customers of the district, operates a shop and foundry at Hoquiam for the manufacture of logging equipment and tools. A new feature in its foundry is a Greene 2-ton electric furnace, used for making steel castings, mostly from open-hearth steel. An accompanying illustration shows this furnace installed, ready for use.

The Northwest Electric & Water Works Co. operates a 500-kw. steam-electric plant at Montesano, and two small hydroelectric units, whereby light and power consumers at Montesano and Elma and vicinities are served.



A 2-ton Greene Electric Furnace for Making Steel Castings in Foundry of Lamb Machine Co., at Hoquiam, Wash.

Proposed Changes in Part II, National Electrical Safety Code

Principal Changes Proposed by Bureau of Standards in the Rules for Construction of Overhead Lines

MUCH controversy has been indulged in for several years and has now been revived with vigor respecting the rules governing the construction of overhead and underground lines that constitute Part II of the National Electrical Safety Code issued by the Bureau of Standards. When given their widest publicity in the 1916 edition of the Code they were declared by many central-station interests to be impracticable because they set standards that were too high and that would involve a prohibitive expense in execution. Other objections were also made. Much more objection was raised to Part II than to all other parts of the Code put together and the overhead line rules have remained the principal bone of contention respecting the Safety Code as a whole.

Since the 1916 edition of the Code is entirely exhausted, the Bureau of Standards has deemed it advisable to revise various parts of the Code before its republication. The revision of Part III, rules for utilization equipment, was completed some time ago; revision of Part I, rules for construction of central stations, substations and the like, was also completed a few months ago. It is not proposed to make any revision (other than correction of errors) of Part IV, rules for operation of generating stations and substations, before the next edition appears. This leaves the revision of Part II as the chief matter delaying the new edition of the Code and, as this third edition is clamorously being called for, the Bureau is anxious to complete the new Part II before the close of the year, if possible.

On account of the great interest taken in the revision of Part II, the short time in which it should be done, and the limited number of copies of the proposed changes available for general distribution, we give below an abstract of the principal changes in the first portion of Part II as suggested by the Bureau after extended investigation of the conditions existing and of the problems involved in complying with the standards of construction called for. The principal changes in the remainder of Part II will be given in our next issue.

A radical revision has been made in the arrangement of the rules in Part II with the belief that the new arrangement will facilitate the use of the rules and will be found much more satisfactory than that of the old edition. The proper requirements for rules 242*b* and 244 are still being studied by the Bureau and it will issue a special communication on these points later. One of the important proposals for change has to do with the voltage classification of supply lines crossing over signal lines as affecting the grade of construction required. A discussion of the reasons for this change will be appended at the end of the list, which gives the principal changes only, as the complete list includes a multitude of minor changes in phraseology, etc., that would be too voluminous for the space available. Where a rule is changed as to position as well as radically regarding text, the old rule number is given in parentheses. New rules are similarly indicated.

Principal Changes in Section 20 (Scope of Rules and General Requirements) and Section 21 (General Rules for Pole Lines).

Rule 203.—Minimum Requirements.—(Added paragraph.)—These minimum values are exceeded in much existing construction; service requirements frequently call for stronger supports and higher factors of safety than the minimum requirements of these rules.

210. Compliance with Other Rules and Special Precautions.—(New.)

(a) Other Rules.—The rules of this section apply to all supply lines, whether or not they are required by Section 23 to have a definite grade of construction. The additional requirements for supply lines in those situations which are required to have a definite grade of construction, A, B or C, will be found in Sections 25, 26 and 27.

The clearances and separations of conductors, climbing space, vertical wiring on poles and clearances from other structures shall comply with the requirements of Section 22.

(b) Special Precautions.—Where conductors are attached to structures other than those used solely or principally for supporting lines, all rules shall be complied with insofar as they apply, and such additional precautions as may be necessary shall be taken to avoid injury to such structures or to the persons using them. The supporting of conductors on trees and roofs should in general be avoided.

217. Strength of Poles and Crossarms.

(a) Poles.—Poles used for lines for which no designated grade is required shall be of such initial size, and so guyed or braced where necessary to safely withstand the loads to which they may be subjected, including linemen working on them.

(b) Crossarm Bracing.—(231*e*.)—Crossarms shall be securely supported, by bracing if necessary, so as to safely support loads to which they may be subjected in use, including linemen working on them. Any crossarm or buckarm, except the top one, shall be capable of supporting a vertical load of 225 lbs. at either extremity in addition to the weight of the conductors.

218. Conductors—Material and Minimum Sizes.

(b) Minimum Sizes.—(221*a* and *b*.)—Supply conductors in urban districts shall not be smaller than listed in the following table:

TABLE 1.—MINIMUM SIZES OF SUPPLY CONDUCTORS (URBAN DISTRICTS).

Soft copper	No. 6
Hard or medium drawn copper	No. 8
Steel	No. 9

Stranded Aluminum:	Spans 150 ft. or less	Spans over 150 ft.
Not reinforced	No. 1 A. W. G.	No. 0 A. W. G.
Steel reinforced	No. 6 A. W. G.	No. 4 A. W. G.

It is recommended that, except as modified in Rule 268, these minimum sizes for copper and steel be not used in spans longer than 150 ft. for heavy-loading districts.

219. Minimum Sizes and Sags of Service Leads.

(a) Above 750 Volts.—(273*c*.)—Supply service leads of over 750 volts to ground shall comply, as to sizes and sags, with the requirements for supply line conductors of the same voltage.

(b) Below 750 Volts.—(273*d*.)—Supply service leads of 750 volts or less in spans not exceeding 150 ft. shall be not smaller than the sizes listed in the table below. Such leads shall have sags not less than 12 ins. for spans 100 ft. or less, 18 ins. for spans up to 125 ft., and 27 ins. for spans up to 150 ft.

TABLE 2.—MINIMUM SIZES OF SERVICE LEADS BELOW 750 VOLTS.

Situation.	Spans 150 ft. or less.
Alone	No. 10 if soft copper
Concerned with signal lines	No. 12 if hard copper
Over supply lines less than 750 volts	No. 12 if steel

Over trolley less than 750 volts .... Over any trolley in rural districts ...... Over supply lines of 750 to 7500 volts... Over supply lines more than 7500 volts in rural districts	No. 8 if soft copper; No. 10 if hard copper; No. 12 if steel
Over trolley more than 750 volts in urban districts .... Over supply lines more than 7500 volts in urban districts	No. 6 if soft copper; No. 8 if hard copper; No. 9 if steel

= Grade C requirements.

Supply-service leads of 750 volts or less in spans exceeding 150 ft. shall be not smaller than required for grade C in Table 10, Rule 246, and shall have sags not less than required for grade C in the sag tables of Appendix A.

Principal Changes in Section 22—Clearances and Separation of Wires.

220. Clearances of Conductors and Wires at Crossings.—(After table of clearances from ground or rails; new.)—For signal conductors along roads where the location of the pole relative to fences, ditches, embankments, etc., is such that the ground under the line will never be traveled except by pedestrians, the clearance above ground may be reduced to 10 ft.

For trolley contact conductors above 1500 volts to ground this clearance shall be increased by 2 ft.

Signal conductors below 150 volts to ground need have only 10 ft. clearance. Supply or other wires (except trolley contact wires) if below 150 volts to ground need not have more than 10 ft. clearance at entrance to buildings.

Where with guys crossing streets or alleys the section of the guy concerned is effectively insulated from the highest voltage to which it is exposed, up to 7500 volts, this value may be decreased, in urban districts, to 16 ft. at the side of the traveled way.

Increased Clearances—[3]—(265*c*).—Where the lowest supply conductor at a crossing over track rails is supported by suspension insulators, the initial clearances shall be sufficient to prevent the minimum clearances over rails given in Table 3 from being reduced more than 10% through the breaking of a conductor in either adjoining span.

222. Required Line-Conductor Clearances and Separations at the Supports.—(242.)

(*a*) *Line-Conductor Separations According to the Sags Concerned.*—The separation, at the supports, of the conductors of the same or different circuits of grades A, B, or C, shall in no case be less than the values given by the following tables, at 60 deg. F. without wind. The requirements of Rule 221 apply if they give a greater separation than this rule.

Separation in Inches Required for Line Conductors Smaller than No. 2 A. W. G.

(Formula: Separation = 0.2 in. per kv. + $6\sqrt{S/3 - 8}$, where *S* is the apparent sag in *inches* of the conductor having the greater sag, and the resultant separation is in inches.)

(See exception under Table 5, note *d.*)

TABLE 6.

Voltage.	Sag in Inches 36	48	72	96	120	180	240
750	12.0	17.0	24.0	29	34	43	51
2200	12.5	17.5	24.5	30	35	44	52
6600	13.5	18.5	25.5	31	36	45	53
22000	16.5	21.5	28.5	34	39	48	55
44000	21.0	26.0	33.0	38	43	53	60
66000	25.0	30.0	37.0	43	47	57	64

Separation in Inches Required for Line Conductors, No. 2 A. W. G. or Larger.

(Formula: Separation = 0.2 in. per kv. + $7\sqrt{S/12}$, where *S* is the apparent sag in *inches* of the conductor having the greater sag, and the resultant separation is in inches.)

(See exception under Table 5, note *d.*)

TABLE 7.

Voltage.	Sag in Inches 36	48	72	96	120	180	240
750	12.0	14.0	17.0	20	22	27	31
2200	12.5	14.5	17.5	21	23	28	32
6600	13.5	15.5	18.5	21	24	29	33
22000	16.5	18.5	21.5	24	27	32	36
44000	21.0	23.0	26.0	29	31	36	40
66000	25.5	27.0	30.5	33	36	41	45

For other voltages, separations may be calculated by formulae.

226. Clearances of Vertical and Lateral Conductors.—(246.)

(*c*) *Vertical Supply Conductors Through Signal Circuits on Poles Used Jointly by Supply and Signal Circuits.*—(New.)—Vertical supply conductors which run through a space occupied by signal circuits shall be inclosed from a point 4 ft. above the highest signal conductor or equipment, if the supply wire is below 7500 volts, or from a point 6 ft. above the highest signal conductor or equipment, if the supply wire is 7500 volts or over, to the ground in insulating conduit or mounted on pins and insulators as provided in (*e*) below.

Vertical supply-circuit ground wires which run through the space occupied by signal circuits shall be inclosed in wood or other insulating conduit from a point not less than 4 ft. above the highest signal conductor or equipment to the ground, except that within 8 ft. of the ground suitable mechanical protection as required by (*g*) below may be used.

227. Clearances of Conductors of One Line from Poles of Another Line.—(245*a*.)

Where conductors of one line are carried within 6 ft. from a supporting structure of a second line, and are not attached thereto, the clearance between the conductors of the first line and any part of the supporting structure of the second line, shall, if practicable, be not less than 3 ft. at 60 deg. F. and no wind. In no case should this clearance be less than the values required by Rules 221 and 222 for separation between similar conductors on the same support, increased by 1 in. for each 2 ft. of the distance from the supporting structure of the second line to the nearest supporting structure of the first line. The climbing space on the structure of the second line shall in no case be reduced by a conductor of the first line.

Principal Changes in Section 23—Classification of Circuits According to the Grade of Construction Required.

230. Required Grades of Overhead Line Construction, and Arrangement of Levels.—(210.)

(*d*) *Limitation of Joint Use.*—(New.)—The joint use of poles by signal lines and supply lines above 7500 volts is not recommended except where it is physically or economically impracticable to separate the lines sufficiently to avoid conflicts.

Between 5000 and 7500 volts conditions in particular cases will determine whether or not joint use of poles is desirable. (See Rule 213 for equivalent lower voltages in grounded circuits.)

231. Supply Lines in Urban Districts (See Rule 251).

(*a*) *Grade B.*—(217.)—Supply lines over 7500 volts in urban districts, unless in cable having permanently grounded continuous metal sheath or armor and installed in compliance with Rule 274, shall comply with the requirements of grade B.

Supply lines of any voltage carried above lines over 7500 volts, unless the lower lines are in cable having permanently grounded continuous metal sheath or armor and installed in compliance with Rule 274, shall comply with the requirements of grade B.

(*b*) *Grade C.*—(New.)—Supply lines above 7500 volts in urban districts if in cable having permanently grounded continuous metal sheath or armor and installed in compliance with Rule 274, shall comply with the requirements of grade C.

(Old No. 218 revised.)—Supply lines between 750 and 7500 volts in urban districts, unless in cable having permanently grounded continuous metal sheath or armor and installed in compliance with Rule 274, shall comply with the requirements of grade C.

Supply lines below 750 volts in urban districts, when carried above lines of between 750 and 7500 volts, shall comply with the requirements of Grade C, except when the lower line is in cable having permanently grounded continuous metal sheath or armor and is installed in compliance with Rules 274*c*, *d*, *e*, *f*.

Exceptions: Lines covered under (*a*) and (*b*) above, when on fenced rights-of-way, need not comply with the above requirements except where crossing over, conflicting with, or higher on joint poles with the conductors of other lines.

Constant-current circuits are included in (*a*) and (*b*) above, the voltage being the nominal full-load voltage.

(*c*) *No Grade.*—(New.)—Supply lines between 750 and 7500 volts in urban districts, if in cable having permanently grounded continuous metal sheath or armor and installed in compliance with Rules 274*c*, *d*, *e*, *f*, need comply only with the general requirements of Sections 20, 21 and 22.

(Old 271*a* revised.)—Supply lines below 750 volts in urban districts, where alone, or where concerned only with signal lines, or only with supply lines below 750 volts, or both, need comply only with the general requirements of Sections 20, 21 and 22.

232. Supply Lines in Rural Districts (See Rule 252).

(*a*) *Grade C.*—(219.)—When either of two supply lines in rural districts, one above 7500 volts and the other below 750 volts, crosses, conflicts with, or has common poles with the other, the upper one shall comply with the requirements of grade C, unless the line of higher voltage is in cable having permanently grounded continuous metal sheath or armor and is installed in compliance with Rules 274*c, d, e, f*.

(*b*) *Service Crossings.*— * * * Constant-current circuits are included in (*a*) and (*b*) above, the voltage being the nominal full-load voltage.

(*c*) *No Grade.*—(272*b*.)—Supply lines above 7500 volts in rural districts, where alone, or where concerned only with supply lines above 750 volts, need comply only with the general requirements of Sections 20, 21 and 22.

Supply lines below 7500 volts in rural districts, except as covered in (*a*) above, need comply only with the general requirements of Sections 20, 21 and 22.

233. Supply Lines Crossing Over Railways. (See Section 26.)

(*e*) *Street-Railway Crossings.*—Supply lines crossing over street railways on traveled portions of highways need conform only to general requirements, but when carried over trolley contact conductors shall have the same grade of construction as where crossing over supply lines of equal voltage (See Rules 231 and 232).

234. Supply Lines in Crossings, Conflicts, and Joint Use of Poles with Signal Lines. (See Section 27.)—(214.)

(*a*) *Grade A.*—Constant-potential alternating-current supply lines of over 7500 volts between conductors (or 4400 volts to neutral or ground), or constant-current circuits exceeding 10 amperes, or direct-current grounded trolley circuits of over 750 volts to ground, where at higher levels and crossing over, conflicting with, or having joint poles with telephone, telegraph, or other signal lines shall comply with the construction requirements of grade A, except as noted below.

(*b*) *Grade B.*—(215*a*.)—Constant-potential alternating-current supply lines of between 5000 and 7500 volts between conductors (or between 2900 and 4400 volts to neutral or ground), or constant-current circuits of between 7.5 and 10 amperes, where at higher levels and crossing over, conflicting with, or having joint poles with telephone, telegraph, or other signal lines, shall comply with the construction requirements of grade B.

(*c*) *Grade C.*—(216*a*.)—Constant-potential alternating-current supply lines between 750 and 5000 volts between conductors (or between 440 and 2900 volts to neutral or ground), and constant-current circuits not exceeding 7.5 amperes, where at higher levels and crossing over, conflicting with, or having joint poles with signal lines, shall comply with the construction requirements of grade C.

Where the supply lines over 5000 volts are in cable having permanently grounded continuous metal sheath or armor and are installed in compliance with Rule 274, grade C may be used for the supply line.

It is not intended that the requirements of (*a*), (*b*) and (*c*) above shall apply to supply lines at higher levels than signal lines, where over individual twisted-pair drop wires only, or where over other unimportant circuits only, if equally effective protection is secured by other methods of construction.

(*d*) *Double Crossing.*—(New.)—Where a line crosses in one span over two other lines, the strength of construction shall not be less than would be required if either of the two lower lines crossed the other.

For example, if a 2300-volt line crosses in the same span over a signal line and a direct-current trolley line over 750 volts, the 2300-volt line would be required to comply with grade A construction at the crossing. This is a double crossing and introduces a greater hazard than where the upper supply line crosses the signal line only.

(*e*) *Inverted Levels.*—Signal lines carried at higher levels than direct-current grounded trolley circuits of over 750 volts to ground in crossings, conflicts, or joint use of poles, shall comply with grade A construction, so far as mechanical strength is concerned. Signal lines carried over trolley contact conductors below 750 volts to ground shall comply with the requirements of grade C, as to conductor sizes and sags, with exceptions as noted in Rule 285.

In other situations, signal lines carried at higher levels than supply lines in crossings, conflicts, or joint use of poles, shall comply with the grade of construction required for the supply lines by (*a*), (*b*), or (*c*) above if in the reversed position, so far as mechanical strength is concerned, except as smaller wire sizes are permitted by Rule 285 for grade C signal lines.

235. Signal Lines Crossing over Railways. (See Section 28.)—(213.)

(*b*) *Grade E.*—Signal lines carried over tracks included in the following list shall conform to the requirements of grade E:

(1) Spurs not exceeding two tracks in the same span.

(2) Branches on which no regular schedule of operation is maintained.

(3) Narrow-gage tracks or other tracks on which standard rolling stock can not, for physical reasons, be operated.

(4) Tracks used only temporarily for construction or similar purposes for a period not exceeding one year.

(5) Tracks not operated as a public utility, such as industrial railways used in logging, mining, etc.

(*e*) *Street Railways.*—Signal lines carried over street railways not having overhead trolley contact conductors, need comply only with the general requirements for signal lines alone. (See Rule 288 and Sections 21 and 22.)

(*d*) *Trolleys.*—Where signal lines cross over trolley contact conductors, below 750 volts to ground, they shall comply with the requirements of Rule 285 as to conductor sizes and sags. For trolley contact conductors above 750 volts to ground, the requirements for crossing over supply lines must be met; namely, grade A for direct-current trolley lines, and grade A, B or C for alternating-current trolley lines, depending upon the voltage.

(*e*) *Signal Lines Classed as Supply Lines.*—Signal lines which are classed as supply lines (see def. 4), shall, where crossing over railways, comply with the construction requirements of Rule 233. (See Rule 289.)

Principal Changes in Section 24—Specifications for Supply Lines of Grades A, B and C.

241. Loads Assumed in Determining Stresses in Conductors.—(222.)

(*a*) *Assumed Loading of Wires.*— * * * The minimum temperature shall be assumed as 0 deg. F. for heavy-loading districts, 15 deg. F. for medium-loading districts and 30 deg. F. for light-loading districts.

Heavy loading for conductors consists of a horizontal wind pressure of 8 lbs. per sq. ft. of projected area and ½ in. of ice. Since the stress in the conductor does not in general exceed one-half the breaking strength for grades A and B, and 60% for grade C, this corresponds to a factor of safety of 2 for grade A and B and 1⅔ for grade C, based upon an 8-lb. wind and the ultimate strength of the conductor. Owing to the elongation of the conductor when stressed beyond the elastic limit, with the resulting increase of sag and decrease of tension, there is usually a greater factor of safety than 2 under normal conditions.

(*b*) *Loading Map.*— * * * (230*c*).—The localities in the different groups are classed according to the relative prevalence of high wind velocity and thickness of ice which accumulates on wires, light loading being in general for places where little if any ice ever accumulates on wires.

(*c*) *Modification of Loading.*— * * * (New.)—In case a state is redistricted by state administrative authority, so as to meet local weather conditions better than the map of Appendix A, a grade of loading above heavy may be used, if necessary, to meet such local conditions.

243. Strength of Steel Poles and Towers and Other Metal Supports.—(234*a*.)

(*a*) *Loads and Limiting Stresses.*— * * * (New.)—Guys are made of various grades of steel wire, the lowest grade generally having a strength of about 60,000 lbs. per sq. in., while the highest grade has a strength of 180,000 lbs. or more per sq. in.

For transverse strength in grade A construction heavy loading consists of a horizontal wind pressure of 12 lbs. per sq. ft. of projected area and ½ in. of ice. Since the stress in the steel does not exceed one-half the ultimate strength under these conditions, this is equivalent to a factor of safety of 3, based on an 8-lb. wind pressure and the ultimate strength of the steel.

245. Strength of Crossarms and Conductor Fastenings.—(231.)

(*a*) Crossarms of Selected Yellow Pine or Fir.*

	For grades A and B.	For grade C.†
2 or 4 Pin.	3 × 4 in.	2¾ × 3¾ in.
6 or 8 Pin.	3¼ × 4¼ in.	3 × 4 in.

(*b*) *Crossarm Strength.*—Crossarms for construction of grades A, B or C shall, when installed, withstand the vertical loads specified in Rule 222 without the stress under these loads exceeding 50% of the assumed ultimate strength of the material. They shall also withstand any unbalanced longitudinal stresses to which they are exposed with a limit of unbalanced tension where conductor pulls are normally balanced, of 700 lbs. at the outer pin.

246. Conductors—Material, Minimum Sizes and Sags.

(*b*) *Minimum Sizes.*—(221*b*.)—Supply wires shall not be smaller than indicated in the following table, except that longer spans may be used with any listed conductor size if the separations and clearances given in Section 22 and the sags given in Appendix A are correspondingly increased.

*If of other material they shall have at least equal strength.

†Grade C signal line crossarms may be 2¾ by 3¾ ins. for 6 pins, and 3 by 4 ins. for 10 pins.

TABLE 10.—MINIMUM ALLOWABLE CONDUCTOR SIZES.
A. W. G. for Copper and Aluminum—Stl. W. G. for Steel.

Medium or Hard-Drawn Covered Copper Wires.

Loading. district.	Grade.	Limiting span length in feet 150	175	200	300
Heavy	A & B	6	4	4	2
	C	8	6	4	2
Medium	A	8	4	4	2
	B	8	6	4	2
	C	8	6	4	2
Light	A	8	6	4	2
	B	8	6	6	2
	C	8	8	6	2

Soft-Drawn Covered Copper Wires.

Loading district.	Grade	Limiting span length in feet 150	175	200	250	300
Heavy	A	4	2	1	...	...
	B	4	2	2	...	...
	C	6	2	2	...	...
Medium	A. & B	4	4	2	1	...
	C	6	4	2	1	...
Light	A, B & C	6	4	4	2	1

Medium or Hard-Drawn Bare Copper Wires.

Loading district.	Grade.	Limiting span length in feet 150	175	200	300	400	500	700	1000
Heavy	A. & B	6	4	4	4	2	2	...	....
	C	8	6	4	4	2	2	...	....
Medium	A. & B	8	6	4	4	4	2	2	00
	C	8	6	4	4	4	2	2	00
Light	A. & B	8	6	6	4	4	4	2	1
	C	8	8	6	4	4	4	2	1

Steel Wires.

Loading district.	Grade.	Spans 175 ft. or less.	Spans over 175 ft.
All	A. & B	6	4
All	C	8	..

Aluminum Wires in Urban Districts.

Loading district.	Grade.	Spans 150 ft. or less.	Spans over 150 ft.
		Without steel reinforcement	
All	A, B & C	1	0
		with steel reinforcement	
All	A, B & C	6	4

Note—For sizes and material requirements of supply service leads see Rule 219.

Lightning-protection wires shall be regarded, in respect to size, material and stringing requirements, as supply conductors with which they are associated.

247. Line Insulators for Grades A and B.

(*b*) *Strain Insulators.*—(254*b*.)—Where strain insulators are used they shall be capable of withstanding without puncture under the normal mechanical stress at least as high a voltage as other insulators on the same line.

(*c*) *Insulators at Grounded Structures.*—Wherever wood pins and crossarms or other ungrounded supports are used within five spans of a crossing span with line conductors there attached to grounded metal pins, grounded crossarms, steel bridges, steel towers or other grounded structures the insulators at the grounded supports shall be capable of withstanding without flashover a voltage 50% higher than those used at adjacent ungrounded supports.

Where the supporting structures for the crossing span are the same as for other parts of the line, the insulators used may also be the same.

The above may be met, by installing insulators within five spans which will withstand a flashover voltage of only two-thirds the voltage which those at the grounded structure will stand, provided the other requirements of this rule are still met.

248. Special Transverse Strength Requirements.

(*a*) *Alternate Construction in Special Cases* (3).—(233*c*.)—The entire section between the transversely strong structures shall comply with the highest grade of construction concerned in the given section, except as to the transverse strength of the intermediate poles or towers.

(*b*) *Strength of Crossarms and Pins.*—(233*b*.)—The crossarms, insulator pins and conductor fastenings connected to the structure at each end of the transversely weak section shall be such as to withstand, under the conditions of loading prescribed in Rule 241 an unbalanced load equivalent to the combined pull in the direction of the transversely weak section of all the conductors supported up to 10,000 pounds for grade C, plus one-half the excess for grade A, or plus one-fourth the excess for grade B.

249. Longitudinal Strength Requirements for Sections of Grades A and B Construction in Certain Special Cases.

(*c*) *Methods of Providing Strength.*—(266*c*.)—The requirements of (*a*) are usually met by placing supporting structures of the required longitudinal strength at either end of the higher grade section of the line.

Where this is impracticable the supporting structures of the required longitudinal strength may be located one or more span lengths away from the section of higher grade, within 500 ft. on either side and with not more than 800 ft. between the longitudinally strong structures, provided such structures and the line between them meet the requirements, as to transverse strength and stringing of conductors, of the highest grade occurring in the section, and provided that the line between the longitudinally strong structures is approximately straight or suitably guyed.

PRINCIPAL CHANGES IN SECTION 25—REQUIREMENTS FOR SUPPLY LINES, INCLUDING ELECTRIC RAILWAY FEEDERS.

250. Compliance with Other Rules.

(*a*) *Grade A, B or C Construction.*—(New.)—In addition to complying with the requirements of Sections 21 and 22, the requirements of this section shall be met by all supply lines in urban and rural districts where a definite grade of construction (A, B or C) is required by Section 23, except in the important cases of crossings over railways or signal lines and the joint use of poles, which are covered by Sections 26 and 27.

(*b*) *Special Strength.*—(New.)—Special longitudinal strength requirements are made in Rule 249 for crossings of supply lines below 7500 volts over supply lines above 7500 volts.

(*c*) *Dead Ends.*—(274*b*.)—Where supply lines over 7500 volts in urban districts come to dead ends or to changes in line direction (even where no crossing exists) the end shall have construction complying with the longitudinal strength requirements of Rule 249.

(*d*) *Clearances.*—(New.)—For clearances of conductors and wires above roadways, railways, and footways, and from other conductors and wires, see rules 220*a* and *b*, 257, and 258.

251. Supply Lines in Urban Districts.

(*a*) *Below 750 Volts.*—(271*a*.)—Supply lines below 750 volts in urban districts, where alone, or where crossing over, conflicting with, or where higher on common poles with, other supply lines below 750 volts need only comply with the general requirements of Sections 20, 21 and 22.

(New.)—If the lower supply lines have a voltage over 750 volts and are not in cable having permanently grounded continuous metal sheath or armor and installed in compliance with Rules 274*c, d, e, f,* both lines shall comply with the requirements of grade C; if over 7500 volts and not in such cable, both lines shall comply with the requirements of grade B.

(*b*) *Between 750 and 7500 Volts.*—(271*b*.)—Supply lines between 750 and 7500 volts in urban districts, where alone, or where crossing over, or conflicting with, or where higher on common poles with, other supply lines not over 7500 volts shall comply with the construction requirements of grade C, as given in Section 24, unless the supply lines are in cable having permanently grounded continuous metal sheath or armor and are installed in compliance with Rules 274*c, d, e, f,* in which case no grade is required.

If the lower supply lines have a voltage over 7500 and are not in such cable, both shall comply with the construction requirements of grade B.

(*c*) *Over 7500 Volts.*—(271*c*.)—Supply lines over 7500 volts in urban districts where alone, or on the same poles with other supply lines of any voltage, or crossing or conflicting with such lines, shall comply with the construction requirements of grade B, except as covered in the next paragraph.

Such lines, if in cable having permanently grounded continuous metal sheath or armor and installed in compliance with Rule 274, need only comply with the construction requirements of grade C.

252. Supply Lines in Rural Districts.

(*a*) *No Grade.*—(272*a, b*.)—Where supply lines of any voltage in rural districts are not concerned with crossings of railways or signal lines, or conflicts or joint use of poles with signal lines, no grade of construction is required for conductors or supports, except as noted in (*b*) below. Such lines are subject only to Rule 246 for conductor materials, and to Sections 20, 21 and 22 for isolation, guarding, clearances, and pole arrangement.

(*b*) *Grade C.*—(272*c*.)—When either of two supply lines in rural districts, one above 7500 volts and the other below 750 volts, crosses, conflicts with, or has common poles with the other, the upper one shall be of grade C, unless the line of higher voltage is in cable having permanently grounded continuous metal sheath or armor and is installed in compliance with Rules 274*c, d, e, f.*

256.—Electric Railway Construction.

(*d*) *Strength of Construction in Urban Districts Generally.*—(276*h*.)—Trolley contact conductors, feeders, and their supports, in urban districts, shall comply with the strength requirements for supply lines of equal voltage. Direct-current circuits of over 750 volts to ground where at higher levels and crossing over, conflicting with, or higher than and having joint poles with, signal lines shall comply with the requirements of grade A (see notes under Rule 234 for special cases).

257. Wire Clearances Above Railways, Roadways, and Footways.—(276*j*.)

(2) Above streets or alleys, roadways, or footways, including track rails of railways where brakemen are not permitted on top of cars, the trolley contact conductors, when not over 1500 volts to ground, shall have a minimum clearance of 16 ft., and when above 1500 volts to ground shall have a minimum clearance of 18 ft.

This clearance is the minimum clear height in the middle of the contact conductor span. The point of support at the pole structure should be not less than 2 ft. higher, thus allowing for maximum sag in span wire and trolley contact conductor at 60 deg. F.

PRINCIPAL CHANGES IN SECTION 26—CROSSINGS OF SUPPLY LINES OVER RAILWAYS.

260. Grades of Construction.—(261*a*.)

Overhead supply lines (or signal lines which have taken on the character of supply lines) crossing over railways shall comply with the construction requirements of grade A, except when over sidings, spurs, branches, or other minor tracks only, in which case they shall comply with the construction requirements of grade B. (See Rule 233 for full statement.)

265. Increase of Clearance in Special Cases.

(*d*) *Increases Cumulative.*—(New.)—The above increases are cumulative when more than one applies.

PRINCIPAL CHANGES IN SECTION 27—SUPPLY LINES OVER SIGNAL LINES AND JOINT USE OF POLES.

270. Special Requirements and Compliance with Other Rules.

(*a*) *Grade of Construction.*—(268*a*.)—Overhead supply lines crossing over signal lines under the circumstances noted in Rule 234 shall comply with grades of construction A, B or C, as noted in the rule referred to.

(*f*) *Clearance Increases.*—(268*f*, *g*, *h*.)—The increases of clearances for longer spans, higher voltages, and for suspension insulators, shall be as given in Rule 220*b*.

(*g*) *Special Requirements.*—(268*i*, *j*, *k*.)—Special longitudinal strength requirements are given in Rule 249.

Requirements for protection against conductor breakage are given in Rule 266.

272. Joint Use of Poles by Signal and Supply Lines—Supply Lines Above Signal Lines.

(*a*) *Avoidance of Conflict.*— * * * —(New.)—The joint use of poles by signal lines and supply lines above 7500 volts between conductors (or 4400 volts to neutral or ground) is not recommended, except where it is impracticable to separate the lines sufficiently to avoid conflicts.

Between 5000 and 7500 volts between conductors (or between 2900 and 4400 volts to neutral or ground) conditions in particular cases will determine whether or not the joint use of poles is desirable.

The general requirements of Sections 20, 21 and 22 shall be complied with, except as modified in the following paragraphs.

(*b*) *Strength of Poles.*—(286*a*.)—Poles used jointly by supply lines and signal lines with the supply lines above shall have the highest grade of construction specified in Rule 234 according to the voltage and character of the various lines carried by the pole.

Where the signal lines are used exclusively in the operation of supply lines the pole strength need not be that required above, but the lines shall occupy the same relative positions noted under (*f*) below.

(*e*) *Longitudinal Stresses.*—(286*a*6.)—In calculating the longitudinal stresses upon jointly used poles complying with grade A or B construction requirements where crossing over railways or over signal lines (where these crossings would of themselves require compliance with grade A or B construction of the crossover span to meet the special longitudinal requirements at such points the tension in the signal conductors may be considered as limited to one-half their breaking strength provided they are smaller than No. 8 Stl.W.G. if of iron or No. 6 A.W.G. if copper, regardless of how small the initial sags of the signal conductors at 60 deg. F.

273. The Joint Use of Poles by Signal and Supply Lines—Signal Lines Above Supply Lines.

(This relation of levels is not in general desirable, and should be avoided where practicable.)

(*a*) *Strength Requirements.*—(287.)—Poles or towers used jointly by signal and supply lines, with the signal lines above the supply lines, shall comply with the requirements and rules referred to in Rule 272 as well as those in this rule.

(*b*) *No Reduction.*—The grade of construction A or B where required for the signal lines, includes the size, material, and sag of conductors as well as the strength of structures required for supply lines of the same grade by Section 24 with no reduction in transverse strength requirements such as is permitted by Rule 272*d* where supply lines are above signal lines.

(*c*) *Grade C Signal Conductors.*—(221*e*.)—Signal conductors which are required to comply with grade C construction may be smaller than Grade C supply conductors but not smaller than given in the following table:

TABLE 12.
(221 *e* revised.)

Span Length and Sag.	Material.	Sizes.
Spans not over 100 ft. with sags not less than 12 ins., and spans over 100 ft. but not over 125 ft. with sags not less than 15 ins.	Hard copper Steel	10 12
Spans over 125 ft. but not over 150 ft. with sags not less than 18 ins.	Hard copper Steel	9 11
Spans over 150 ft. with sags of Grade C supply conductors or more, as given in Appendix A.	Hard copper Steel	Sizes of Grade C supply conductors as given in Rule 246.

Paragraph 272*d* does not apply to such conductors.

274. Joint Use of Poles by Cabled Supply Lines and Signal Lines.—(New.)

(*a*) *Requirements When Cable Is Unsheathed.*—Poles used jointly by signal lines and cabled supply lines not having permanently grounded continuous metal sheath or armor shall meet all the requirements for poles used jointly by open supply and signal lines given in Rule 272.

(*b*) *Strength of Poles When Cable Is Sheathed.*—Cabled supply lines having permanently grounded continuous metal sheath or armor shall be installed in compliance with (*c*), (*d*), (*e*) and (*f*) below. When the voltage of the cabled supply lines is over 750 the poles shall meet the strength requirements of grade C as given in Section 24.

(*c*) *Messengers.*—Messengers shall be stranded and of galvanized or copper-covered steel with strengths and sags as specified in Rule 280, or if of other sizes shall not be stressed beyond half their ultimate strength when the cable and messenger are coated with ½ in. of ice and subjected to a transverse wind pressure of 8 lbs. per sq. ft. of projected area.

(*d*) *Grounding of Cable Sheath.*—Each section of cable between splices shall be suitably and permanently bonded to the messenger wire at not less than two places. The messenger wire shall be grounded at the ends of the line and at intermediate points not exceeding 800 ft. apart. (See Section 9 for method.)

(*e*) *Splices.*—Splices in the cable shall be so made that their insulation is not materially weaker than the remainder of the cable. The sheath or armor at the splice shall be made electrically continuous.

(*f*) *Insulation.*—The conductors of the cable shall be so insulated as to withstand a factory potential test of at least twice the operating voltage at operating frequency applied continuously for 5 minutes between conductors and between any conductor and the sheath or armor.

275. Special Crossing Construction.

(*b*) *Cradles.*—(New.)—Cradles are not recommended. It is believed better to build the supply line strong enough to withstand extreme conditions than to build a cradle of sufficient strength to catch and hold the supply line if it falls.

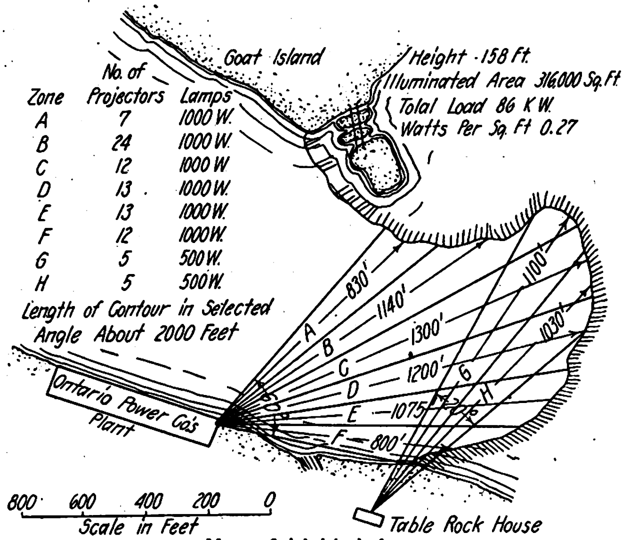
(To be concluded in the next issue.)

FLOOD LIGHTING OF CANADIAN FALLS AT NIAGARA.

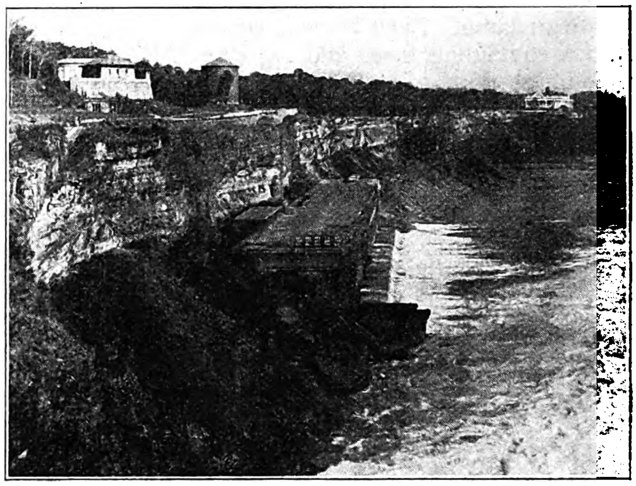
Remarkable Effects Secured by Use of 91 Projectors—Prince of Wales Lights Installation for First Time.

Lifting himself by his boot straps is something man has yet to accomplish. But he has by his ingenuity enabled the Horseshoe Falls at Niagara to illuminate themselves. It amounts to that. Because the force of water that goes tumbling over the falls supplies the power utilized in generating the electrical energy which, through the medium of 91 projecting lamps, of a total load of 86 kw., makes the view of the falls by night more awesome even than it is by day.

The Prince of Wales it was who supplied the final touch that made the lighting of the falls an accomplished fact. On the evening of Oct. 18, while a visitor at the home of Dr. Harry Grant, park commis-



Map of Lighted Area.


Battery of Projectors on Roof.

sioner of Queen Victoria Park, the Prince pushed the button that made the view of the falls by night more fascinating even than it is by day.

The illustrations convey only so much of the witchery of the view of the electrically lighted falls as can be caught by the unimaginative camera. One must visit the falls to secure the full effect. Then one becomes an active advocate of the policy of flood lighting all show places.

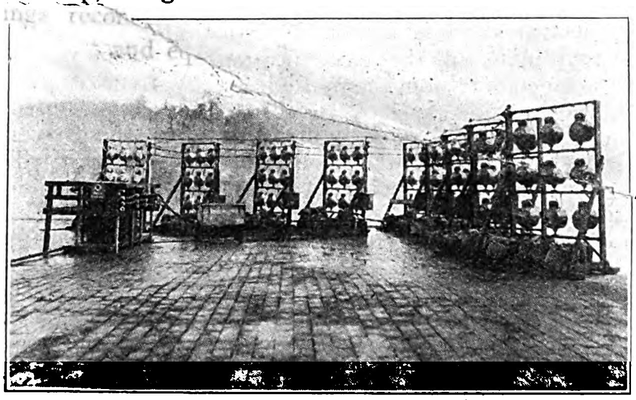
The lighting is by means of a main and a secondary battery of projectors, located with careful regard for all essential considerations. The plan of illumination installation shows the location of the main battery on the corner of the roof of the Ontario Power Co.'s plant, and of the secondary battery on the roof of Table Rock House. From the location of the main battery light can be directed to all parts of the falls, with the unique advantage also that the apparatus makes no bid for the attention of sightseers during the daytime. It does not intrude upon their gaze; only those having a special purpose will spy out its location. Another advantage of that location is that it is adjacent to an ample source of power. But there is one disadvantage necessitating the installing of the secondary battery on Table Rock House and which results from the occasional rising clouds of spray. When the spray is up it is impossible to see from the roof of the power house the crest of the falls near the apex of the horseshoe. This necessitated the installing of the secondary battery of ten 500-watt short-focus projectors on Table Rock House.

The distances, as will be seen by an inspection of the map, are greater than occur with the usual flood-lighting problem. The height of the falls is 158 ft. And at the longer distances the diameter of the beams is greater than is necessary to cover the face of the falls. Where this occurs the top of the beams are directed to the crest, while the diffused light from the main projectors is depended upon to illuminate the waters at the base of the falls.

No attempt has been made to penetrate the rising spray with artificial light, because even though this were done the view of the falls would still be obstructed by the spray itself. Better results have been attained by lighting up the falls by means of the secondary battery on Table Rock House from which a splendid view is had. It was found too, in the final adjustment of the beams, that more of the contour of the falls towards Goat Island could be illuminated than is shown in the map and each zone was spread out slightly to accomplish this end.

The installation was designed and erected by the engineers of the Hydro-Electric Power Commission of Ontario, and George Beattie, of the Electric Shop, Toronto, Ont., co-operated with the Commission and supplied the reflectors. Long-focus projectors, utilizing the regular type of gas-filled lamps, comprise the main battery. These were selected because such lamps are more readily obtainable, and also because it was not thought necessary to utilize high beam concentration. The areas to be lighted are large and they are both vertical and horizontal. And as all the light below the rim of the falls illuminates interesting surfaces there is little or none of it that can be deemed wasted.

The main battery is divided into nine banks of nine


Rear View of Projectors.


Niagara's Horseshoe Falls Floodlighted.

units each, and each of the 81 projectors contains one 1000-watt lamp. Each bank is equipped with a service box containing fuses and switch and is a complete three-phase unit in itself. And all service boxes are protected from spray to tight fitting wooden housings. Flexible conduits connect the subfeeders to the projector sockets. The conduits are securely fastened at each end so that any accumulation of ice will not impose a strain on the wires. Three 30-kw. transformers, located close to the projectors, are connected to the 2200-volt buses in the power house by lead-covered cable in conduit. Weatherproof cable is used for low-tension feeders.

PROSPECTS OF RAILROAD ELECTRIFICATION IN AMERICA AND ABROAD.

General Survey of Conditions Indicates That Extensive Electrification Will Be Brought About During Next Decade.

By F. H. Shepard,

Director of Heavy Traction, Westinghouse Electric & Manufacturing Co.

The world-wide shortage of coal during the great war and the present coal tieup in this country have emphasized more clearly the necessity of fuel economy in industry, while the present general shortage of labor and the certainty of its continuing scarcity throughout the reconstruction period forms another most serious problem. But fortunately we have at our disposal a means that will greatly assist in alleviating both of these conditions, namely, electrification.

The use of electricity in industry saves both fuel and labor. This fact is recognized throughout the world today, and in order to secure these advantages, practically all of the nations are now considering plans for the electric generation of power. In England, Belgium and France, among other countries, these plans are being prepared by official commissions so that a tremendous activity in electrical power development may be expected with the stabilization following the advent of peace. In all cases the ideal in view is a broad one: To use electricity for all possible power purposes, including railroad operation.

The operation of the railroads will naturally form an important part of any program of general electrification, for in almost every country the railroads form one of the largest users of fuel and labor. Nor are the advantages obtained from railroad electrification limited solely to economy in fuel consumption and the more effective use of labor. Among others, the following can be mentioned:

1. Greater speed of movement for the heaviest trains, due to the fact that electric locomotives can be made much more powerful than the largest steam locomotives.
2. Greater nicety of control.
3. Increased traffic capacity of existing tracks, terminals, grades, tunnels and other points of traffic restriction, because when electricity is used, heavier trains can be operated at higher speeds and less time is consumed at terminals and in yards.
4. Operation where the use of steam is [illegible] or objectionable, as in long tunnels.
5. Independence of weather conditions, since the electric locomotive is not affected by cold weather.
6. More reliable operation, as proved by the statistics of all existing electrifications.
7. More effective use of all rolling stock, due to more expeditious movement of traffic.

These are some of the advantages that are now being obtained from the mere substitution of the electric locomotive for the steam locomotive, but they by no means tell the whole story.

Since the United States has an abundance of coal, railroad electrification here has been determined solely by local conditions. Passenger terminal problems caused the electrification of the New York Central at New York and the Pennsylvania at New York and Philadelphia. The limitations of the steam locomotive determined the electrification of the Baltimore tunnel on the Baltimore & Ohio, the Cascade tunnel on the Great Northern, the St. Clair tunnel on the Grand Trunk, the Hoosac tunnel on the Boston & Maine and the Detroit River tunnel on the Michigan Central. Examples of electrified railroads with freight as well as passenger service are the Norfolk & Western, the Chicago, Milwaukee & St. Paul and the New York, New Haven & Hartford.

While the other electrifications are successful and interesting, the last three are more properly representative of general railroad electrification. The Norfolk & Western is an example of electrification under the heaviest conditions of freight traffic on a mountain grade. The Chicago, Milwaukee & St. Paul has in operation the longest continuous mileage in the world and when completed will cross five mountain ranges. The New York, New Haven & Hartford has a very large movement of both freight and passenger traffic. All three installations are successful and profitable and, when financial conditions are stabilized and the American railroad question settled, it is expected that all three of these systems will extend their electrified service.

In addition there are sections of railroads about the country where the present congestion of traffic or the availability of water power warrants the early adoption of electric power. These possibilities alone promise under normal conditions of finance (as no engineering problems now remain to be solved) extensive activity in the electrification of railroads for many years to come.

Differing from America, European and South American countries, with the exception of England alone, lack an adequate supply of fuel, but many of them, including Norway, Sweden, Switzerland, Italy, Spain and Brazil, have large amounts of water power while France has a moderate amount. These resources combined with the high cost of fuel make extensive railroad electrification in these countries inevitable sooner or later.

The neutral countries will probably be the first to undertake this work, Switzerland having a program covering a term of years well established, while both Norway and Sweden are giving active consideration to definite projects. In England a considerable [illegible] of electrification is in contemplation [illegible] general plan for the electrification [illegible] country. A French commission [illegible] government and railroad engineers, [illegible] visited the United States in order [illegible] thoroughly familiarize themselves with [illegible] practice. The Italian Government will [illegible] its definite program as soon as financial conditions permit. An official Belgian commission is already planning to rehabilitate with electric power at least a portion of the railroads destroyed by the Germans. In Spain, Brazil and South Africa as well railroad electrification is under active consideration.

It is evident, therefore, that the next decade will see a large amount of railroad electrification in almost every quarter of the world.

Editorial Comment

The Coal Issue and Ultimate Issue

FOR MORE than thirty-five days the bituminous coal miners have been on strike. The rate of coal production throughout the country is about 35 per cent of normal. Only because of vast stores of coal in storage have the nation's industries and our national life been able to continue their usual course and each hour brings nearer the time when the supply of coal on hand will be consumed.

In recommending a wage increase of 14 per cent, Dr. Garfield stated that such a wage increase could be awarded the miners without increasing the cost of coal to the public. But this was not his only recommendation. He asked that the miners return to work while a Federal investigation of the entire coal industry be taken up. His wage increase of 14 per cent was not final; it was but temporary. Dr. Garfield's finding was not offered as the permanent solution to the problem, but merely as a palliative that would enable the nation's coal to be mined pro tem, until such time as a thorough investigation would enable a solution at onc equitable and wise to be formulated upon actual facts.

But the miners refused to work. Instead they decided to fight. Apparently they are out for all they can get, regardless of how gotten, or how the nation may meet their demands, or the hardship and suffering capitulation to their demands entails. In this crisis the American people are showing admirable *sang-froid,* typical of our best traditions. Hardship is, however, already being suffered by many, and culmination of the deadlock is not yet in sight. But America must keep her sang-froid, and become cold, if necessary, for a little while, for the issue before the nation will decide who it is that rules the nation.

The miners have thrown down the gauntlet, determined to fight our government for their demands. The issue is thus no longer whether miners are justified in obtaining more money, shorter hours, steadier employment or better working conditions, for Dr. Garfield has promised to determine these things, and on the findings recommend not "what the traffic will bear" but a just and equitable award. The issue between America and the miners now is whether America is to be ruled by those elected by the people to govern them or whether a certain class, representing a very small minority of the people, shall dictate terms and force its will upon the nation regardless of our government and any other element of society.

The issue before us is plain. The immediate issue is whether this country shall be coerced, domineered and browbeaten by a few wilful men who attempt to dictate to a hundred million free people that half a million may obtain their own ends. This is the issue every true American faces today. It is an issue that can no longer be side-stepped. It is an issue that must no longer be shirked by anyone an American in fact as well as name.

We must now decide whether our present form of government shall stand, or whether we shall capitulate to the ultimatum of the self-appointed few to force their will upon us, by ruthless methods, and thus create a precedent that may ultimately result in the overthrow of our present form of government.

Sentiment Versus Logic in the Electrical Christmas Appeal

ALL DECISIONS in life are either the result of sentiment or of logic. Everyone prides himself in being logical in all his decisions, yet in reality most decisions in life are the result of sentiment.

There was only one nation that went into the recent war for purely logical reasons. It was Germany. America went into the war for a sentimental reason—"To make the world safe for democracy." Cool-blooded logic on the part of Germany failed to win the war.

Let us now consider why the middle class of today—largely composed of the former poorer classes—are buying higher priced goods. It isn't because of logic, for logic shows that they should be contented with the class of goods they were accustomed to before, or merely a slightly better grade, as labor cannot logically hope for the present high wage scales to continue. These people, and most people, buy the higher grades of goods, labor-saving devices, electrical table utensils, near luxuries and luxuries for but one reason—sentiment—in the form of pride, love for one's wife, love for the home, the desire for an element of refinement, etc.

They are not interested so much in how much it costs to make coffee in an electric percolator nor its cost, if apparently within the range of their pocketbooks, but in the air of refinement it will give the home, how well it will look on the table and how much it will please the housewife.

Similarly in the case of washing machines and vacuum cleaners. Bridget, who married the milkman, is now on easy street. For sentimental reasons both she and her husband want the washtub and the broom forgotten. Similarly Bridget's former mistress for sentimental reasons wouldn't think of using Bridget's old washtub and broom. It is beneath her dignity to use or handle such things. Logic shows that if the hands are toughened and muscles strengthened this is good from a physical point of view. But neither

Bridget nor her former mistress nor the husbands of either are really logical. For sentimental reasons all prefer the modern labor-saving devices.

Too many advertisements overlook the power of sentiment, yet the good salesman recognizes sentiment as one of the most potent factors in a sale. In the first place, he does all he can to cause his prospect to take a fancy to him, then he learns his hobbies and tries to talk about them, whether the hobby be golf, dogs or baseball, and finally ends the interview with a little selling talk and an order. This isn't, of course, how all sales are made but it is the easiest and quickest way of making a sale.

In advertising, as well as in selling, sentiment must be taken into consideration. Sometimes it should be subordinated to logic. In other cases logic should be subordinated to it. Sentiment has been too far subordinated in much electrical advertising. A common percolator on the stove will make as good coffee as an electric one on the table—but it doesn't make the same sentimental appeal as does an electric one.

Christmas is a sentimental period. The emotion, the desire to give and to please hold sway often to the extent of one spending much more than he can logically afford to spend on presents.

Let sentiment play a part in your Christmas advertising and selling. Appeal to the sentiments of love of wife, of mother, of home and to the sentiments of pride, of desire for refinement, for progress, etc. What more striking appeal could be made at Christmas time than that used by a well-known central station, "Do you love her?" A man does not seek to please his wife or any one else as a rule for logical reasons but for sentimental reasons.

Oil as a Peak-Load and Emergency Fuel

CONSIDERABLE has been said of late regarding the relative values of oil and coal as fuel. The oil men have been very active in furthering the use of oil for industrial and domestic purposes ever since coal became a high-priced commodity and sometimes a scarce one. How does the use of oil fuel in any way affect central stations located in territory where neither gaseous nor liquid fuel are obtainable without considerable transport, in fact in the coal zones?

What are the advantages of oil over solid fuel? The calorific value of oil is about 35% higher per pound than coal; for a given storage space about 50% more heat value can be stored as oil than as coal. Oil is more easily handled than coal, dust and ashes are absent, resulting in lower investment in equipment and smaller labor costs. As to combustion, oil enables fires to be lighted instantly, and instantly shut down, smoke is practically eliminated and combustion may be made more nearly perfect with less trouble than when burning coal. Control of combustion, hence more constant steam pressure and efficiency, are easier when consuming liquid fuel than solid fuel in the lump state. These advantages are very real ones, and yet even when considered upon a basis of investment cost and cost per thermal unit, oil fuel cannot threaten the use of coal with many central stations, because there are other factors involved.

However, while the probability of fuel oil usurping coal must continue to be the exception rather than the rule it would seem that there exists an application for fuel oil among the central stations that might be a very promising one for the oil salesmen to take up. That application is for emergency and peak-load service. Used in this way, primarily, oil fuel would affect considerable fuel saving since banked fires and large stand-by losses would be much reduced, emergency starting would be much more rapidly attained, and the capacity of existing equipment could be considerably augmented.

It is not proposed that oil-burning furnaces and boiler should be available, awaiting the peak demand or the emergency to arise. But we do believe that the use of oil under double-fired boilers so that the oil might be turned to supplement the coal firing whenever needed, would add immensely to the flexibility of operation, likewise the economy. With many, it may be said most, installations, it is the rate of coal burning that limits the capacity of a unit rather than the ability to evaporate water. The addition of oil burners to one or more existing stoker installations would extend this limitation. When the peak load abated or the emergency passed, the oil would be turned off and its consumption immediately cease.

Underfeed stokers are able to bring a boiler up to high rates of steaming in very short time, and sufficiently quickly for central-station purposes and the welfare of the furnace lining, hence the even better performance of oil fuel in this respect is of limited capitalization. But it is the ability to reduce to an absolute minimum the consumption of coal for banked fires and similar stand-by service, that oil fuel offers advantages. Moreover, the use of oil burners in addition to stokers extends the limits constituted by ability to consume coal, hence increases the steam generating capacity of existing equipment while also adding to the flexibility and economy of the plant as a whole.

The above generalities have been dwelt upon in the idea that there may be an application of fuel oil in many a central station if employed as above, whereas if not so used there is no application. By this we mean that central stations located within reasonable distance of sources of coal will find coal their chief source of combustible for many a year to come. It is beneficial that they should, for fuel oil is being used at a rapid rate and there are many instances where exists little choice other than fuel oil. Most central stations are best able to burn coal efficiently, and therefore should stick to the use of coal. Leave the oil for the steamships, the battleships and the plants where coal cannot be readily obtained. But use it when its use is indicated or promising.

Current Events

Light and Power Curtailment Necessiated by Coal Shortage—Water-Power Development for California and Alaska

PUBLIC UTILITIES AFFECTED BY COAL-SAVING PLANS.

Drastic Measures Enforced by Federal Fuel Administration in Effort to Economize on Coal Used by Central Stations.

With the settlement of the strike of the bituminous coal miners remaining indefinite and with the depletion of stocks of coal held in storage by central stations, the situation became such this week that the Federal Fuel Administration issued an order to the effect that in the release of coal to public utilities the latter shall, in furnishing power to manufacturing plants which purchase power produced by use of coal, curtail service to place such plants in the same situation as if they were using coal. This order affects all central stations throughout the United States and as a result unnecessary expenditure of coal has been curtailed also by dimming street lights, cutting off electric signs, show-window lights, etc.

The situation in eastern states has not become alarming, as far as the central stations are concerned, because of large storage of bituminous coal and of the availability of anthracite coal. There are numerous hydroelectric plants in New England and other eastern states which are able to supply much of the demand for power in industrial centers.

However, in middle western states, especially in the northern part, the situation is becoming acute. The public utilities in Chicago and other middle western cities have but a few weeks' supply. Furthermore, if the coal strike should be settled at once it would be several weeks before the fuel shortage could be relieved by fresh deliveries. Because of these conditions drastic measures were deemed necessary by the Illinois State Public Utilities Commission, and as a result it issued the following order to all public utilities subject to its jurisdiction:

"To immediately cease furnishing service for all unnecessary interior and exterior illumination, including signs, display lights and show windows.

"To permit service to shops, industries, business establishments and warehouses (except cold storage) for but 6½ hours per day; provided, where there is continuous operation such service must be discontinued for two working days each week.

"To permit service to retail stores in the central district of Chicago from 11 o'clock a.m. to 5 o'clock p.m. only, and in the outlying districts from 10 o'clock a.m. to 6 o'clock p.m., and until 9 o'clock p.m. on Saturdays.

"To permit service to offices, banks and other places of business, including office buildings, from 9 o'clock a.m. to 3:30 o'clock p.m. each day.

"To permit service to theaters and similar places of amusement for six performances each week, one in the afternoon and five in the evening, without restriction upon motion picture houses."

The Commission earnestly urged upon the public the necessity of co-operating in every way possible to make this order effective, and expressly urges upon domestic consumers of electricity the importance of reducing their consumption of the same to the very lowest point possible, lest there be none for their necessities within a very short time.

Representatives of the Fuel Administration in Chicago ordered the Commonwealth Edison Co. and the Sanitary District of Chicago to cease supplying energy to nonessentials, and the Sanitary District, which operates a hydroelectric plant, was ordered to deliver to the Edison company any surplus power gained by the restrictions on supply of energy to nonessential industries.

The coming of cold weather has reduced the output of hydroelectric plants in north central states, and this, coupled with the fact that very little coal is being moved by the railroads and only a small percentage of that released to the public utilities, makes the situation alarming for central-station companies. Unless the strike is settled soon, even more drastic measures concerning the generation and distribution of electrical energy probably will be taken.

A. I. E. E. MEETING TO BE HELD AT CHICAGO JAN. 9.

Electrical Distribution for Street Lighting to Be Considered in Three Papers.

A national meeting of the American Institute of Electrical Engineers has been arranged for Jan. 9, 1920, at Chicago. The general subject of this meeting is to be "Electrical Distribution for Street-Lighting Purposes." There will be two sessions, afternoon and evening. The morning of Jan. 9 will be devoted to registration, getting together, Board of Directors and committee meetings of various kinds, the Western Society of Engineers' rooms in the Monadnock Block being the headquarters.

The first session will be at 2 p. m., at which the following papers will be presented:

"Series Systems of Distribution for Street Lighting," by W. P. Hurley, of the Westinghouse Electric & Manufacturing Co.

"Multiple Systems of Distribution for Street Lighting," by Ward Harrison, of National Lamp Works of General Electric Co.

At 6 p. m. there will be an informal dinner at the City Club.

At 7:30 p. m. the evening session at the City Club will be opened by an address by Dr. Charles P. Steinmetz on "Constant Potential-Series Distribution for Street Lighting." After this address an extended discussion of this subject is being arranged. As a number of modifications of the old series and multiple systems of distribution have been devised recently for meeting the changed conditions brought about by the new types of street-lighting lamps, it is anticipated that this discussion will bring out much of interest.

The Chicago Section of the Illuminating Engineering Society and the Electrical Section of the Western Society of Engineers will join in this meeting. Local arrangements for this meeting are in charge of J. R. Cravath, of Fowle & Cravath, Monadnock Block, Chicago.

N. E. L. A. COMMITTEES ON WATER POWER AND CO-OPERATION.

Strong and Influential Personnel of These Committees and Outline of Their Work.

President R. H. Ballard of the National Electric Light Association announces that the Committee on Water Power Development under the chairmanship of Franklin T. Griffith, president of the Portland Railway, Light & Power Co., Portland, Ore., will include the following personnel:

William A. Brackenridge, president, Southern California Edison Co., Los Angeles; John A. Britton, vice-president and general manager, Pacific Gas & Electric Co., San Francisco; H. T. Edgar, president, Mississippi River Power Co., Keokuk, Iowa; G. C. Egbert, consulting engineer, Niagara Falls Power Co., Niagara, N. Y.; Mortimer Fleishchhacker, president, Great Western Power Co., San Francisco; H. I. Harriman, president, New England Power Co., Boston, Mass.; D. L. Huntington, president, Washington Water Power Co., Spokane, Wash.; H. F. Jackson, president, Sierra & San Francisco Power Co., San Francisco; Frank M. Kerr, vice-president and general manager, Montana Power Co., Butte, Mont.; W. S. Lee, chief engineer, Southern Power Co., Charlotte, N. C.; A. W. Leonard, president, Puget Sound Traction, Light & Power Co., Seattle, Wash.; J. D. McKee, vice-president, California-Oregon Power Co., San Francisco; G. W. Talbot, president; Pacific Power & Light Co., Portland, Ore.; A. B. West, vice-president and general manager, Southern Sierras Power Co., Riverside, Cal.; A. G. Wishon, vice-president and general manager, San Joaquin Light & Power Co., Fresno, Cal.

A complete investigation of the water-power resources of the country, both developed and undeveloped, will be undertaken by this committee. The great aid to national industrial and agricultural development that will result from commercial and economic use of the nation's natural resources in water supply will be fully set forth for the benefit of the industry at large, bankers and investors. A study will be made respecting the practical application of pending national legislation on the subject and of the economic advantages to be obtained through a more general interconnection of water-power systems.

President Ballard also announces that the following is the personnel of the Committee on Co-operation in the Industry:

Chairman, Lee H. Newbert, Pacific Gas & Electric Co., San Francisco; vice-chairman, Robert Sibley, editor, *Journal of Electricity,* San Francisco; John J. Gibson, Westinghouse Electric & Manufacturing Co., Pittsburgh, Pa.; D. R. Bullen, General Electric Co., Schenectady, N. Y.; S. M. Seelman, Jr., Brooklyn Edison Co., Brooklyn, N. Y.; R. S. Hale, Boston Edison Co., Boston, Mass.; William Creighton Peet, Peet & Powers, New York City; Frank Price, Pettingill-Andrews Co., Boston, Mass.

This committee is formed to investigate generally conditions throughout the country, and particularly within geographic sections, in regard to the matter of general co-operation in the industry, and will be prepared to make a report and some general recommendations at one of the sessions of the annual convention to be held in Pasadena, May 18 to 21, 1920.

INDUSTRIAL ECONOMICS DISCUSSED AT CHICAGO MEETING.

Chicago Sections of A. I. E. E., A. S. M. E., I. E. S., and Electrical Section of W. S. E. Hold Joint Meeting.

Three papers dealing with various phases of industrial economics were presented at a largely attended meeting of the Chicago Sections of the American Institute of Electrical Engineers, the American Society of Mechanical Engineers and Illuminating Engineering Society with the Electrical Section, Western Society of Engineers, held in Chicago on Nov. 24.

Edwin D. Tillson, testing engineer, Commonwealth Edison Co., took as his subject, "Reaction of Labor to Intensive Lighting." The progress of good factory lighting has been comparatively slow, although if plant owners realized what high financial returns the investment in this line brings they would quickly insist on it. Chicago tests on the productive value of intensive factory lighting showed returns of up to 700% on the investment involved. Many installations of such lighting have been made under the guidance of the Edison company's engineers; in these the intensity has been increased all the way from 3 or 4 up to 50 times the original intensity. Such installations have been carefully designed on basic data and principles derived from numerous tests and well known authorities, and after a detailed survey of the premises has been made. Tests of productive value of lighting are very difficult to make, but two schemes have been proposed by the Lighting Sales Bureau of the National Electric Light Association whereby fairly reliable data on this point will be obtained under varied conditions.

Higher intensity is not the only desirable feature of a good factory lighting system; much more uniform light distribution and absence of dense shadows are of almost equal importance. Under drop-cord lighting now slowly becoming obsolete the workman had a very small brightly lighted area surrounded by a wall of deep darkness that acted like a physical obstruction to his effective and efficient work, and that led to many accidents. Removal of this wall of darkness by provision of good general lighting has a very remarkable effect in making the workman more alert and attentive and much more efficient in every way. By means of a cleverly contrived working model of a factory, Mr. Tillson showed the difference in illumination and in shadows of drop-cord lighting and two systems of general lighting having average intensities of 4 and 12 ft-cdls. on the working plane.

George H. Jones, power engineer, Commonwealth Edison Co., read a paper on "Central-Station Power as a Means of Effecting Economies and Increasing Production." He showed that it is now, especially in view of the coal situation, just as necessary to conserve our resources and eliminate waste as it was during the war. In doing this electric power is a vital factor in many ways as was so effectively demonstrated in the war. Valuable economies result from the logical machinery arrangement and freedom from much shafting and belting permissible when electric power is used for machine drive, and yet these are not its most important advantages when the power is supplied from a central-station system. During the war we submitted gladly to lighting and heating restrictions in the effort to conserve fuel, but the saving thus effected was small in comparison with that resulting from replacing isolated plants with central-station service.

The marked economies of central-station power supply were strikingly shown in a number of curves, the first showing that the annual output of the Edison company in kilowatt-hours has increased several times as fast as the investment in its entire system, also much faster than the total number of its employes; other curves showed the marked reduction in coal consumption per kilowatt-hour generated by the company and the decreased rates for power, both being due to the much higher efficiency of generation in very large, modern power stations. Mr. Jones cited by contrast the very low economy of the average isolated plant; even well operated and maintained plants of this type often use 10 to 12 lbs. of coal per kw-hr., which is almost a criminal waste of fuel. During the summer the Edison company took over the supply of electric power to ten such isolated plants, enabling their steam equipment to be shut down with a saving per season of some 13,000 tons of coal or enough to supply the entire neighboring city of Evanston for about 15 months.

Harold Almert, consulting engineer, Chicago, presented the third paper, which dealt with the "Personal Efficiency of the Employe." He called attention to the heavy exodus of alien workmen going back to native lands. This and the dearth of immigration for many years have depleted our labor supply very seriously. If we are to get the same output from the remaining workmen we should have increased efficiency from each one of them. During the war the idea of service to the nation spurred everyone on. Now, on the contrary, the spirit of service seems to have vanished and instead we see nearly everyone trying to work less and yet get more pay. Increase in the standard of living is desirable, but it must be kept in bounds to prevent further excessive increases in the costs of commodities.

Mr. Almert cited public utility service as having increased in price probably less than nearly all other services or commodities. And yet analysis of the labor costs of public utilities shows a decided slackening of effort on the part of employes since signing of the armistice. During the present year not only have the wages of such employes gone up, but the time necessary to complete a unit quantity of work has increased, in many cases over double that during the war. Figures were given on the setting of telephone poles, installing telephones, erecting gas holders, etc., which verified this evident decreased efficiency of the employe and which is largely to blame for our increased costs. It is well to provide machinery, power and lighting to increase the efficiency of the plant, that is, the output per employe, but the personal efficiency of the employe must not be allowed to drop further to offset these other gains. Mr. Almert thought that if the workmen were left free from false leadership and agitators, they would return to war-time efficiency. Meantime the employers must make a closer study of human nature, make better selection of his employes and try to stimulate interest in their work by means of profit sharing or other methods that impress on them their obligation to co-operate in meeting the wants of the community.

SOUTHERN CALIFORNIA EDISON CO. TO SPEND $41,800,000 ON WATER POWERS.

Will Build New and Extend Present Hydroelectric Plants Within Next Four Years, Thus Conserving About 2,560,000 Barrels of Oil Annually.

The Southern California Edison Co., with headquarters in Los Angeles, has been authorized by the Railroad Commission of California to sell $7,500,000 of 6% 25-year bonds. Of this amount all but $1,843,000 is to be used to carry out part of the company's construction program, which calls for an expenditure in the next four years, for new water-power plants and extensions, of $41,800,000. The balance is to be used to meet notes issued in connection with construction work now under way. The company has issued a statement to the effect that the proposed new water-power plants will produce electrical energy that would require the burning of 2,560,000 bbls. of oil a year if generated by steam. The statement further declares that approximately one-half of the new power will be needed for electric pumping plants for the irrigation of lands in southern California, the number of acres being estimated at 370,000. In a supplemental order issued by the Commission the Edison company has been granted authority to exchange $1,970,000 of its 1915 debentures at par for $1,970,000 of series of 1919 bonds at 97.

WIRE CONTROL COSTS GOVERNMENT FOURTEEN MILLION DOLLARS.

Deficit Between Net Earnings and Guarantees Was More Than 20% During Government Operation.

War-time operation of telephone and telegraph systems of the country cost the Federal Government $14,418,237, according to the report of Postmaster General Burleson transmitted to Congress on Nov. 13 by the President. The sum represents the difference between the net earnings of the companies and the compensation guaranteed by the Government. Figures showing the result of the operation of the cable companies, which were under Federal control during six months, were not included in the report because reports from these companies had not been received when the postmaster general made his report.

Total net earnings of the telephone and telegraph lines during Federal control were reported at $70,387,532, while the compensation assured was $83,055,769. The total deficit included an estimated $3,000,000 for settlement of future claims. Small independent companies operated by the Government reported a surplus of $57,428.

HYDROELECTRIC DEVELOPMENT PROJECTED IN ALASKA.

Nonfreezing Mountain Springs to Furnish Power for Operation of Gold Dredges at Nome.

Plans, tentatively outlined two years ago, for the development of hydroelectric power on the north slope of the Sawtooth mountain range, on Seward Peninsula, Alaska, apparently are being completed for

New York men who are interested in the project. The source of water for power is in springs on the mountainside which do not freeze in winter. In this flow there is a fall of about 700 ft. This water runs into the Kuzitrin river, the latter into Salt lake, which has an outlet into Clarence bay.

It is understood that two 5000-hp. generators, as the initial units, may be installed in 1920, and that the project contemplates other similar-sized units. The first installation, it is reported, will require a 56-in. pressure pipe two miles in length, and a transmission line to Nome, a distance of about 80 miles. The principal market for power is for the operation of gold dredges on the Nome tundra and elsewhere on Seward Peninsula, concerning which plans on a large scale are being considered.

PACIFIC GAS AND ELECTRIC TO TAKE OVER ANOTHER UTILITY.

Proposes to Operate Sierra & San Francisco Power Co.'s Plant and Transmission Line for 15 Years.

The Pacific Gas & Electric Co. has completed a preliminary agreement with the Sierra & San Francisco Power Co. to lease and operate all the properties of that company for 15 years. Application being made to the California Railroad Commission for permission to complete the agreement, according to a statement made by John A. Britton, vice-president and general manager of the Pacific Gas & Electric Co. The principal properties and power house of the Sierra & San Francisco company are in Tuolumne county, and it owns a transmission line to San Francisco, where it supplies the United Railroads and Universal Electric & Gas Co. with power. The company also owns a distribution system in the San Joaquin valley and operates in Stanislaus and Calaveras counties. The proposed lease will enlarge the facilities and equipment of the Pacific Gas & Electric Co. Should the Railroad Commission rule favorably on the matter, the Pacific Gas & Electric Co. will, it is stated, make improvements that the Sierra & San Francisco Power Co. has had under consideration and probably will also make some extensions.

DEVELOPMENT OF ELECTRICAL SIGNALING DURING THE WAR.

Dr. Jewett Reviews Progress in Communication and Signaling—Address Before Seattle Section, A. I. E. E.

Dr. F. B. Jewett, chief engineer of the Western Electric Co., made the principal address at a well attended meeting of the Seattle Section of the American Institute of Electrical Engineers at Seattle, Wash., on the evening of Nov. 17. His address related to the development of means of communication for the army and navy during the war, in which special attention was given to use of the telephone at the battlefront, radiotelephony and radiotelegraphy for both army and navy. He illustrated and described submarine detectors and instruments for sound ranging of big guns. He also explained the apparatus developed whereby pilots on several airplanes had successfully communicated with each other and with stations on the ground. This had proved a success in cases where visual signaling was impossible. He exhibited numerous lantern slides and motion pictures of the highest interest.

During the war Dr. Jewett was a lieutenant colonel of the Signal Corps, and had a directing hand in developing radiotelephony to its acknowledged efficiency in military and naval service.

AUTOMATIC TELEPHONES FOR NEW YORK CITY.

The New York Telephone Co. has announced that following exhaustive experiments it has developed a machine switching central office system that has proved so satisfactory in a number of practical trials as to warrant its use in several places within its territory.

Installations are now being made in Dunkirk, Ithaca and Geneva and the work is expected to be completed about the first of the year. In New York City it is planned to place this apparatus in the three new exchanges, but none of these installations can be completed, according to present estimates, much before the end of 1920. The latter changes are expected to help meet the abnormal demand for telephone service in that city.

The new system has been so carefully worked out and the means of co-ordinating it with the other types of switchboards have been so perfected that the different types of equipment will interconnect without difficulty. In fact, a subscriber connected with one of the new switchboards will not need to know whether the called party is connected to a machine switching or a manually operated switchboard and vice versa.

N. E. L. A. COMMITTEE TO COMPILE FACTS ON LINE DEVICES.

The Overhead Systems Committee of the National Electric Light Association is planning in its 1920 report to bring to the attention of the industry any new devices that, in the committee's opinion, would be useful in line construction or line maintenance work. In order to make the report as useful as possible, the committee would be glad to get into touch with any manufacturers making such tools or devices for use in overhead line work.

It is not the committee's plan to include in its report anything whatever regarding the various lines of standard fixtures that are on the market, but to call attention to special articles that might prove of particular value to operating companies.

Any data regarding such items should be sent to W. K. Vanderpoel, chairman of the Overhead Systems Committee, 80 Park place, Newark, N. J.

N. E. L. A. COMMITTEE MEETINGS SCHEDULED.

The following National Electric Light Association committee meetings have been scheduled during the month of December: Committee on Inductive Interference and Committee on Overhead Systems, Denver, Colo., Dec. 1-3; Committee on Meters, Ft. Wayne, Ind., Dec. 2; Committee on Membership and Committee on Credits and Collections, 29 W. 39th street, New York City, Dec. 3; Executive Committee, 29 W. 39th street, New York City, Dec. 4; Committee on Prime Movers, Pittsburgh, Dec. 8; Committee on Bonus Systems, 29 W. 39th street, New York City, Dec. 10; Committee on Underground Systems, Detroit, either Dec. 15 or 17.

Commercial Practice

Customers Buy Central-Station Stock—Sterilizing Instruments with Electric Heat—Campaign for Window Lighting

CENTRAL STATIONS SELL STOCK TO CUSTOMERS AND EMPLOYES.

Blocks of Stock Offered to Customers and Employes by Commonwealth Edison Co. and Public Service Co. of Northern Illinois.

With a view to increasing the number of local stockholders the Commonwealth Edison Co., Chicago, offered during November a block of 5000 shares of its stock to customers and employes.

The stock was offered at $112.50 (which was a little above the market price), on installment terms, with the initial payment of $5 per share, and subsequent payments of $5 per month per share. Thus the total payments cover a period of 22 months, the payment for the last month being $2.50. The company issued to each customer or employe signing an application and making the required initial payment a stock purchase receipt which contained the terms and conditions of the contract by which the company sold the stock and which provided for indorsement of the payment of the various installments due from the purchaser. When all installments are paid the purchaser will receive a stock certificate for the number of shares covered by the receipt, the stock not being new but that which has been validly issued and reacquired by the company.

So long as no default is made in the payment of any of the installments when due, the purchaser will be credited with any dividends paid on the stock and will be charged with simple interest at the rate of 6% on each installment from date of purchase to the date of payment of such installment. As the dividends have been and will likely be more than 6% they probably will more than offset the interest charge. In case any purchaser fails to pay any of the installments when due, it is provided that the receipts evidencing payment of prior installments will become void and that the purchaser will lose all interest in the amounts paid by him, but he will be entitled to receive an amount equal to the sum for which his stock purchase receipt could have sold upon the market on the day of his default.

Notice of the sale of the stock, which is regarded as a choice investment, was sent out in circular form to the customers of the company. Sales teams were organized among the employes of the company, ten-men teams under the leadership of appointed captains being assigned to each of the 35 wards in the city. A commission of $1 per share was offered to the salesmen for selling the stock, the work being done on their spare time. Rivalry between the different teams was engendered by the offer of cash prizes ranging from $75 for the winning team down to $5 for the fifteenth.

The original offer of 5000 shares was extended, the sales of the 385 salesmen totaling 8747 shares. These were sold to 3714 persons, a maximum of 5 shares to a person being set. The winning team sold 697 shares, while the highest individual sale was 186 shares. The sale was limited to a three-day period, and the returns showed very satisfactory results.

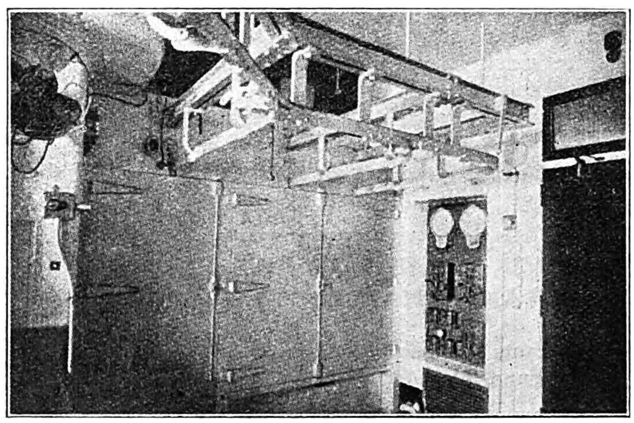
Following the sale of Commonwealth Edison Co. stock comes the announcement that the Public Service Co. of Northern Illinois will offer a block of stock for sale to its customers and employes. The terms, conditions and methods of sale will be somewhat similar to these outlined above, and it is expected that the sale will result in the addition of a large number of stockholders who are customers of the company.

ELECTRIC HEAT EFFICIENT IN STERILIZING INSTRUMENTS.

Gas Oven Supplanted by Electric Oven, Which Proves Superiority in Economy, Efficiency and Simplicity of Operation.

Besides furnishing electrical energy for power, heat and light, central-station companies have taken upon themselves the duty of investigating and becoming familiar with the thousand and one uses in which electricity has been found economical, efficient and satisfactory.

A noteworthy case of this kind was brought to light by the Boston Edison Co. in connection with the Forsyth Dental Hospital, Boston. This institution treats daily the teeth of some 300 to 400 children.



Electric Oven for Sterilizing Dental Instruments.

In a hospital, sterilization is the watchword and as a result it is necessary to properly sterilize 300 to 400 sets of instruments each day, or practically 21,000 separate instruments. For this purpose a gas-heated oven was originally installed. It was successful insofar as it performed its functions after a fashion, but it proved expensive to operate and hard to maintain temperature control. It also generated moisture which coated the instruments with rust, rendering them useless. If the temperature went above a certain point, which it often did, owing to the failure of the controlling apparatus, the intense heat "drew" the temper, also rendering the instruments useless. After destroying several thousand sets, it was suggested that the ovens be electrically equipped.

The ovens are now electrically heated, automatically controlled, and perform the sterilization perfectly at a cost of about $48 per month for energy.

The ovens have attracted widespread attention from physicians, hospital authorities and the electrical fraternity, and further application of this method is contemplated in other institutions.

CAMPAIGN BRINGS OUT ADVANTAGES OF GOOD WINDOW LIGHTING.

Contractors and Dealers of Rochester, N. Y., Co-operate with Central Station in Campaign for Better Lighting of Window Displays in That City.

The industrial department of the Rochester (N. Y.) Railway & Light Co. is conducting an organized campaign for better show window lighting among the merchants of Rochester. A survey showed that approximately 80% of the window displays in the city were poorly lighted. In order to spread the idea of good lighting the central-station company, in co-operation with the Rochester Electrical Contractors and Dealers Association, decided upon definite plans under which to work.

A list of merchants having poorly lighted window displays was compiled, and circular letters were sent to all on the list inviting them to call and inspect some examples of modern show window lighting prepared by the Rochester Railway & Light Co. These consisted of exhibits of colored fabrics, loaned by one of the department stores, one exhibit being correctly illuminated with modern methods and the other incorrectly illuminated by old methods. At the same time advertisements in the daily papers were used to interest the prospects and other merchants who were not on the list.

Salesmen used arguments to the effect that store managers were slow to realize that $15 a month spent for electricity in maintaining good lighting in their window space meant an increase from 50 to 200% in their sales; also that the public was becoming familiar with well lighted window displays and that merchants should not neglect the opportunity of showing their goods to the best advantage.

PRESENT VALUATION HELD MORE IMPORTANT THAN ONE BEFORE WAR.

Court Grants Injunction Against a Fare Increase on Ground That It Was Not High Enough to Cover Increasing Costs.

Valuation of public utility properties for rate-making purposes cannot be estimated, fairly, on the basis of original costs in a before-the-war period, said the Federal Court of Appeals in a recent case in Kansas City, Mo. Three judges passed on the question. The decision was in the application of the Joplin & Pittsburg Railway Co., for an injunction to prevent the enforcement of the Missouri Public Service Commission's order increasing the passenger-mile rate from 1.93 cents to 2.12 cents. The court held that it could enjoin such increase if it did not go far enough to allow the company a remunerative return. It held that such increased rate was not remunerative, and set a rate of 2.5 cents as a maximum that the company could charge pending further adjustment by the state commission. The court had reviewed the valuation figures as prepared by the commission, and the figures presented by the company. It declared that apparently the commission had laid too much emphasis on the cost of the property before the war, when the railroad was completed. "It cannot be said," the court declared, "that the present period of high prices is so temporary or abnormal that it may practically be disregarded in arriving at the value of the complainant's properties. No one can say what degree of depression may ultimately come, but it is reasonably certain that the cost of the properties now under consideration will never again approximate figures prevailing in the years before the World War."

LOW COST OF ELECTRICITY SHOWN BY FIGURES FROM LOUISVILLE.

The relative cheapness of electric service in households is shown in a striking way in a tabulation recently prepared by Robert Montgomery, commercial manager of the Louisville Gas & Electric Co. Mr. Montgomery shows that it is possible for a five-room cottage to obtain electric service for about one-third the cost of that of 19 years ago, and at a much lower price than before the war. The basis upon which the comparisons are made is a monthly consumption of 50 kilowatt-hours either in a five-room cottage or apartment.

As the Louisville company has an optional rate calling for a price of but 3 cents a kilowatt-hour for all energy in excess of 6 kilowatt-hours per room per month, it is possible to obtain the 50-kilowatt-hours for $2.88. On the ordinary residence rate the monthly bill would be $3.80, compared with $5 in 1910, $8.34 in 1905 and $10 in 1900.

PITTSBURGH COMPANY SETS NEW HOUSE-WIRING RECORD.

Early in the current year the Duquesne Light Co., Pittsburgh, set out to secure 5000 contracts for the wiring of old houses during the twelve-month period. This seemed rather a high mark to strive for, and the progress of the campaign was watched closely by others in the industry, particularly managers of central-station commercial departments. As month after month went by, reports showed that the company was exceeding its quota. The latest information is that on Nov. 10 a total of 4794 contracts for wiring old houses had been secured, and indications pointed to the fact that close to 6000 contracts would be signed before the end of the year.

The campaign is a record-breaking one, and shows emphatically the possibilities that exist in the house-wiring field.

CAMPAIGN FOR PORCH LIGHTING.

The Puget Sound Traction, Light & Power Co. has inaugurated a campaign for the purpose of inducing customers in residential districts to install porch lights for all-night service. The idea behind the campaign is that wholesale use of porch lights will provide protection against burglaries as well as enhance the effectiveness of the street lighting, making the streets of Seattle safer for pedestrians as well as vehicles.

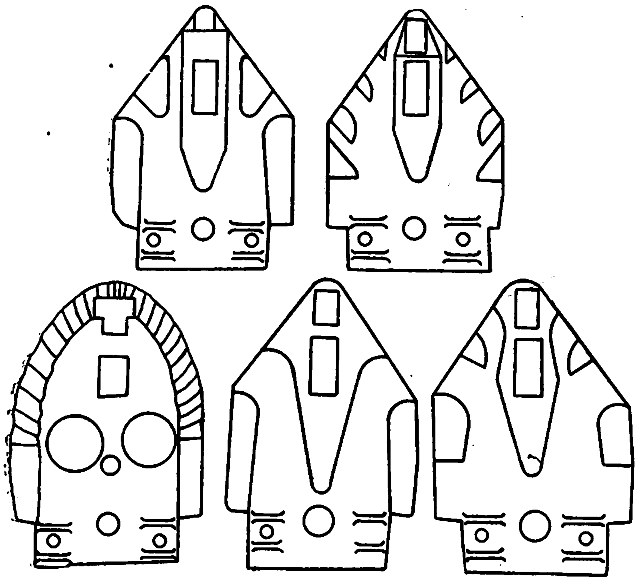
Operating Practice

Influence of Tuyeres Upon Combustion Efficiency—Instrument "Service"—Factors Affecting Underground Cables

INFLUENCE OF CHOICE OF TUYERE UPON STOKER EFFICIENCY.

Interesting Data Obtained by Detroit Edison Co. Clue to Higher Furnace Efficiency and Over-all Economy.

During the year 1918 a decided drop in operating efficiency was found to have occurred at the Delray station of the Detroit Edison Co., part of this decrease being chargeable to the boiler room. Previously, some modifications had been made in some of the stokers, and it was suggested by Mr. Stark of the Delray station that these changes might be responsible for the drop in efficiency. The modifications that had been made to the stokers, of the underfeed type, consisted in changing the type of tuyere originally used by the stoker manufacturer for one designed by the Detroit Edison Co. Several different designs had been evolved by the company, but because of changing personnel due to the war, complete tests were not run and the new tuyere designs were adopted before determining their efficiency as compared with that of the original tuyeres. It was thought that these might be the cause of less efficient stoker performance.



Different Types of Tuyeres Experimented Upon by Detroit Edison Co.

The original underfeed stokers installed at Delray were Taylors, the tuyeres for which have a front nose of solid cast iron. This nose burns in course of time, and to overcome this a tuyere was designed in 1913 that had the same cross section (5.5 sq. ins.) for the flow of air through it as the Taylor, but so divided that half the air passed through the nose and half through the sides instead of entirely through the sides as was the case with the original Taylor tuyere. This tuyere was called the Delray tuyere. Later on, the Conners Creek tuyere was designed for about 9 sq. ins. of air passages which consisted of eight holes spaced around the tuyere.

The accompanying illustration shows various tuyeres used by the Detroit Edison Co. with its underfeed stokers. The tuyere which has since been found the most efficient, after extensive furnace and boiler tests, is the Taylor tuyere and the one originally furnished with the Taylor stoker. It is the one in the center of the bottom row. The top left-hand tuyere is the Delray type, that on the top right-hand side being the Conners Creek tuyere. The bottom left-hand tuyere is of a well-known make, while the one shown on the right-hand side at the bottom is another tuyere experimented with. The above information was presented by J. P. Considine, Detroit Edison Co., in the October issue of the *Synchroscope*.

COMMON SENSE A FACTOR IN MAINTENANCE OF INSTRUMENTS.

Example of Misuse of Recording Instruments Shows Difficulties of Manufacturers in Maintenance.

It is often stated that "service" after a sale of equipment may mean that the manufacturer is called upon on frequent occasions to repair or maintain some piece of apparatus damaged through misuse or abuse and not through ordinary wear and tear. This form of "service" is a very expensive one for the manufacturers, for which they receive neither credit nor reward of any kind, but instead usually much complaint.

In one case that occurred quite recently in a very large power plant where the personnel had both quality and quantity a large number of recording thermometers had been installed. There were so many of these instruments in use, that it was one man's job to go round daily and wind them up. The time taken for this operation, plus the foot-pounds required to wind the clock mechanism, suggested a time and energy-saving method.

One of the keys for winding the clock had the handle cut off and the shank was then fitted to a brace. The attendant was then able to quickly and easily wind up the clocks. Unfortunately, with the brace, because of the leverage obtained, it was very easy to overwind the clocks, and many springs were broken from this cause. At first, the manufacturer replaced the springs, but as spring failures became quite frequent, broke incessantly, investigation was started to determine the cause, and, of course, a complaint was lodged by the manufacturer with the user as to the manner of winding the clocks. As soon as the brace method of winding was discontinued, the clock springs ceased to break.

This incident has been mentioned to emphasize the fact that the responsibility for using commonsense and discretion rests with the purchaser of equipment for no instrument can be made absolutely foolproof.

PAPER-INSULATED CABLE PROPERTIES.

Considerations Involving Safety of Operation and Life of Underground Lead-Covered Conductors.

Paper-insulated, lead-covered, underground conductors are employed to a greater extent than conductors insulated with varnished cambric or vulcanized rubber.

Impregnated paper will stand higher operating temperature with a lower rate of deterioration than rubber or varnished cambric. It has high dielectric strength and when properly made has reasonable temperature variation curves for insulation and dielectric loss. It has the lowest cost of the three.

Its greatest drawback is its tendency to absorb moisture, requiring a waterproof outer jacket and the careful sealing of ends. It is also the least flexible of the three insulations. It follows that its life and rate of deterioration are really entirely the rate applying to its outer jacket.

As to form of conductor, on account of the saving in material and space, the semi-sector shaped conductor will undoubtedly become standard for all 3-conductor cables with paper insulation larger than No. 1/0. Limiting the over-all diameter to about 3 ins. and limiting the smallest cable by one giving a tension of about 90 volts per mi. at the surface conductor, the present range available is shown in Table 1.

Three-Phase, Paper-Insulated, Lead-Covered Cables.
Y-Connected Neutral-Grounded Circuits.

Working pressure, a-c, r.m.s. Volts.	Insulation on each, ins.	Belt.	Small.	Large.	5-minute test between conductors, volts.	5-minute test to earth, volts.
30,000	11/32	11/64	3/0	3/0	75,000	45,000
25,000	9/32	9/64	1/0	250,000	62,500	37,500
15,000	11/64	5.5/64	2	650,000	37,500	22,500
10,000	4/32	2/32	7	750,000	25,000	15,000

It is self-evident that in selecting the working pressure of a system, the size of the distribution feeders in kilowatt capacity is a most important factor.

The smallest 30,000-volt cable is good for at least 8000 kw. at 100% power-factor under ordinary conditions. It would appear, therefore, that plants with a probable 25,000-kw. maximum output are not justified, except by requirements of interconnection, in going to 30,000 volts unless its feeders are of extraordinary length.

Table 1 refers to cables for Y-connected grounded neutral circuits and some of the reasons for excluding the consideration of the open-delta connection are outlined below:

(1) Maximum kilowatt capacity in given duct with grounded Y.

(2) Minimum cable cost for given kilowatt capacity. If a 3-conductor No. 4/0 15,000-volt cable, 6/32 by 6/32 in. paper cost $1, a 3-conductor No. 4/0 15,000-volt cable, 6/32 by 3/32 in. paper would cost 90 cents.

A comparison of change of voltage and connection:

3-conductor, 500,000 cir. mil.—15,000-volt delta, 325 amp., 8400 kv-a.—about 8 watts per duct-foot loss. Cost, $1.

3-conductor, 350,000 cir. mil.—25,000-volt "Y," 250 amp., 11,000 kv-a.—about 7 watts per duct-foot loss. Cost, 88 cents.

Increased capacity 30%
Decreased investment 12%
Decreased transmission loss... 12½%

As to operating, many companies have changed from open delta to improve operation. Almost none have taken the reverse step.

Tests made seem to show that where no voltage stress is present, a temperature of 85° C. does not produce any appreciable deterioration in properly made paper cables in one year. Temperatures of 100° C. maintained for two months produced less than 10% reduction in tensile strength of the paper. These results, of course, apply only to the particular paper and saturating compound used and are not universally true but they indicate what can be done.

If cable insulation were perfect the charging current would have zero power-factor. In practice the power-factor varies from 2 to 6% at 25° C. and from 18 to 50% at 100° C., tests being at operating voltage and 60 cycles. This energy must all go towards heating the cable and when a point is reached where the sum of C^2R loss and the dielectric loss exceeds the amount of energy which can be dissipated, a burn-out must and does result. This is why cable manufacturers object to operating temperatures of 100° C. for short periods and 85° C. continuously.

It follows, therefore, that every size of every make of cable of each voltage rating has a definite safe operating current and temperature under a given set of conditions. It is not possible for a manufacturer to state either the current or the temperature because he does not know the rate at which the cable can dissipate its heat, due to losses at all points of its length. Cases have been recorded of a 12,000-volt line operating at 11 watts C^2R loss per duct-foot, for periods of 12 hours or more daily and this represents an extreme condition without artificial cooling. Probably 8 watts on 13,200 volts and 7 watts C^2R on 25,000 volts are nearer general safe practice. There is, of course, a variation with the season; one company rating cables in conduit with air in the open at 30° F. at approximately double the rating with temperature at 100° F. Another large company increases the winter load over summer load 25%.

With reference to the so-called dielectric losses in three-phase cables, that is, the loss due to the pressure stress in the insulating material independent of the current carried. This loss varies with the frequency, with the square of the voltage (unless insulation is over-stressed), and with the temperature. Power-factor of the charging current varies in the same way and the figures given below outline a very good cable and a very poor one, at 60 cycles, 14,000 volts.

	Good cable.		Poor cable.	
Temperature.	Power-factor.	Watts loss per duct-foot.	Power-factor.	Watts loss per duct-foot.
20° C.	1%	.05	10%	.5
40° C.	7%	.15	20%	1.0
60° C.	10%	.30	35%	2.5
80° C.	15%	.50	59%	6.0
100° C.	20%	.70	73%	13.0

The poor cable had been in use six years. The watts, of course, will vary with the size of the cable while the power-factor does not increase with the size of conductor. Therefore, even with the best cable allowance must be made for this dielectric loss. The above are excerpts from a paper on "High-Tension Cables," presented by Wallace S. Clark before the New England Section, N. E. L. A.

Contracting-Construction

Repair of Large Alternator—Platform for Overhead Motor —Motor Maintenance Cost Form—Convenient Fuse Rack

REPAIR OF ALTERNATOR HAS INTERESTING FEATURES.

Customer's Specifications Make Difficult Work for Contractor in Reinsulating Stator Coils of Big Alternating-Current Generator.

Instead of giving the customer what he wants, most American business concerns would rather give him the kind of goods and service they think is best for him. This sort of policy has lost a great deal of foreign business for American exporters, and at the same time it has lost business in this country for concerns whose policies are not flexible enough to allow them to place their reliance on the judgment of the buyer.

This fact holds true, in many instances, for the electrical contractor. Of course, there are occasions when the customer is in error to his own detriment, and in order to properly serve him it is necessary for the electrical contractor to offer advice from his experience. But there are times when the customer is right.

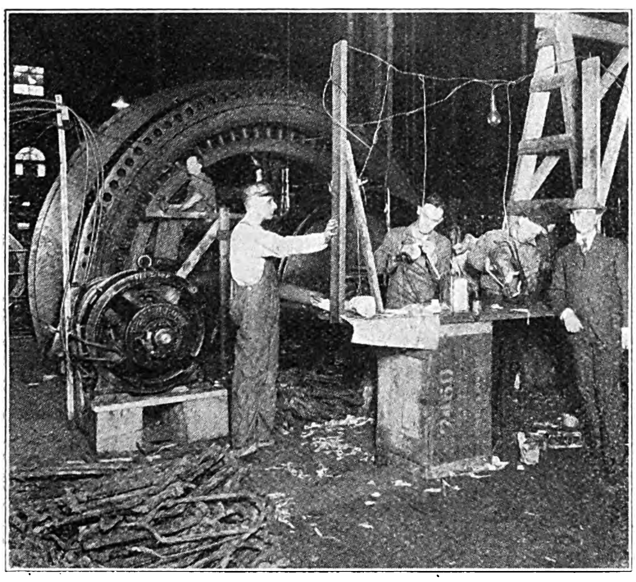
An illustration of this point is given in the case of the repair of an a-c. generator in the power plant of Morris & Co., Chicago. The machine in question is a 600-kv-a., 440-volt, 60-cycle, three-phase, engine-type Bullock alternator that has been in service about 18 years. The insulation on the stator coils began to deteriorate and this fall the company decided that it was necessary to repair the machine, reinsulating the stator coils. However, the demand for power nearly equals the capacity of the generating equipment in the plant, and precautions had to be taken so that only one generating unit was out of commission at a time. Accordingly, repairs to the alternator were a matter of speed. Furthermore, the company stipulated that the repairs should be made in the power house and that parts could not be taken to the contractor's shop to be repaired. The reason for this was that the company was afraid that a strike might occur when parts were out of the power house and that such an occurrence might prevent the return of the parts and would endanger the capacity of the plant, especially if one of the other units should fail.

In spite of these stipulations, the work of repairing the alternator was undertaken by the Electric Service Construction Co., Chicago. The stator has 72 poles, made up of 288 coils of ¾-in. by 1/16-in. form-wound copper. These were all removed and found to be insulated with a wrap of linen tape varnished, then a wrap of oiled linen tape, a sleeve of mica, a wrap of linen tape and finally a covering of fish-paper. The coils were soaked in a vat of hot water and lime, the old insulation scraped off and the copper cleaned and wiped.

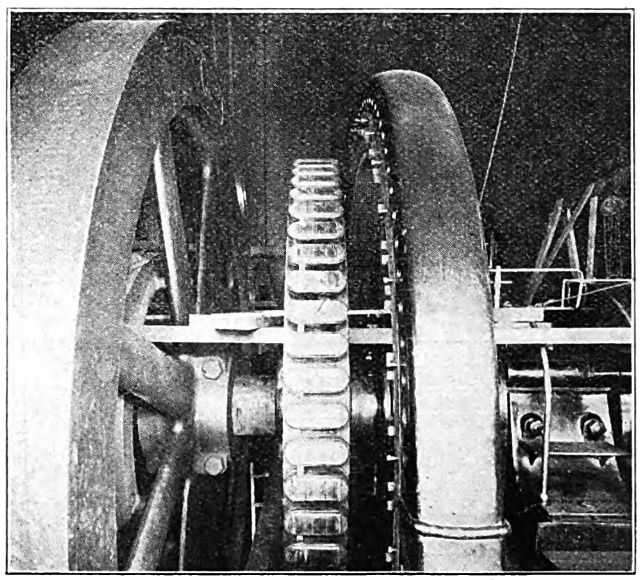
The coils were wrapped with linen tape, double lapped, and after being dipped in Sterling varnish were placed in a baking oven for 16 hours. Two layers of double-lapped oiled linen tape were then placed on each coil, followed by a wrap of double-lapped linen tape and a sleeve of fish-paper. The coils were then put back into place on the stator frame and the connections soldered in.

Two shifts of 5 men, each working 8 hours, accomplished the work of repairing the alternator in 24 days, which was deemed very satisfactory, considering the amount and nature of the repairs made.

After the repairs were completed the machine was tested at 2300 volts for grounds and then run with 600 kv-a. load for 10 hours without appreciable temperature rise.



Improvised Work Bench Used by Contractor in Reinsulating Stator Coils of Alternator.

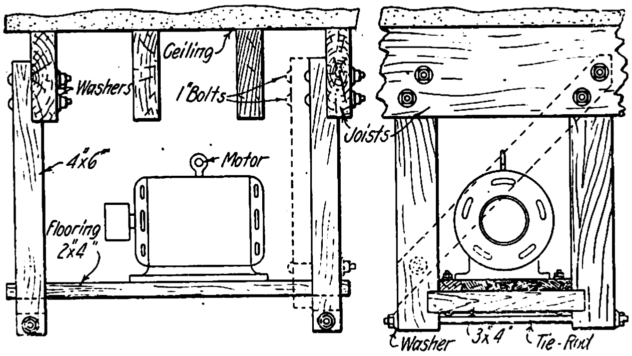


Rotor of 600-kv-a. Alternator Shifted to One Side to Permit Repair of Stator Coils.

CONSTRUCTION OF AN OVERHEAD PLATFORM FOR MOTORS.

By L. M. Harrison.

When floor space is at a premium it may be desirable to mount electric motors on platforms suspended from ceilings instead of supporting them on the floor. In the accompanying illustration are shown the details of a satisfactory support for motors of capacities up to about 30 hp.



Construction of Wooden Motor Platform for Overhead Installation.

Four 4 by 6 timbers bolted to the floor joists sustain the floor of the support. To these vertical pieces are clamped two 3 by 4 cross timbers, which act as beams to which the 2 by 4 tongue-and-groove flooring is spiked. A 1-in. tie rod binds together the lower ends of the verticals. Where the side pull is great to insure against shifting, diagonal pieces, as shown by the dotted lines, may be used to prevent lateral displacement.

CONCISE FORM FOR KEEPING MAINTENANCE COST RECORDS.

Those responsible for the upkeep and maintenance of electrical equipment often desire accurate data to determine just what each appliance costs in upkeep, labor and spare parts. It is necessary to keep proper records to obtain this information, and for this purpose Mr. Bower, chief electrician of the Berwick (Pa.) plant of the American Car & Foundry Co., has originated a form which is noteworthy because it can be kept up easily and at the same time give essential maintenance costs.

The accompanying illustration shows the form and in this particular instance is applied to data on maintenance costs of a motor, although it is suitable for practically any type of electrical apparatus on which such costs are desired.

MOTOR FORM

TYPE	SERIAL NO	R P M	FIRM	H P	MOTOR NO
G.E.	53954	1040	General Electric	20	1840

F S M FT 2320 NO 8 SIZE OF BRUSH 2¼"x 1¼"x ½"

SPARE ARMATURES 1 GRADE 702

REMARKS

Drives fan 1537
Front C & E
Aisle #1

DATE	BRUSH GRADE	REMARKS	CHECK NO.	HRS	RATE	COST
7/15/19		Changed armature	2949	6	60	$3.60
"		Repaired commutator	2847	2	65	1.30
7/18/19	5-702					1.60
"		Changed brushes	2949	½	60	.30
7/19/19	1-60					.05
7/24/19	1					3.00
"		Changed bearing	2949	2	60	1.20

Form for Keeping Records of Maintenance Costs of Motors and Other Electrical Apparatus.

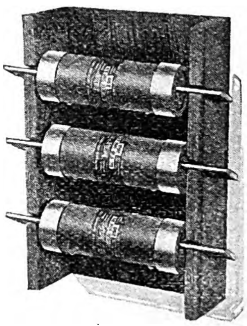
ELECTRICIAN'S LICENSE LAW DISCUSSED.

At a meeting of the Massachusetts State Association of Electrical Contractors and Dealers, held Nov. 20 at Boston, F. A. Williams, clerk of the State Board of Examiners of Electricians, read a paper on the license law passed in Massachusetts in 1915, giving facts and figures regarding the law from its inception up to the present time.

Since that time 3912 examinations have been made, or an average of about 100 a month. The last six months the average examinations were 114, while the month of November will probably show 250 examinations. There are at present about 8000 journeymen electricians licensed and 700 masters. Since 1915 there have been 3000 licenses lapsed, a large majority of these were journeymen. Mr. Williams told of many cases where men were arrested for disobeying the law and spoke of the proposed legislation to more fully fortify the law. He requested the co-operation of the contractors in the coming proposed legislation.

FUSE RACK SAVES TIME.

Maximum production is what is demanded of manufacturers these days, and when production depends on electric motive power, any device that will help shorten the time of stoppages has merit. In order to avoid delay as much as possible extra fuses should be kept handy near every motor.



Handy Rack for Extra Fuses.

A convenient and practical method is to build a wooden rack like that shown in the accompanying illustration. It should be installed near the motor and accommodate an extra set of fuses, of correct rating, so they will be available immediately a fuse is blown.

NEW YORK CONTRACTORS AND DEALERS HOLD MEETING.

The regular semiannual meeting of the Metropolitan District Association of Electrical Contractors and Dealers was held in New York Nov. 24. In addition to reports of officers covering the activities of the association for the current fiscal year, the report of the secretary covered the work of the license board and the elimination of special permits. Addresses were delivered by W. L. Goodwin and Samuel A. Chase.

New Appliances

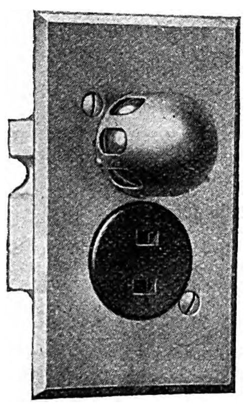
Compact Wall Receptacle and Pilot Light—Double Toggle Switch for Automobiles—Magnetically Operated Oil Switch

Combination Receptacle and Warning Light for Single Switch Box.

It is a recommendation of the National Electrical Code that in connection with smoothing irons, sadirons and other heating devices intended to be applied to combustible articles, there should be a warning signal to indicate that the current is flowing. Compliance with this recommendation has been rather slow because of the nature of the fittings available for the purpose. These were expensive in first cost and were also expensive to install because of their size, some of them requiring a two-gang box, but most of them a three-gang box.

The Bryant Electric Co., Bridgeport, Conn., just placed on the market a device which is a combination of its standard Spartan flush receptacle and warning light. The two are combined in a single porcelain which can be installed in a single switch box. The Spartan receptacle will receive any of the numerous Spartan and other standard parallel-bladed caps. The 2-cp., 125-volt candelabra-base warning lamp, which is connected in parallel with the receptacle, is protected from mechanical injury by a perforated brass cage. When occasion requires, the lamp can be renewed by removing the faceplate of the device. The connections in the receptacle are such that the lamp automatically lights up when the attachment-plug cap is inserted, thus doing away with the necessity of a snap switch which is frequently a component part of devices designed for the purpose.

The use of a device of this kind is not only advisable from the fire-prevention

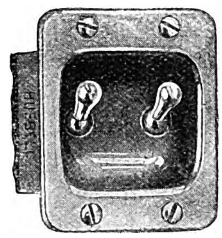


Combined Wall Receptacle and Pilot Lamp for Flatiron and Similar Outlets.

standpoint but also from the standpoint of economy in connection with the less hazardous but widely used domestic appliances, such as percolators, toasters, chafing dishes, curling irons, etc., since it tends to diminish the unintentional and undiscovered consumption of current. All internal connections are made complete at the factory so that the device can be substituted for any receptacle at present installed by simply attaching the line wires to the two terminals that are provided. The new device is designated by catalog No. 121.

Two-Gang Toggle Switch for Automobiles.

Harvey Hubbell, Inc., Bridgeport, Conn., has just brought out a new type of two-gang switch for automobile use generally, but perhaps more especially adapted for closed-car interiors. It is in the popular toggle pattern and so designed that the handles are countersunk



New Toggle Switch for Automobiles—Handles Countersunk in Recesses.

in gracefully curved recesses which add materially to its artistic appearance. Several of the leading automobile manufacturers have already adopted this switch for their car bodies. This new type will be listed as the No. 8022 switch.

Oil-Immersed Switch Operated by Clapper-Type Magnet.

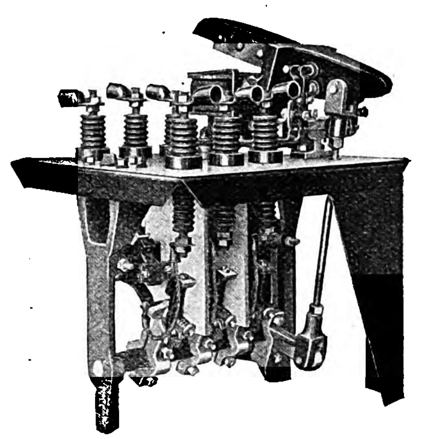
Magnetically operated main-line switches on alternating-current light and power circuits are at times slow and unreliable in closing when a solenoid and plunger must be depended upon for their operation. If the plunger is slightly out of adjustment its movement becomes jerky and noisy, its sealing pull is diminished, and it does not seat properly.

The Cutler-Hammer Manufacturing Co., Milwaukee, Wis., has developed a new oil-immersed magnetic contactor, operated by a clapper-type magnet, which makes possible a more rigid mechanical structure and greater reliability in operation than is obtained in contactors of the solenoid and plunger type. This contactor has a capacity of 100 amperes at 2200 volts, and is particularly desirable as a main-line switch for an automatic 2200-volt motor starter, or for the remote control of any 2200-volt light or power circuit. It is built with three poles, unless used with an auto-transformer starter when five poles are provided.

The frame of the contactor, which is of heavy sheet iron, is arranged for wall or switchboard mounting, and carries two cast-iron supports with two insulated shafts carrying the contacts. The copper leaf brush contacts are saved from all wear due to breaking the circuit because auxiliary arcing contacts are provided for this purpose. Leads from the contacts connect with suitable terminals extending through high-tension insulators mounted on the top of the frame. The armature is firmly pivoted to the frame, and is connected by a rod to an arm of the shaft carrying the moving contacts. The attraction of the armature against the face of the magnet rotates the shaft and closes the switch, which is normally held open by the weight of the moving parts.

A good head of oil is maintained over the contacts by providing a sheet-metal tank of ample capacity, and as the contacts are situated above the operating shaft they are away from any sediment which might accumulate in the bottom of the tank. The arc is broken at the contacts in a horizontal direction and therefore rises to the point of rupture without burning other parts. Transite shields prevent arcing across adjacent poles.

This new oil-immersed switch may be arranged to have two contactors act as a reversing switch, in which case they are mounted side by side, so when one switch is closed the nose



Oil Tank Removed, Showing Contacts and Arcing Shields—By Breaking in a Horizontal Plane the Arcs Do Not Damage Other Parts.

on the armature interferes with the movement of the armature of the other contactor, thereby preventing the closing of the other switch, which would short-circuit the line.

Trade Activities

Booth Electric Furnace Establishes District Offices—Wodack Electric Tool Organized—Literature Distributed

Westinghouse, Church, Kerr & Co., Inc., New York City, has issued an illustrated folder which has for its subject "Shops." It contains a brief discussion of shops, a list of organizations for whom the company has designed and built shops, and views of several shops that it has built. The organizations for which the shops have been built include manufacturers, automobile companies, steel and iron companies, and railroads.

Trumbull Electric Manufacturing Co., Plainville, Conn., is sending out a new eight-page pamphlet on "Circle T" externally operated entrance switches and meter protective trim. It illustrates and describes in a brief and comprehensive manner two and three-pole switches with fusible top and bottom, for use either with or without meter trim. Meter trim knockouts and back plates for use with externally operated entrance switches are also illustrated and briefly described.

Harvey Hubbell, Inc., Bridgeport, Conn., is sending out a new illustrated circular on the Hubbell current tap No. 6700, showing the convenience offered to users of electrical current by this device, whether in the home, office or factory. Another circular which the company is distributing illustrates and briefly describes Hubbell multiple plugs, which increase facilities for making current connections and are a further incentive to greater use of a wider variety of devices.

Bacharach Industrial Instrument Co., Pittsburgh, Pa., manufacturer of precision instruments, is making distribution of two new pamphlets dealing with its products. Pamphlet P discusses Pitot tubes and orifices for measuring the flow of gases in connection with hydro-flow meters, and summarizes the extensive experiences of the Bacharach company in this field. Pamphlet F is devoted to Bacharach "Easy Read" pressure volume indicator for the control of air delivery to cupolas. This instrument consists of a Pitot tube installed in the blastpipe and connected to the pressure and volume indicator. The accuracy of this device is unquestioned and it is suitable for either permanent installations or testing purposes.

Wodack Electric Tool Corp., 23-27 South Jefferson street, Chicago, has recently been organized by Oscar P. Wodack to manufacture portable electric drills, grinders, hammers, etc. It succeeds the Electric Tool Repair & Maintenance Co., which has for the past 3 years been engaged in the repair and rebuilding of electric tools of all kinds. Mr. Wodack, who is president and treasurer of the new organization, recently resigned as district manager in Chicago of the James Clark Jr., Electric Co., with which he has been affiliated for 12 years. A. K. Wodack is vice-president of the company, and Albert T. Lochner, secretary and superintendent.

Delta Electric Engineering Co., Philadelphia, has undergone a change in ownership, having recently been purchased by George B. McClennen, P. J. McBride and Andrew I. Mehan, who have changed its name to the Delta Equipment Co. and will maintain headquarters at 140-142 North Third street. Mr. McClennen was for 7 years identified with the machine tool department of Frank Toomey, Inc., Philadelphia, and resigned recently, as did Mr. McBride, who in the same period was in the steam and electrical department of the same concern.

Nichols Electric Co., 123-124 North Kenton street, Dayton, O., has recently been incorporated under the laws of Ohio with a capitalization of $30,000, to conduct a wholesale electrical supply business. It now represents the following companies: J. H. Parker & Son, Bryant Electric Co., Ivanhoe-Regent Works, Detroit Insulated Wire Co., Bryan-Marsh Co., Monarch Electric & Wire Co., National Metal Molding Co., Barkelew Electric Manufacturing Co., Chicago Fuse Co., and the Square D Co. M. W. Nichols is president and treasurer of the company; G. D. Carver, vice-president, and N. J. Meyers, secretary, all of who were formerly connected with the William Hall Electric Co., Dayton.

Booth Electric Furnace Co., Chicago, whose incorporation was announced in these columns a few weeks ago, has opened up the following district offices in connection with the sale of electric furnaces for melting steel, iron, and non-ferrous metals. For New York and New England, Edward B. Stott & Co., Flatiron building, New York City, with E. F. Tweedy, secretary of the company, directly in charge; for eastern Pennsylvania, New Jersey, Maryland, Delaware and southern Atlantic Coast states, Northern Engineering Co., 308 Chestnut street, Philadelphia, with F. W. Doran in charge; for northeastern Ohio, western Pennsylvania and western New York state, Charles L. Foster, formerly sales manager of the Electric Furnace Co., Alliance, Ohio, with offices at 879 The Arcade, Cleveland, O. In connection with these district offices a complete staff of engineers and metallurgists will be maintained so that the needs of customers can be promptly met and adequately taken care of. Further announcements will be made of the opening of other district offices, arrangements for which are being completed.

Cutler-Hammer Manufacturing Co., Milwaukee, Wis., is now distributing a new 4-page, 2-color folder which illustrates the distinctive features of the new swivel attachment plug recently developed by the company. This consists primarily of an inner member on which an outer member revolves, the inner member having openings for the conductor. Numerous illustrations in this folder portray the novel construction and the simple operations necessary for wiring. It is shown how the component parts of the new plug are permanently fastened together when manufactured, insuring them against becoming disassembled, separated or lost in shipment or distribution. Delay and losses due to a difference in the number of component parts in the electric appliance manufacturer's stock are thus avoided. Illustrations also show the time-saving methods of attaching to cords. Space is provided on the folder for the dealer's or jobber's imprint.

International Trade Commission Visits Westinghouse Works.—The International Trade Commission, which has been touring the United States for the purpose of studying our methods and to work out plans whereby trade conditions between their countries and ours might be improved, made a special visit to the works of the Westinghouse Electric & Manufacturing Co. at East Pittsburgh, Pa., in course of their tour of inspection. This commission consists of prominent manufacturers, bankers and merchants as well as professional and representative business men of France, Italy, Belgium and Great Britain. Probably the most interesting member of the Commission was Monsieur Schneider who is known as the steel king of Paris. Dr. Schneider is head of the firm of Schneider & Cie of Creusot, France. This firm was largely responsible for the manufacture of the 75 mm. guns used very effectively by the Allies against the Boches. In view of the fact that this company probably supplied the American Army in France with all of its small artillery and a large part of its heavy artillery, while many American companies were shipping shells to France to be used in this gun, it seemed of special significance that Monsieur Schneider should visit our American industries. After completing the tour through the plant the party proceeded to the University of Pittsburgh where the degree of Doctor of Science was conferred upon Monsieur Schneider by the university.

Current News

Weekly Record of Construction Activities—Conventions

EASTERN STATES.

Orange, Mass.—Fire which caused a loss of $100 000 at the car barns and terminal of the Orange & Athol Street Railway Co., recently destroyed a large quantity of electrical equipment. It is understood that the company is considering plans for immediate rebuilding.

Bridgeport, Conn.—United Illuminating Co., furnishing light and power service to New Haven, Bridgeport, and other nearby municipalities, has completed negotiations for the purchase of the property formerly held by the Farist Steel Corp., comprising about 8 acres of land, to be used as a site for the construction of a large new power station. It is said that the proposed plant, which will have a capacity of about 75,000 hp. for initial operations, will be one of the largest works in this section of New England.

Bridgeport, Conn.—In connection with the construction of the proposed new addition to the local plant of the Singer Sewing Machine Co. on Waterview avenue, plans have been prepared for the erection of a new pumping building at the works.

Hartford, Conn.—Hartford Electric Light Co. has had plans prepared for the construction of a new one-story brick and concrete building at its plant at 1040 Windsor avenue, to cost about $40,000. Contract for erection has been awarded to the J. H. Grozier Co., 721 Main street.

Bath, N. Y.—Bids will be received Dec. 10 for the recent issue of village bonds authorized at a special election. The issue is for $35,000 to pay for the enlargement of the municipal electric light and power plant.

Binghamton, N. Y.—Kroehler Manufacturing Co. has had plans prepared for a power house, 1-story, 34x 100 ft.

Binghamton, N. Y.—George Q. Moon & Co. have awarded a contract to the Binghamton Light, Heat & Power Co. for furnishing additional electric energy for the operation of their plant. An increase of about 75 hp. is required by the company.

Binghamton, N. Y.—Binghamton Light, Heat & Power Co. has completed arrangements for the furnishing of electrical energy to the Metropolitan Construction Co.

Churchville, N. Y.—Plans are under consideration by the borough officials for the installation of a new electric light and power plant for municipal service. The work will include an underground conduit system and is estimated to cost $25,000.

Endicott, N. Y.—Endicott Johnson Corp. is considering plans for the construction of a new power plant at its works.

Medina, N. Y.—Western New York Utilities Co., Inc., has filed application with the Public Service Commission for approval of a franchise granted by Clarendon officials, and permission to construct the necessary power lines for the furnishing of electric energy for light and power service. It is proposed to have this work completed by July 1.

Newport, N. Y.—Application has been filed with the Public Service Commission by the Newport Electric Light & Power Co. for permission to construct and operate a transmission system to extend from Newport to the plant of the Middletown Light Co., a distance of about 4½ miles.

New York, N. Y.—Henry L. Doherty & Co., 60 Wall street, will erect a new building on Battery place, occupying the block from Greenwich to Washington streets.

Rochester, N. Y.—Bastian Brothers Co., Clinton avenue, will erect a power house.

Rochester, N. Y.—New York State Railways Co. has arranged for the construction of a new freight terminal in the vicinity of its State street car barns, with proposed plant to include electrically operated facilities for freight handling, loading, etc.

Rochester, N. Y.—Rapid progress is being made on the installation of a new street-lighting system in the new extension of Melville road, extending beyond Culver road.

Annandale, N. J.—Plans are being arranged by prominent local interests for the formation of a new company to be known as the Annandale Light & Power Co. It is proposed to construct and operate a local electric system, electric energy to be purchased from the plant at High Bridge.

Butler, N. J.—Borough Council is completing plans for an extension of the municipal electric lighting system through Wanaque avenue, Bloomingdale district. It is understood that plans are also under consideration for an extension of the system in Larry avenue in the same section.

Newark, N. J.—Kaltenbach & Stevens, Inc., Bigelow street and Sherman avenue, has filed plans for the erection of a new boiler and plant and engine room, about 46x57 ft., at its plant. It is also planned to erect a garage building at the works the additions being estimated to cost $35,000.

Newark, N. J.—United Electric Specialty Co. has filed notice of organization to operate at 30 Clinton street to deal in electric supplies. Frederick A. Schiller, 117 Rose Terrace, heads the company.

Newark, N. J.—P. Ballantine & Sons will erect a 71x80-ft. power house. Plans provide for the installation of 4 500-hp. boilers and additional space for four similar power units.

Newark, N. J.—A factory building to cost about $45,000 will be erected by Blanchard & Co. The structure will be 2 story, 50x100 ft.

Trenton, N. J.—Plans are under consideration by the city commission for the installation of oil-burning equipment at the municipal waterworks station to replace the present apparatus at the works designed to utilize coal for fuel. It is said that the present coal situation has been a prominent factor in forwarding these plans.

Trenton, N. J.—City commission is making rapid progress on extensive alterations and improvements in the municipal electric police and fire alarm signal systems. It is understood that plans are being arranged for the installation of underground conduits to replace the present overhead wires. Electric energy for operation is furnished by the Public Service Electric Co.

Trenton, N. J.—Freeman Electric Co. has had plans prepared for the erection of a new extension, one-story, to be located on Walnut avenue.

Wildwood, N. J.—City commissioners have authorized a bond issue of $20,000, the proceeds to be used for improvements in the municipal waterworks plant, to increase the present capacity.

Allentown, Pa.—Lehigh Valley Light & Power Co. is making rapid progress on the installation of new generating equipment of increased capacity at its local power plant.

Allentown, Pa.—In connection with the expansion plant of the Steward Auto Co., 13th and Turner streets, operating a large automobile repair works, plans have been prepared for the installation of complete modern machinery, to be operated by individual motor drive. Electrically operated welding apparatus will also be installed as well as auxiliary equipment.

Catasauqua, Pa.—Borough council has approved a new ordinance providing for a new electric lighting system. The ordinance will be submitted to the Public Service Commission at once for approval.

Clearfield, Pa.—Penn Public Service Co. has inaugurated construction work on the proposed power station to be located in the vicinity of Seward, and to be used for the furnishing of electric service for light and power purposes to 5 counties in the Johnstown district. The proposed works are estimated to cost $3,000,000.

Erie, Pa.—The city will appropriate $75,000 for a system for electric lighting. Address Theodore Eickhorn, superintendent.

Harrisburg, Pa.—Philadelphia Suburban Gas & Electric Co. has been ordered by the Public Service Commission to make extensions to its mains in Springfield township, Delaware county, for extensions in its service.

Macungie, Pa.—Macungie Electric Light, Heat & Power Co. is making rapid progress on the extension of its system at East Macungie, to provide for increased service.

Philadelphia, Pa.—Penn Central Light & Power Co. has recently been awarded a contract by the Borough council, Carrolltown, Cambria county, for furnishing electric service for the operation of the municipal electric street-lighting system for a period of 5 years.

Philadelphia, Pa.—General Carbonic Co. has awarded a contract to M. H. McCloskey, Jr., 1620 Thompson street, for the erection of a new one-story brick power plant, about 30x93 ft., to be located at 838-44 North 3d street. The structure is estimated to cost about $10,000. Contract has also been awarded to the same contractor by the company for the erection of a new two-story brick assembly plant and administration building, about 48 x90 ft.; and 1-story brick garage building, about 27x30 ft.

Philadelphia, Pa.—United States Government, Frankford Arsenal, Captain Hugh Lumsden in charge, has awarded a contract to M. H. McCloskey, Jr., 1620 Thompson street, for the construction of a new addition to the power plant at the Frankford Arsenal. Alterations and improvements will also be made in the existing structure, the entire work being estimated to cost $60,000.

Pittsburgh, Pa.—Plans are under consideration by the McClintic-Marshall Co. for the complete electrification of its plant at Leetsdale, definite details of which have not as yet been arranged. The company has also completed negotiations for the purchase of property aggregating about 100 acres of land in the vicinity of Leetsdale, to be used for its future expansion plans, for a consideration of about $300,000.

Seward, Pa.—Pennsylvania Public Service Co., Pittsburgh, has broken ground for a power plant to cost about $3,000,000, and which will supply current in Westmoreland, Indiana, Jefferson, Clearfield and Center counties. The first unit of the plant will be ready for operation next year.

Washington, D. C.—Fire recently damaged the conduit system in the electric substation of the Potomac Electric Power Co. at 14th and C streets. The company will commence repairs at once.

Greensboro, N. C.—Guilford Lumber Manufacturing Co. is considering plans for the installation of new engine equipment at its plant. William B. Mendenhall is secretary and treasurer.

Atlanta, Ga.—M. C. Kizer, a realty man, is considering ways and means for extending the white way system on Peachtree street and Ponce de Leon avenue.

Spring Creek, Ga.—Bainbridge Power Co., recently organized with a capital of $100,000, is arranging for the construction of a large new hydroelectric power plant and dam in the Spring Creek district, to cost in excess of $75,000. The plans of the company include the construction of a new transmission system and the installation of necessary machinery and equipment, to cost over $50,000. Contract for construction has been awarded to E. O'Brien, New Orleans, La. E. J. Perry, Bainbridge, Ga., is secretary and treasurer of the company.

DATES AHEAD.

Electric Power Club. Meeting. Hot Springs, Va., Dec. 11, 12 and 13. Headquarters, Homestead Hotel. Secretary, C. H. Roth, 1410 West Adams street, Chicago.

National Council of Lighting Fixture Manufacturers. Annual convention, Detroit, Mich., February, 1920. Secretary-treasurer, Charles H. Hofrichter, Cleveland, O.

American Electrochemical Society. Annual convention, Boston, Mass., April 7-10, 1920. Friday, April 9, joint session with American Institute of Electrical Engineers on "Electrically Produced Alloys." Secretary, Joseph W. Richards, Bethlehem, Pa.

National Electric Light Association. Annual convention, Pasadena, Cal., May 18-21, 1920. Headquarters, Hotel Huntington. Acting secretary, S. A. Sewall, 29 West 39th street, New York City.

NORTH CENTRAL STATES.

Ada, Ohio.—Ada Water & Light Co. will expend $15,000 for improving its plant. Address city clerk.

Bangor, Mich.—Benton Harbor & St. Joseph Railway & Light Co. has purchased from the village of Bangor the municipal light and power plant. The local company has obtained a 30-year franchise to furnish electricity to Bangor consumers. The plant has been in operation 18 years, but the high cost of coal, together with the need for repairs, which the village was unable to make, compelled the council to dispose of it.

Jamestown, Mich.—The village has decided to install an electric light plant. The plant will have a capacity of 500 lights, together with 4 or 5 street lamps.

Auburn, Ind.—Auburn Water & Electric Light Co. will file petition for authority to issue $40,000 in bonds for improvements.

Creagerstown, Ind.—Town Council has recently completed work on the installation of a new electric street-lighting system. Power is furnished by the Hagerstown & Frederick Railway Co., Hagerstown.

Bloomington, Ill.—Petitions are being made to light 12 blocks of city street with cluster lights. Address S. Rosenbluth, promoter.

Chicago, Ill.—Old Colony Life Insurance Co. will erect a 15-story building, 50x165 ft., to cost $1,000,000. The new building, together with the remodeled Lombard Hotel into a 15-story structure, will make an L shaped building of uniform height and design with over 170,000 sq. ft. of rentable space. The new structure will be called Jackson-Quincy-Wells building.

Chicago, Ill.—A 6-story factory building will be erected by the Chicago Addressing Co. and will involve an expenditure of about $200,000. Construction work will begin in the spring.

Chicago, Ill.—M. Born & Co., 540 South Wells street, will erect a 12-story building to cost approximately $600,000, to adjoin its present plant. The total floor space of the combined buildings will be 138,000 sq. ft.

Chicago, Ill.—Industrial Engineers have leased the entire sixth floor of the Trustees' building, 63 East Adams street, for a term of 7 years. The floor will be used as a general office by the engineering company.

Chicago, Ill.—Construction work has begun on the new plant of the Walker Vehicle Co., 531 West 39th street. The building will be 1-story and provide about 100,000 sq. ft. of floor space.

Galesburg, Ill.—Ornamental street lights will be installed on North Chambers, Willard, Bateman and East Losey streets.

Harvey, Ill.—The new welded high pressure gas line built by the Public Service Co. of Northern Illinois between the Blue Island Gas Works and Harvey was connected up to the system last month. The line will have the effect of greatly improving conditions in the district.

Rock Island, Ill.—Property owners in the vicinity of 9½ and 10th avenues on 31st street have petitioned the council to place electric lights. Address Commissioner Frank Wich, department of streets and public improvements.

Springfield, Ill.—A new lighting system for Williams place will be installed at a cost of $3812. Address City Engineer Wade Seeley.

Urbana, Ill.—Board of local improvements has ordered the installation of an ornamental lighting system on West Elm street, to cost $3160.

Antigo, Wis.—Antigo Tractor Co., recently organized, will erect a machine shop and assembling plant to cost $150,000.

Ashland, Wis.—Ashland Light & Power Co. contemplates a lighting plant at Junction.

Monroe, Wis.—Monroe Electric Co. will build an addition to its power plant. L. A. Turner, general manager.

Duluth, Minn.—Minnesota Steel Co. plans to spend about $5,000,000 for the erection of additional units to its plant. The projects include the conversion of a rail mill into a continuous billet mill, the construction of a rod mill, a wire nail mill, and a new residence section at Morgan Park to house employes. The housing project is estimated to cost $2,000,000 alone.

Faribault, Minn.—Northern States Power Co. (Faribault division) has received an order for an additional 150 hp. in motors to be installed in the addition being made to the Zumbrota Clay Manufacturing Co.'s plant.

Minneapolis, Minn. — During the week ended Nov. 14 the sales department of the Minneapolis General Electric Co. (Northern States Power Co.) secured 328 new electric light and power customers with 192 kw. of lighting and 256 hp. in motors. The sale of electric household appliances continues very good. New business connected to the company's lines shows a gain of 223 customers with 224 kw. of lighting and 20 hp. in motors. Output of electric energy was 37.8% greater than during the corresponding week last year.

St. Paul, Minn.—Northern States Power Co. has accepted a contract covering the electric requirements of a new bakery being established by the Zinsmaster Baking Co.

Buck Grove, Ia.—City has signed contract between Denison and Buck Grove for electric current to be furnished from Denison by December.

Clinton, Ia.—Clinton Street Railway Co. contemplates constructing a line to South Clinton. A. L. Schuyler, attorney for county.

Dubuque, Ia.—Eastern Iowa Electric Co. of Dubuque contemplates extension of transmission lines from Peosta to points in Vernon, Prairie Creek, Whitewater and New Wine townships.

Massena, Ia.—City contemplates the construction of municipal electric light plant. C. W. Stoker, village clerk.

Minerva, Ia.—Minerva Electric Co. will construct transmission lines along public highways in Marietta township. W. F. Goecke, president.

West Liberty, Ia.—Town will hold an election to vote $38,000 bond issue for a municipal electric light plant. Irwin Atkins, town clerk.

Bertrand, Mo.—Electric power and current will be furnished within a short time by the Missouri Public Utilities Co. from Charleston.

Abilene, Kan.—Election will be held Dec. 13 to vote $450,000 in bonds for the purpose of building a pipeline connection to Lake Abilene.

Canton, Kan.—Election will be held Dec. 8 to vote $37,000 in bonds for erecting and equipping a waterworks plant and $18,000 in bonds for erecting buildings or additions thereto and purchase of machinery, equipment and for the purchase of pole lines for producing and transmitting electric current.

Geneseo, Kan.—Bonds will be voted in the near future for the erection of an electric power plant or to build a transmission line from the United Water, Gas & Electric Co. at Hutchinson. Estimates on the latter have been furnished and bonds to the amount of $25,000 will probably be voted.

Girard, Kan.—The city commissioners passed an ordinance authorizing the issuance of $40,300 in water and light bonds to cover the cost of purchasing and installing new oil engines and other equipment at the light plant. Two 200-hp. Fairbanks-Morse oil engines will be installed with built-in generators.

Hugoton, Kan.—Election to vote bonds for the installation of a city water and light plant carried. The bonds have been sold, but the contract has not been let for the plant. The site is not yet selected.

Hutchinson, Kan.—Plans are being made for the enlargement of the plant of the United Water, Gas & Electric Co. at Hutchinson, because of the increased demand from surrounding towns.

Lenexa, Kan.—The proposition of building a power plant is being discussed. The plant will be built in the near future unless it is found advisable to connect with the high power line to Olathe by the Kansas City Light & Power Co. which is under construction.

Little River, Kan.—Election to vote $30,000 in bonds for the improvement of the electric light system, carried. A high-tension transmission line is to be constructed to connect with wires of the United Water, Gas & Electric Co. at Lyons.

Lyndon, Kan.—A special bond election is contemplated in the near future to vote bonds for improving the electric system.

Olathe, Kan.—Olathe Electric Light & Power Co. has perfected arrangements by which it is to receive high-voltage current from Kansas City. A new substation will be erected for its reception.

Palmer, Kan.—Election will be held Dec. 22 to vote $21,000 for a new waterworks system, work including complete new plant pipe lines and stand pipe. W. B. Rollins, 209 Railway Exchange building, Kansas City, Mo., engineer. E. H. Hornbustel, city clerk.

Solomon, Kan.—A special election is to be called in the near future to vote $75,000 in bonds to install a system of waterworks.

Spivey, Kan.—A $10,000 bond election for the purchase of 1 30-hp. oil engine and storage battery, carried. Mattie Friend, city clerk.

St. Francis, Kan.—Election to vote $55,000 in bonds for the erection of a new electric light plant building and equipment for same, carried.

Mitchell, S. D.—Dakota Central Telephone Co. will build additions and install 200 telephones. B. J. Savis, engineer.

SOUTH CENTRAL STATES.

Hazard, Ky.—Kentucky & West Virginia Power Co. has had plans prepared for extensive improvements and extensions at its plant, including the installation of new equipment. It is proposed to install 2 new 833-hp. boilers, equipped with underfeed stokers; 3000-kw. turbine, with surface condenser, and auxiliary apparatus. The plans of the company also include extensions to the boiler plant.

Louisville, Ky.—The commercial department of the Louisville Gas & Electric Co. during the week ended Nov. 18 secured 96 new electric light and power customers with 41 kw. of lighting and 77 hp. in motors, and accepted contracts for wiring 39 already built houses. New business connected by the company shows an increase of 74 customers with 38 kw. of lighting and 27 hp. in motors. Electric energy output was 23.1% greater than during the corresponding week last year.

Pikeville, Ky.—Kentucky & West Virginia Power Co. is having plans prepared for the installation of a new electric substation on the Big Sandy river, of 10,000-kv-a., step-down type; and extensions in its 88,000-volt transmission line and 44,000-volt distributing system for increased service for local and nearby coal mining operations.

Monroe, La.—Election to vote $450,000 in bonds for an electric light plant, carried. Bonds will be sold about Jan. 20. P. A. Poag, city clerk.

Claremore, Okla. — Representatives of the Charles Page interests are contemplating erecting a high-tension transmission line from Sand Springs to Claremore for commercial purposes.

Enid, Okla.—The local distribution system at Bison will be completed within a week or two, with the exception of the substation. Work on the Garber-Covington transmission line will be started soon, most of the material having already been received.

Grandfield, Okla.—City has approved the issuance of bonds for $75,000, the proceeds to be used for improvements and extensions in the municipal electric light and waterworks systems.

Minco, Okla.—Bonds to the extent of $11,000 which were recently voted have been approved and the money will be expended immediately for the improvement of the light and water system. New machinery is to be installed at the light plant and extensions made on the water mains.

Oklahoma City, Okla.—New business secured by the Oklahoma Gas & Electric Co. includes contracts covering an initial installation of 400 hp. in motors for operating casinghead gasoline plants near Beggs, Okla.

Perry, Okla.—City council has completed arrangements for improvements in the municipal electric-light and water systems. The plans include the installation of 2 new oil-engine generating units, switchboard, and auxiliary apparatus. Black & Veatch, Kansas City, Mo., are engineers.

Sulphur, Okla.—Plans are being made for a white way on the main street.

Thomas, Okla.—City contemplates the installation of 90-hp. Diesel engine to improve electric light to furnish power for 18-hour service. Address mayor.

Wilson, Okla.—Plans are in progress for the installation of 2 200-hp. boilers, also a 200-hp. engine. J.

W. Ryder, 614 C street, N. W. Ardmore, Okla., engineer.

Fort Worth, Tex.—Fire originating in the boiler plant of the Farmers' Gin Co., Roanoke, near Fort Worth, recently damaged the plant to the extent of $25,000.

Marlin, Tex.—Work on the new electric light and power plant will begin not later than Jan. 1, 1920. Contracts for material have been let.

Normangee, Tex.—W. L. Martin has purchased the electric light plant together with the water works plant from H. E. Shaw, at a consideration of $10,000.

Olden, Tex.—A telephone exchange building and an electric street lighting system are under consideration. Address mayor.

WESTERN STATES.

Sandpoint, Ida.—The city has renewed for two years its street lighting contract with the Mountain States Power Co.

Cordova, Alaska.—Alaska Public Utilities Co., which produces electricity by water power and a Diesel engine, has a new generator on the ground for the driving of which additional Diesel engines will be provided.

Centralia, Wash.—Surveying the ground and laying out the site preparatory to the erection of the steam plant of the Sherman County Light & Power Co. is under way, same to cost about $150,000. Machinery which was formerly intended for a steam plant at Lewiston, Ida., is on hand.

Everett, Wash.—Eclipse lumber mill, now operating under steam power, is to be completely equipped for electric drive. A new building is to be erected to house machinery for finishing operations, electrical equipment for which will be installed.

Molson, Wash.—This city is considering the matter of establishing its own utilities, particularly light and water.

Seattle, Wash.—Contract for furnishing 3 5000-kv-a. transformers at $222.50, for use at Cedar Falls extensions of the city light plant, has been awarded to Allis-Chalmers Manufacturing Co.

Seattle, Wash.—Saxe & Hussey have opened an electrical appliance store, and contemplate serving the local trade and engaging in export business with oriental countries.

Seattle, Wash.—J. D. Ross, superintendent of the lighting department, has requested that $500,000 of utility bonds be sold as soon as possible to provide funds for financing extension of the light plant imperatively needed, while waiting, pending decision of the supreme court as to validity of a $1,755,000 bond issue.

Seattle, Wash.—NePage McKenney & Co., electrical engineers, contractors and manufacturers, are installing electrical equipment for lights and power in the Mallory apartments, at 47th street and 14th avenue, North East, and installing electrical equipment in the new store building of John Graham at Second avenue and Pine street. They have completed installation of the electrical equipment at the schools in Bremerton and Charleston, Wash., and in the Togo Hotel at Bremerton. They are installing electrical equipment in the infirmary building and in an addition to the female ward Northern State Hospital at Sedro Woolley, Washington, and have practically completed work in the new high school at Hamilton, Wash. They are now installing stage lighting, border lights, foot lights, strip lights, announcement letters and dimmers in the Liberty theater at Wenatchee, Wash.

Vancouver, Wash.—Petitions have been circulated in the business district asking that cluster lights be installed on both Main and Washington streets.

Roseburg, Ore.—The proposal to issue bonds in the sum of $500,000 for constructing a municipal light and water plant will probably be decided at the coming special election.

Eureka, Cal.—An order has just been placed by an electrical dealer in Ferndale for 69 single-phase motors to be used for operating milking machines to be served with power by extensions now being made by Western States Gas & Electric Co.

Los Angeles, Cal.—San Joaquin Light & Power Co. is now erecting a 40,000-hp. plant. A still larger plant is now being contemplated which will generate 300,000 hp. It will be located on the north fork of the Kings river canyon and will be one of the largest power plants in the country. Construction on this plant will not start for a number of years. The first steps toward the erecting of the power house will be the building of a first-class road along the banks of the Kings river to the site. This it is understood will entail an expenditure of $250,000. W. G. Kerchoff, president.

Salinas, Cal.—Mayor George A. Daugherty has appointed a committee to co-operate with the city council in investigating the taking over of local gas, water and electrical service system, now owned and operated by the Coast Valleys Gas & Electric Co., or installing new plants in case the Coast Valley's interest cannot be acquired at a satisfactory figure. A public utility expert from Los Angeles has been engaged to make an inventory of the Coast Valleys' properties as a basis for negotiations.

CANADA.

Almonte, Ont.—The council plans to remodel its power plant and to purchase a new generator. Chairman of Commission, Mayor McDowall.

Jarvis, Ont.—Estimates will be secured at once on the cost of installing a hydroelectric street lighting and power distribution system. Clerk C. S. McCarter.

Toronto, Ont. — Canadian Allis-Chalmers, Ltd., is erecting a new 1-story plant, 65x150 ft. for the purpose of electrogalvanizing and enameling electric conduit. Electric monorail cranes will operate over the pickling and plating tanks. Three plating dynamos, each of 5000 amperes and other modern equipment will be installed. In addition to equipment used in zinc plating, baking furnaces and appliances for black enameling of conduit in all sizes will be installed. About 12,000,000 ft. of conduit per year will be produced.

PROPOSALS

Wireless Station.—Bids will be received until June 30, 1920, by Ministerio de Fomento de los Estadoa Unidos de Venezuela for the construction and installation of a new wireless station and system to be located in the vicinity of Caracas.

Electric Light Plant.—Bids will be received until March 15, 1920, by the Port Commission, Port Commission Offices, Santiago, Chile, for the installation of an electric lighting and motive power plant for the furnishing of service for the port of Valparaiso.

Electrical Equipment.—Until Dec. 10, bids will be received by the Secretary of the Board of Commissioners, 509 District building, Washington, D. C., for electrical equipment, including switchboard installation at the Central High School, as well as machine shop equipment.

Electric Work.—Bids will be opened in the office of the supervising architect, Treasury Department, Washington, D. C., at 3 p. m., Dec. 23, for furnishing materials for the construction of an extension to the Animal House for the Hygienic Laboratory, United States Public Health Service, Washington, D. C., including materials for concrete, reinforced concrete, stone, brick, miscellaneous iron and steel work, composition roofing, sheet metal work, lumber, millwork, electric work, hardware, etc., in accordance with drawings, specifications and bills of quantities attached thereto, copies of which may be obtained at this office, in the discretion of the supervising architect. James A. Wetmore, acting supervising architect.

FOREIGN TRADE

[*Addresses of firms referred to in these trade opportunities may be obtained by writing to the Bureau of Foreign and Domestic Commerce, Washington, D. C., or its branch and local co-operative offices. Request for each opportunity should be on a separate sheet and the file number given.*]

Engineering Materials (31,312).—A civil and mechanical engineering firm in India desires to represent manufacturers and exporters for the introduction into India of American machinery, and engineering and structural materials. Quotations should be given c. i. f. ports of India. References.

Electrical Apparatus (31,345).—A manufacturer in Spain desires to secure an agency for the sale of motors and dynamos, electric heating apparatus, electrical conductors, electric lamps of ½ and 1-watt (tools) insulated and enameled copper wire on bobbins and resistance wires. Correspondence should be in Spanish. References.

Personals

J. W. Carpenter Appointed Vice-President of Texas Power —H. B. Joyce Joins United Electric Light & Power Co.

A. P. HARRIS, manager of the Hickman plant of the Kentucky Light & Power Co., Fulton, Ky., has resigned to enter the service of the Edwardsville (Ill.) Water Co.

THOMAS E. DEMPSEY has resigned as chairman of the Illinois Public Utilities Commission and is succeeded by James H. Wilkerson, a member of the commission and formerly United States district attorney in Chicago.

E. H. SNIFFEN, manager of the power department of the Westinghouse Electric & Manufacturing Co., Pittsburgh, Pa., recently tendered an interesting address on "The Steam Turbine" at a meeting of the Duquesne Light Co. Section of the National Electric Light Association in the auditorium of the Chamber of Commerce building.

J. C. GRINDELL, formerly with the Wagner Electric Co., is now district manager for St. Louis Electrical Works at 1427 L. C. Smith building, Seattle, having charge of sales in Washington, Oregon and in the Orient. He recently sold between 40 and 50 motors to the Aladdin Co., which is establishing a factory in Portland, Ore.

CARROLL G. BROWN, for 4 years professor of electrical engineering at Cornell University and more recently connected with the testing department of the General Electric Co., has accepted a position on the faculty of the School of Engineering of Milwaukee. He was also connected with the American Telephone & Telegraph Co. and conducted the research department of the Rochester Railway & Light Co.

J. W. CARPENTER, manager of the Dallas Power & Light Co., Dallas, Tex., has been appointed vice-president and general manager of the Texas Power & Light Co., succeeding Fred R. Slater, resigned. Mr. Carpenter began work in the electrical field as a day laborer and by his efforts and industry steadily advanced to high executive positions. After taking a course in electrical engineering, Mr. Carpenter was employed in some of the large electrical machinery factories. He was for some time connected with the Northern Ohio Traction Co. as construction engineer, resigning this position to take over the management of the Corsicana Gas & Electrical Co., Corsicana, Tex. He later became president of the company and at the same time was president and general manager of the Athens Electric Light & Power Co. and other smaller companies. He resigned these connections about two years ago to accept the position of manager of the Dallas company, from which he has just been promoted. Mr. Carpenter has been identified with the electric utility business for the last 18 years and is well known in business, social and civic affairs of Dallas. He is president of the Dallas Jovian League and is a member of various other organizations.

W. D. BAKER, assistant division superintendent of Division "K" of the Public Service Co. of Northern Illinois, has resigned and is succeeded by E. S. Looker.

R. W. SUTHERLAND, secretary of the Splitdorf Electrical Co., Newark, N. J., has been elected general manager of the company to succeed C. W. Curtiss, recently resigned. Mr. Sutherland will also continue in the capacity of secretary.

JAMES H. WILKERSON, former United States District Attorney, has been appointed chairman of the Illinois Public Utilities Commission by Governor Frank O. Lowden to succeed Thomas E. Dempsey, of East St. Louis, Ill., who has resigned. Mr. Wilkerson has been a member of the commission for a number of months, succeeding Fred E. Sterling, who was elected state treasurer of Illinois at the last election. Mr. Wilkerson has been a prominent attorney in Chicago and has served as United States district attorney in that city.

RALPH NEUMULLER, formerly assistant advertising manager of the New York Edison Co. and general manager of the Electric Publications Syndicate, has been appointed advertising manager of the United Electric Light & Power Co., New York. During the war, Mr. Neumuller was a member of the 326th Infantry, 82nd Division, which saw considerable action in France. The division had the distinction of remaining in continuous offensive action for a longer period without relief, during the Meuse-Argonne operations, than any other unit in the American Expeditionary Forces. Following the armistice, Mr. Neumuller was assigned to G-5 (Athletics), Paris, where he was placed in charge of Ceremonies and Parades during the Inter-Allied games at the Pershing Stadium.

MATHEW RUTHERFORD BIDDELL has been appointed assistant professor of aeronautic engineering and assistant director of the Engineering Experiment Station of the University of Illinois, Urbana, Ill., effective Jan. 1. He will be a member of the staff of the mechanical engineering faculty. His specialty in experimental work will be in studies of aeroplane crankshafts and other parts of planes which have been subject to breaks and defects. Professor Biddell has been until recently chief engineer for the Canadian Aeroplanes, Ltd., of Canada, and had previously served that company as chief draftsman and later as testing engineer. In the latter position he tested all materials which entered into the construction of planes built by the company. From June, 1915, to Dec., 1916, he was chief draftsman for the Curtiss Aeroplane & Motors Co., Ltd., of Canada. He was graduated from the School of Applied Science and Engineering of the University of Toronto in 1906 with the degree of Bachelor of Applied Science. He received both preliminary and final honors.

MAJ. H. B. JOYCE, recently discharged from military service, has been appointed manager of the power bureau of the United Electric Light & Power Co., New York. Commissioned a captain in the Quartermaster Corps, and assigned to Chief Construction Division on Aug. 13, 1918, he was immediately placed in charge of the operation of all refrigerating equipment under the jurisdiction of that division handled by the maintenance and repair branch. In November, 1918, Mr. Joyce was placed in charge of the section of the maintenance and repair branch handling the operation and maintenance of all electric generation, distribution and its utilization; heating equipment and its operation and maintenance, and refrigerating equipment together with its operation and maintenance which were under the jurisdiction of the Construction Division. These utilities were in some 370 odd separate and distinct locations scattered throughout the United States and dependencies. The approval of technical terms and conditions in all service contracts for the supply of electricity, heat, gas, refrigeration, etc., were also handled in this section. Promoted to Major on May 28, 1919, he continued in the same work. On July 1, 1919, Mr. Joyce was placed in charge of the operating section of the Engineering Division. He handled all engineering necessary for the operation and maintenance of utilities including that necessary in connection with the repairs to buildings, roads, water and sewer systems, purification plants, etc., under the jurisdiction of the Construction Division, in all camps, cantonments, base hospitals, storage depots, port terminals and regular army posts throughout the United States and its dependencies.

Obituary.

JAMES B. MCCARTHY, of Detroit, Mich., who for many years has been special representative of the National Metal Molding Co., was killed on his farm near Detroit last week. At the time of going to press no details are available regarding the circumstances. Mr. McCarthy was publisher of *Electrocraft*, which paper was absorbed by the ELECTRICAL REVIEW AND WESTERN ELECTRICIAN in December, 1911. He was connected with the Electrical Review Publishing Co. for several years after this as assistant general manager. Later he joined the National Metal Molding So. and during his connection with that firm assigned to it many valuable patents on brackets and other construction devices.

Financial News

Montana Power Pays Dividend.

Montana Power Co. declared regular quarterly dividend of ¾% on the common stock and 1¾% on the preferred. Both dividends payable Jan. 2 to stock of record Dec. 13. Action of the directors of Montana Power Co. in declaring a 75-cent dividend on the common stock, the same as last quarter, definitely disposes of the unfounded rumors that the company would omit the disbursement of the junior issue this quarter. Referring to this matter, following the meeting of the board, an official of the company stated that these rumors had no foundation, as directors had never contemplated passing the common stock dividend.

While earnings statement for the third quarter of this year did not show up as well as 1918, this has been due primarily to extremely poor business conditions throughout Montana, brought about by a severe drought. Conditions the first part of the final quarter have shown improvement which is expected to be reflected in earnings.

The Montana Power Co. for the 9 months to Sept. 30 showed earnings available for dividends on the preferred and common stocks of $1,901,031. Deducting preferred dividends for this period amounting to $509,250, left a balance of $1,391,781 available for common stock dividends or $3.20 a share. This is at an annual rate of $4.25 a share compared with $5 87 a share actually earned for the fiscal year 1918.

Emerson Electric Stock Offered.

Caldwell & Co., St. Louis, are offering $1,000,000 7% cumulative preferred stock of the Emerson Electric Manufacturing Co., at 97½ and accrued dividend to yield about 7.18%. The proceeds of this issue will be used for the construction of a new factory building immediately adjoining its plant and provide additional working capital. The demand for the company's products is increasing rapidly, and the company is unable to handle all business offered it with present facilities. Upon completion of the new factory building, the sound valuation of plant and equipment will be equal to approximately 143% of the present issue of $1,000,000 preferred stock. In addition, net quick assets on Sept. 30, 1919, after giving effect to present financing were equal to over 130% of the par value of the preferred stock, thus giving the company net tangible assets equal to over 273% of the preferred stock.

The net earnings of the company after taxes, depreciation, etc., available for dividends in the four years ended Sept. 30, 1919, averaged $247,887.80 per year, equivalent to over three and one-half times the annual dividend requirements on the $1,000,000 7% cumulative preferred stock. Net earnings after taxes, depreciation, etc., for the year ended Sept. 30, 1919, were $281,498.37, equivalent to over four times the annual dividend requirements on preferred stock.

Niagara & Erie Power Bonds Authorized.

Public Service Commission has granted permission to the Buffalo & Lake Erie Traction Co. and its receiver to sell, assign and transfer to the Niagara & Erie Power Co., Buffalo, certain of the special franchises granted the company by the municipalities of Dunkirk, Silver Creek, Angola, and Brocton under which the company's transmission system between Athol Springs and West Portland exists. The Niagara & Erie Power Co. at the same time is authorized to issue bonds for $225,000 and common stock for $44,500, the proceeds to be used for the purchase of this transmission line. The commission has also authorized the Niagara, Lockport & Ontario Power Co. to issue bonds for $101,000 and first preferred stock for $28,600, the proceeds to be used for the purchase of 480 shares of the common stock of the Niagara & Erie Power Co. held by the receiver of the Buffalo & Lake Erie Traction Co.

Kansas City Capital Increase.

The Kansas City Light & Power Co. has filed a statement with the secretary of state increasing its capital stock to $20,000,000. This sum the company was authorized to issue by the state public service commission some time ago. The incorporation fee paid by the company to the secretary of state was $10,001.25.

The commission has also authorized the company to issue $717,000 of new securities. It is said that the company will apply to the commission for additional authority to increase the issue of its securities.

Gas & Electric Securities to Declare Monthly Dividends.

Gas & Electric Securities Co., which financed the organization of the Cities Service Co., has declared a dividend of 3%, payable Dec. 1 in common stock at par to common stockholders of record Nov. 15. Announcement is also made that the company intends to declare monthly dividends in common stock at par at the rate of ½ of 1% on the first day of each month in 1920 to stock of record the 15th of the preceding month, these dividends being in addition to the regular cash dividends of ½ of 1% being paid monthly at present.

It is understood that the board of directors of Gas & Electric Securities Co. has adopted a dividend policy for the common stock of regular dividends, payable in common stock at par, in addition to the regular monthly cash dividends, this policy providing for the payment of the 3% dividend on Dec. 1, with 6% in stock dividends in 1920, payable monthly at the rate of ½ of 1% a month, with an increase in this stock dividend each year thereafter of 3% so long as earnings of the company are sufficient to justify the payment of such stock dividends. A similar policy is now being carried out respecting the common stock of Cities Service Co.

Commonwealth Power Earnings Compare Favorably.

During the last three months of 1918 earnings of Commonwealth Power, Railway & Light Co. and subsidiaries were adversely affected by the influenza epidemic. The statement for October, 1918, showed a deficit of $48,082 after fixed charges, which compares with a surplus of $218,878 earned during October, 1919.

Surplus after charges for 12 months ended Oct. 31, 1919, amounts to $2,185,058, equal to $12.23 on $17,953,000 of 6% cumulative preferred stock. Preferred dividends in cash were discontinued with the last payment in 1917. Since then regular quarterly dividends have been paid in 6% interest-bearing scrip maturing six years from date of issuance. After allowing for deduction of 6% on the preferred, the latest 12 months' earnings show $5.96 earned on $18,585,900 of common stock.

Earnings of Commonwealth Power, Railway & Light Co., and subsidiaries, for October, 10 and 12 months ended Oct. 31, compare as follows:

	1919.	1918.
October gross	$2,289,807	$1,799,628
Net earnings	913,113	600,587
Surplus after charges	218,878	*48,082
Balance, after preferred dividend	129,113	*137,847
10 months' gross	20,929,618	17,715,992
Net earnings	8,586,629	6,720,818
Surplus after charges	1,777,246	543,091
Balance, after preferred dividend	879,596	*354,558
12 months' gross	25,131,687	21,534,193
Net earnings	10,365,843	8,300,450
Surplus after charges	2,185,058	916,994
Balance, after preferred dividend	1,107,878	*160,185

*Deficit.

Surplus after charges, as shown is available for dividends, replacements and depreciation. Fixed charges include dividends on outstanding preferred stock of constituent companies in addition to taxes and interest.

American Capital to Finance Italian Electric Trust.

The long protracted negotiations under the minister of transport have resulted in the formation of a joint Italo-American combine, with a capital of 800,000,000 lire (at normal rates, $150,000,000) for electrification of the state railways of Italy and for the utilization of water power in the Trentino and other parts of Italy. All of the plant will be supplied by America.

Marconi Deal Ratified.

At a special meeting the stockholders of Marconi Co. of America voted in favor of the absorption of the company by the Radio Corp. of America. The General Electric Co., which is backing the Radio corporation, is to contribute $2,500,000, part of which will be used to acquire American Marconi shares held by the British Marconi Co.

The new company is to have a capital of 5,000,000 shares of 7% preferred stock, $5 par, and 5,000,000 shares of common stock of no par value, of which the General Electric Co. will receive 135,174 shares of preferred stock and 2,000,000 common. American Marconi stockholders are to have the privilege of exchanging their holdings, par for par, for Radio preferred and in addition to receive Radio common shares equal to number of Marconi shares held.

Detroit Edison Increases Stock.

At a special meeting of Detroit Edison Co. held last Monday, stockholders approved an increase in the authorized capital stock from $35,000,000 to $60,000,000, and authorized the issue of an additional $10,000,000 face value of debentures. The board of directors was also authorized to issue and dispose of the additional stock and bonds, at such time and in such manner as they by resolution prescribe and to confer conversion privileges on the holders of the debts or obligations evidenced by the debentures.

During October, the maximum load on the company's plants ranged between 15 and 20% above the maximum of the war period, and the 24-hour output of current was largely in excess of the wartime figures, notwithstanding the cessation of night shifts and of Sunday work which were required last year by the war necessities of the Government.

Hurley Machine Sales Show Big Gain.

At a special meeting of the board of directors of the Hurley Machine Co. an initial quarterly dividend of $1 a share on the new no par value common stock was declared, payable Jan. 5, to stockholders of record as at Dec. 10.

The rate indicates a considerable increase of that paid on the old common. The quarterly dividend paid Oct. 1 was at the rate of 8% per annum on the old shares, which were of a par value of $100, and which has now been exchanged for the new shares on the basis of seven new shares for one of old. The dividend declared therefore is equivalent to an annual rate of 28% on the old stock.

The report made to the board showed the net sales of the company for the 11 months ended Nov. 28, 1919, to be $5,072,281, as compared with the first 11 months of 1918 of $2,553,577, or an increase of $2,518,709. The sales for the 3 months ended Nov. 28, 1919, were $1,884,974, as compared with the same 3 months of 1918, which were $978,884. This increase, it is stated, is not due to higher selling prices, but to enlarged quantities.

Dividends.

General Electric Co. has declared a dividend of $2 per share, payable in cash on Jan. 15, 1920, to stockholders of record Dec. 6; also a dividend of 2% has been declared, payable in stock of the company at par on Jan. 15, 1920, to stockholders of record Dec. 6. Stockholders will be paid the cash value of fractional shares aris-

For the Readjustment Period—What?

LX.

BRAVO DUNEDIN!

Under this heading the "Electrical Review" of London prints an item as follows:

"We are indebted to a New Zealand correspondent for a copy of a local newspaper dated July 30th, reporting the proceedings at the Dunedin City Council when it was resolved to give preference to a British tender for electrical plant over an American tender which was £800 less. The Council, says the report, decided to accept the tender of the British Westinghouse Co. for a synchronous motor for Half-Way Bush, although the American General Electric Co.'s tender was £3,258, as against the British firm's £4,070, and the latter required a longer term for delivery.

"Councillor Shacklock, in introducing the matter, said that at the last meeting of the Council the matter of accepting a tender for the motor had been held over for further information by cablegram. This had been received and the engineer recommended that the tender of the British Westinghouse Co. be accepted. The purpose of recommending this tender was to obtain a motor of English manufacture. An American machine could be obtained for £800 less and delivery got in five months, whereas the British machine could not be delivered for nine months. The delay might involve some restriction on the users of electric power. He would move that the tender of the British Westinghouse Co. be accepted, provided delivery be given in nine months.

"Councillor Sincock asked would the Westinghouse machine be a more durable machine and what loss was involved to the small users (at present restricted) in the fact that the machine would not get here for nine months. Unless there was some defect in the American machine, he felt inclined to adhere to their original idea of getting the American machine, which could be secured quicker.

"Councillor Clark said he was surprised to hear Councillor Sincock. He hoped the Council would not go beyond the Empire because a little inconvenience or money was involved.

"Councillor Shacklock, in reply, said the British Westinghouse machine was quite satisfactory. The department would do its best to meet the demands of the consumers without restrictions, and if such were necessary it would be only in the depth of winter. The tender was accepted."

This item of news reflects very clearly the prevailing tendency of Great Britain, her dominions and her colonies to do their trading within the Empire itself. American manufacturers can most profitably concentrate on other countries—particularly non-European—for export business. For the present, however, domestic trade should be our chief, although by no means our only, concern.

C. A. TUPPER, Chicago.
President International Trade Press, Inc.

ing out of such stock dividend, based upon the market price of the stock on Dec. 6, except as to those who request script certificates for fractions.

The Chicago Telephone Co. has declared a quarterly dividend of 2%, payable Dec. 31, to stockholders of record Dec. 30.

The Montana Power Co. has declared a dividend of ¾ of 1% on common stock and a quarterly dividend of 1¾%, both payable Jan. 2, 1920, to stockholders of record of Dec. 13, 1919.

Earnings.

ADIRONDACK ELECTRIC POWER.

	1919.	1918.
October gross	$ 161,982	$ 161,932
Net after taxes	71,481	47,290
Surplus after charges	44,813	26,025
12 months' gross	1,741,846	1,794,744
Net after taxes	622,513	322,946
Surplus after charges	331,389	66,770

VIRGINIA RAILWAY & POWER CO.

Earnings for October and four months ended Oct. 31, compare as follows:

	1919.	1918.
October gross	$ 811,308	$ 594,947
Net after taxes	294,612	128,278
Surplus after charges	119,032	*30,421
4 months' gross	3,104,506	2,666,613
Net after taxes	1,213,842	857,203
Surplus after charges	535,547	211,348

*Deficit.

ALABAMA TRACTION, LIGHT & POWER CO.

Earnings of Alabama Power Co., operating subsidiary of Alabama Traction, Light & Power Co., Ltd., compare as follows for October and 12 months ended Oct. 31:

	1919.	1918.
October gross	$ 275,142	$ 275,827
Net after taxes	129,806	114,931
12 months' gross	3,099,126	2,828,804
Net after taxes	1,725,930	1,521,132

PHILADELPHIA RAPID TRANSIT.

Earnings of Philadelphia Rapid Transit Co. for October and 10 months ended Oct. 31, compare as follows:

	1919.	1918.
October gross	$3,165,552	$2,411,985
Net after taxes	1,025,141	617,267
Surplus after charges	256,806	*138,925
10 months gross	29,160,983	25,535,542
Net after taxes	9,131,942	8,651,775
Surplus after charges	1,463,758	1,154,797

*Deficit.

DETROIT UNITED RAILWAY.

	1919.	1918.
September gross	$2,320,351	$1,710,423
Net earnings	470,279	350,838
Surplus after charges and taxes	280,383	144,275
9 months' gross	17,862,320	14,103,983
Net earnings	3,712,837	3,256,220
Surplus after charges and taxes	1,919,633	1,520,416

AMERICAN WATER WORKS & ELECTRIC CO.

American Water Works & Electric Co., Inc., reports earnings for the year ended June 30, as follows:

	1919.	1918.
Water Works earn.	$ 5,011,316	$ 4,973,352
West Penn. Rys.	10,362,483	8,601,358
Total gross earn.	$15,373,799	$13,574,750
Net earnings	1,263,953	1,396,258
Surplus after charges	435,110	585,185

GREAT WESTERN POWER.

Earnings of the Great Western Power System for October and 12 months ended Oct. 31, compare as follows:

	1919.	1918.
October gross	$ 420,450	$ 401,070
Net after taxes	245,339	240,651
Surplus after charges	55,658	69,093
12 months' gross	5,224,303	4,515,249
Net after taxes	3,055,230	2,588,380
Surplus after charges	929,350	762,592

MASSACHUSETTS LIGHTING COMPANIES.

The gas and electric light companies owned by the Massachusetts Lighting Companies report aggregate sales of gas and electricity, excluding inter-company items, as follows:

	1919.	1918.
October net	$ 161,666	$ 138,849
4 months' net	621,389	557,823

COLUMBIA GAS & ELECTRIC CO.

Consolidated earnings statement of Columbia Gas & Electric Co. and subsidiaries, compares as follows.

	1919.	1918.
October gross	$ 939,757	$ 856,709
Net after taxes	426,686	386,530
Surplus after charges	192,034	197,085
10 months' gross	9,525,602	9,353,690
Net after taxes	4,641,886	4,647,649
Surplus after charges	2,427,708	2,715,252

Paducah Electric Bonds Offered.

An offering of first mortgage 6% five-year gold bonds of the Paducah Electric Co. is being made by Powell, Garard & Co., Chicago. They are selling at 95.75 and interest and yield over 7%. The properties owned and controlled by the company include an electric station, with a rated capacity of 2440 hp.; gas works, with a daily generating capacity of 490,000 cu. ft.; electric and gas distributing systems, reaching all of the desirable portions of the city; steam heating mains, serving the central business district; 17 miles of standard gauge street railways, and 75 acres of valuable real estate and miscellaneous buildings. The present depreciated value of properties, exclusive of any allowance for franchises and going value, is conservatively estimated at $1,315,202, or 117% in excess of first mortgage bonds now outstanding.

The consolidated statement of operation of the company and its subsidiary and predecessor companies for years ended Sept. 30, 1917, to 1919, is as follows:

	1917.	1918.	1919.
Gross earnings	$304,588.70	$313,570.38	$390,642.92
Operating expenses, including taxes and maintenance charges	228,803.44	231,114.38	278,655.80
Net earnings	$ 75,785.36	$ 82,456.00	$111,987.12
Annual interest requirement on $236,400 5% and $368,100 6% first mortgage (this issue) bonds			33,906.00
Balance			$ 78,081.12

CITIES SERVICE CO.

	12 mos. ending Oct. 31, 1919.	12 mos. ending Oct. 31, 1918.	Oct., 1919. Month of	Oct., 1918. Month of
Gross earnings	$20,234,196.07	$22,097,814.00	$1,498,677.15	$1,784,000.30
Expenses	692,101.57	476,727.02	57,782.33	57,012.65
Net earnings	$19,542,094.50	$21,621,087.88	$1,440,894.82	$1,726,987.65
Interest on debentures	1,714,934.39	160,761.48	159,206.02	60,344.78
Net to stock	$17,827,160.11	$21,460,326.40	$1,281,688.80	$1,666,642.87
Dividends, pfd. stock	4,158,225.00	4,019,574.00	357,895.50	337,024.50
Net to common stock and reserves	$13,668,935.11	$17,440,752.40	$ 923,793.30	$1,329,618.37
Debenture fund				$ 906,895.12
Contingent fund				568,274.14
Stock surplus				1,607,720.74
Surplus reserve				6,980,534.64
Surplus				32,263,171.41
Total surplus and reserve				$42,326,596.05

WEEKLY COMPARISON OF CLOSING-BID PRICES OF SECURITIES OF LEADING ELECTRICAL COMPANIES.

Quotations furnished by F. M. Zeiler & Co., Rookery Bldg., Chicago.

Public Utilities.	Div. rate. Per cent.	Bid Nov. 25.	Bid Dec. 2.
Adirondack Electric Power of Glens Falls, common	6	12	..
Adirondack Electric Power of Glens Falls, preferred	6	76	76
American Gas & Electric of New York, common	10+extra	120	125
American Gas & Electric of New York, preferred	6	39½	39
American Light & Traction of New York, common	..	210	208
American Light & Traction of New York, preferred	6	93	93
American Power & Light of New York, common	4	57	60
American Power & Light of New York, preferred	6	70	72
American Public Utilities of Grand Rapids, common	..	8	8
American Public Utilities of Grand Rapids, preferred	7	24	23
American Telephone & Telegraph of New York	..	100	99¾
American Water Works & Elec. of New York, common	..	5	3
American Water Works & Elec. of New York, particip.	7	9	8
American Water Works & Elec. of New York, first preferred	..	50	45
Appalachian Power, common	..	4	3
Appalachian Power, preferred	7	21	21
Cities Service of New York, common	+extra	437	410
Cities Service of New York, preferred	6	75	75½
Commonwealth Edison of Chicago	8	110¼	109½
Comm. Power, Railway & Light of Jackson, common	..	21	20
Comm. Power, Railway & Light of Jackson, preferred	6	46	45
Federal Light & Traction of New York, common	..	8	7
Federal Light & Traction of New York, preferred	..	43	43
Illinois Northern Utilities of Dixon	6	..	..
Middle West Utilities of Chicago, common	2+extra	25	25
Middle West Utilities of Chicago, preferred	6	49½	48
Northern States Power of Chicago, common	..	65	63
Northern States Power of Chicago, preferred	ex.div.7	90	89
Pacific Gas & Electric of San Francisco, common	..	62	60½
Pacific Gas & Electric of San Francisco, preferred	6	..	..
Public Service of Northern Illinois, Chicago, common	7	83	80
Public Service of Northern Illinois, Chicago, preferred	6	86	85
Republic Railway & Light of Youngstown, common	4	14	16
Republic Railway & Light of Youngstown, preferred	6	50	56
Standard Gas & Electric of Chicago, common	..	28	27½
Standard Gas & Electric of Chicago, preferred	6	42	41
Tennessee Railway, Light & Power of Chattanooga, common	..	3	2½
Tennessee Railway, Light & Power of Chattanooga, preferred	6	5	5
United Light & Railways of Grand Rapids, common	4	43	41
United Light & Railways of Grand Rapids, preferred	6	70	65
Western Power of San Francisco, common	..	20	21
Western Union Telegraph of New York	extra	88	89¼
Industries.			
Electric Storage of Philadelphia, common	4	141	135
General Electric of Schenectady	8	169½	173½
Westinghouse Electric & Mfg. of Pittsburgh, common	7	53¾	51¾
Westinghouse Electric & Mfg. of Pittsburgh, preferred	7	..	..

Electrical Review

Vol. 75. No. 24. CHICAGO, DECEMBER 13, 1919 Three Dollars a Year

Electrical Review
WITH WHICH IS CONSOLIDATED WESTERN ELECTRICIAN AND ELECTROCRAFT

VOL. 75—No. 24. CHICAGO, SATURDAY, DECEMBER 13, 1919. PAGE 973.

The Coal Situation—An Editorial

WHILE advices from Indianapolis and Washington indicate an early resumption of bituminous coal mining in all fields, the country is still suffering under the most stringent and far-reaching fuel restrictions in its history. Particularly in Chicago and in the Middle West has the need for unprecedented curtailment been necessary. Many factories are closed and all others are working on a part-time basis. Stores are only open between the hours of 12 noon and 6 p. m. and street and interurban railway service has been reduced to a minimum entirely inadequate for the needs. And as this issue of ELECTRICAL REVIEW goes to press orders are being sent out for still further curtailment in every direction.

Every restricting order is being met in a splendid spirit of Americanism. No one questions the justice or authority of the steps that are being taken but all are willing and anxious to co-operate for the common good.

Naturally, our own publishing facilities have been seriously curtailed; hence this issue of considerably fewer pages than usual. With publishers already facing a critical shortage of paper and with the fuel restrictions that have now come to pass, the outlook is anything but favorable. However, we bespeak the patience and co-operation of our readers in this crisis. Nothing will be left undone to continue on the best basis possible with hopes for the early return to normal conditions.

The central stations, being the largest consumers of coal next to the railroads, naturally were most affected by the strike. The National Electric Light Association's committee, headed by John W. Lieb, which did such notable work during the war, was again called into service to assist utilities in getting coal supplies, and while this committee has done its utmost, the Federal Railroad and Fuel Administrations either have underrated the coal needs of the Central West or have been unable to supply fuel from other sources.

The situation in Chicago and vicinity became so critical as the result that a committee of five leading business men with Samuel Insull, president of the Commonwealth Edison Co., Chicago, chairman, appealed to the Illinois Public Utilities Commission to reduce the loads on utilities. Plans which were ultimately adopted provided for spreading out the load to get greater diversity-factor, cut the peak load and improve load-factor so as to dispense with as much reserve capacity, banked fires, etc., as possible. According to Mr. Insull, the Commonwealth Edison Co., as the result of the restrictions enforced, had cut down its peak load 34% and on Dec. 6 had reduced its output over 25%. Similar conditions obtained in other communities where like restrictions were enforced.

It is undeniable that the coal reserve maintained by utilities generally has virtually saved the nation, yet many central stations had smaller stocks of coal on hand this year than in previous years. High prices and a feeling that peace had settled conditions are probably responsible for this. Steadier work is one of the conditions which are due to the miners in mere justice. The central stations are one of the largest consumers of coal. If they buy more coal during the summer or off months, they will be enabled to maintain larger reserves, probably obtain a better unit price and enable the miners to obtain steadier work.

At present we do not feel that the miners deserve very well of the country after the manner in which they, or their leaders, issued an ultimatum of complete capitulation to their demands or annihilation. However, the coal problem will be settled only when settled right. This means among the first things that the miners must be offered continuous employment. Summer buying by all central stations, and thereby the maintenance of larger coal reserves than usual to guard against unforeseen contingencies, is necessary.

Collective bargaining is recognized. This means that until some way can be evolved for other methods of settlement, the country is at the mercy of such bodies of men controlling the key industries as coal and transportation. The steel strike affected the country but little. The coal strike has paralyzed a large section of the country, and we are not yet out of the dilemma. A protracted strike of the railroad men might work even greater havoc.

Industry seems to be in a bellicose state. There is increasing ill-feeling between the unionized and the nonunionized workers, not civil war, but a feeling by the latter that they are being exploited by the former. There is not peace between the employer and the employe, a condition often incorrectly spoken of as war between capital and labor.

The sum total of these things is that the central stations must lay in larger stores of coal in future, for recent events have taught the value of the coal pile.

Central-Station Rates in Theory and Practice

Twenty-third Article — Public Utility Regulation by State Commissions—Organization and Procedure of Commissions—Scope of Their Powers as to Rates, Service, Capitalization, Etc.

By H. E. EISENMENGER

This is the twenty-third article of this series which began in the issue of July 12. Part I consisted of seven articles on the cost of electric service. Part II included six articles on the principles governing selection of a rate system. The six articles in Part III dealt with the various rate systems in use. Two articles constituted Part IV on rate analysis. Last week's article included Part V on accuracy of rates and began Part VI, which is continued in the present and will be concluded in the two remaining articles of the series.

PART VI—PUBLIC UTILITIES AND PUBLIC REGULATION—(Continued).

CONTRIBUTED BY S. F. WALKER,
Formerly Associate Editor of Rate Research.

II. REGULATION BY COMMISSION.

UTILITY COMMISSIONS MUST BE DISINTERESTED AND UNBIASED ADMINISTRATIVE BODIES.

COMMISSIONS are not courts of punishment, but are administrative bodies intimately related to many phases of the utility business. A commission should not usurp the position of management in determining the development and operation of a utility, but as an administrative body, act in a corrective and advisory capacity. The underlying authority for the regulatory powers vested in commissions is the common-law principle that all business affected with a public interest is subject to public regulation.

Unbiased Judgment versus Home Rule.—The difficulty in regulation of public utilities by local franchises was that the municipality was a party to the contract and at the same time acted as the regulatory body. Therefore, free service to the municipality was exacted of the companies, heavy paving requirements, special taxes, unprofitable extensions and other unjustifiable burdens were placed upon the companies to their detriment and also to the detriment of the general public served by the utilities.

A statewide interest as against the companies operated in several states, such as railroad companies, natural-gas companies, or interstate power companies, may affect the judgment of the state commission to shade the findings in favor of a low rate for service within the state.

In order to secure an unbiased point of view the regulating body must be the agent of a larger unit than that affected by the regulation. State commissions pass upon the rights and privileges of the city and the local companies; the Interstate Commerce Commission deals with matters affecting the often conflicting interests of different sections of the United States.

In the future certain public utilities may outgrow the limits of state commissions and provision may be made for the delegation of matters affecting interstate operation of power-transmission companies, natural-gas companies and similar industries to an interstate or national commission.

Another consideration which favors regulation by state commission rather than by the municipality is that men with the desired education and training, capable of exercising the broad administrative powers affecting various industries, cannot readily be secured for local commissions. Furthermore, extensive investigations are often called for in determining proper standards of service, in adopting a policy of rate making or in deciding the advisability of adopting new inventions and improvements in operating conditions, which investigations can be conducted by the state body for the benefit of the industry in the entire state. The necessary equipment, such as meter-testing equipment is not often available to the local body, but may be acquired by the state commission for use throughout the state, or the state commission may use certain equipment jointly with other state departments or the state university.

Special Laws.—Prior to the establishment of commissions, special laws had been passed in some states, fixing a rate or standard of service for individual companies or for the railroads, gas, electric or other public utilities throughout the state.

This sort of regulation is too haphazard and limited in scope. Furthermore, it has the objection obtaining in the case of regulation by local franchise, that of inflexibility. The rate or service requirement, if reasonable when the special law or franchise became effective, may not continue reasonable and suitable to developments throughout the term of the franchise or the period during which the law remains in effect.

After the establishment of commission regulation there should be no occasion justifying the passage of a special law of this kind; and the special laws already passed should be nullified to give the commission entire freedom to make changes when they are found to be justified, the special rates and regulations to remain in effect only until reasonable rates and regulations can be determined by the commission.

COMMISSION ORGANIZATION.

The majority of the state laws provide for three members on a commission, but there are commissions of four, five and seven members. The majority of the laws also provide for appointment of the commission by the governor, by and with the consent of the senate. In some of the laws, provision is made for the election of the commissioners by the people, but the appointive commission has grown in favor, and this plan is adopted in the laws most recently enacted.

Term of Office.—The different state laws provide for a term of office for the commissioners varying from two to ten years, but the term most common is that of six years.

The body is given a greater degree of stability by providing for the expiration of the term of but one commissioner at a time, and there are many instances where men, who have proved their special adaptability for the work, have been returned for successive terms to the best interest of the regulatory system. There is an unwritten obligation that the governor maintain a commission divided as to party affiliations so that it may act entirely in a nonpartisan manner.

Qualifications.—In practically all of the laws, men appointed or elected to commissions are not to have any direct or indirect pecuniary interest in the industries to be regulated, and the requirement is often exacted that the members and employes of the commission are not to engage in any other business or hold any other political office.

The training of the men eligible to the office of commissioner is specified in some of the laws, while in others certain standards have been established by precedent. The men making up a commission should have different qualifications and training. For example one member may be a lawyer, and associated with him may be a business man familiar with railroad and public utility problems, an engineer of broad training and a man familiar with the financial and economic aspect of the regulated industries.

Provision is often made in the law for a secretary or clerk of the commission and for a special attorney.

The Staff of the Commission.—There is a commission staff, the members of which are appointed by the commission, to supplement the work of the commissioners, make investigations of operating conditions, make appraisals, compile data for submission to the commission, and conduct investigations in the field. The staff usually is organized by departments; the engineering department, accounting and statistical departments, and the tariff or rate departments. These are in turn subdivided. The engineering department, for example, is made up of subdivisions presided over by a railroad engineer, electrical engineer, gas engineer and experts in whatever line is included in the commission's jurisdiction.

COMMISSION PROCEDURE.

The commissions are in practically every case free to adopt their own rules and practice of procedure in making investigations and in conducting formal hearings.

The commission need not wait for the presenting of a formal case. Some of the most valuable work of commissions has not been recorded in formal opinions and cases. Especially is this true in the case of small companies who have been required to keep proper accounts, directed to make improvements in operating machinery, and advised in the development of their business under a favorable rate system.

Informal Cases.—A great part of the complaints made to the state commission are handled informally by correspondence and by visits of some member of the commission's staff.

Formal Cases.—Generally speaking, the less like a court the sittings of the commission in formal cases are the better the results. Matters may be brought up which are outside of the original case presented on complaint, petition or application. The scope of the case may be broadened to include parties other than those bringing the case to the commission and the final order of the commission is not necessarily limited to the initial proceedings but may present a full and complete disposition of all matters brought up during the progress of the case. For example, complaint against a rate charged one individual for electric power service may result in a change in schedule for all classes of service by the company involved.

The commission is given power to require the furnishing of records and data considered necessary to the case and has power to summon witnesses similar to the powers of a court in that respect.

Review by Court.—The judgment of the commission as to the proper findings in a case is practically paramount. The commission's decision may be taken to court for review, but the judgment of the court may not be substituted for that of the commission. If the court finds that the commission has exceeded its powers or made a decision contrary to law and fact, the case must be remanded to the commission for modification in accordance with the court's finding. If new and additional evidence is introduced when the case is presented to the court, the case is returned to the commission for consideration of the new evidence.

The finding of the commission is *prima facie* reasonable, and the burden is upon those carrying the case to the court to prove that the commission's finding is otherwise.

SCOPE OF REGULATION.

Without taking up separately the regulation provided for in the different states, it may be said that commission regulation of public utilities includes regulation of rates, service, accounting practice, the issue of securities, and the valuation of public utility properties.

Rates.—In a few of the state laws the commission is given the power to fix maximum rates only, and in Ohio the rates are in the first instance fixed by municipal ordinance subject in all cases to appeal to the state commission. In the large majority of states, however, the commission is charged with the duty of determining reasonable rates, and may order changes in individual rates or may prescribe entire new schedules. In about half of the states where the commission is given the more complete jurisdiction over rates, the rates of municipal utilities are exempt from regulation.

Provision is made for the commission to make valuations and obtain whatever data it may consider necessary to the determination of proper rates.

Rates Fixed by Contract.—When the utility services were first established, the utility companies were left free to make what agreement they could to gain permission to operate and to induce the customers to take the service. Many promises were made to individuals and to communities naming rates for the service, and these promises were often embodied in special contracts between the company and the customers. With the establishment of regulation, the interesting question arose as to whether or not the company should be permitted or required to carry out these original agreements. It has been generally established that these special contracts must be abolished as constituting unjust discrimination, and the reasonable rates adopted by the commission should be generally applied to all customers regardless of whether these special agreements called for a higher rate or a more advantageous rate to the customer than those found by the commission to be reasonable.

Franchise Rates.—Likewise rates fixed by franchise have been changed after investigation by commission. The franchise rates are binding upon the company only until modified by the commission.

Such orders of the commission have been upheld in cases of review by the courts upon the general ground that the state's power to regulate in cases affected with public interest cannot be bargained away by such special agreements.

Increases above rates fixed by franchise are allowed as well as decreases in such rates, since this is only just to the company, and rate increases may be as much in public interest as rate decreases.

Publicity in Rates.—All rate schedules are to be filed with the commission and all changes in such schedules are to be filed prior to their going into effect. Duplicate schedules and rate changes are to be filed in a place and manner readily accessible to the public. Such provisions securing publicity of rates are made in the interest of elimination of discrimination.

Different rates may be prescribed for different classes of service, but all customers whose service comes under a certain class are entitled to the same rates, rules and regulations.

Modification in rates.—Rates once determined by the commission may be reviewed at any time, either on the commission's own motion or upon complaint of either the company or the customer.

Emergency Rates.—Flexibility of rate regulation was secured by special provision in some of the laws permitting the commission to fix rates in an emergency without recourse to the extended investigation made in usual cases and the advance notice to the public of the proposed increase. Emergency increases have been resorted to in many cases under such provisions to meet the unprecedented increase in operating costs attendant upon war conditions.

Service.—The regulation of the service of public utilities is one of the most important branches of regulation.

Standards of Service.—In the case of gas and electric services, commissions have quite generally worked out statewide standards of service, covering, in the case of electric companies, such matters as accuracy of meters, meter tests, voltage regulation, variations in frequency; and in the case of gas companies, meter accuracy, heating value and illuminating value of gas, tests for purity of product and maintenance of uniform pressure. In some states following the establishment of such rules, regular inspections are made by the engineers in the gas and electric departments of the commission and the companies are required to keep operating records affording a check upon their operation under the standards set by the commission.

Other rules have been adopted covering the method and manner of construction of electric transmission lines, crossing of power lines, street car and railroad crossings, prescribing the intervals of service on car lines and frequency of car stops, regulating telephone and water service and many other matters affecting the safety and adequacy of service in these various utilities

Extension of Service.—The commission has power to determine what extensions of service are necessary, and when the cost of such extensions should be borne by the company. In some cases the commission has required extensions to be made only upon condition that part or all of the cost be borne by the customers to be served from the extension or only upon such customers guaranteeing a specified return upon the company's investment in the extension.

Joint Service.—The supervision of service covers the rendering of joint service by utility companies. The companies may be required to co-operate in rendering joint service to the public and the compensation for such service may be divided between the companies on a basis determined by the commission.

Refusal of Service.—Public utilities cannot arbitrarily refuse to serve certain customers, but must render service without discrimination. If an application for service is refused by a company it must be in accordance with rules on file with the commission and meeting with its approval. Upon complaint of the applicant to the commission, a determination will be made as to whether or not service should be given in that particular case.

Abandonment of Service.—A utility once having undertaken a service to the public, cannot abandon that service without approval by the commission after proper cause has been shown.

Neither can public utilities change hands by transfer or lease without commission approval; and reorganization and mergers are also made under commission supervision, the theory being that the public is an interested party to all such proceedings to the extent of determining that no unnecessary financial burdens are placed on the public service and that those acquiring control of the property are competent to conduct it in such manner as to afford adequate service to the public.

Accounting.—Commissions have been given the power to establish uniform systems of accounts for all utilities subject to regulation and to require regular company reports.

The information thus on file in the commission's office is of use in capitalization and rate cases and, being uniform, these accounts afford valuable sources of comparisons between operating companies. Complete accounting records for a number of years may afford a better basis for rate making than a valuation prepared for the immediate purpose at great expenditure of time and labor. Such data have been used in regular rate cases as well as in many of the recent emergency increase cases.

Issue of Securities.—The public utility laws vest in the commission power to regulate capitalization, varying from a general provision stating that no public utility should issue securities without the commission's approval, to an elaboration of the commission's power until regulation affords a practical guarantee that there is a property value upon which the company is entitled to a return for all securities issued.

The continued regulation of capital expenditures by the same body regulating rates makes it possible to use the capitalization as a rate base. The company is assured before making an expenditure that it will meet the commission's approval and that it is such that it should be allowed to earn a return upon the amount expended. In the past, companies have made expenditures which have not been justified by future developments. Extensions have been made which never have been profitable and perhaps never will be, and plants have been enlarged to an extent not justified by the later growth of the town. But if these expenditures had been approved by a commission, the judgment of the company at the time having appeared reasonable to the commission, there would be less opportunity to penalize the company in a future rate case on the ground that poor judgment had been shown in the expenditures which proved to be unnecessarily high.

Valuations.—Appraisals of public utility property may be made by the commission in capitalization and rate cases. In most laws where valuations are mentioned it is left optional with the commission to determine what and when valuations will be made. In one or two laws where it was made mandatory upon the commission to value all public utility property it was found to be practically impossible to determine a basis for such general valuations and it proved to be an unjustifiable burden and expense upon the commission and the utilities.

In some of the states, the staff of engineers organized by the commission has made property valuations for purposes of taxation.

Valuation, especially as concerned in rate cases, is later treated at length in the last two articles of this series as the subject most closely related to the discussion of rates.

Protection From Competition.—The companies most generally subjected to regulation are those in which competition increases the cost of service and is otherwise undesirable. Electric, gas, telephone, water and railway companies are called natural monopolies, because it is possible to have competition only at the expense of running duplicate systems of wires, mains and tracks through the city's streets, as well as maintaining greater plant capacities than otherwise necessary. Regulation by competition is secured by duplication of expenses in other industries, but the objections to duplication in the case of natural monopolies are more obvious. There is absolutely no excuse for duplication of expense under commission regulation.

Before the establishment of commission regulation, municipalities often followed the policy of granting franchises to as many companies as applied, thinking to secure the benefit of low prices during the rate war which invariably followed the establishment of duplicate properties, but the resulting waste, unwise expenditure, and failure to earn an adequate return resulted in the elimination of the weaker competitors or led to a general price agreement, and the price of the service had to be high enough to retrieve the losses during the rate war. Measures to prevent this state of affairs under regulation have been incorporated in many of the state laws. Companies desiring to establish new plants or established companies desiring to extend their service into new fields are required to first obtain a certificate of convenience and necessity from the regulating commission; and practically without exception the disadvantages of duplication have been recognized by the commission and the certificate of convenience and necessity has been withheld when the territory in question is already served by another company.

With one company in the field, if the service is inadequate the commission may order it improved, and if the rates are unreasonable new rates may be prescribed by the commission, leaving no excuse for resorting to the old unsatisfactory method of regulation by competition.

The greater stability given investment in a public utility under protection from competition makes it just that much easier to secure necessary capital for the development of these utilities and is reflected in a lower cost of capital. This protection should be against the establishment of municipal utilities as well as private utilities.

Municipal Utilities.—In about half of the states having regulation of utilities, municipal utilities are subject to the same regulation as private companies under the law. Regulation of the municipal utilities in these states has shown that they are greatly in need of revision of their accounting practice (in many cases the utility accounts are confused with the other municipal accounts until it is impossible to tell what the costs of the utility service are), revision of rates to eliminate discriminations and to afford a proper system for developing the business, and supervision of operation requiring improvements in equipment and operating conditions.

Only in those states placing municipal and private utilities upon the same basis can fair comparisons be made between municipal and private ownership and operation of utilities.

Indeterminate Permit.—In the case of the short-term franchise, capital is secured under the uncertainty as to what will happen when the franchise expires. Capital is under the practical necessity of getting what compensation it can within the term designated in the franchise, often at the expense of quality of the service rendered and upkeep of its property.

Bargaining for renewal of the franchise is often drawn out over a period of years and is a disturbing factor in local politics and company enterprise.

Under proper state regulation there appears to be no reason for continuing the term franchise. Grants to operate indefinitely do not prejudice public welfare as long as regulation requires adequate service at reasonable rates with power to enforce all reasonable requirements in public interest.

In Massachusetts the term franchise was abandoned for what were termed "grants of location," which were in fact franchises granted for an indefinite period during good behavior. Indeterminate-franchise forms have been adopted by the Federal Government: for example, franchises granted by Congress to public service companies operating in the District of Columbia, Porto Rico and the Philippine Islands. The indeterminate-permit provision was written into the Wisconsin law and has proved satisfactory to the companies and the public. In that state all franchises were arbitrarily made indeterminate by law in 1911. Indiana adopted the indeterminate-permit provision, leaving the acceptance of the indeterminate permit optional with the utilities. Commissioners in both states have publicly pointed out the advantages of the indeterminate permit.

Holding Companies.—Under proper regulation, all possible benefits to be derived from the organization of public utility holding companies may be secured without fear of the abuse of their power as against public interest.

Among the advantages to be gained from the holding company is the aid in securing capital for the further development of the subsidiary properties, in securing managing ability to advise in the development of the local enterprises, in building up better accounting practice and in the furnishing of legal and engineering advice from a central office. The expense of furnishing such services is shared by all the subsidiaries, and the pooling of the various risks and hazards makes it easier to secure necessary capital through the central holding company than by the local companies at a similar expenditure of time and money.

With the financial transactions subject to commission regulation, the accounts of the local companies open to public inspection, the service and rates regulated by the commission, the public interest is protected in the cases where holding companies are involved the same as in any other instances.

Consolidation.—Similarly, combinations of public utilities under regulation are not against public welfare. In fact, combination of business under these conditions is attended with the benefits of economic operation without fear of monopolistic power to be used against the public. The consolidations are under commission supervision as to capitalization, reliability of parties and similar matters of public interest; and after the consolidation has been effected regulation is still just as efficient, not being dependent upon the maintenance of competition. The consolidation of electric utilities, for example, results in more economical operation because the load is more uniform and the reserve maintained at one consolidated plant is not as great as the sum of the reserves necessary in separate plants. The desirability of effecting this saving in electric utility operation has been most marked under the shortage of coal and other war conditions.

The Massachusetts Gas and Electric Commissioners in their thirty-third annual report included in their recommendations for legislation the following request for an extension of their powers to make it possible to order consolidations that would be in public interest:

"Considerable progress has been made by the companies in tying together the electric generating stations, but in a great national emergency a matter so vital to the public interest should not rest entirely on the initiative of the companies. What has been said of power plants applies with equal force to gas works. With a view to prevent unnecessary duplication of investment and to conserve natural fuel resources, the Board recommends that it be given authority, after proper proceedings, to require the physical connection of power stations and gas works, the supply of gas or electric energy to other companies and municipal lighting plants, and the shutting down of such power plants and gas works as may be unnecessary, upon such terms and for such periods as may be just and reasonable, and to exercise the right of eminent domain wherever essential to this end."

Such a law was passed by the Legislature in accordance with the Board's suggestion as Chapter 152 of the General Acts of the year 1918.

Interconnection of electric systems, the pooling of electric power, and its distribution under the direction of a power administrator were secured in other states by the co-operation of the companies and under the direction of the state commissions and the Federal authorities, the aim being to overcome the shortage of power, eliminate wherever possible its uneconomical generation and assure the furnishing of adequate power for the essential industries.

(To be continued.)

STORAGE-BATTERY LOCOMOTIVES IN MINES DISPLACE TROLLEYS.

Examples of Efficient Use of Battery Locomotives in Idaho Mine and of Battery Lumber Carriers in Washington Lumber Mills.

It is of interest to make note of the tendency in coal and metal mines to use storage-battery locomotives instead of those equipped for trolley lines for underground and yard haulage. Some good examples of this means of ore transportation may be observed in numerous deep mines in the West.

The two illustrations presented herewith are from photographs taken on the deep levels in the Bunker Hill & Sullivan lead-silver mine at Kellogg, Idaho. Fig. 1 shows a battery-charging station on the 1100-ft. level, where Edison storage-battery cells are being charged for a Jeffrey 2½-ton locomotive. In Fig. 2

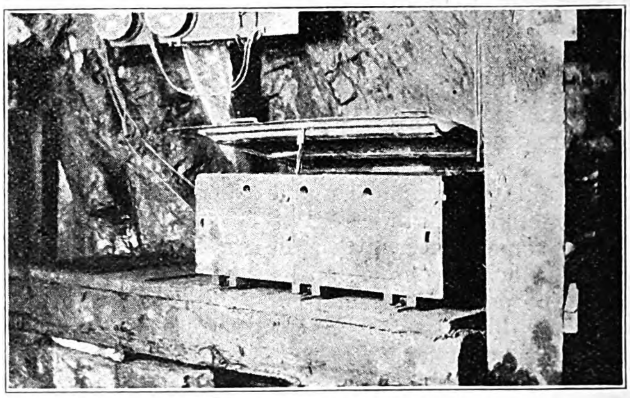


Fig. 1.—Simple Charging Station in Deep Mine for Charging Storage Batteries for Mining Locomotives.

is shown a charging and watering station on the 1300-ft. level of that mine, where a General Electric 3½-ton locomotive with Edison batteries is being charged.

In operating under this system, one favorable feature is that the batteries may be charged at times of the off-peak load, and of course the elimination of trolley wires counts for greater safety and economy of installation and maintenance costs. The number of loaded mine cars that may be pulled by a storage-battery locomotive of a given capacity depends, as in other cases, upon the condition and grade of the tracks and weight of ore per cubic yard. Some mine haulage locomotives having storage-battery equipment have as great as 9 tons capacity. Six or seven locomotives of

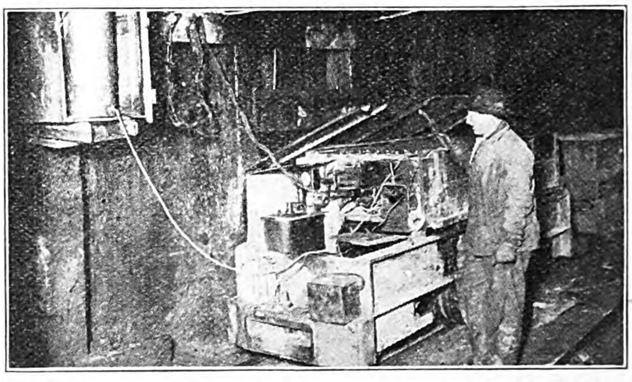


Fig. 2.—Charging and Watering Station on 13th Level of an Idaho Mine—A 3½-ton Battery Locomotive Is Being Charged.

this class, of various makes and capacities, are used in the Bunker Hill & Sullivan mine.

A similar tendency to use battery tractive equipment is observed in looking over the lumber mills of the Pacific Northwest. For instance, in the Grays Harbor region in the state of Washington there are 14 Foss electric lumber carriers, operated by storage batteries, in use. Many of these are equipped with Edison cells, giving each carrier a storage capacity of 18 kw-hrs.

Interesting Examples of Graphic Meter Records

What Graphic Records Signify—Superiority of Graphics Over Other Forms — Typical Instances of Graphics

GRAPHICS visualize a fact. Columns of figures may state a fact; but it takes a curve, a graph or a diagram to interpret the figures, to bring home just what the figures signify. Graphics tell the tale.

Electricity often offers the most convenient and often the most accurate method of measuring energy, speed, temperature and motion. And it is the recording instrument that enables the metering to be visualized by graphic registration. It has often been said that the electrical graphic recording instrument is the efficiency engineer of the industrial plant, because it shows what is being done, what conditions change, when they change and enable the cause of the change to be discovered.

In some instances it is practically out of the question to make a determination unless the electrical measuring instrument—and almost invariably this means the graphic recording instrument—is employed. For example, it would be very difficult, extremely laborious and quite costly to determine unless electrically just at what rate the output of a machine shop drops off as the lunch hour aproaches, whether work is resumed promptly when the whistle blows again, and whether the individual machines are kept busily employed until the time to stop arrives. The electric recording graphic meter shows just what happens, every instant of the time, when machines are started and stopped, when a machine runs idle for a bluff, when a machinist takes a light cut instead of a heavy one, and so forth. In the steel mill, the graphic instrument accomplishes the same purpose, it visualizes conditions, shows when something happens, shows the effect of changed operating conditions, indicates what ought to be done.

The applications of the graphic meter, for measuring current, voltage, energy, power-factor, speed, temperature and so on are endless. Not long ago in these columns it was shown where an industrial plant had been able by the use of a graphic wattmeter to purchase additional power from the central station instead of building additional plant of its own by simply modifying slightly the method of operating A few days ago an instance came to our knowledge where by the use of a recording ammeter, it had been possible to redesign a large machine in a steel mill and thereby brought about considerable operating economy. Such instances are legion.

The pictorial history of a heat in an electric furnace melting steel is shown in Fig. 1. The furnace is of the Heroult arc type, and takes a charge of 3000 lbs. of steel for producing nickel steel. The charge was fed to the furnace without preheating. At the start, the power taken by the furnace is small, but as the resistance of the furnace circuit constituted by the steel decreases as the electrodes heat up and the charge consolidates the current increases until stable conditions are obtained. The excessive variations are due to individual pieces of metal falling between the electrodes and causing what is in effect a short circuit. These short circuits are, of course, only temporary and result from movement of metal under the heavy current rush across it. The gradual lowering of current toward the end of the run was for the special treatment given the nickel-steel.

In following the records of a graphic meter in connection with electric furnaces, it is possible to know almost exactly when the heat will be ready for pouring, when various constituents should be added, as zinc to the brass furnace, and so forth.

Figs. 2 and 3 show respectively the load curves of two metal-working plants engaged in automobile finished parts production, the former working upon the day system, the latter on the bonus system. In most metal-working plants the power input varies with the output in finished parts. Fig. 2 shows that

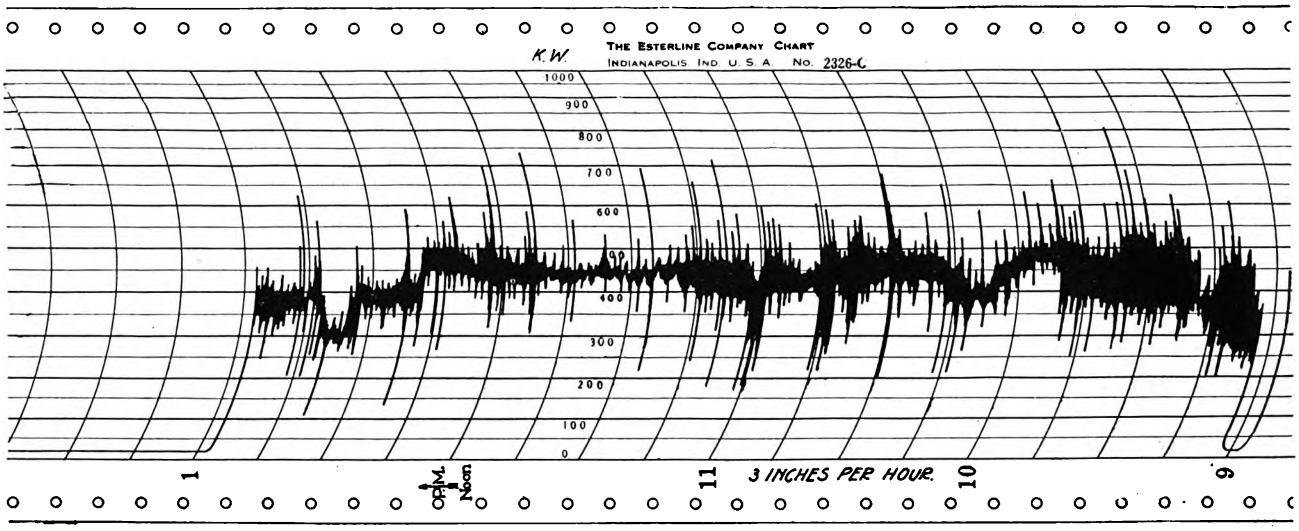


Fig. 1.

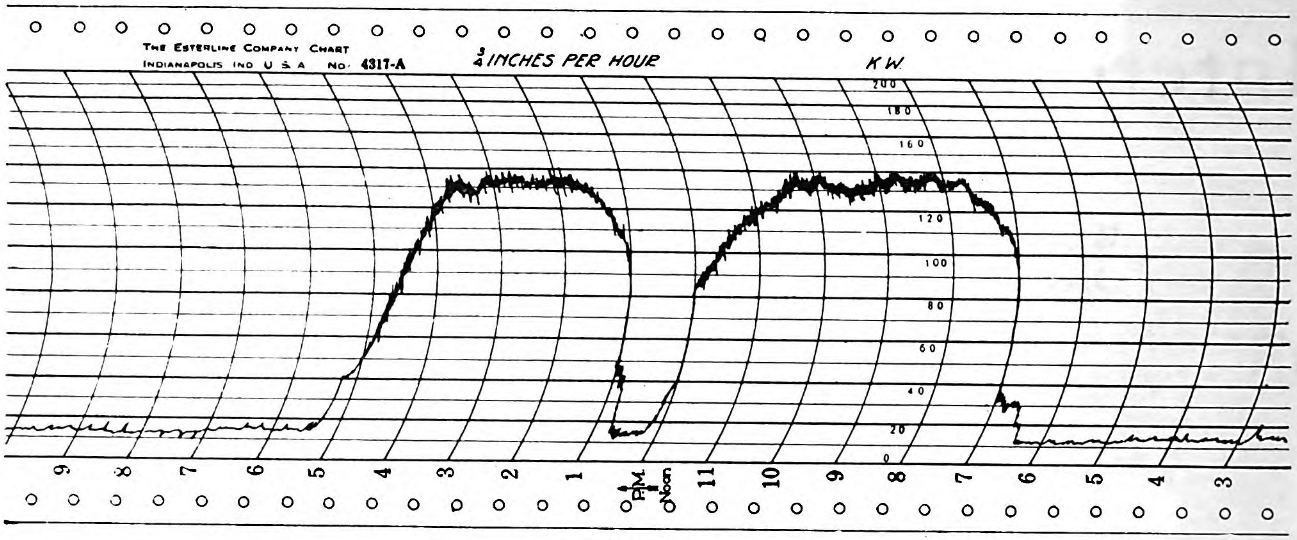


Fig. 2.

it took 45 minutes for the men to get the production up to normal in the morning and that the noon hour was anticipated by approximately 1½ hrs. probably given over to washing hands, preparing lunch, buying from peddlers, etc. Forty-five minutes were required too for the men to get production up to normal after the noon recess and then falling off commenced to occur about 1½ hours before quitting time.

In contrast is Fig. 3, which shows the load curve in a similar plant, but with the workers paid on the bonus system. Here the production commences directly the whistle blows and the rate of production is maintained right up to the noon hour. Work starts immediately when the lunch hour is over, with production slightly lower during the afternoon (chargeable to human fatigue rather than slackening such as is prone to occur when there is no special incentive to maintain the pace) and continues steadily without let-up till quitting time. These two records, when properly interpreted and studied, might result in a saving of many thousands of dollars to a concern paying its workers according to time instead of according to production.

Power-factor is the ban of many a central-station company. It interferes with voltage regulation; it limits the current-carrying capacity of generator fields, of underground and overhead lines and makes itself objectionable in many other ways. The graphic record of power-factor as obtained by one central station shows in an illuminating manner the value of the graphic recording meter for making surveys and getting to the root of a problem. Low power-factor was existent and a synchronous condenser was installed in one of the customers' plants to remedy conditions.

The size and necessity for a synchronous condenser were determined by surveys with graphic recording instruments, and these were later used to determine the correctness of the diagnosis and degree of solution. The record covers the period from 4:45 a. m. to 9:30 a. m. The power-factor is about 85% during the night, rising to 87% as the morning lighting load comes on. At 6:30 a. m. it begins to drop rapidly as induction motors are started and reaches 57% at 7:00 a. m., and would probably range about 60% throughout the day if no corrective apparatus were used. At 7:05 the synchronous machine is started, which, when the field is properly adjusted, maintains a power-factor of about 95% throughout the day. These facts are well visualized in the record shown on page 981, Fig. 4.

The electric elevator is overcoming competition with elevators of the hydraulic type in the large cities where high water pressure is available. They are without competition in the smaller cities where the

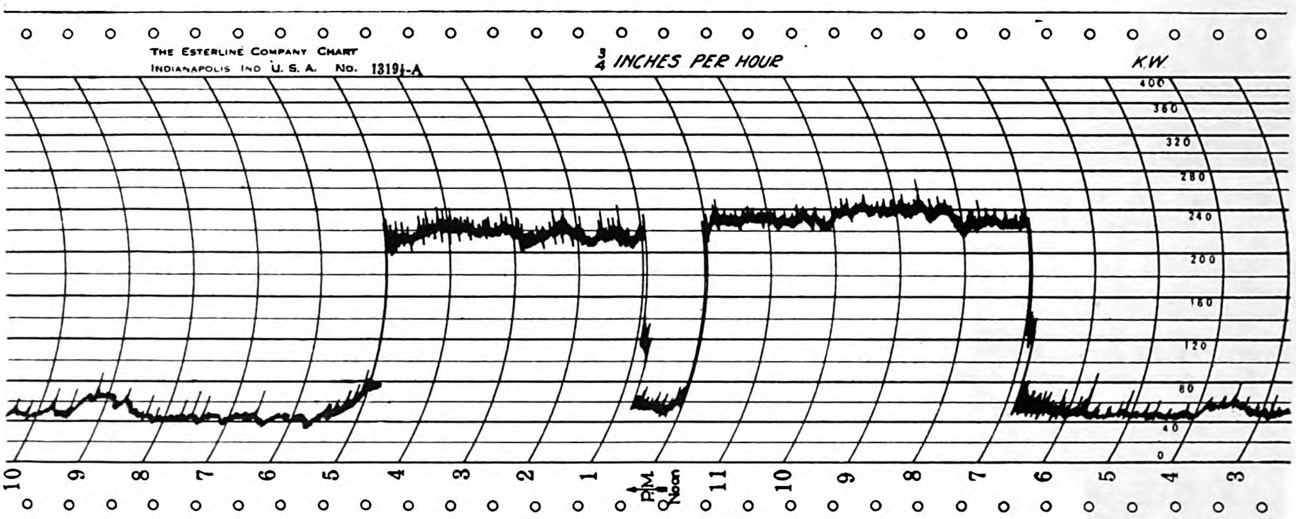


Fig. 3.

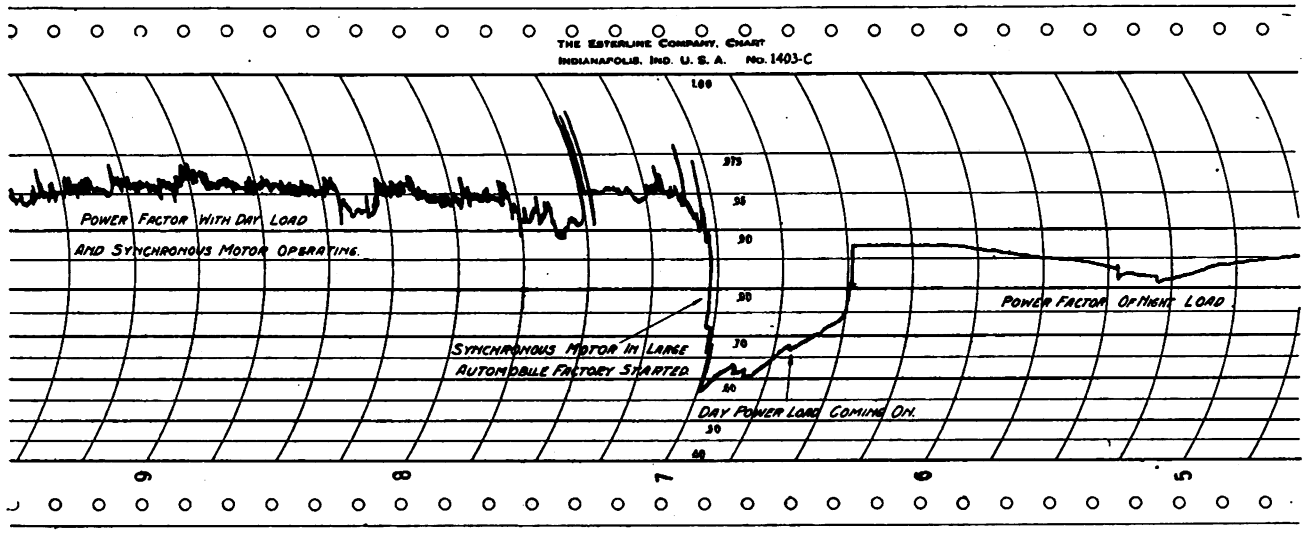


Fig. 4.

hydraulic elevator is not utilized. The amount of weight used for the counterweight is an important factor in operating economy and starting demand and this factor becomes of great importance where a number of elevators are used and where power is purchased upon a basis of kilowatt-hours consumed and kilovolt-amperes or kilowatts demand.

The graphic record shown in Fig. 5 shows the performance of an electric passenger elevator operated by a 25-hp., 220-volt, 60-r.p.m. direct-current motor. This elevator was tested running light, and the effect of the counterweight is clearly shown, the power requirements when running down being considerably greater than the power required to raise the cage. The operation of the automatic controlling equipment as well as the regeneration when braking is clearly shown. Records of this kind are useful to determine the condition of the elevator equipment, the handling by the operator and to secure data necessary for the correct scheduling of the cars.

The graphic records shown have been presented as being merely typical of what the electric graphic recording instrument enables to be done.

Similar applications could be discussed to much greater length. Sufficient has been said, however, to emphasize once more the value of the recording graphic instrument.

CREDITABLE PERFORMANCE OF STAND-BY STORAGE BATTERY.

A 150-cell, 1000-kw. storage battery installed in Station 6, Rochester Railway & Light Co., in 1905, has just been taken out of service to be sold as junk, it having completed its term of useful life of fourteen years since installed in 1905 by the Electric Storage Battery Co.

The function of the battery was to maintain continuity of service of the company's Edison system during such times of accidental interruption which would otherwise have occurred. A further use was to help out generating apparatus, transforming apparatus and underground lines, during periods of peak and excessive load. During its lifetime of fourteen years the battery furnished 1,844,803 kw-hrs., every one of which served a very useful purpose and often prevented a serious predicament from arising.

It might be pointed out that central stations are now recognizing that a storage battery is too valuable to be used for assisting over the peak load except under exceptional circumstances. When used for standby service only, which is the condition existing invariably today, a battery should have a life exceeding the one mentioned above, namely fourteen years. Obviously such an investment is a sound one.

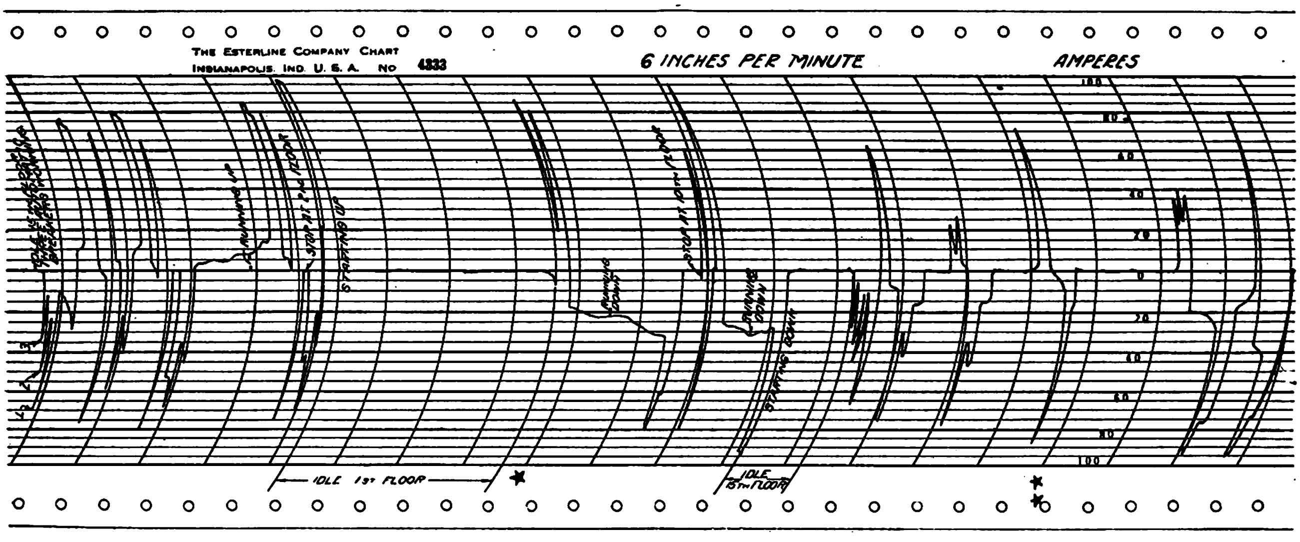


Fig. 5.

Proposed Changes in Part II, National Electrical Safety Code

Text of Proposed Revision of Section 28 and Comment on Voltage Classification Prepared by Bureau of Standards

CONSIDERABLE interest has been aroused among our readers by the compilation of the principal changes proposed in Sections 20 to 27 of Part II, National Electrical Safety Code, which was published in our issue of last week. In order to understand the significance of the proposed changes readily, a copy of the 1916 edition of the Safety Code should be available for comparison.

Such a comparison shows that rearrangement of the order of the rules has been carried out very extensively; this at first is confusing, but the old numbers of the rules given in the parentheses are a useful guide. The Bureau of Standards has prepared a table of contents of Part II, giving both old and new numbers. This gives a comprehensive view of the grouping of the rules in the present draft and will facilitate finding the location of any specific rule of the old edition. In contrast to the general opinion, some of the proposed rules are more lenient than the old ones.

On account of the numerous changes made in Section 28, the proposed complete revised text of it is given below, following generally the method used last week in presenting the principal changes in Sections 20 to 27, inclusive. In Section 29, on the contrary, only one minor change is proposed, so this section is omitted.

A discussion of the new voltage classification proposed is appended. This was prepared by Dr. E. B. Rosa, chief physicist of the Bureau of Standards, and explains why this classification is to be changed and how it will affect different types of circuits. Supplementing Part II in the new edition of the Code will be much similar explanatory matter making clear the reasons for many of the rules and interpreting them where there is possibility for not grasping their real significance.

The Bureau courts comments and constructive criticisms of the proposed changes before these are formally adopted. Such suggestions and comments should reach the Bureau of Standards, Washington, D. C., before Dec. 26 if possible so as not to delay the new edition of the Safety Code.

PROPOSED REVISED DRAFT OF SECTION 28—SIGNAL LINES AT CROSSINGS AND USED ALONE.

280. *Loading and Guying for Grade D.*

(*a*) *Conditions Determining Grade.*—(Revised.)—Signal lines crossing over railways, except in the cases mentioned in Rule 235 (*b*), (*c*), (*d*), (*e*), are classed as grade D and shall have construction in accordance with the following requirements. Where also crossing over supply lines (or signal lines having the character of supply lines) in the same span the construction required shall comply either with grade D, grade E (Rule 284), or grade A or B, according to the voltage of the supply line (see Section 23).

Signal lines crossing over the supply lines covered in Rule 234, and also crossing over railways in the same span, should comply with grade D or E requirements for supporting structures; but grade C requirements apply to conductor sizes and sags in such cases. (See Rule 241.)

(*b*) *Transverse Guying.*—(New.)—The poles supporting the crossing span shall be side-guyed or braced to withstand the transverse load put upon them in accordance with the conditions specified in the two following paragraphs, except that, if the poles are of such strength that the material will not be stressed beyond one-half its ultimate strength when the poles have deteriorated to 50% of their original strength, the guys or braces may be omitted. The guys shall be considered as taking, in the direction in which they act, the horizontal component of the entire load, the poles, acting as struts, resisting the vertical component. The calculated stresses in the guys shall not exceed one-half of the ultimate strength of the material.

(*c*) *Heavy Transverse Loading.*—(New.)—In regions of heavy loading the assumed horizontal wind pressure at right angles to the direction of the line upon the poles and conductors shall be taken as 8 lbs. per sq. ft. of projected area on cylindrical surfaces. The pressure shall be computed upon the poles without ice covering, while the conductors shall be assumed to be covered with a layer of ice one-half inch in radial thickness. In computing the transverse pressure on conductors the actual number of conductors shall be used up to 10. For larger number of wires only two-thirds of the total number shall be counted, with a minimum of 10.

(*d*) *Medium and Light Loading.*—(New.)—In regions of medium loading the transverse wind pressure shall be taken as two-thirds that for heavy loading. In regions of light loading the transverse wind pressure shall be taken as four-ninths that for heavy loading. (See (*h*) below as to three loading districts.)

(From 280*c*.)—In calculating transverse load, a cable with its supporting messenger shall be considered equivalent to the number of open wires obtained by multiplying the diameter of the cable in inches by three.

(*e*) *Longitudinal Guying.*—(New.)—The poles supporting the crossing span shall be head-guyed away from the crossing so as to withstand the load specified in the two following paragraphs, except that, where there are not more than two wires in a crossing span and the poles are not required by (*b*) to have side guys, the head guys may be omitted, if the poles are of such strength that the material will not be stressed beyond its ultimate strength when the poles have deteriorated to 50% of their original strength. The guys shall be considered as taking, in the direction in which they act, the horizontal component of the entire load, the poles, acting as struts, resisting the vertical component. The calculated stresses in the guys shall not exceed the ultimate strength of the material.

(*f*) *Heavy Longitudinal Loading.*—(New.)—In regions of heavy loading the longitudinal load shall be assumed equivalent to an unbalanced pull in the direction of the crossing of all the conductors or wires supported, the pull of each conductor or wire being taken as one-half its ultimate strength. In any case where the total pull exceeds 10,000 lbs. the load shall be taken as 10,000 lbs. plus one-quarter the excess above 10,000 lbs.

(*g*) *Medium and Light Loading.*—(New.)—In regions of medium loading the longitudinal load shall be taken as two-thirds that for heavy loading. In regions of light loading the longitudinal load shall be taken as four-ninths that for heavy loading.

For head guying cables are not included in the count of wires since the messenger serves as a head guy.

(*h*) *Three Loading Districts.*—(New.)—Three districts have been outlined in which heavy, medium and light loading, respectively, are considered to be justified by weather reports as to wind and ice and by local experience of the utilities using overhead lines. A map of the United States showing the territory falling into each class of loading is given in Appendix A.

(*i*) *Combined Effect of Ice and Wind.*—(New.)—The localities in the different groups are classified according to the relative prevalence of high wind velocity and thickness of ice which accumulates on the wires, light loading being in general for places where little if any ice ever accumulates on wire. If high wind velocities are frequent in a given place the loading for that place may be classed as heavy even though ice does not accumulate to any greater extent than at some other place having less severe winds which has been classed as a medium-loading district.

(*j*) *Modification of Loading Areas.*—(New.)—In the absence of any action by the administrative authority fixing the loadings for any given jurisdiction the classification of loadings shown on the map in Appendix A shall be considered to apply unless the party or parties responsible for the lines concerned assume some modification of the same, based upon local experience or weather records, or both. These modifications shall be subject to review by the administrative authority.

In case a state is redistricted by state administrative authority, so as to meet local weather conditions better than the map of Appendix A, a grade of loading above heavy may be used, if necessary to meet such local conditions.

(*k*) *Guy Leads.*—(280 *f.*)—Guy anchors shall, where possible, be located so that the horizontal distance from the ground line of the pole to the guy or guy rod will be not less than the height above ground of the attachment of the guy to the poles for head guys, and not less than one-third that height for side guys. The guys shall be attached as near to the center of the load as practicable. The guys and anchors shall be maintained so that the guys are kept taut and serve the purpose for which they are intended.

281. Poles, Crossarms and Wires for Grade D.

(*a*) *Size of Pole and Setting.*—(280 *d.*)—Wood poles supporting the crossing span shall be of selected timber, sound and reasonably straight. Poles shall have dimensions not smaller than the values given in the tables of Appendix B when carrying the numbers of wires there designated.

(New.)—The minimum dimensions given in the table of Appendix B correspond to poles designated by the wire-owning companies as class C, where less than 20 wires are carried; class B, where 20 to 40 wires are carried; class A, where more than 40 wires are carried.

(New.)—Poles shall be set to such a depth and in such a manner and back filling shall be tamped so thoroughly that the applied load will break the pole before the butt is pulled loose in its setting.

A table of recommended depths of setting is given in Appendix B.

(*b*) *Crossarms.*—(280 *h.*)—Wood crossarms supporting the crossing span shall be of yellow pine, fir or other suitable timber and shall have a minimum section of 2¾ by ¾ ins. for 6-ft. arms or shorter and 3 by 4 ins. for arms longer than 6 ft. Galvanized or painted iron or steel crossarms of equal strength may be used.

In rural districts in arid regions where the practice has been established by using 2¾ by 3¾-in. arms in 8 and 10-pin lengths, this practice may be continued where conductors are not larger than No. 10.

Crossarms and insulators shall be double on the crossing poles. The crossarms shall be held together with properly fitted spacing blocks or bolts placed immediately adjoining the outside pins and shall not support more than 10 conductors. Brackets or racks may be used only if used in duplicate or otherwise designed so as to afford two points of support for each conductor, except that for supporting twisted-pair wires, a single metal bracket, designed to safely withstand the full dead-end pull of the wires, may be used.

(*c*) *Pins, Insulators and Tie Wires.*—(280 *i.*)—Insulator pins shall be of steel, wrought iron, malleable cast iron, or locust or equivalent wood. Wood pins shall be sound and straight-grained with a minimum diameter of shank of 1¼ ins. and a maximum length of 8¾ ins. Steel or iron pins shall have a minimum diameter of shank of ½ in. and a maximum length of 9¼ ins.

(280 *j.*)—Each insulator shall be of such pattern, design and material that when mounted it will withstand, without injury and without being pulled off the pin, the ultimate strength of the conductor attached to the insulator. The conductors shall be securely tied to each supporting insulator.

(*d*) *Conductors.*—(280 *k.*)—Conductors shall be of hard-drawn copper, copper-covered steel, galvanized steel or other hard-drawn, corrosion-resisting metal, provided, however, that galvanized steel shall not be used in localities where excessive corrosion would result.

The minimum allowable sizes for conductors of the crossing span are given in the following table:

TABLE 13.—MINIMUM WIRE SIZES FOR GRADE D.

Conductor.	Spans 125 ft. or less.	Spans over 125 ft. up to 150 ft.
Hard-drawn copper	No. 10 A. W. G.	No. 9 A. W. G.
Galvanized steel	No. 10 Stl. W. G.	No. 8 Stl. W. G.
Galvanized steel in rural districts of arid regions	No. 12 Stl. W. G.	No. 8 Stl. W. G.
Steel-reinforced aluminum	No. 6 A. W. G.	No. 6 A. W. G.

If spans in excess of 150 ft. are necessary, the size of conductors specified above shall be increased.

Conductors of material other than the above shall be of such size and so erected as to have a mechanical strength not less than that of the sizes of copper conductors given above.

(280 *l.*)—The use of twisted-paid wires without a supporting messenger shall be eliminated as far as practicable. In no case shall this kind of wire be used in spans longer than 100 ft. without a supporting messenger. Each wire of a twisted pair not supported by a messenger shall be tinned hard-drawn copper not smaller than No. 14, or tinned copper-covered steel not smaller than No. 17.

Conductors of the crossing span shall be strung with sags not less than shown in the following table:

TABLE 14.—SAGS OF HARD-DRAWN BARE COPPER WIRE OR STEEL.

Length of span.	Sag in inches At 20° F.	At 60° F.	At 100° F.
No. 10 or larger—			
80 ft.	2½	4½	8½
90 ft.	3½	5½	10
100 ft.	4½	7	12
110 ft.	5½	8½	14
120 ft.	6½	10	16
No. 9 or larger—			
130 ft.	9	12	21
140 ft.	10	15	22
150 ft.	12	18	25

(*e*) *Messengers.*—(280 *n.*)—The following table gives the minimum sizes of galvanized steel strand messenger cable to be used for supporting different sizes of cable:

TABLE 15.—MINIMUM SIZES OF MESSENGER CABLE.

Size of cable in weight per foot.	Messenger cable (nominal ultimate tensile strength).
Less than 2.25 lbs.	6,000 lbs.
2.25 to 4.5 lbs.	10,000 lbs.
Over 4.5 and under 7.25 lbs.	16,000 lbs.

For spans exceeding 150 ft. or for heavier cables a proportionately larger messenger cable or other proportionately stronger means of support shall be used.

Multiple-wire cables and their messengers shall be suspended with a normal sag at 60 deg. F. not less than given in the following table:

TABLE 16.—MINIMUM SAGS OF MESSENGER CABLES.

Length of span.	Sag.
80 ft.	11 in.
90 ft.	13 in.
100 ft.	17 in.
110 ft.	20 in.
120 ft.	24 in.
130 ft.	28 in.
140 ft.	33 in.
150 ft.	37 in.

282. Signal-Line Clearances.

(*a*) *Clearances from Ground.*—(280 *c.*)—The clear space between the lowest signal conductor, guy or messenger and the heads of rails shall, at 60 deg. F. with no wind, be in general not less than 27 ft.

When the signal conductors are paralleled on the same highway by a trolley contact conductor at a lower level, the clearance of the signal conductors from the rail may be reduced to 25 ft.

When signal conductors cross tracks not carrying traffic which involves brakemen riding on top of standard freight cars, the above clearance may be reduced to 18 ft.

When spans exceed 150 ft. in length, additional clearance must be provided as given by Rule 220 *a*.

(*b*) *Clearances from Other Wires.*—(280 *c.*)—The clear space between the lowest signal conductor, guy or messenger and the highest wire of a similar nature paralleling the track shall be not less than 2 ft. where the span is 100 ft. or less. For longer spans and for crossings over supply wires, the requirements of Rule 220 *b* must be met.

The vertical clearance between conductors supported on the same pole or structure and at different levels shall in no case be less than 12 ins. and preferably 24 ins. (see also Rule 223).

(*c*) *Pole Clearances.*—(280 *a.*)—Unless physical conditions or municipal requirements prevent, the side clearance of poles shall be not less than 12 ft. from the nearest track rail, except at sidings where clearance of not less than 7 ft. may be allowed. Where conductors of one pole line cross over or under conductors of the second line there shall, if practicable, be not less than 3 ft. clearance between the conductors of the first line and any pole or tower of the second line, unless the conductors are attached thereto.

283. Relation of Crossing Span to Line.

(*a*) *Span Length.*—(280 *a.*)—Poles should, where practicable, be so located that crossing and adjacent spans are in a straight line and free from exposure to overhanging or closely adjacent trees or inflammable material or structures. (See Rule 211 for requirements as to location of poles.)

(280 *b*.)—The crossing span shall be as short as practicable, and in general shall not be longer than the normal span of the line. No crossing span should exceed 125 ft. in length if this can be avoided.

(*b*) *Vertical Displacement of Crossing Span.*—(*New.*)—The vertical distance from the top crossarm of a crossing pole to a straight line connecting the top crossarms of the next adjacent poles on either side of this crossing pole shall not exceed the values given in the following table:

Average length of span in feet.	Allowable vertical distance in feet.
Under 100	4
100 to 130	5
Over 130	6

(*c*) *Guying in Special Cases.*—(280 *g*.)—Where on account of physical conditions it is impracticable to guy or brace the crossing poles as specified in (*b*) and (*c*) the requirements there given may be met by head guying and side guying the line as near as practicable to the crossing, but at a distance not exceeding 500 ft. from the nearest crossing pole, provided that the line is approximately straight and that a cable of strength equivalent to that of the head guy is run between the two guyed poles, being attached to the guyed poles at the point at which the head guys are attached, this cable being securely attached to every pole between the guyed poles.

Where the poles supporting the crossing span are not in line with the poles in the adjoining spans, additional guying shall be placed to take care of the increased stress.

(*d*) *Inspection.*—(*New.*)—All parts of the supporting structures of the crossing span shall be examined annually by the owner and all defective parts shall be promptly restored to a safe condition.

284. Signal Lines Crossing Over Minor Tracks—Grade E.

(*a*) *Grade.*—(281.)—Signal lines crossing above minor tracks (as described in Rule 235 *b*) shall conform to the requirements for grade E. These requirements differ from those of grade D only in the respects specified in (*b*), (*c*) and (*d*) below.

(*b*) *Transverse and Longitudinal Strength.*—(New.)—The transverse and longitudinal strength of crossing supports of grade E construction shall be equivalent to two-thirds of that required for grade D construction by Rule 280.

(*c*) *Size of Pole.*—(281 *a*.)—Poles shall have dimensions not smaller than the values given in the tables of Appendix B when carrying the numbers of wires there designated.

The minimum dimensions given in the tables of Appendix B correspond to poles designated by the wire-owning companies as class C where not more than 40 wires are carried; class B where more than 40 wires are carried.

(*d*) *Conductors.*—(281 *d*.)—The minimum allowable sizes for conductors of the crossing span shall be as follows:

TABLE 17.—MINIMUM WIRE SIZES FOR GRADE E.

Conductor.	Spans 125 ft. or less.	Spans over 125 ft. up to 150 ft.
Hard-drawn copper in heavy loading districts	No. 10 A. W. G.	No. 10 A. W. G.
Hard-drawn copper in medium and light-loading districts	No. 12 A. W. G.	No. 10 A. W. G.
Galvanized steel	No. 12 Stl. W. G.	No. 10 Stl. W. G.
Steel-reinforced aluminum	No. 6 A. W. G.	No. 6 A. W. G.

If spans in excess of 150 ft. are necessary the size of conductors specified above shall be increased.

Conductors of material other than the above shall be of such size and so erected as to have a mechanical strength not less than that of the sizes of copper conductors given above.

The use of twisted-pair wires without supporting messenger shall be confined to spans not exceeding 125 ft.

285. Minimum Sizes of Grade C Signal Conductors.

(New.)—Signal conductors which are required to comply with grade C construction may be smaller than grade C supply conductors but not smaller than given in the following table:

TABLE 18.

Span length and sag.	Material.	Size.
Spans not over 100 ft. with sags not less than 12 ins., and spans over 100 ft. but not over 125 ft. with sags not less than 15 ins.	Hard copper. Steel.	10 A. W. G. 12 Stl. W. G.
Spans over 125 ft. but not over 150 ft. with sags not less than 18 ins.	Hard copper. Steel.	9 A. W. G. 11 Stl. W. G.
Spans over 150 ft. with sags of grade C supply conductors or more, as given in Appendix A.	Hard copper. Steel.	Sizes of grade C supply conductors as given in Rule 246.

Paragraph 272 *d* does not apply to such conductors.

286. Signal Lines Crossing Over Trolley Contact Conductors.

(*a*) *Not Exceeding 750 Volts.*—(282 *a*.)—(1) Signal lines, except twisted-pair conductors [see (2)] and fire-alarm conductors [see (3)], carried over trolley contact conductors below 750 volts shall have conductor sizes as specified for grade C in Rule 246 and sags as specified for grade C in Appendix A; except that for crossings where grades D or E are not required, for spans not exceeding 100 ft., No. 12 hard-drawn copper or steel is permitted with a sag of not less than 12 ins., for spans between 100 and 125 ft. No. 10 is permitted with a sag not less than 15 ins., and for spans between 125 and 150 ft. No. 9 is permitted with a sag not less than 18 ins.

Where the signal lines concerned cross over railways under circumstances requiring grade D or E construction for signal lines, the requirement of the above rule applies as to size and sag of conductors, while grade D or E applies to the supporting structures.

(2) Twisted-pair conductors, unsupported by messengers, shall not be used in spans over 100 ft., if carried over trolley contact conductors below 750 volts, unless each wire is hard-drawn copper not less than No. 14 or copper-covered steel not less than No. 17.

(3) Fire-alarm conductors shall in no case be smaller than required for grade C signal lines by Rule 285.

(4) The clearance of signal lines above contact conductors crossed over shall be in accordance with the values given in the table of Rule 220 *b*.

(*b*) *Exceeding 750 Volts.*—(282 *b*.)—(1) For signal lines carried over trolley contact conductors above 750 volts to ground see Rule 233.

(2) Twisted-pair conductors may be used under the restrictions given in (*a*) (2) above, but if in A or B construction, they shall have sags not less than those required by Appendix A for No. 8 hard-drawn copper, and where supported by a messenger, the messenger shall have the sags required in Rule 281 *e*. Where supply-line voltage exceeds 7500 volts the twisted pair shall always be supported by a messenger.

(3) The clearances of signal lines above the contact conductors crossed over shall be in accordance with the values given in the table of Rule 220 *b*.

287. Signal Lines Crossing Over or Conflicting With Supply Lines Above 750 Volts (Not Recommended Except Over Trolley Feeders).

(*a*) *Strength of Construction.*—(283 *a*.)—Overhead signal lines crossing over supply lines under the circumstances noted in Rule 233 *e* shall comply with the construction requirements of grade A, B or C as required in that rule. (See Rule 289 for signal lines used in the operation of supply lines.)

(*b*) *Compliance With Other Rules.*—(283 *b*.)—Where signal lines crossing over supply lines are required to comply with grade A, B or C construction, they shall comply as to conductor sizes, materials and sags and as to materials and strength of supporting structures and attachments with Section 24; as to separation and clearances of conductors and wires of the signal lines themselves with the requirements of Section 22; as to guys and their insulators with the requirements of Rules 212 and 213, and in general with the requirements of Sections 20 and 21.

(*c*) *Where Concerned Also With Railways.*—(283 *c*.)—Where the signal lines referred to in (*a*) above are required to comply with grade C construction and also cross over railways under circumstances calling for compliance with grade D or E construction requirements for the signal lines, the requirement for grade C construction may be waived as to strength of supports, being replaced by those of grades D or E, but grade C requirements apply as to size and sag of conductor. (See Rule 285.)

(*d*) *Pole Clearance.*—(283 *d*.)—The pole or tower structures of each line concerned in the crossover shall have clearances from the conductors of the other line as required by Rule 221 or 227, whichever applies.

(*e*) *Wire Clearance Above Supply Lines.*—(283 *e*.)—The clear space between the lowest overhead signal-line conductor (or guy, messenger or span wire) crossing over any supply line conductor or guy, span or messenger wire* shall not be less than given below, at 60 deg. F. with no wind

*Except for crossings between conductors and guy, messenger or span wires on the same pole, for which see Rule 220b.

where the upper conductor or wire has fixed supports, and the sum of the distances from the point of intersection to the nearest supporting structure of each span does not exceed 100 ft.

	Feet.
Signal lines above supply conductors below 7500 volts....	4
Above supply conductors 7500 to 50,000 volts...........	6
Above supply service conductors........................	2
Above supply guy, messenger, and span wires............	2
Guy, span and messenger wires above supply conductors below 750 volts..	2
Above supply conductors 750 to 7500 volts...............	4
Above supply conductors 7500 to 50,000 volts............	6

(*f*) *Clearance Increases.*—(Replacing 283 *f* and *g.*)—Clearance increases for long spans and high voltages are given in Rule 220 *b*.

(*g*) *Falling Trees.*—(283 *h.*)—The crossing span and the next adjoining spans, so far as practicable, shall be kept free from overhanging or decayed trees, which might fall into the line. (See also Rules 209 and 220 *d.*)

(*h.*) *Special Longitudinal Requirements.*—(283 *i.*)—For special requirements for longitudinal strength of crossover supports of signal lines crossing over supply lines, where compliance with grade A or B is required for the signal lines, see Rule 249.

(*i*) *Special Short-Span Crossovers.*—(283 *j.*)—For special short-span crossing construction, see Rule 275.

(*j*) *Guys.*—(283 *k.*)—Guys may be used to meet the strength requirements of Section 24 and where used they and their insulators and guards shall conform to Rules 212 and 213

(*k*) *Signal Lines Conflicting With Supply Lines.*—(284 *a.*)—Where signal lines are at higher levels and conflict with supply lines the requirements of (*a*) and (*b*) above apply in general to the conflicting signal lines just as they apply where the signal lines cross over the same supply lines.

Clearances from the poles and conductors of a second line are given in Rule 227.

Requirements for guys are given in Rule 212.

288. *Signal Lines Alone (or Concerned Only With Other Signal Lines).*

(*a*) *Fire-Alarm Lines.*—Conductors used for fire-alarm circuits shall comply with the requirements of Rule 285 for grade C signal lines.

Where carried at higher levels than supply conductors in crossings, conflicts or common use of poles, they shall comply with grade A, B or C construction requirements according to Rule 233 *e*.

(*b*) *Other Signal Lines.*—Conductors for signal lines other than fire-alarm lines, unless crossing at higher levels or conflicting with, or on the same poles above supply (or trolley) lines, need not comply with any requirements as to size, material or sag.

(*c*) *Supporting Structures for Signal Lines.*—The poles used for other signal lines, unless exposed to supply (or trolley) lines by crossing above, conflicting with, or being carried above the supply lines on the same poles, need not comply with any requirements as to strength and material except that poles and crossarms shall be of such initial size and so guyed or braced where necessary as to safely withstand the vertical loads to which they may be subjected, including linemen working on them.

In other respects all signal-line supports shall comply with the general requirements of Sections 20 and 21 covering traffic guards, pole clearances, guys and other matters.

(*d*) *Clearances Above Ground* (see also Rule 220 a.)—Signal conductors alone and their guys, span wires and messengers shall have clearances above streets, highways, alleys or generally accessible spaces across or along (and above) which the former pass, not less than the following at 60 deg. F., with no wind, when the spans do not exceed 150 ft.

Signal lines, or guy, span or messenger wires:	Feet.
Above streets and other traveled roadways............	18
Along roads in rural districts...........................	15
Crossing above spaces or ways accessible only to pedestrians	10
Above roadways to residence garages....................	10

The clearances do not apply to guys not carried over roadways, or to guys along one side of a street or alley, unless over driveways. For guys on private right-of-way, or parallel to sidewalk curbs, when not passing over pathways or roadways, no clearance is required; and if passing over only pathways the clearance may be reduced to 8 ft.

For signal-line spans over 150 ft. these clearances shall be increased at the rate of 1 in. for each 10 ft. excess.

(*e*) *Clearances From Other Signal Lines.* (*See also Rule* 220 *b.*)—Signal conductors and their guy, span or messenger lines concerned in crossings, conflicts or common use of poles with other signal lines only shall have a minimum of 2 ft. clearance from those of other lines.

Except for fire-alarm lines this may be reduced where desired, unless one set of conductors is for public use and the other is used in the operation of supply lines.

(*f*) *Grounding, Isolation or Protection.*—Signal lines, including fire-alarm lines, if at any point in their course exposed by supply (or trolley) lines over 400 volts to ground, shall be protected at each station for public use by one of the methods specified in Part III, Section 39. These lines shall elsewhere be isolated by elevation or otherwise guarded so as to be inaccessible to the public.

Signal lines used in the operation of supply lines shall be at all points isolated by elevation or otherwise guarded so as to be inaccessible to the public.

Metal-sheathed cables and messengers shall be isolated or grounded in conformity with the general requirements of Section 20.

289. *Signal Lines Used Exclusively in the Operation of Supply Lines.*

(*a*) *Under Other Lines.*—(210 *c* and 288 *g.*)—Such signal lines when (1) crossed over by, or (2) having conflicting with them, or (3) on common poles and below, high-voltage direct-current trolley circuits or other supply lines in the operation of which they are used, may be considered and run as ordinary signal lines if (1) the signal lines do not cross over or conflict with, and are not on common poles with and higher than other lines or equipment, and (2) the signal lines and connected equipment are adequately guarded and accessible only to authorized persons, and (3) the precautions of Sections 39 and 54 have been taken.

The supply lines concerned above are not required by the conditions described to comply with the requirements of Sections 25 and 27 as to strength of construction, but the conductors shall be not smaller than permitted by Rule 286.

(*b*) *Over Other Lines.*—(210 *c* and 288 *g.*)—Such signal lines, if crossing over, conflicting with or higher on common poles with other lines or equipment shall comply with all the requirements for the highest voltage supply lines not over 7500 volts with which the signal lines may come in contact, except as to wire sizes for grade C, for which see Rule 285. If, however, the signal lines are protected by fuseless lightning arresters, drainage coils, or other suitable protective devices to prevent the signal-line voltage from normally exceeding 400 volts to ground, they may be run as ordinary signal lines. The method used shall be consistently adhered to throughout the extent of the signal system.

Discussion on Voltage Classification for Power Lines Over Signal Lines.

The grade of construction required for supply lines where crossing over signal lines is given in Rule 214 of the present edition of the National Electrical Safety Code as follows:

Constant-potential alternating-current supply lines of over 7500 volts are placed in grade A; between 5000 and 7500 volts they are placed in grade B; between 750 and 5000 volts they are placed in grade C. Direct-current grounded trolley circuits of over 750 volts are classed in grade A, but other direct-current circuits do not require a definite grade unless they are constant-current circuits. Such circuits are classed according to the value of the current.

Where the crossing of the supply line is over individual twisted-pair drop wires only, or over other unimportant circuits only, the above grading does not apply if effective protection is otherwise secured. Grade B may be submitted for grade A whenever the signal line is restricted to four wires used mainly for local exchange service, where it carries only subscribers' loops or where it carries only two unimportant commercial telegraph wires.

According to definition 6 the voltage stated above means the highest effective voltage between the conductors of the circuit. When one circuit is directly connected to another circuit of high voltage, both are considered as of the higher voltage unless the circuit of lower voltage is permanently grounded.

Examples.—Except for the cases of unimportant wires noted above, the interpretation of these rules in special instances is as follows: An 11,000-volt, three-phase circuit calls for grade A construction in all cases. If it is star-connected and a single-phase tap of approximately 6600 volts between one phase wire and neutral is run off from this system, this tap would call for grade A construction if ungrounded, but for grade B construction if the neutral wire were grounded. A 6000-volt single-phase circuit run directly from a single-phase transformer or a generator would call for grade B construction whether grounded or not grounded. The same would be true of a three-phase circuit with 6600 volts between the line wires whether delta or star-connected and whether grounded or ungrounded.

Revised Rule.—Telephone engineers claim that the hazard occasioned by the contact of supply wires with telephone conductors is dependent upon the voltage of the supply wires to ground and that, wherever grounded circuits are considered, the grade of construction required should consequently be based upon the voltage to ground rather than upon the voltage between the separate wires of the circuit. This claim appears to be substantiated by the operating experience of telephone companies and is in accord with the means utilized to protect telephone equipment and persons handling it from supply-line voltage which may be superposed upon the line wire.

It has consequently been proposed to change the wording of present Rule 214 so that the grade of construction required for a supply line crossing over or in conflict with a signal line will be expressed in the following manner.

"Constant-potential alternating-current supply lines of over 7500 volts between conductors or 4400 volts to neutral or ground * * * crossing over, conflicting with or having common poles with signal lines, shall comply with the construction requirements of grade A."

Similarly 2900 volts to ground would be stated as the equivalent of 5000 volts between wires, and 440 volts to ground would be stated as the equivalent of 750 volts between wires, in classifying the supply lines as to grade of construction required.

Effect of This Change.—By referring again to particular cases, it will be seen that the change in classification will make a difference when applied to single-phase grounded circuits. For instance, an independent single-phase 6600-volt circuit if ungrounded would still require grade B construction, but if grounded on one side it would now require grade A construction. This is true also if it is derived from a three-phase star-connected 11,000-volt circuit with neutral grounded. A 6600-volt single-phase circuit derived from a delta-connected three-phase 6600-volt circuit and representing one phase of the same would require grade B as before, but if one wire of the delta three-phase line should be grounded the grade of construction is raised to grade A. In practice high-voltage delta-connected circuits are seldom grounded so that such a case is of little practical importance. For ungrounded circuits the requirements would remain as heretofore.

For star-connected grounded circuits the grade of construction required remains as before where all three-line wires are involved, but it is raised for a single-phase tap from such a grounded circuit. This is the particular instance which requires most serious consideration because it will most frequently arise. The hazard which such a circuit presents to a signal line with which in case of failure it may become crossed is regarded to be the same as in the case of a failure of the entire three-phase line from which it is derived, and it consequently seems reasonable to make the same requirements as to the strength of construction since the purpose of a definite strength of construction is to avoid the contingency of such failure and resulting contact.

Summary.—1. The construction required for direct-current circuits will not be altered by the proposed changes in the rules. 2. The construction for any ungrounded circuits will not be altered. 3. Single-phase circuits grounded on one side, whether run separately or derived from three-phase star-connected grounded circuits, will be raised one grade in requirements if coming within certain limits, where signal lines are exposed. For example, a 6600-volt single-phase branch from a four-wire 11,000-volt main would be grade A where signal circuits are exposed, instead of grade B as heretofore.

This change in classification seems reasonable in order to more adequately meet the hazard actually involved and place the classification upon a more logical basis than in the previous edition.

A NEW STEAM-ELECTRIC POWER PLANT AT LUMBER MILL.

Addition of 3200 Hp. in Motors in Large Bellingham Lumber Mill Requires Power-House Extension.

The Bloedel-Donovan Lumber Co., of Bellingham, Wash., has had plans prepared and has begun work on a new power house, by which provision will be made for an additional motor load of 3200 hp. Its lumber plant, which comprises sawmill, planing mill, box factory and sash and door factory, is operated partly by steam and partly by electricity.

A new boiler and turbine house of reinforced concrete and steel will be built for housing two Allis-Chalmers generating units of 2000 kw. and 1000 kw.; a 500-volt motor-generator set, the necessary exciter sets, and a 13-panel switchboard. Barometric condensers will be provided for both turbines. The condensing water will flow by gravity to the cold well, the circulating pumps to be set over that well.

The 1000-kw. generator to be installed is now in use, and will be moved from the old power house to the new one; the 2000-kw. generator is a nearly new machine that formerly was operated in a cement plant. This is a 2400-volt, 1800-r.p.m. unit, the 1000-kw. unit being for 480 volts, and 3600 r.p.m. The plan is to connect the two units together through a bank of three 350-kv-a. transformers, whereby all motors of 50 hp. and higher will be operated at 2200 volts, and motors below that capacity at 440 volts. Direct-current energy at 500 volts will be produced by means of the motor-generator for an electric railway operating on the premises.

The old wooden boiler house, which contains Stirling and Badenhausen boilers, will be enclosed in a larger structure of reinforced concrete, affording room for B. & W. boilers of 2000 hp., which will be installed. "Hog" fuel storage bins are to be built above the new boiler house, and conveyors will be installed to carry the fuel to the bins and to the boiler-furnace hoppers. Several storage-battery trucks are to be ordered for yard service.

The construction of boiler and generator buildings, and the installation of new equipment are in the hands of Chas. C. Moore & Co., with A. F. Blair as consulting engineer. Geo. T. Thirsk, electrical engineer, of Seattle, made designs for the electrical installations and will supervise them.

Editorial Comment

City and State Utility Regulation

THE outrageous bungling with which our average municipalities handle public utility matters is again coming into strong contrast with the sensible procedure followed by our state public service commissions. For example, if street-car fares were left to the dictates of our demagogic city politicians, they would remain at the old five-cent level, even though much higher wages of the crews and other increased costs and burdens are driving the traction companies into bankruptcy. As a result of municipal blundering one large city was without street-car service for a month and in almost countless other cities the companies are in dire straits or actually in the hands of receivers. As if this muddling were not bad enough, many city officials are advocating municipal ownership of traction lines; in one city a commission has just been appointed to waste $250,000 in drawing up plans for a municipal traction system and not one of the commissioners is versed on traction matters.

In striking contrast is the orderly manner in which those state commissions vested with authority on traction fares have gone about revising these up or down as conditions require. Obeying the findings of the courts that the regulatory powers of the state are superior to any implied fixity of franchise rates, they make an unbiased investigation and, if this discloses existing rates as too low or high for rendering good service and allowing reasonable return on the investment, the rates are adjusted to suit. In view of the fairness of this regulation to all concerned, any effort to curtail state regulation and restore city control should be strongly opposed.

Customer Ownership of Utility Stock

NOT many years ago it was quite prevalent among public utility corporations to regard the public as a sort of avowed enemy. The reason for it was simple enough. Most institutions that serve the public learn, through the petty bickerings, attacks and complaints of individuals that go to represent the public, to acquire a genuine disrespect for it; and this in spite of the fact that the public is the only source of income for the utility.

It is a common instinct for people to return like for like. Disrespect breeds disrespect. So the disrespect between the public and the utilities was mutual. It was due chiefly to misunderstanding and lack of knowledge of each other, that is, to absence of community of interests.

With the latter in view, several central-station companies inaugurated about two years ago the practice of offering shares of their stock or other securities to their customers. Since that time a large number of the representative public utility corporations have followed this lead, and from time to time announcements are made of companies adopting the plan.

Customer ownership has proved advantageous for a number of reasons. For the central station it is an excellent builder of good will, which is now considered necessary to the successful operation of a public utility; customers owning stock are more appreciative of the service and are better prospects for additional appliances and load; customer ownership helps partly to solve the question of securing additional capital. For the customer, purchase of public utility stock usually proves to be an excellent investment.

It is gratifying to note the change of attitude that is developing between the public and the central stations. Another hindrance to progress is thus being eliminated.

Electrical Christmas Decorations and Wiring

SANTA CLAUS without the Christmas tree and the fairy lights of varigated color would hardly be a real Christmas, such as all of us that are now grown up look back upon our childhood days with fond recollection and treasured memory, such as the little ones of today await in the expectancy of hope and joy of innocent youth.

Every Christmas brings its list of accidents and tragedies because of fires, starting from naked flames or sparks around the Christmas trees and seasonal festoon. Every naked flame from candle, or oil or spirit lamp, and every match used around the flimsy decorations is a fire hazard. And many of the hazards materialize every year, to turn joy and merriment to sadness, suffering and death. Every electrically illuminated Christmas tree is a safety measure, every electric lamp that replaces an oil or spirit lamp and the tallow candle makes the danger of fire less.

Electrical interests in selling Christmas tree lamps and fittings have a magnificent opportunity to further the gospel of safety. That such decorations are installed instead of other dangerous types is an immense gain for the cause of safety. Safety should be made still safer, however, by careful workmanship and due regard to the essentials of electric wiring. And that this may obtain is largely a matter of education and publicity.

The electrical industry has a very great responsibility in advocating and encouraging the electrical Christmas decorations. But it has a further moral responsibility of advocating safe wiring methods and the practice of common-sense precautions.

Current Events

New York Section, A.I.E.E., Organized—O.E.L.A. Holds One-Day Meeting — Rural Line Extensions in Wisconsin

A. I. E. E. SECTION TO BE ORGANIZED IN NEW YORK CITY.

Meeting Held on Dec. 10 to Make Arrangements for Organization of Local Section in Metropolis.

The question of organizing a New York City Section of the American Institute of Electrical Engineers has been discussed informally from time to time for several years past, but, as most of the monthly Institute meetings were held regularly in New York City, the need for a local organization was not so urgent as in the other cities of the country. In recent years, however, it has become more and more the custom for some of the Institute meetings to be held in other cities. The growth of the Institute membership and the industrial developments throughout the country make it more essential that in order better to fulfill its function as a national organization, an increasing number of meetings of the Institute, in addition to regular section meetings, must be held in the various cities of the country.

This year, for example, an Institute meeting was held in Philadelphia in October, and others will be held in Chicago, Pittsburgh and Boston, during the months of January, March, and April, no meetings having been arranged to be held in New York City during those months. In order, therefore, that monthly meetings may be held in New York City whenever the Institute meetings are held elsewhere, it is considered essential that a local section be formed, thus placing the New York City membership on the same basis with relation to the Institute as the membership in other parts of the country.

At a meeting of the Board of Directors of the Institute, held Nov. 14, a petition, signed by over 100 members in New York City and vicinity, was presented for authority to organize a section to be conducted under the same general plan as the other 34 sections of the Institute. The directors approved the request and a special meeting for the purpose of organizing, electing officers and taking such other action as was deemed desirable was held in the Engineering Societies building, 29 West 39th street, at 8:15 p. m. Dec. 10.

SPECIAL MEETING OF OHIO ELECTRIC LIGHT ASSOCIATION.

Association Revenues Increased—Safety Code, Fire Marshal's Orders and Legislation Discussed.

At the call of its Executive Committee a special one-day meeting of the Ohio Electric Light Association was held at Miami Hotel, Dayton, Ohio, on Dec. 3. Vice-President F. H. Golding presided because of the inability of President C. H. Howell to attend. About 200 representatives of central-station companies were present. Secretary D. L. Gaskill presented an amendment to the constitution increasing the dues of member companies so as to strengthen the financial resources of the association and enable it to broaden its work in spite of increased costs. After discussion and revision it was adopted. It provides for payment of one-eightieth of 1% of the gross annual receipts, with minimum charges of $5 for towns of 2000 and less, $10 for cities of 2000 to 5000, $25 for those of 5000 to 20,000, and $50 for cities of over 20,000; where companies serve more than one municipality the aggregate population of the cities served is to be taken in determining the minimum charge. It is estimated that the annual income from member companies will be raised from $1754 to $5327 by the change.

There was some discussion of the proposed changes in Part II of the National Electrical Safety Code, containing rules for construction of overhead lines. H. W. Hough, of Cleveland, presented a report of the meeting held at Philadelphia on Oct. 27 to 29 and attended by representatives of the Bureau of Standards, National Electric Light Association and other central-station interests, the object of which gathering was to discuss the proposed changes in these rules.

The recent orders of the Ohio fire marshal calling for inspection of electrical installations of all premises before central stations furnish service thereto, and also requiring safety inclosed switches for service and other locations came in for considerable spirited discussion.

Legislation pending before the Ohio Legislature that affects central stations was reviewed by Secretary Gaskill. One bill proposes to assess part of the cost of street lighting of special character on the abutting property owners. Another bill would allow the State Utility Commission to postpone any proposed rate increase after same and the reasons for it had been filed by the utility company.

As to the coal situation most of the Ohio central stations reported they were in fairly good condition; although some of them had only a few days' supply on hand, they were able to secure more as needed. W. W. Freeman, of Cincinnati, who was assisting the regional coal administrator of that district, urged that the central stations use their best judgment in coal conservation and refrain from bothering the coal administrators unless absolutely necessary.

WISCONSIN CONFERENCE ON RURAL LINE EXTENSIONS.

Meeting Held at Madison to Discuss Formulation of a General Policy on Rural Line Extensions of Central Stations.

At Madison, Wis., there was held on Nov. 21 a conference of utility interests, rural customers and others interested in the extension of electric light and power lines into rural districts. The meeting was called by and held in the rooms of the Railroad Commission of Wisconsin.

The conference was not as successful as was wished, although there was quite a large attendance from all parts of the state. The question of rural extensions and use of electricity by the farmers has come to the fore very rapidly in the last two years due, no doubt, to the unprecedented prosperity of the agricultural districts. This demand for service has come at a time when all utilities were suffering from the financial stringency and were practically unable to secure capital to make needed extensions. It was recognized and was admitted by all utility operators that the most satisfactory method of extending this service would be to have the work done at the expense of the utility. Practical considerations at the present time make this out of the question.

Two methods have been followed in Wisconsin. By the first the utility has made the extension where the cost of it has been borne by the farmers to be served. The result of this method has been that the farmers on a line extending, say, east from the utility, would receive service at an initial expense of $250 each, while the farmers residing, say, west of the utility would be obliged to pay $350 or $400 each due to the fact that their district was more sparsely settled than the district on the other side of town. Another serious objection has been that there might be 12 possible customers on the proposed line, 9 of whom would contribute to the cost of its building. The other three farmers, although refusing to contribute to the initial cost of the line, would demand in many cases and would be able to force the utility to give them service since the utility is a public service corporation and has facilities for serving such farmers passing alongside their farms. In selling energy to rural customers, if the expense of constructing the line has been borne by such customers, the utility has usually put into effect the urban rate modified in some instances by a higher minimum monthly charge.

The other method which has been followed to a considerable extent in Wisconsin has been for the farmers in a certain district wishing to receive electrical service to incorporate as a distributing company, the prospective consumers taking stock enough to cover the cost of building the proposed line. This distributing utility purchases its energy on a wholesale rate at the city limits and in turn bills it to its customers at a higher rate planned to include the ordinary distribution and operating expenses of the farmers' utility. This has resulted in farmers usually paying a higher rate than was charged by the local utility in the city and has also been open to the objection that certain farmers would refuse to become stockholders and yet demand and be entitled to receive service from the company.

At the conference, the utility operators who were present were quite unanimous in their opinion that the present rates for rural electric service in effect are unremunerative and in fact throw a burden upon the urban consumers of making up the deficit arising from the operation of the rural business. The representatives of the farmers and consumers and the representatives of the farmers' distributing companies who were present agreed that the rates for rural business ought to be compensatory and that no burden should be thrown on the urban customers by reason of rural service. The rural distributing companies that have been formed aim in their rates to cover merely operation and provide no return on the investment.

It was pointed out that, if the rate were made sufficiently high to cover a return on the investment, they would then be able to sell their stock on an investment basis and could offer service on equal basis to all prospective customers who applied, whether stockholders or not. One suggestion was made that in both cases the utility should establish a consumer charge which should be equal to the interest charge upon the investment per consumer and that, where the consumer was a stockholder, or where the consumer had contributed his proportion of the expense of constructing the line, this consumer charge should be waived. It was claimed that this would place the nonstockholder and the farmer who refused to contribute to the cost of building the line on the same basis with stockholders and those who did contribute.

All of these plans have ignored those elements of the excess cost of rural service over urban service, such as increased depreciation per customer, increased maintenance per customer, the increased line losses due to the fact that there are fewer customers per mile of line, increased transformer losses due to fewer customers per transformer, etc.

It was agreed when the meeting adjourned that those present should formulate their experience and views and submit them to the commission which would then make a study of the matter presented and, if feasible, have printed in pamphlet form a summary of this information together with such recommendations or proposals as the Commission might deem advisable. In calling this conference it was not the Commission's idea that it would be able to put into effect any hard and fast rule governing rural extensions. It was thought, however, that it might perhaps establish some general principles which would govern the formulating of such rules.

TORONTO CONTRACTOR-DEALERS HEAR ADDRESS ON CO-OPERATION.

At a meeting of the Toronto (Can.) District of the Ontario Association of Electrical Dealers and Contractors, held in Toronto Nov. 24, at which there were present 50 members of the association besides representatives of the Toronto Hydro-Electric System and Hydro-Electric Commission of Ontario, James M. Wakeman, general manager of the Society for Electrical Development, gave an address on cooperation in the electrical industry. He outlined the activities of the Society for Electrical Development, told what it had done in the United States and explained its ability to render similar service in Canada. The Society has among its Toronto members the Hydro-Electric System and the Canadian General Electric Co., besides a number of the largest and most progressive contractor-dealers.

Among other suggestions Mr. Wakeman made were the establishment of an electrical page in a leading Toronto paper and the holding of an electrical exposition in Toronto early next year, with the possibility of having a building devoted entirely to electricity at the great Canadian National Exhibition held each fall in Toronto. These suggestions met with the approval of the meeting and steps were taken to form a committee to perfect the plans.

After Mr. Wakeman had spoken, H. H. Couzens, general manager of the Toronto Hydro-Electric System; C. H. Wilson of the Apex Electric Appliance Co.; George J. Beattie, well-known Toronto contractor-dealer, and Kenneth McIntyre, secretary of the Association, all spoke, expressing their appreciation of the good work the Society has done for them.

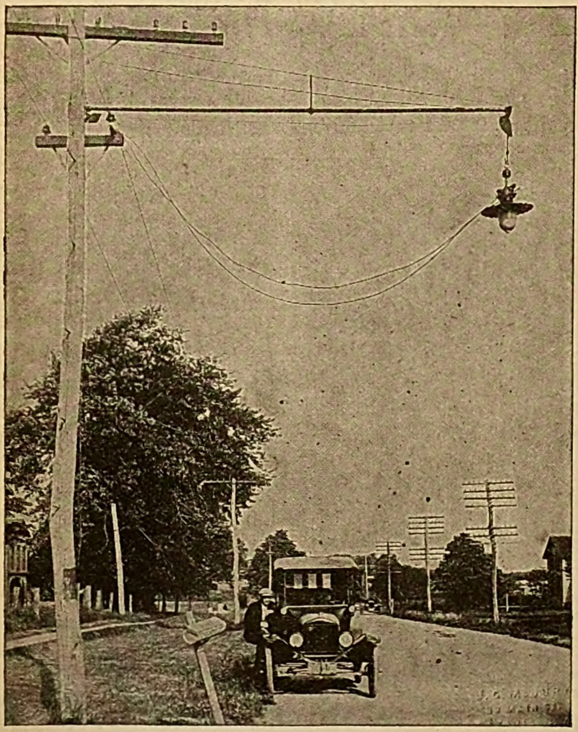
Commercial Practice

Better Highway Illumination—Municipal Christmas Tree Lighting — Electricity for Heat Treatment of Metals

NECESSITY FOR BETTER LIGHTING OF COUNTRY ROADS.

Trend of the Times Shows Need for Extensions of Lighting to Country Roads—Field for Central-Station Commercial Departments.

The matter of providing illumination for our country roads has been given scant consideration in the past because the need for it has never been seriously felt. The rural roads of today are far different from the rural roads of yesterday. There are conditions existing which demand a better and higher grade of illumination. The great volume of automobile traffic not only demands better illumination from the standpoint of safety to the tourists and pedestrians but also for greater convenience and comfort in traveling. A large number of country roads are narrow and in



Mast-Arm Fixture Suitable for Lighting Country Roads.

order to permit drivers of the various vehicles to pass one another without a collision a reasonable amount of illumination is indispensable. Where the roads are rough and in poor condition, illumination should be provided to help the tourists avoid mudholes and irregularities. This is particularly true in bad weather or after heavy rains when ruts and mudholes are quite common even on the best roads.

One of the main reasons for the retarding of rural lighting is the wrong impression that it would be a very costly and expensive venture. However, under present-day methods of efficient and economical distribution of power, the expense is comparatively small.

In many cases the roads already carry cross-country transmission systems from which power may be taken, and by means of small regulating transformers mounted on the poles the high-voltage transmission may be reduced to voltages suitable for operating small circuits of lamps connected in series and covering several miles of country road. Fixtures of an inexpensive design, with or without glassware, may be used. They should be placed by means of long mast arms, as shown in the accompanying illustration, or by cable strung across the road from post to post, so that the light is well out toward the center of the road where it cannot be obstructed by trees. These fixtures require little attention other than the occasional cleaning of the reflector and renewal of lamps. The entire system may be operated automatically by means of a time switch controlling the regulating transformer, so that no personal attention is needed other than the winding of the clock once in 8 days. In this way a system may be operated at a relatively low first cost and with a maintenance expense consisting mainly of power cost and lamp renewals.

It should not be expected to have a uniform intensity of light attained throughout, because the spacing distance would of necessity be relatively large and direct illumination over the entire area would be out of the question. The silhouette principle may, however, be used to good advantage under these circumstances. The lighting creates a light background on the road surface against which dark objects intervening along the road are shown up in relief. The nature and location of the object may be discerned by its dark outline against the light background. While this type of illumination does not enable one to discriminate or to observe the details of an object in the road, it is at least possible to see enough of it to avoid collision and increase the safety and convenience of travel.

In some cases prismatic refracting glassware can be used to good advantage. The refractor prisms send the light rays into useful directions and cause them to be distributed more extensively along the length of the road. Their function is to make the light intensity more nearly uniform over the entire area to be lighted.

The illustration shows a type of fixture very suitable for road lighting. It is a 20-in. radial-wave reflector streethood body equipped with a diffuser and may be used with lamps as large as 600 cp., consuming approximately 350 watts. The long mast-arm serves to bring the light well into the center of the road, making it possible for the light to be utilized for a considerable distance over the road. Another type of fixture consists of a streethood equipped with a cable clamp for mounting in the center of the road on a cable strung across the road between posts. This is a less expensive method of removing the light from the obstruction of trees hanging over the road, but it has the disadvantage of not being so readily accessible as the mast-arm fixture where the lamp may be lowered to the road for cleaning or renewal by means of the lamp rope and pulleys.

ADVANTAGES OF ELECTRICITY IN HEAT TREATMENT OF METALS.

In presenting the argument for the use of electricity for heat treatment of metals, the central-station salesman can enumerate the following advantages of the electric resistance type furnace, which were compiled by C. A. Winder, industrial heating engineer, General Electric Co.

(1) Their automatic operation greatly reduces the labor cost and does away with the human element, an uncertain thing at all times.

(2) The upkeep of an electric furnace is extremely low and its life very long.

(3) It is possible to obtain a neutral or reducing atmosphere meaning decreased oxidation of the product.

(4) Rejects are practically eliminated often effecting a saving of thousands of dollars.

(5) Experience has demonstrated that gear blanks which have been treated in the electric furnace can be machined 20% faster than heretofore.

(6) Working conditions in a heat treating room equipped with electric furnaces show a great improvement over others due to a lower temperature of the room and the absence of fumes and noise.

(7) Floor space, which is always an item to be considered, is reduced to a minimum on account of the absence of piping, storage tanks, etc.

(8) A reduced fire hazard as a medium for lower insurance rates; again a saving in actual dollars and cents is effected.

The General Electric Co. has equipped heat-treating furnaces in sizes varying from a small car type furnace 4 ft. long, 3 ft. wide and 2 ft. high having a connected load of 18 kw. and a maximum operating temperature of 1800 deg. F. to a vertical cylindrical furnace 34 ft. deep by 7 ft. 6 ins. diameter with a connected load of 750 kw.

ILLINOIS CENTRAL STATION GETS INCREASE IN RATES.

An increase in rates for electric service has been granted to the Athens (Ill.) Electric Light & Power Co. in an order issued by the Public Utilities Commission. The new rates are: For the first 50 kw-hrs. per month, 11 cents per kw-hr.; for the next 250 kw-hrs., 8 cents; over 300 kw-hrs., 6.5 cents. A minimum charge of 50 cents per horsepower of connected load is fixed, no charge to be less than $1 per month per customer.

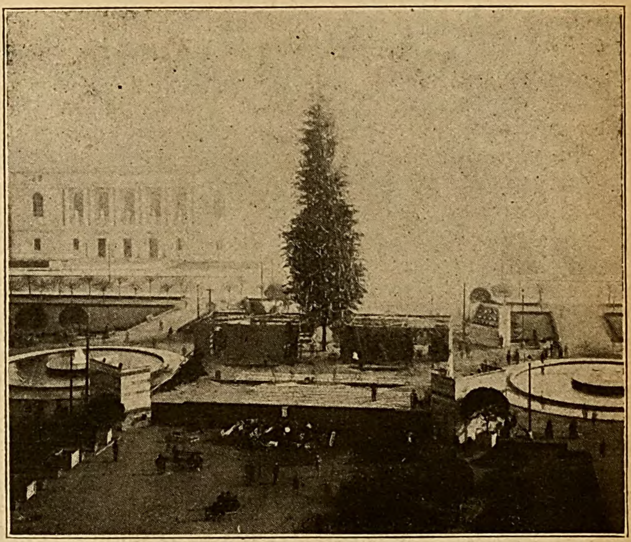
CREDITABLE SPEED IN CHANGING FROM STEAM TO ELECTRIC DRIVE.

The Southern Wood Preserving Co., Georgia, operated its own steam plant, used not only for power purposes but also for producing steam in their operations. The steam engine broke down, immediately interrupting all shafting. Asked to render assistance, the Georgia Railway & Power Co. investigated the situation and the layout of the plant. On the Saturday morning apparatus was ordered and the utility got under way to deliver service. The following Tuesday morning the plant was working again, after two days of interruption, and has been working ever since.

ILLUMINATED CHRISTMAS TREE AT SAN FRANCISCO.

Municipalities contemplating the installation of a Christmas tree in connection with a civic celebration of Yuletide can obtain valuable suggestions from the installation of a tree that was erected in the San Francisco civic center and which was a part of the Christmas eve celebration last year.

The tree was 150 ft. in height and was decorated with 10,000 jewels from the tower of jewels at the Panama-Pacific Exposition. The tree and jewels were illuminated by powerful searchlights placed on the roofs of adjoining buildings and in addition 100 flood-



View of Civic Center at San Francisco, Showing Platforms for Installation of Lighting Projectors for Illuminating Christmas Tree.

lighting units, installed on elevated platforms near the tree, were used to make the lighting effective.

Telephones played an important part in directing the pageant held in connection with the celebration. It was necessary to install a switchboard and a large number of transmitter and receiver sets at various points of the civic center. These were also used in directing the illumination of the tree.

PROVIDING FACILITIES FOR FUTURE POWER REQUIREMENTS.

A good illustration of the advantages to be gained by using foresight in planning for transformer station equipment is given by the case of the Eastman Kodak Co., Rochester, N. Y. About two years ago the company contracted with the Rochester Railway & Light Co. for a maximum demand service of 500 kw. With good exercise of foresight, a transformer vault much larger than was needed was installed. Now, with the approaching completion of a new factory building this service is to be increased to 1200 kw., which can easily be done simply by the installation of additional transformers in the vault. The money saved in planning and construction will more than offset the first cost and aid investment charge on the vault, and there is still room in it to take care of future requirements for a long time.

Operating Practice

Transformer Cooling—Underground Steam Lines—Safety Barriers—Mixing Solid Fuels—Air Supply—Condensers

AUTOMOBILE RADIATORS INCREASE TRANSFORMER CAPACITY.

Georgia Railway & Power Co. Follows Interesting and Unique Practice to Increase Capacity of Large Transformer Bank.

The Georgia Railway & Power Co. connects up with the Tennessee Power through a bank of tie-in transformers of 3000 kv-a. capacity at the Lindale substation owned by the latter company. As it became necessary to take additional quantities of power from the Tennessee Power Co.'s lines it was found that the tie-in bank of transformers was running very hot. The average overload varied between 125 and 150%, so it became necessary to provide additional cooling or higher rate for the dissipation of heat.

The method employed by the Georgia Railway & Power Co. to increase the capacity of the existing transformers was very ingenious and has so increased the safe current-carrying capacity of the transformer bank that 125 to 150% can be carried continuously. Six radiators from Ford cars were mounted close to the transformers and connected in multiple between a 3-in. over-flow pipe at the top of the transformers and a 2½-in. discharge pipe at the bottom of the transformers. A centrifugal pump was connected in the discharge pipe line, this pump being motor driven. The pump forced the oil in the bottom of the tanks under pressure and out of the top, where it was then forced through the six Ford radiators back to the transformers again. Another motor, driving a blower was so located that the air current passed along and through the radiators. The air was humidified before passing over the radiator surface, in this way still further lowering the temperature of the oil.

With the above installation the company was able to pass 150 g.p.m. through the transformers, equivalent to 216,000 g.p.m. every 24 hrs., and by so doing have been enabled to keep the temperature of the transformer oil down to about 40 deg. C. with the transformers carrying 150% of load continuous. A similar outfit is being used by the Georgia Railway & Power Co. where they tie-in with the Columbus Power Co. at the Newman substation.

FACTORS IN INSTALLING UNDERGROUND STEAM LINES.

Recommendations by Wisconsin's State Power Plant Engineer for Reliability and Economy of Maintenance of Underground Steam Lines.

Pipe lines for the transmission of steam and hot water should be installed with greater forethought and care to detail when installed underground than when laid in tunnels and buildings where they are reasonably accessible for inspection and maintenance. When laid in ground, deterioration and failure is only brought to light by failure, which usually occurs during the winter when the demand for service is most pressing and the difficulties for making repairs are greatest.

John C. White, power plant engineer for the state of Wisconsin, recommends careful attention to the following features, if service at the least cost and service of the highest continuity (often compatible with low cost) are to be obtained:

(1) Correct design of piping and construction suitable to the conditions encountered.

(2) The pipes should be protected by a conduit not easily displaced nor broken, and one that is not affected by the temperatures to which it is subjected nor by the character of the soil in which it is laid.

(3) The pipes should be so anchored and supported that their position is assured and that freedom of movement under their temperature changes be ample.

(4) Steam and hot water lines should be so insulated that the heat loss is reduced to the economical minimum, and the insulation should be so applied that it will not be displaced by the movement of the pipes under temperature changes.

(5) Drainage should be such that the pipes are always protected from water, either dripping from above or rising about them, and it should be possible to determine their condition at any time by inspection at manholes or outlets.

(6) The arrangement of the pipes in the conduit should be such that any one of the lines may be removed and replaced without disturbing the others. It is desirable also that a renewal can be accomplished by releasing at anchors and connecting points and uncovering only such length of the conduit as may be necessary to permit withdrawal and replacement.

(7) Steam pipes should be so pitched and drained that they are always free from water.

SAFETY PANEL TO PREVENT EXPLOSION IN TRANSFORMER COMPARTMENTS.

Pertinent Features in Protecting Station Buses, Instrument Transformers, Etc., from Accidental Contact and Internal Explosions.

The Philadelphia Electric Co. has done much toward furthering the interests of safety. Part of this work has taken the form of safety appliances, methods and practices. Part has been in the form of education and instruction for, after all, it is the human element wherein lies the greatest weakness and the most danger.

Telling of some of the practices of the Philadelphia Electric Co. before the Safety Congress convening in Cleveland last October, Walter C. Wagner brought out some pertinent facts relating to barriers for segregating buses, potential and current transformers, disconnecting switches, phases, etc.

He advised that barriers should not support live buses or apparatus subject to stress due to electrical disturbance, and, where isolating live parts, should have a minimum of reinforcement consistent with mechanically safe construction. Doors should cover the openings between the barriers, and be designed to be readily removed for access to the compartments covered. Such doors may be painted white pine frames, paneled with impregnated asbestos where they enclose conductor runs and instrument transformers; paneled with clear wire glass in front of disconnecting switches; and built of heavy wire screening where heat radiation necessitates this construction, as in front of reactance coils. Such doors must be of small size, light weight, not easily damaged in handling, and rugged in construction. A pair of handles for detachable wall doors, and detachable hinge supports, should allow ready removal. Where covering ceiling runs, the doors should be permanently hinged, with latches to fasten them in place. A door having a special panel in which a spring-hinged panel is inserted is placed in front of locked current transformer and oil switch compartments, where an electrical breakdown might cause a sudden formation of gases by the Philadelphia Electric Co.

The general identification of the character of equipment by those concerned in the maintenance and operation of electrical stations, should be based on a knowledge of the nature of the construction—namely, the method of isolation, type of barrier, support, and insulation—and of the general characteristics of the apparatus connected thereto. In a system where unvarying practice in arrangement of equipment exists, as a fixed order of phases and number of compartments and apparatus, the relative positions are a further means of identification, especially when clear and adequate, yet simple, wiring diagrams showing physical arrangements of units, apparatus, and circuits should be at hand, and where the more hazardous situations are, in general, made inaccessible by elevation or enclosures.

HUGE VOLUME OF AIR HANDLED BY POWER PLANTS EMPHASIZED.

Provision for Air and Need for Comforts for the Men Brought Out—Velocity of 26½ Miles an Hour Often Attained.

In commending the Electrical Review upon a recent editorial on "Air Supply to the Boiler Room," because of the importance and timeliness of this subject that affects at once the performance of the furnace, the capacity of the plant and the health, comfort and output of the boiler-room crew, O. R. McBride, Andrews-Bradshaw Co., points out the question of air supply assumes greater importance in the larger plants than in the smaller ones.

"In the small plant the question as to how the air gets into the boiler room and thence into the furnace does not assume the importance that it does for the larger plant," says Mr. McBride. "For a single one-thousand horsepower output, 18,000 to 20,000 cu. ft. of air must get into the boiler room per min. At a velocity of 30 ft. per sec., corresponding to, approximately, 26½ miles per hr., the combined area of all openings is quite large. The above, surely, serves to indicate the serious effects of restricted openings upon the action of draft-producing agencies, regardless of whether the draft is due to chimney or mechanical means.

"Comfort of the man in the boiler room is very important. The old idea that a man would become lazy if comforts were provided him has been answered by facts. It belongs in the discard along with the other one that the use of automatic devices makes men careless."

In designing a boiler room it should be borne in mind that human beings must spend a large portion of their lives in it. Make the boiler room habitable—and men who are comfortable are able to put in more time and effort on their work, lay out the station so that the furnaces will not be partially asphyxiated during the cold weather. Install whatever automatic appliances are indicated, that they may accomplish better work than men, alone, can accomplish, but with the intention that comfortable, satisfied men may supervise the entire performance of the boiler room because that is all that remains for them to do.

MIXTURE OF ANTHRACITE DUST AND SCREENINGS LOWERS FUEL BILL.

Saving of Nearly 14 Per Cent Obtained by Mixing Coals with Underfeed Type of Stoker.

A power plant located on the lake front in Minnesota has brought about a considerable saving in its coal bill and at the same time has so far been unaffected by the shortage of bituminous coal resulting from the strike, by mixing anthracite dust and Pittsburgh screenings in the proportion of 40% of the former to 60% of the latter. The plant contains three 228-boiler hp. B & W boilers, served by 3-retort Taylor stokers.

The anthracite dust and screenings when mixed in the above proportion effect a cost saving of 13.5% per ton of coal burned. High combustion efficiencies are obtained and ratings up to about 125% nominal are maintained, the limit being imposed by permissible draft in the wind box, which if exceeded causes the anthracite dust to be blown into the furnace. By using anthracite dust for banking their fires the company is able to make a further saving, the fuel for banked fires being about 15% of the total fuel used.

INFLUENCE OF THE CONDENSER UPON FUEL ECONOMY.

Attention to the Condenser as Well as to Proper Use of Fuel Emphasized.

It should be borne in mind that economies obtained by careful firing and high combustion efficiency may be counteracted and neutralized through careless operation and maintenance of the condenser. In other words, efficiency in production of steam may be made very largely ineffective by inefficiency in the utilization of the steam. Dirty tubes and leaks will lower the vacuum, and the lower the vacuum the higher the coal consumption per pound of steam, requiring a greater power input to maintain it. Boiler-room instruments are a good investment when used intelligently. So are instruments for indicating the vacuum. Conditions change rapidly in the furnace and one must be ever on the alert if combustion efficiency and operating economies are to be sustained. The condition of the condenser usually changes gradually and so can be the more readily watched and remedied. The thing to bear in mind at all times is that a clean condenser is a factor in coal conservation.

Contractor-Dealer

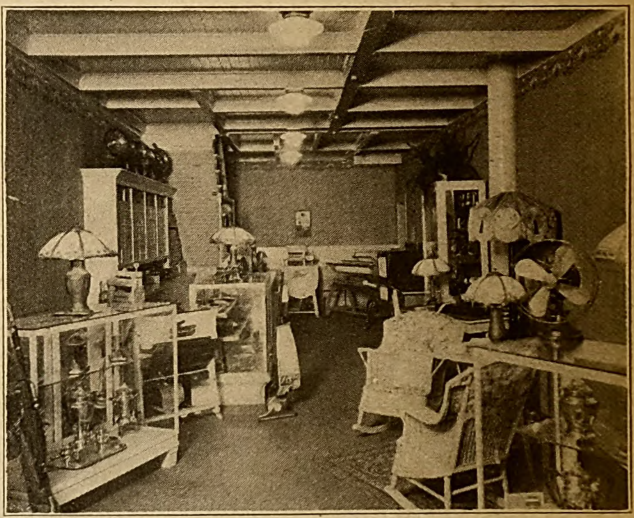
Portland Contractor Opens an Attractive Electric Store—Comments on the Different Angles of Appliance Selling

NOVEL ARRANGEMENT OF NEW PORTLAND ELECTRIC SHOP.

Contractor, Who Becomes Dealer, Shows Ingenuity in Planning New Store in Oregon City—Makes the Most of Window-Display Space.

There is a growing tendency among electrical contractors to enter the merchandising field, and while many statements have been made to the effect that the contractor, as a general rule, makes a poor merchant, this assertion is being disproved in the majority of cases. People are too apt to look for failures than successes in electrical merchandising. But, given a few years' experience in installing electrical material and with an insight into business methods, the contractor is in much better position to ultimately become a successful electrical dealer than some general merchant who branches out to handle electrical appliances. If anything it is less difficult for the contractor to learn merchandising methods than it is for the general merchant to acquire knowledge about the uses and sales points of electrical appliances.

The Smith-McCoy Electric Co. has been in the contracting business in Portland, Ore., for a number of years and recently decided to retail electrical devices. Selecting a desirable location—on Fifth street, between Washington and Clark streets—the company opened a store which demonstrates its insight into merchandising methods. The store has small street frontage, but this disadvantage was overcome in a very effective way. Realizing the value of window display space the company arranged the ground floor of its store so that the entire floor could be easily seen from the street. White walls, high-



Pleasing Arrangement of Interior of New Electric Shop Opened in Portland.

Store Front in Which Window Display Is Used to Fullest Advantage.

intensity lighting, window displays with comparatively little background, and an uncrowded arrangement of electric washing machines, vacuum cleaners, table lamps, etc.—these made an effective display that presented an inviting appearance to the would-be customer. Then to accentuate the effect of the first-floor display the company made window display space out of the second-story front of the store. The novelty and effectiveness of the brilliantly lighted window displays and store are shown in the accompanying illustration.

The other illustration shows there is little counter space on the first floor, but the arrangement makes possible easy demonstration of the larger electrical devices such as washing machines, ranges, ironing machines and vacuum cleaners. It is a novel departure from the usual "store" arrangement.

TRIMMING WINDOWS TO GET CHRISTMAS TRADE.

Some one has said that: "Merchandise well displayed is half sold." This being true, the proper display of merchandise becomes one of the most important phases of the modern retail store. Especially is this true during the holiday season. People are frequently at a loss to know what to purchase as gifts for their relatives or friends. The store that has its merchandise well displayed in the store and its windows well trimmed is the one likely to get the business.

Merchandising Suggestions for the Electrical Dealer

How Salespeople Can Improve Themselves—The Philosophy of Long Profits—Good Illustration of Use of Motion in Displays

IN COMMON with salesmen in other lines, the salesman in an electrical store, in order to increase his income and prospects, should make efforts to improve himself along three general lines—appearance, language and general intelligence.

As to appearance, a great deal of progress has been made in other lines in the general appearance of the salesman. These things should be carefully considered by the salesman—first his haircut, then the collar, shirt, clothing, shoes and the appearance of his face and hands.

At a sales conference held in New York City recently, 100 men were analyzed as to their appearance. Eight men had hair cuts that passed; 20 had collars that were the right size and right style; 10 had neckties that harmonized with their shirts; 15 had shirts that fitted and were of the right sleeve length; 12 had suits that fitted and were pressed and clean; while only 18 had shoes that fitted with heels that were not run down.

It is a difficult matter to criticize a salesman's appearance, but if salesmen and saleswomen are not carefully groomed, absolutely clean from head to foot and trim in appearance, they lose greatly as the customer approaches them. Any salesman can dress better for the same amount of money. The trouble with most salesmen is that they compromise and buy cheap things. They do not study colors and invariably are too "flashy." If their appearance is right, customers sense it very quickly, and the customer unconsciously buys more readily.

As to language—there are more than 100,000 words in the English language, but the average salesman uses less than 2000 in his daily selling. There are four ways of improving one's English. First, study grammar; second, read books rich in description, such as those written by Dickens; third, write a great deal (for instance, write two or three advertisements or sales-letters about electrical appliances each week); fourth, cultivate the acquaintance of and associate with people who use pure English.

By general intelligence is meant knowledge of the merchandise the salesman is handling as well as courtesy, good manners and tact in dealing with customers. The salesman must get out of his own environment and improve his general education regarding people—in other words, live the lives of other people mentally—if he wishes to succeed in selling large quantities of merchandise.

Long Profits or Fat Ones for the Electrical Merchant.

Which would you rather make—40% profit or $10,000?

Forty per cent is a rather long profit. Ten thousand dollars is a fat profit. Nine out of ten electrical merchants, new at the merchandising game, are often hypnotized by the length of a profit and do not stop to figure up its probable fatness. The experienced merchant pays little attention to the discount but figures up his probable gain. Many a man has become a millionaire on 1% profit.

For example, if some bright salesman should offer you some electric irons at "40 off" the proposition would look good at first glance. At $6.50 list, you would be making $2.60 on each iron instead of, say, $2.28. You would want a gross.

But wait—

It is going to be hard to sell these irons. They do not look quite as good as the standard irons. Maybe you can sell only two dozen of these with a gross profit of $67.20 in the same time it would take to sell three dozen of the others, with a gross profit of $77.40. There will undoubtedly be more repairs which will cost time and money, too. So on second thought you had better not buy them. Of course, the clever salesman will tell you his long-profit iron is just as good, that his firm does not advertise and gives you the benefit of the advertising expense.

But don't let that fool you.

National advertising is *not* paid for by the dealer or the consumer. It is paid for out of the reduction in selling expense and the savings of quantity production. A concern making 150,000 irons a year can certainly build and sell irons 20 cents apiece cheaper than the concern making 5000. And 20 cents apiece, saved, will pay for $30,000 worth of advertising to maintain the big production. Not alone that, but the advertising is the surest possible guarantee of quality, because no manufacturer can advertise continuously an inferior product. Advertising acts as a deadly poison to the four-flusher.

There is only one excuse for an exceptionally long profit—cheapness. And for this reason a long profit is generally skinny.

Mechanical Figures in Window Display Attract Attention.

Life or its simulation attracts more attention than anything else in window displays. When wax figures are used and these figures move mechanically, the display is one that never fails to bring to a halt all who pass. The Oklahoma City (Okla.) Electric Co. recently had a display which represented a living room, with the usual quota of chairs, table, rug, curtains, pictures, etc. At one side was a small boy, who at intervals pulled a string attached to a basket in the ceiling, releasing a stream of corn meal. Close at hand was a young matron, with vacuum cleaner, who immediately swept up the fallen meal.

Considerable ingenuity was expended in arranging the mechanical figures. The mechanism required included a fractional horsepower motor belted to a 3-in. pulley keyed in turn to a worm gear shaft, which operated the arm of the patent mother. As the cleaner moved back along a guide wire it struck a button, which, connected to the corn meal trap, opened the trap, each time spilling some meal, and at the same operation lowering the boy's hand as if he had pulled the string.

New Appliances

Small Inclosed Motor for Appliance Drives—Combination Fire Pump—Auto Lamp—Steel Mill Electrical Apparatus

Small Direct-Current Motor Embodies Unique Splashproof Feature.

A new small direct-current motor incorporating a splashproof housing of unique design which completely protects the winding and all live parts from splashing water or accidental contact is proving popular for light domestic and industrial purposes. Made by the Westinghouse Electric & Manufacturing Co., it is known as the CDH type and is built in ⅛ and ¼-hp. sizes.

The large commutators and box-type brush holders with large brush area make these motors particularly well adapted for operation from the low-voltage storage-battery plants now being installed in great numbers on farms and in suburban residences. Motors wound for 32 volts are in great demand in rural communities for application to house pumps, washing machines, cream separators and similar machines.

Also, a wide field of application for motors of this type, wound for 115 and 230 volts, comprises light labor-saving machines used in homes, offices, stores, manufacturing plants, etc. They are interchangeable mechanically with alternating-current motors of similar ratings, and therefore appeal strongly to the manufacturer of motor-driven devices. Their splashproof feature makes them especially adapted to use on washing machines.

The frame consists of a seamless, forged-steel ring to which the cast-iron foot and end brackets are bolted. The pole pieces are bolted to the steel ring, thereby permitting the use of form-wound field coils, which are easily replaced in case of injury. The motors are light in weight, compact, sturdy and uniform in performance.

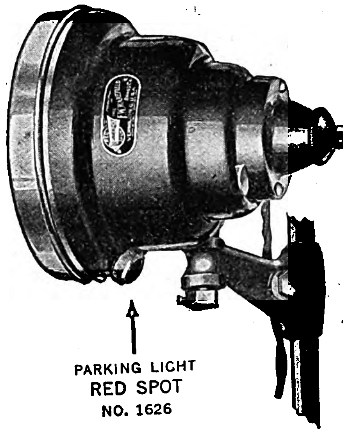
Automobile Searchlight That Also Serves as Parking Lamp.

An improved model of the "Red Spot" searchlight for automobiles is offered by the F. W. Wakefield Brass Co., Vermilion, O. The unique feature of this model is a small deflector and lens in the housing of the lamp which throws a red beam to the rear, thus making it a practical one-bulb "parking light."

Motorists will quickly appreciate the economy and desirability of this device. Cars parked at night at the curb or roadside must be lighted front and rear to comply with the law, and for protection against collision. This commonly requires that sidelights and tail light be left burning, sometimes for several hours at a time—a very serious drain upon the batteries, especially in winter when starting takes more than the normal amount of energy.

The manufacturer of this outfit points out that not only does his invention provide adequate and legal front and rear lighting from a single lamp, but that this light is placed in the position on the car which will insure the greatest protection, since the searchlight is invariably mounted at the extreme left side and well outside the wind shield frame so that passing vehicles will naturally give the parked car plenty of clearance.

This parking light feature makes the "Red Spot" searchlight a triple-duty accessory. In normal service it is a keen and penetrating searchlight with easily adjustable focus and wide range. In emergency and by a single touch of the finger it becomes a red danger signal. Now, with the rearward deflector and lens, it becomes also an economical and safe parking lamp. This device is made in 5½-in. and 7-in. diameters.



"Red Spot" Automobile Searchlight with Rearward Deflector and Lens Serving as Parking Lamp.

Notable Export Shipment of Electrical Apparatus for Steel Mill Operation.

Seventeen carloads of electrical equipment for steel-mill operation are now being delivered for installation with what will be the first electrically driven steel blooming mill to be erected in the Far East. This equipment is to replace a steam engine now operating a 40-in. reversing mill.

The mill will form a part of the plant of the Imperial Steel Works of Japan, located near Tokio, and the electrical apparatus is being furnished by the Westinghouse Electric & Manufacturing Co., East Pittsburgh, Pa.

The blooming mill in question will be capable of rolling steel ingots measuring 0.5 by 0.5 meters (19.7 ins. square) and weighing 3000 kg. (3.3 tons) normal or 5000 kg. (5.5 tons) maximum. The capacity will be 50 tons per hour.

The mill will be operated by a 3500-hp. single-unit motor, of the reversing blooming-mill type, taking direct-current power at a voltage of 600 and operating with a speed range of 0 to 100 r.p.m. To supply power to the motor a flywheel motor-generator set is being furnished. The direct-current generator is of 2800 kw. capacity, 600 volts, 368 r.p.m. It will be connected in series with the reversing motor and is designed to stand the same momentary current peaks as the reversing motor. The generator is driven by a 2500-hp., 8-pole alternating-current motor of the wound-rotor induction type, taking 3-phase power at 3400 volts, 25 cycles and operating at a speed of 368 r.p.m. A slip regulator is used to control this set. A notable feature of the motor-generator set is a 75,000-lb. cast-steel flywheel measuring 14 ft. 9 ins. in diameter.

For field excitation, there is being furnished a motor-driven exciter set consisting of one 32½-kw., 125-volt, constant-potential exciter, one 12½-kw., 125-volt, variable-potential exciter, and a 70-hp., three-phase, 25-cycle, 220-volt driving motor, all direct-connected and mounted on a common bedplate.

Accessories used with the foregoing equipment are a Sirocco blower driven by a 40-hp. three-phase, 25-cycle, 220-volt squirrel-cage induction motor; an air washer to be used in connection with the blower; and a 125-kv-a. 3400/220-volt, three-phase, 25-cycle transformer (connected high-voltage side in star, and low-voltage side in delta) to supply power for the exciter set and blower motor.

Another part of the shipment comprises switchboard panels containing instruments, switches, circuit-breakers, shunts and relays for the control of the motors, generators and feeders. Additional equipment includes disconnecting switches, oil circuit-breakers, and current transformers to be mounted on pipe framing.

A Motor and Gasoline-Engine-Driven Fire Pump.

It is always desirable to have two independent sources of power for a fire pump so as to lessen the chances of its being put out of commission when a fire occurs. In some states a double drive is required by the underwriters' regulations.

The usual form of drive is a steam engine and electric motor, though where there are two separate sources of current two electric motors are frequently used. Sometimes neither steam nor a second source of current is available, and in that case a pump driven by a motor and internal combustion engine can be used.

This pump is of 1500 g.p.m. capacity and is driven by a Westinghouse 150-hp. alternating-current motor and a 140-hp. gasoline engine. It is built by the Lea-Courtney Co., Newark, N. J.

Trade Activities

Diamond Specialties to Move Factory to Newark—National Carbon Company's Prize Contest—New Trade Literature

W. B. Richards & Co., whose New York office is at 71 Broadway, announce that Ralph S. Rainsford, formerly with J. G. White & Co., Inc., has become vice president of the company. The firm has offices in Boston and Chicago as well as in New York.

Commercial Electric Co. has been incorporated at Seattle, Wash., by A. B. Nelson and associates to build and sell a farm lighting unit of its own design, and to install marine lighting equipment, including the "Ceco" set. Mr. Nelson was formerly connected with the Boat Lighting & Equipment Co.

Harvey Hubbell, Inc., Bridgeport, Conn., is sending out to the trade a new trade discount sheet, dated Nov. 14. Numerous changes on Hubbell material are shown, these applying on Schedules C-1, C-3, D, G, E and H, which include various types of reflectors, shade holders, lamp guards and plug material.

American Steam Conveyor Corp., Chicago, manufacturer of all types of equipment for the economical handling of ashes, soot, coal siftings and similar material, is sending out a new folder which has for its title "A Yard of Installations." It shows in an attractive panel views of installations of the American steam ash conveyor. The folder itself is about a yard in length, as its title indicates, and depicts 19 or 20 installations of this equipment. An attractive post card accompanies the folder and aids in giving the interested prospect an opportunity to secure further information. This folder is being extensively distributed among power plant executives and is one of a series being issued.

Allis-Chalmers Manufacturing Co., Milwaukee, Wis., is distributing bulletin No. 1532-A devoted to Allis-Chalmers oil engines of the Diesel type. This publication comprises 20 pages and fully explains the operation and detailed construction of the Allis-Chalmers Diesel type of oil engine which, it is claimed, combines all the economical advantages of the Diesel system, together with special constructive features essential for reliability in service. The engine is of the four stroke cycle horizontal type with an open fuel nozzle and a low pressure starting system. These features simplify the design and overcome the chief objections of inaccessibility, uncertain piston lubrication and the clogging of the fuel nozzle, to which the older types were subject. The bulletin is well illustrated with cross-sectional and longitudinal views of the engine, diagrams, views of typical installations, and the various parts entering into its construction.

Cooper Hewitt Electric Co. on Oct. 27 and 28 held a convention of its salesmen at the main office of the plant at Hoboken, N. J. About thirty salesmen attended the convention which closed with a dinner at the Hotel Pennsylvania, Tuesday night, Oct. 28.

Edison Electric Appliance Co., 5600 West Taylor street, Chicago, recently issued a new pamphlet describing the "Hotpoint" engine and carburetor heater, which is nationally recommended by dealers as a winter driving necessity for easy starting on cold mornings. This is an electric heating device quickly attached to a garage light socket, placed under the hood of the car, where a steady, uniform heat is concentrated to keep the motor primed for an instant start on a cool morning.

Charles C. Moore & Co., San Francisco and Seattle, have an order for building and installing two new generating units in the mill of Bloedel-Donovan Lumber Co., at Bellingham, Wash. There will be one 2000-kw. unit and one of 1000-kw., to be housed in a concrete building. This firm has an order to furnish three Stirling boilers of 500-hp. each in the plant of Crown Willamette Paper Co. at West Lynn, Ore.; and to install two similar boilers in the paper plant of Pacific Mills, Ltd., at Ocean Falls, B. C.; also, two 500-hp. boilers in plant of E. K. Wood Lumber Co., Bellingham, Wash., and two 500-hp. B. & W. boilers in the plant of Granby Consolidated Mining & Smelting Co., at Granby, B. C.

Cutler-Hammer Manufacturing Co., Milwaukee and New York, is distributing a new booklet on electrical operation of gate valves, which contains a reprint of an address given by Peter Payne Dean before the Metropolitan Section of the American Society of Mechanical Engineers. Several illustrations and drawings have been added to aid the description of the Dean system of electrical control of gate valves. Primarily, the Dean control system consists of a totally enclosed waterproof driving motor, reduction gears and limit trip mechanism combined into a single unit for the operation of the valve gate. The control of the valves is secured by means of one or more remote control stations. The booklet makes mention of the desirability of having remote controlled valves in power stations, waterworks, dry docks, refrigerating plants and oil refineries. It describes some of the standard valves and explains how these may be equipped for power operation with remote control without removing the valve or putting it out of service.

Black & Decker Manufacturing Co., Baltimore, manufacturer of portable electric tools, has placed A. E. Nordwall in charge of the Seattle branch, with headquarters at 201 Maynard building. Mr. Nordwall will have charge of the distribution of the company's products in the state of Washington, under the direction of the main Pacific coast office, 918 Hearst building, San Francisco.

Diamond Electric Specialties Corp., successor to the Import Sales Co., New York City, has purchased from H. Sobo & Sons, Newark, N. J., their three-story brick building located at 101-03 South Orange avenue. The Diamond company will use the premises for the manufacture of its well-known line of Diamond flashlights, batteries and Diamond electric Christmas tree outfits, which heretofore have been manufactured at 27-33 West 20th street, New York. The structure has a frontage of 65 ft. on South Orange avenue and a depth of 100 ft. on Richmond street. The Diamond company was attracted to Newark by the excellent manufacturing and labor advantages afforded in that city, and will take possession of the new quarters after Jan. 1, 1920.

National Carbon Co., Cleveland, Ohio, manufacturer of batteries and carbon products, recently conducted a contest for an appropriate name for its new house organ, which will be published periodically in the interests of salesmen, jobbers and jobbers' salesmen. It was a departure from the usual prize award for similar activities in that an offer of a suit of clothes was made the incentive for suggesting a title. Names were received from all parts of the country, many from owners, presidents, sales managers and advertising managers of progressive concerns. The name selected by the judges was "Columbia Hot Shot," which was considered ideal in implying the purpose of the publication, suggestive of the company's products and in being "catchy," short and easy to pronounce. Instead of one winner, there were 12 salesmen of jobbers and one salesman of the company who each received a check of $75 with which to purchase a new suit of clothes. Eight other contestants were given recognition by the company by the award of a $15 prize for a pair of shoes. In sending the checks which totaled over $1,000 to the winners, the company inferred that the amount of $75 for a suit and $15 for shoes would cover the cost of this apparel, but assumed no obligation for the market fluctuation which might ensue between the time the prizes were mailed and the date when checks were received.

Current News

Weekly Record of Construction Activities—Conventions

EASTERN STATES.

New Bedford, Mass.—Leigh & Butler, 232 Summer street, Boston, manufacturers of textile machinery, etc., have completed negotiations for the acquirement of the plant formerly occupied by the Baker Manufacturing Co., New Bedford, and will utilize the structure for the establishment of a new plant. Considerable electrical equipment will be required in connection with the new work.

Windsor, Conn.—General Electric Co., Schenectady, N. Y., will double the capacity of its plant here by the erection of a building of 40,000 sq. ft.

Binghamton, N. Y.—An appropriation of $25,000 has been made for ornamental lighting and underground conduit system. Address city clerk.

Lancaster, N. Y.—Plans are under consideration by the Depew & Lancaster Light, Power & Conduit Co., operating in Erie county, for the construction of an electric power plant at Alden, N. Y., for furnishing service to local and neighboring districts.

Little Falls, N. Y.—Barnet Leather Co., Inc., 81 Fulton street, New York, is considering plans for the construction of a new one-story brick addition to its plant at Little Falls. The structure will be about 25x40 ft., and is estimated to cost $7,000. L. E. White is local manager.

New York, N. Y.—Melville Clark Piano Company, 518 West 55th street, has had plans prepared for the construction of a one-story concrete boiler plant addition to its works about 60x93 ft., to be located on 135th street, near Locust avenue. The structure is estimated to cost $20,000.

New York, N. Y.—It is expected that Westinghouse, Church, Kerr & Co. will be in the market soon for electric cranes for a fertilizer plant in Baltimore for Armour & Co.

Sayville, L. I., N. Y.—Navy Department has authorized the immediate installation of new radio apparatus at the local radio transmission station, estimated to cost about $50,000. The new equipment will be of the high-speed sending type recently perfected. The work also includes improvements in the present receiving equipment at the plant.

Oneida, N. Y.—The common council voted to accept the proposition of the Adirondack Electric Co. for ornamental lights in Madison street. Mayor Munson was authorized to sign the contract.

Bloomfield, N. J.—Sprague Electric Works of the General Electric Co. has filed plans for the construction of a new addition to its plant. It is understood that a portion of the proposed extension will be used for storage purposes; the building is to cost about $40,000.

Cape May, N. J.—Fire on Dec. 1 damaged the plant of the Cape May Illuminating Co. to the extent of approximately $5,000. It is understood that the company is considering plans for immediate rebuilding.

Dover, N. J.—New Jersey Power & Light Co. has been awarded a contract by the Mountain Ice Co. for furnishing electric energy for the operation of its plant for a period of five years. The company is planning for the extension of its electric system to the Dickerson mine of the Wharton Steel Co. for the serving of a motor load of 600 hp.

Jersey City, N. J.—Burke Brothers Co. has had plans prepared for the erection of a new boiler plant at its property at 380-84 5th street.

Kearny, N. J.—Town council is considering plans for the installation of a new arc lighting system in Kearny avenue. It is proposed to inaugurate work on the improvement at once.

Newark, N. J.—American Platinum Works, 231 New Jersey Railroad avenue, is making rapid progress on the construction of its proposed factory and boiler plant, to be located at Oliver and New Jersey Railroad avenues. It is understood that the work will be completed at an early date.

Newark, N. J.—John Campbell & Co., Monticello, N. Y., has had plans prepared for the construction of a new two-story factory and boiler plant, about 10x125 ft., at 13-23 New York avenue. The structure is estimated to cost $50,000.

Newark, N. J.—Dye Products Chemical Co., 202 Vanderpool street, has had plans prepared for the erection of a new one-story boiler plant addition to its works. William E. Lehman, 738 Broad street, is architect.

Port Norris, N. J.—Plans are under consideration by the Township Committee for the installation of new street lighting systems in Port Norris, Mauricetown, Bivalse and Haleyville.

Allentown, Pa.—Phoenix Silk Manufacturing Co. is having plans prepared for the construction of a new central power plant, to be utilized for the furnishing of light and heat for its two local mills. The company has been granted permission by the city council to install an underground conduit system between its Adelaide Mill and its ribbon mill in connection with the proposed construction.

Chester, Pa.—American Locomotive Co., 30 Church street, New York, has awarded a contract to Almirall & Co., Inc., 1 Dominick street, New York, for the construction of a new one-story power house at its local plant, about 80x100 ft., to be located on East Dunkirk street.

Connellsville, Pa.—Yough Electric Co. is having plans prepared for a plant.

Littleton, Pa.—Board of Managers of the Hoffman Orphanage is having preliminary plans prepared for the construction of a new one-story central heating plant for the institution, to cost about $15,000. Rev. Andrew H. Smith is in charge.

Liverpool, Pa.—Juniata Light & Service Co. has commenced work on the extension of its electric system to the upper section of the borough to furnish service for lighting. It is understood that a new street-lighting system will also be installed in this district.

Philadelphia, Pa.—Pennsylvania Forge Co., Jenks and Bath streets, has awarded a contract to the William G. Donley Co., Drexel building, for the erection of a new one-story brick power house addition to its plant, about 42x51 ft. The structure is estimated to cost about $5,000.

Philadelphia, Pa.—Philadelphia Electric Co. has awarded a contract to the Stone & Webster Engineering Corp., Boston, Mass., for the construction of its proposed one-story reinforced concrete power station at Beach and Palmer streets. The structure will be about 197x300 ft., and with equipment installation will cost about $5,000,000.

Pittsburgh, Pa.—Jones & Laughlin Steel Co. has filed plans for the erection of a new one-story brick and steel pump house to be located on Second avenue, near Bates street.

Reading, Pa.—Lebanon Steel Co. has had plans prepared for the construction of a new one-story air-compressor building and substation, about 33x39 ft., at its plant.

Scranton, Pa.—Delaware, Lackawanna & Western Railroad Co. has awarded a contract for the foundations for the proposed power plant to be located in the vicinity of Nanticoke, Pa. It is proposed to call for bids for the superstructure early in the coming spring. The new plant is estimated to cost $75,000.

Danville, Va.—Danville Valley Power Co. has been incorporated with a capital of $50,000. H. L. Mitchell and others are interested. The company will build a hydroelectric plant which will be located in Walnut Cove.

Baltimore, Md.—Kaufman Beef Co. has had plans prepared for the construction of a new packing plant and power house, to be located at Sixth street, near Wilkens avenue.

Murphy, N. C.—The city plans to construct a 500 to 700-hp. hydroelectric power plant. Address mayor.

Newbern, N. C.—City is having plans prepared for extensions in the municipal electric lighting plant to increase the present capacity.

Laurens, S. C.—Watts Mills Co. is having plans prepared for the installation of a new transmission system for the purpose of furnishing electric lighting for its mill village and operatives' homes. The work is estimated to cost $15,000. Power is furnished by the Reedy River Power Co. George M. Wright is president.

Ridgeville, S. C.—H. R. Elsworth is in market for a private electric plant.

Melbourne, Fla.—An electric light plant will be established by the Melbourne Beach Co.

St. Petersburg, Fla.—W. D. McAdoo and others contemplate the construction of an electric railway between St. Petersburg and St. Petersburg Beach.

NORTH CENTRAL STATES.

Dayton, O.—Domestic Engineering Co. has purchased the 4-story plant of the Mutual Manufacturing Co., and will use it for making farm lighting systems.

Detroit, Mich.—Mutual Electric & Machine Co., 232 West Fort street, will build a 3-story plant addition to cost $12,000.

Detroit, Mich.—A 1-story plant, 100x120 ft., and a boiler house 40x50 ft. will be erected by the General Carbonic Co. at a cost of $150,000.

Grand Rapids, Mich.—A hydroelectric power plant capable of generating 2500 hp. will be added to the present plant of the Consolidated Water Power & Paper Co., the new building to be completed by next fall. Power for the new paper machines to be installed by the company will be furnished, and surplus power will be sold to concerns in the city. The company is also planning to erect a new sulphite mill to cost more than $500,000.

Manistee, Mich.—An electric railroad is proposed between Manistee and Arcadia. Address J. N. Junge.

Evansville, Ind. — Architect Gilbert Karges, 305 Furniture Exchange building, Indianapolis, Ind., has prepared plans and will let contract for a $75,000 power plant to be erected by Globe-Besse-World Furniture Co., Evansville, Ind. The building will be of brick, steel and concrete construction. Specifications include a freight elevator, steam heating, plumbing and electric lighting.

Indianapolis, Ind.—Commercial Engineering Co. has increased its capital stock from $50,000 to $100,000.

South Bend, Ind.—Heavy rains are saving 100 tons of coal a day for the Indiana & Michigan Electric Co.'s power plant. The St. Joseph river, swollen far beyond its height for this season of the year, is generating enough power to make the use of coal almost negligible.

DATES AHEAD.

Electric Power Club. Meeting, Hot Springs, Va., Dec. 11, 12 and 13. Headquarters, Homestead Hotel. Secretary, C. H. Roth, 1410 West Adams street, Chicago.

American Society of Civil Engineers. Annual meeting, New York City, Jan. 21-22, 1920. Secretary, Charles W. Hunt, 33 West 39th street, New York City.

National Council of Lighting Fixture Manufacturers. Annual convention, Detroit, Mich., February, 1920. Secretary-treasurer, Charles H. Hofrichter, Cleveland, O.

Oklahoma Utilities Association. Annual convention, Oklahoma City, Feb. 10-13, 1920. Secretary, H. A. Lane, 611 State National Bank building, Oklahoma City.

American Electrochemical Society. Annual convention, Boston, Mass., April 7-10, 1920. Friday, April 9, joint session with American Institute of Electrical Engineers on "Electrically Produced Alloys." Secretary, Joseph W. Richards, Bethlehem, Pa.

National Electric Light Association. Annual convention, Pasadena, Cal., May 18-21, 1920. Headquarters, Hotel Huntington. Acting secretary, S. A. Sewall, 29 West 39th street, New York City.

Mahomet, Ill.—This village is to have an electric light system, a high-tension line to be constructed from Champaign to Mahomet for the purpose of supplying current. Power will be furnished by the Urbana & Champaign Railway, Gas & Electric Co., a subsidiary of the Illinois Traction System.

Bruce, Wis.—A bond issue of $12,000 has been approved for the construction of a municipal lighting system.

Chippewa Falls, Wis.—Wisconsin-Minnesota Light & Power Co. will erect a power line between Stanley and Chippewa Falls to carry current from Wiasota dam to consumers along Soo railway.

Sheboygan, Wis. — Citizen's Telephone Co. will make additions to system at an estimated cost of $85,000.

Marceline, Mo. — Plans are under consideration by the city officials for the construction of a new municipal electric plant.

St. Louis, Mo.—Emerson Electric Co. has purchased a site for a large commercial structure, adjoining on the east the company's present quarters. The projected building, plans for which are being prepared, will be a 7-story structure.

Chanute, Kan.—Architect I. R. Timlin, Boatmen's Bank building, St. Louis, has prepared plans for a $15,000 telephone exchange. Contract let to Geo. W. Copley, Chanute, Kan. Owner Southwestern Bell Telephone Co., Boatmen's Bank building, St. Louis, Mo.

Iola, Kan.—Archt. I. R. Timlin, Boatmen's Bank building, St. Louis, has prepared plans for a $15,000 telephone exchange. Owner Southwestern Bell Telephone Co., Boatmen's Bank building, St. Louis, Mo.

Beatrice, Neb.—Consolidated Electric Co. will build a transmission line from Homeville to Filley, Virginia and Rockford.

Guide Rock, Neb.—Bonds have been voted for installing an electric light system in the city.

Havelock, Neb.—Omaha, Lincoln & Beatrice Interurban Railroad Co., Ralston, has asked for a franchise to construct lines through Havelock. Mr. Bramlette, general manager.

Lebanon, Neb.—The city will hold an election for a bond issue for an electric plant. The erection of a transmission line from the McCook Electric Co., McCook, is also contemplated. Danbury will also secure light from the lines of the McCook company.

Prague, Neb.—The city has voted to issue $12,000 electric light bonds. Work on the line will commence at once, it being an extension of the Blue River Light & Power Co.'s line from Brainard to the towns of Bruno, Abie and Prague.

Scribner, Neb.—City will construct electric lighting plant. Estimated cost, $35,000.

SOUTH CENTRAL STATES.

Birmingham, Ala.—Sloss-Sheffield Steel & Iron Co. is having plans prepared for the construction of a new power house addition to its plant, to cost about $9000.

Birmingham, Ala.—Birmingham Light & Power Co. has had plans prepared for the construction of a new local electric substation, to be equipped with 1000-kw. rotary converter with switchboards, as well as auxiliary apparatus. L. L. Newman is engineer.

Amite, La.—Central Light & Power Co. is understood to be considering plans for increasing the present capacity of its plant. New machinery and equipment will be installed.

Boyce, La.—City officials are planning for a bond issue of $30,000, the proceeds to be used for improvements and extensions in the municipal electric light and water plants. Xavier A. Kramer, Magnolia, Miss., is consulting engineer.

Monroe, La.—Plans are under consideration by the city for the construction of a new electric plant and waterworks system, a bond issue for $450,000 to cover the cost of the proposed work having been passed. Arnold Bernstein is mayor; Walter G. Kirkpatrick is consulting engineer.

Fort Smith, Ark. — Fort Smith Light & Traction Co. is preparing to enlarge its power plant by the erection of an addition to cost $250,000.

Sallisaw, Okla.—City has completed arrangements for improvements and extensions in the municipal electric light plant, to cost about $30,000.

Clarendon, Tex. — Texas Gas & Power Co. is considering plans for extensions and improvements in its electric light plant to increase its present capacity. Plans and specifications will be prepared at once.

Dallas, Tex. — Dallas Power & Light Co. has purchased a 15-acre tract of land on which it proposed to erect a reserve oil storage tank. The tank is to be of 50,000-bbl. capacity and will be erected to insure continuity of service at such times when oil could not be delivered through pipe lines or in tank cars.

WESTERN STATES.

Pueblo, Colo. — About $1,000,000 will be spent in 1920 for improvements by the Arkansas Valley Railway Light & Power Co., according to announcement by W. F. Raber, manager of the plant. Among the items of expense is a new power house made necessary by the increased distribution of electricity both for lighting and power purposes and the present plant is inadequate to care for the expanding business much longer. The present plant is only 7500 h.p., while the new plant will be 10,000 hp. and modern in every respect.

Seattle, Wash.—City Council has recently awarded a contract to the Allis-Chalmers Manufacturing Co. for a new 12,500 kw. steam turbine unit, equipped with exciter. Arrangements have also been completed for the installation of boilers and auxiliary apparatus, for increased operations.

Seattle, Wash.—Contract has been awarded to the Pelton Water Wheel Co. by the city for the furnishing of a new 18,000 hp. capacity water wheel, estimated to cost $76,616. A generating unit will also be furnished by the Westinghouse Electric & Manufacturing Co., 14,285 kw. capacity, to cost $63,175.

Wenatchee, Wash.—Plans are under consideration by the Wenatchee Valley Gas & Electric Co. for extensive additions and improvement in its plant. It is proposed to increase the capacity of the Chelan Falls power station by approximately 1000 hp., at an estimated cost of about $80,000. George D. Brown is general manager.

Astoria, Ore. — Plans are under consideration by the Pacific Power & Light Co. for the rebuilding of its repair shop recently destroyed by fire, with loss estimated at about $20,000.

Baker, Ore.—To prevent a recurrence of the present grave lighting and power situation in Baker and Union counties, extensive improvements that may include the installation of one or more power plants will be made by the Eastern Oregon Light & Power Co., according to J. P. Lottridge, manager.

Bend, Ore. — The construction of two power plants along the Fumalo river at a cost of $229,000 for the development of 4325 hp. is contemplated by the Bend Water, Light & Power Co., which filed application with the state engineer's office for permission to appropriate 50 second feet of water from Tumalo creek.

Auburn, Cal.—Pacific Gas & Electric Co. is making rapid progress on the installation of a new power line from its Wise power station for the furnishing of electric energy to the Sacramento Valley district. It is understood that the company is considering plans for the construction of a new power station to be located in the vicinity of Loomis.

Glendale, Cal. — City has recently authorized the issuance of bonds for $260,000, the proceeds to be used for extensions and improvements in the water and light departments. Included in the proposed work will be the construction of a new pumping plant, with equipment, etc., at San Fernando road and Grand View avenue, to cost $33,500; pumping plant at Grand View reservoir; quantity of new pumping equipment in Verdugo canyon; electric generating plant at Verdugo canyon reservoir, and other work.

Manhattan Beach, Cal.—Town officials have voted a bond issue of $30,000, the proceeds to be used for improvements and extensions in the municipal water system.

Orange, Cal. — In connection with the proposed installation by the city trustees of the new ornamental lighting system on Shapman and Glassell streets, J. A. Lieb, Orange, has submitted the low bid, at $18,000.

Richmond, Cal. — Plans are under consideration by the city council for the early installation of a new electrolier system in the business section of the city, to replace the present arc lighting units. The Merchants' Association is interested in the proposed work.

San Francisco, Cal.—Contract has recently been awarded to the Western States Gas & Electric Co. for the furnishing of electric energy for the operation of the proposed new plant of the Fresno Cooperage Co. at Richmond. The company is a subsidiary organization of the California Wine Association, and about 150 hp. will be required.

Woodland, Cal.—Council is understood to be arranging plans for the installation of a new underground conduit system to be utilized for light and power purposes.

FOREIGN TRADE

[Addresses of firms referred to in these trade opportunities may be obtained by writing to the Bureau of Foreign and Domestic Commerce, Washington, D. C., or its branch and local co-operative offices. Request for each opportunity should be on a separate sheet and the file number given.]

Electrical Supplies (31,332).—Samples, catalogs and price lists are desired by a man in Spain with a view to representing firms for the sale of electrical supplies, carpenters and cabinet-makers' tools and accessories, leather and imitation leather visors for military caps, barber supplies, etc. Correspondence should be in Spanish.

Electrical Appliances (31,394).—A firm in England having a branch office in the United States, desires to be placed in touch with manufacturers of electrical labor-saving appliances, with a view to their sale in England. It is particularly interested in washing machines, vacuum cleaners, dishwashing machines, electrical clothes dryers, motor-driven sewing machines, and electric water heating apparatus. Articles of the highest class, and in large quantities are wanted.

Electrical Supplies (31,395).—An importer in France desires to secure an agency for the sale of hardware, enamel ware, household appliances, electrical supplies, novelties, and toys. Reference.

Lighting Equipment (31,399).—A company in Spain desires to secure agencies for the sale of oils, lubricating greases, crude rubber, chemicals, industrial products, cables, wire, switches, portable lamps, insulators, etc. Correspondence should be in Spanish or French. References.

Electric Vehicles (31,402).—A firm in South Africa desires to get in touch with manufacturers with a view to securing an agency for the sale of motor cars, electric or petrol, of a medium and cheap price; also of elevators for passenger and freight.

Electrical Machinery (31,346).—An American firm in Poland, which is planning to erect a machine shop, desires to secure an agency, purchasing goods outright, for the sale of machine tools, agricultural machinery, machinists' tools, and electrical equipment. Quotations should be given f. o. b. New York. Payment cash. References. Catalogs and price lists are requested.

Electric Lamps (31,196).—A business man in Spain desires to purchase and secure an agency for life-saving motor boats, in accordance with specifications which may be secured from the Bureau or its district offices. He also desires machinery for making cans, bottlers, perfumery, etc., filament electric lamps, hardware and tools. Quotations should be given c. i. f Spanish port. Payment preferably by irrevocable credit in any Spanish bank. Correspondence may be in English. Reference.

Electrical Supplies (31,408).—A trading company in Denmark desires to secure an agency on commission for the sale of foodstuffs, chemicals, electrical supplies, steam turbines, machinery, iron and steel for shipyards, anchors and chains. Quotations should be given c. i. f. Copenhagen or other Scandinavian port. Payment, letter of credit in United States. References.

PROPOSALS

Electric Light System.—Bids will be received by Unadilla, Ga., until Dec. 31 for the installation of an electric lighting system and extension of the water works system. Address the mayor.

Electric Light.—Bids will be received until Jan. 21, 1920, for furnishing electric lighting for streets, residences and industries for 10 years to Natchez, Miss., from Jan. 1, 1921. Address mayor.

Electric Light Plant.—Bids will be received Dec. 19 by J. W. Reig, mayor of Tahlequah, Okla., for an electric light and power plant. Specifications are on file with clerk at Tahlequah and can be secured from W. N. Gladson and E. M. Ratliff, engineers, Fayetteville, Ark.

Personals

W. C. Heath, P. S. Pogue, A. J. Lubeck, F. W. Sinram Promoted—Mrs. Walker's Career in Public Utility Literature

GEN. GEORGE H. HARRIES, vice-president of H. M. Byllesby & Co., New York, will address the New York Electrical League at a December meeting.

HORACE C. DU VAL at a recent meeting of the board of directors, was elected a director of the Brooklyn Edison Co., Inc., Brooklyn, N. Y., to fill the vacancy occasioned by the death of the late James N. Wallace.

J. H. DEPPELER, of the Metal & Thermit Corp., has been elected a vice-president of the American Welding Society, and P. F. Willis, president of the Henderson-Willis Welding & Cutting Co., elected a director of the society.

W. P. NASER, whose resignation as manager of the Trumbull Electric Manufacturing Co., Chicago, was announced in the Aug. 23 issue of ELECTRICAL REVIEW, has accepted the appointment of general manager of the Northern Electric Co., with executive and main offices in Minneapolis, with a branch office in Duluth. Mr. Naser was connected with the Trumbull company for nearly 7 years. During the World's Fair he opened an office in San Francisco and was later promoted to the larger Chicago branch of the company.

W. C. HEATH, assistant general superintendent of Fairbanks, Morse & Co., Chicago, was recently promoted to the office of general superintendent of the Beloit (Wis.) plant. Mr. Heath joined the company in May, 1909, as a draftsman, after leaving Lewis Institute, and by reason by his ability, industry and character, was rapidly advanced in the organization. After spending about 7 years in detail and general designing work in the engineering department, he was transferred to the shops where for a time he looked after drawings, production schedules, standardization and similar matters. He was later appointed superintendent of the BW shop and then promoted to the position of assistant general superintendent.

PHILLIP S. POGUE, general manager of the Louisville Home Telephone Co., Louisville, Ky., for the past 10 years, has been elected president of the company, succeeding E. H. Cady, resigned. Mr. Pogue has been with the Louisville Home company since its inception. After assisting in the construction of the plant in 1901-2, he served as purchasing agent for a year. He was later made general superintendent, in which capacity he continued until 1907, when he was promoted to the position of general manager. He is vice-president and director of the Louisville Heating Co., director of the Louisville Gas & Electric Co., the vice-president of the Kentucky Association of Public Utilities. He is a member of the Pendennis Club, the Engineers and Architects Club and the Jovian Order.

C. W. JOHNSON, general superintendent of the Westinghouse Electric & Manufacturing Co., Pittsburgh, Pa., delivered an interesting address at the December meeting of the Industrial Supervisors' Club of Pittsburgh, held on December 3.

ARTHUR J. LUBECK, whose appointment as assistant western sales manager of the Hart & Hegeman Manufacturing Co., Chicago, was recorded in a recent issue of ELECTRICAL REVIEW, has been promoted to the position of sales manager of the Chicago district, succeeding Haynes L. Everest, who has been appointed general sales manager, with headquarters at Hartford, Conn. Prior to his connection with the Hart & Hegeman company Mr. Lubeck was for a number of years in the service of the Benjamin Electric Manufacturing Co., Chicago, serving for 5 years as sales representative in the Middle West. When in May, 1917, the Detroit office of the company was opened, he was appointed manager of that office, having charge of sales in the states of Michigan, Minnesota and Wisconsin, and continued in this capacity until last September, when he resigned to become assistant western sales manager of the Hart & Hegeman company.

Arthur J. Lubeck.

FREDERICK W. SINRAM, who since the death of H. H. Hodell about 2 years ago has acted as head of the Van Dorn & Dutton Co., Cleveland, was recently elected president of the company. This recognition of his services comes after a period of 9 years' service with the company, which began in 1910 when he was made secretary and manager of sales. In 1911 he was elected treasurer of the company, retaining the duties of secretary. He is also treasurer of the Van Dorn Electric Tool Co., and since its organization, about 3 years ago, has been president of the American Gear Manufacturers' Association.

MRS. STELLA FORD WALKER, who is contributing Part VI to the series of articles by H. E. Eisenmenger on "Central-Station Rates in Theory and Practice" appearing in the ELECTRICAL REVIEW weekly since last July, is an experienced student and analyst of public utility regulation by commissions. A graduate of the University of Wisconsin with the degree Bachelor of Arts, she joined the staff of the Railroad Commission of Wisconsin, which she served for 2 years, principally in analyzing and indexing the decisions of the Commission and preparing syllabi in final form for publication. On leaving the Wisconsin Commission's staff she became associate editor of *Rate Research*, the weekly publication of the Rate Research Committee of the National Electric Light Association. This work involved painstaking preparation of abstracts of commission rulings, reviews of court decisions affecting utility companies, digests of state utility laws, besides many special reports and papers on a variety of related subjects, such as going value, rate of return, franchise regulation, discrimination, etc. For nearly 6 years Mrs. Walker had practically complete responsibility of compiling and editing *Rate Research*. During the recent war, when her husband joined the army Mrs. Walker engaged in war camp community service. Since then she has engaged in varied literary work. Mrs. Walker is a well versed, lucid and fluent writer on the many phases of public utility relations, as is readily manifest from perusal of her articles on commission regulation in last week's and the present issue of the ELECTRICAL REVIEW. These articles will be continued in the next two issues.

Obituary.

ALFRED H. MEECH, aged 55 years, an electrical engineer and inventor of an elevator lift air brake, died Nov. 28 in New York.

WILLIAM E. RICE, former president of Washburn & Moen Mfg. Co., and later connected with the American Steel & Wire Co. for many years, died in Worcester, Mass., Dec. 2, at the age of 86 years.

ROBERT FARIES, founder and president of the Faries Manufacturing Co., Decatur, Ill., manufacturer of pumps, regulators, electrical fittings and fixtures, etc., passed away on Nov. 17 at the age of 82 years. He was one of the first men, if not the first, to devise adjustable fixtures for electric lights, and in that line of manufacture and in the manufacture of fixtures for display windows, the business he established has grown to large proportions. He was a leader in industry in Decatur for 50 years and his passing is mourned by the community as well as his many friends in the industry.

Financial News

Little Rock Company to Extend Lines.

Permission has been granted by the Arkansas Corporation Commission to the Little Rock Railway & Electric Co. to sell $376,500 of bonds. The proceeds of this bond issue will be used to make extensive improvements in its plant, extend its electric transmission lines and improve its service generally. The bonds are to be sold at not less than 80 and will bear 6% interest.

American Public Service Offering.

The National City Co. is offering $215,000 first lien 6% bonds of the American Public Service Co., dated Dec. 1, 1912, and falling due Dec. 1, 1942, at 93 and interest, to yield 6.60%. The bonds are redeemable on any interest date at 105 and accrued interest upon 60 days' notice. The American Public Service Co. was incorporated in Delaware in October, 1912, and has acquired the entire capital stock and the bonds of eighteen public utility operating companies situated in eastern Oklahoma and central and eastern Texas.

Standard Gas & Electric Calls Dividend Scrip for Redemption.

Standard Gas & Electric Co. has called for redemption $202,144 outstanding dividend scrip issued several years ago. After Dec. 15 it will cease to bear interest. The scrip will be redeemed at the company's office, Chicago, at face value and accrued interest, in accordance with the following notice from Robert J. Graf, secretary:

"Standard Gas & Electric Co. hereby calls all of its outstanding dividend scrip for payment at its office, Room 1900 Continental and Commercial Bank building, Chicago, Ill., on Dec. 15, 1919. Said dividend scrip will be redeemed at its face value and accrued interest to Dec. 15, 1919.

"You are hereby notified to present your scrip at the said office of the company for payment on said date. On and after said date, interest on said scrip will cease."

Pacific Gas-Sierra Companies' Power Lease in Detail.

In leasing properties of Sierra & San Francisco Power Co. for 15 years, Pacific Gas & Electric Co. will assume responsibility for all fixed charges, according to announcement made by A. F. Hockenbeamer, vice-president of the latter company. These charges during the fiscal year ended June 30, 1919, amounted to $863,567. In addition company will set aside a small amount for bond discount.

Pacific Gas & Electric Co. for the first year will pay a rental of $50,000, $100,000 for the second and third years and $150,000 annually thereafter. In addition Pacific Gas & Electric agrees to maintain the properties in their present state, advancing money to make any additions and extensions required by the California Railroad Commission, taking first mortgage bonds of the Sierra Co. in payment.

Assumption of the fixed charges of the Sierra company by Pacific Gas Company is no doubt responsible for the activity and strength of the series B fives of 1949 of the former company recently. The lease will now go before the state commission for approval. In taking over the plants of Sierra company Pacific Gas Company acquires the 28,000-kw. steam plant located in San Francisco. Major part of the output of Sierra company is sold to United Railroads of San Francisco. The Pacific Gas & Electric Co. will assume this contract under the terms of the lease.

Dividends.

Detroit Edison Co. has declared a quarterly dividend on 2%, payable Jan. 15 to stock of record Jan. 2, 1920.

Babcock & Wilcox Co. has declared a quarterly dividend of 2%, payable Jan. 1, 1920, to stockholders of record Dec. 20.

American Public Service Co. has declared a quarterly dividend of 1¾% on preferred stock, payable Jan. 2 to stock of record Dec. 15.

The board of directors of the Buffalo General Electric Co. has declared a quarterly dividend of 2%, payable Dec. 31 to stock of record Dec. 20.

Twin City Railway & Light Co. has declared a quarterly dividend of 1¾% on preferred stock, payable Jan. 2, 1920, to stockholders of record Dec. 20.

Electric Storage Battery Co. has declared a quarterly dividend of $2.50 per share on both common and preferred stocks, payable Jan. 2 to stockholders of record Dec. 15.

The board of directors of the Springfield Railway & Light Co. has declared a quarterly dividend of 1¾% on preferred stock, payable Jan. 2 to stockholders of record Dec. 15.

The regular quarterly dividend of 1½% on the issued and outstanding preferred stock of the American Gas & Electric Co. has been declared, payable Feb. 2 to stock of record Jan. 16.

Manhattan Electrical Supply Co. has declared the regular quarterly dividends of 1% on common stock and 1¾% on both the first and second preferred stocks. Both dividends are payable Jan. 2 to stock of record Dec. 20.

Niagara Falls Power Co. has declared a dividend of $1.00 per share on common stock, payable Dec. 15 to stock of record Dec. 10; also a dividend of $1.75 per share on preferred stock, payable Jan. 15, 1920, to stock of record Dec. 31.

The Allis-Chalmers Manufacturing Co. has declared a quarterly dividend of 1¾% and an additional dividend of 1¾% in payment of the remaining unpaid and accumulated dividends on the preferred stock of the company, both dividends payable Jan. 15 to the stock of record Dec. 31.

Earnings.

LAKE SHORE ELECTRIC RAILWAY SYSTEM.

	1919.	1918.
September gross	$ 232,645	$ 216,052
Net after taxes	71,231	65,481
Surplus after charges	35,831	29,593
9 months' gross	1,940,762	1,633,750
Net after taxes	547,359	471,227
Surplus after charges	225,409	145,937

CONSUMERS POWER CO.

Earnings of this subsidiary of Commonwealth Power, Railway & Light Co. compare as follows:

	1919.	1918.
October gross	$ 721,249	$ 582,240
Net earnings	342,391	268,832
Surplus after charges	174,029	100,713
Bal. after pref. div.	123,534	50,506
12 months' gross	7,904,824	6,381,701
Net earnings	4,191,644	3,236,838
Surplus after charges	1,987,295	1,413,119
Bal. after pref. div.	1,352,511	814,250

Surplus after charges as shown is available for dividends, replacements and depreciation. Fixed charges include taxes.

DETROIT EDISON CO.

Consolidated statement of Detroit Edison Co., including all constituent companies, compares as follows for October and 10 months ended Oct. 31:

	1919.	1918.
October gross	$1,539,272	$1,268,289
Net after taxes	356,802	356,514
Surplus after charges	208,254	228,256
10 months' gross	13,130,801	11,063,958
Net after taxes	3,355,515	2,866,765
Surplus after charges	1,947,685	1,770,502

DAYTON POWER & LIGHT CO.

	1919.	1918.
October gross	$ 259,176	$ 218,689
Net after taxes	83,564	65,458
Surplus after charges	22,497	23,367
Balance after preferred dividend	5,987	8,148

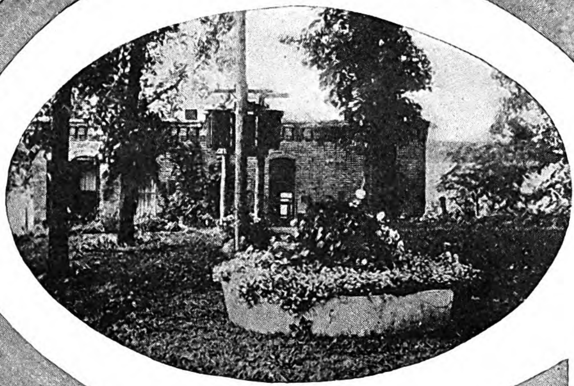
WEEKLY COMPARISON OF CLOSING-BID PRICES OF SECURITIES OF LEADING ELECTRICAL COMPANIES.

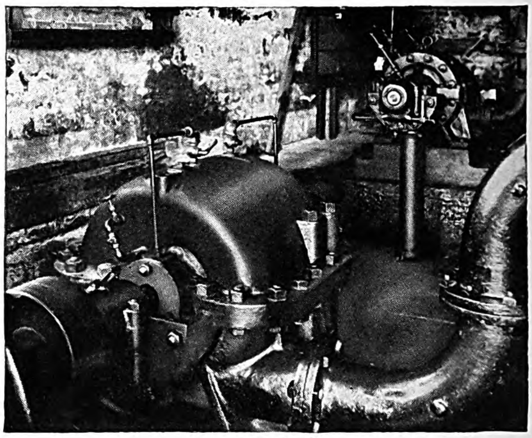
Quotations furnished by F. M. Zeller & Co., Rookery Bldg., Chicago.

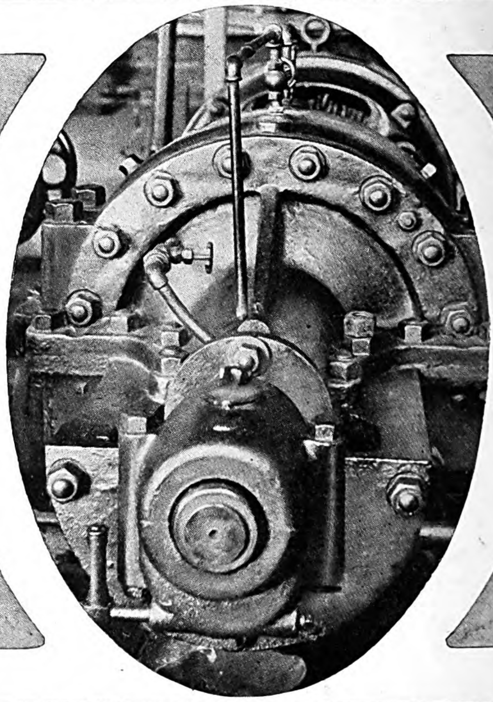
Public Utilities.	Div. rate Per cent	Bid Dec. 2.	Bid Dec. 9.
Adirondack Electric Power of Glens Falls, common	6	..	14
Adirondack Electric Power of Glens Falls, preferred	6	76	76
American Gas & Electric of New York, common	10+extra	125	124
American Gas & Electric of New York, preferred	6	39	39
American Light & Traction of New York, common	..	208	208
American Light & Traction of New York, preferred	6	93	92
American Power & Light of New York, common	4	60	60
American Power & Light of New York, preferred	6	72	73
American Public Utilities of Grand Rapids, common	..	8	8
American Public Utilities of Grand Rapids, preferred	7	23	22
American Telephone & Telegraph of New York	..	99¾	99¼
American Water Works & Elec. of New York, common	..	3	3
American Water Works & Elec. of New York, particip	7	8	9
American Water Works & Elec. of New York, first preferred	..	45	45
Appalachian Power, common	..	3	4
Appalachian Power, preferred	7	21	21
Cities Service of New York, common	+extra	410	405
Cities Service of New York, preferred	6	75½	73½
Commonwealth Edison of Chicago	8	109½	108
Comm. Power, Railway & Light of Jackson, common	..	20	21
Comm. Power, Railway & Light of Jackson, preferred	6	45	45
Federal Light & Traction of New York, common	..	7	7
Federal Light & Traction of New York, preferred	..	43	42
Illinois Northern Utilities of Dixon	6	..	..
Middle West Utilities of Chicago, common	2+extra	25	25
Middle West Utilities of Chicago, preferred	6	48	48
Northern States Power of Chicago, common	..	63	63
Northern States Power of Chicago, preferred	ex.div.7	89	90
Pacific Gas & Electric of San Francisco, common	..	60½	63
Pacific Gas & Electric of San Francisco, preferred	6	..	..
Public Service of Northern Illinois, Chicago, common	7	80	80
Public Service of Northern Illinois, Chicago, preferred	6	85	85
Republic Railway & Light of Youngstown, common	4	16	13
Republic Railway & Light of Youngstown, preferred	6	50	48
Standard Gas & Electric of Chicago, common	..	27½	27½
Standard Gas & Electric of Chicago, preferred	6	41	41¾
Tennessee Railway, Light & Power of Chattanooga, common	..	2½	3
Tennessee Railway, Light & Power of Chattanooga, preferred	6	5	5
United Light & Railways of Grand Rapids, common	4	41	41½
United Light & Railways of Grand Rapid, preferred	6	65	67
Western Power of San Francisco, common	..	21	27
Western Union Telegraph of New York	extra	89¼	89½
Industries.			
Electric Storage of Philadelphia, common	4	135	137
General Electric of Schenectady	8	173½	168
Westinghouse Electric & Mfg. of Pittsburgh, common	7	51¾	53½
Westinghouse Electric & Mfg. of Pittsburgh, preferred	7	..	..

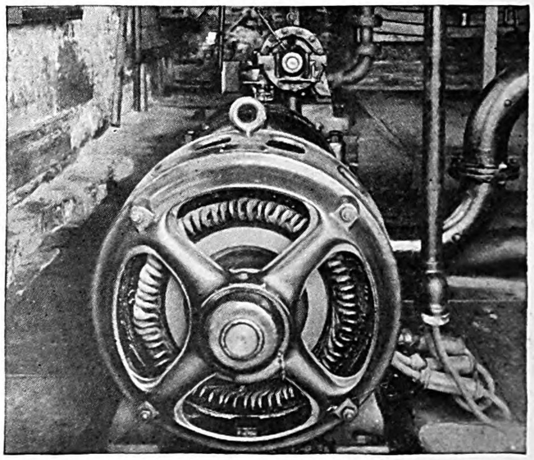
Electrical Review

Vol. 75. No. 25. CHICAGO, DECEMBER 20, 1919 Three Dollars a Year









Electrical Review

WITH WHICH IS CONSOLIDATED WESTERN ELECTRICIAN AND ELECTROCRAFT.

Vol. 75—No. 25. CHICAGO, SATURDAY, DECEMBER 20, 1919. Page 1003.

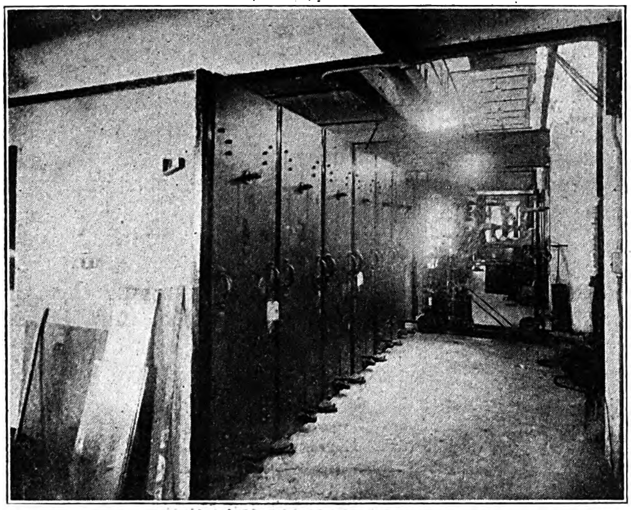


Fig. 1.—Truck Type Panels for the Main Control Board.

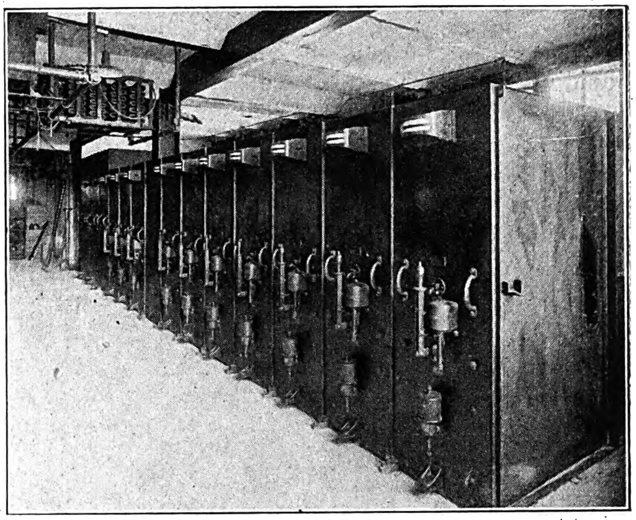


Fig. 2.—Truck Type Panels for 2300-Volt Single-Phase Feeders.

Selecting a Switchboard for a Plant of Moderate Size

How a 30,000-kw. Central Station Came to Select a Truck Type Switchboard — Comparison of Cell and Truck Types—Paper Before Pennsylvania Electric Association

By G. E. WENDLE

Lycoming Edison Co., Williamsport, Pa.

ABOUT the year 1904, the developments about Williamsport indicated clearly the need of a new and efficient generating and distributing plant. This plant was duly authorized, and particular attention was given to the switchboard in the matters of accessibility, convenience and safety and of provision for large future growth.

The board was of the standard marble panel type, supported by a pipe framework upon which the various apparatus was mounted. In order to provide ample space for operation and for safety, the face of the board was placed 8 ft. from the building wall, and when completed and all of the existing outgoing feeders connected, the general effect was one of spaciousness and our satisfaction was complete except for one thought—where was the business to load the spare panels we had bought?

At the time this board was placed in service the principal load on the combined systems was street railway and lighting. Commercial power was only a small percentage of the total output, and what little there was of power was mainly incidental to the large lighting installations. There was not a single polyphase motor on the system except those at the generating station.

The reason for this condition is evident when you consider that the majority of our manufacturing plants were engaged in various woodworking lines and obtained large quantities of wood waste in manufacturing. In order to get rid of this waste, specially designed boiler plants were installed to furnish steam for power and dry-kiln service, and it was a fundamental belief among the majority of our manufacturers that their power not only cost them nothing, but even saved them the expense of hauling the waste away. Under such circumstances our expectations in the addition of power loads were very, very modest. Hence, in planning our board, we provided power panels largely as a matter of faith, and because everybody we talked to, including the salesman, assured us that no self-respecting central-station board was complete without a full line of these panels.

As the years rolled around, we managed to pick up a few power services—mainly to operate special machines in plants where the engines were overloaded or for emergency conditions. The convenience of the motor drive, the added production, and the lessened risk of complete shutdown gradually resulted in additional permanent motor installations in spite of the cheap waste fuel. Finally the development of special machines by which much of the so-called waste could be worked into fillers for veneered doors, etc., and the increased local market for the smaller pieces for kindling reduced the "waste" materially. Power was no longer obtained for nothing—the coal account in the ledgers ended that dream, and we began to add on more power.

The power business developed more and more rapidly until we had used up all of the power panels. overflowed into the reserve lighting panels, and had

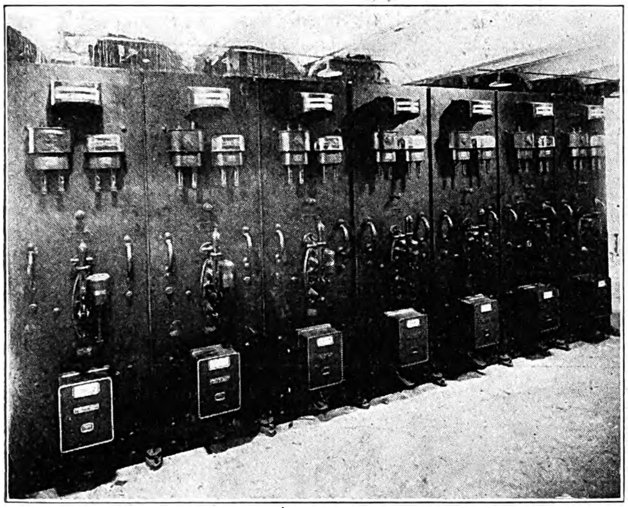


Fig. 3.—Truck Type Panels for 6600-Volt Three-Phase Feeders.

even tied in extra power feeders on existing lighting feeder panels. The old spaciousness disappeared; congestion was everywhere. It was almost impossible to obtain proper clearance spaces so that our operating men could attend to the operation, inspection and maintenance of the various apparatus properly and safely. We devised various ways and means to expand the old board; but the additional capacity obtainable was not worth the price and there still remained the inadequacy of the remodeled board in the matters of safety to our service and to our operators. There was but one proper remedy—a new switchboard, with ample room for expansion. The question was: What type of switchboard was best adapted to our requirements, or to the needs of any station of moderate capacity and voltage?

As a necessary preliminary, the ultimate station capacity, the maximum size and voltage of generating unit, and the probable number of feeders were carefully estimated upon the operating data of the present equipment and the anticipated development of our tributary territory. The figures assumed for these several items were as follows: 30,000 kw.; 7500 to 10,000 kv-a. at 11,000 volts, and 16 three-phase and 10 single-phase feeders in addition to our present lines. These estimated additions actually provided for three times our present capacity and between four and five times our present output.

It was further proposed to build a switchhouse addition to our present plant, in which all switching, controlling, regulating and protective apparatus would be placed. This decision eliminated any switchboard system which did not permit close grouping of the various units; and really limited our choice to three systems, namely, the usual panel type, consisting of a pipe framework which supported the various apparatus, etc., and on which were mounted the marble or slate panels with operating handles, instruments, etc.; the cell type with benchboard control; and the safety enclosed removable-truck type with remote control of all main or master trucks.

After a short study of the panel type, it was eliminated because of the large number of exposed high-voltage parts and the difficulty in meeting the present and anticipating the future requirements of our state safety code in the matter of isolation of dangerous parts. This isolation involved screens, etc., and when these were added, the cost was largely increased and the accessibility greatly reduced. In addition, the present tendency towards more stringent safety requirements made us doubtful of the permanence of our investment in this type of board.

The matter of selection was thus reduced to the cell and the safety enclosed truck types, and as these two types were available in units of ample size and were practically equal in cost for equal number and subdivision of units, the final choice was made after careful consideration of the relative merits of these types under our local conditions.

Essential Requirements of the Installation.

In order to determine some standard basis for comparison of switchboard types, we made up the following list of features which we considered essential in our case:

1. Reliability and continuity of service.
2. Safety to employes and the public.
3. Facility of installation.
4. Facility of inspection and maintenance.
5. Economy in operation.
6. Localization and isolation of troubles and consequent damages.
7. Time required for resumption of service after any interruption due to the switchboard.
8. First cost.
9. Reserve equipment required.
10. Provision for future growth.

Let us consider these features seriatim, assuming that both the cell and truck types have the same subdivisions of the same capacity.

1. *Reliability and Continuity of Service.*—Absolute reliability and continuity are impossible, but an examination of large modern switchboards shows how far designers have gone along these lines. In many of the larger plants duplication is carried to extreme limits, but in every case with which we are familiar duplication was limited to some particular step in the progress from the generator to the outgoing feeder. Usually the main generator leads were not in duplicate, but at the generator panel these leads could, by duplicate oil switches, be thrown on either of the duplicate main buses. Throughout the rest of the board the duplication was carried out as far as the outgoing feeder lines. This method represents the most advanced practice where large amounts of energy are distributed in large units, and commercial considerations warrant the increased investment.

The questions which the station of moderate size must solve are—what investment is warranted by the revenues from the energy distributed and how much will the customers pay for extra insurance of the service against breakdowns and interruptions. These questions can be answered only from a thorough knowledge of local conditions. In our case, we were sure that duplication must be of limited extent and that any extensive safeguarding of the service must be obtained through higher factors of safety in the matters of carrying capacity of the apparatus, insulation of the high-voltage parts and subdivision of the board by fireproof partitions. Having reached this conclusion, we investigated the cell and truck types on the same basis of subdivision, equipment, etc., and found that the devices and separate compartments used were the same in both types; but the material used in making up the compartments, the supporting system for the operating devices and the relative locations of these devices were different. Essentially these types are similar, and for the kilowatt capacity involved in our plant we concluded that equally reliable and continuous service would be obtained from either type.

2. *Safety to Employes and the Public.*—As all high-voltage parts are placed in closed compartments in both types, there is equal safety as far as regular operation is concerned, but when maintenance or repair work is required on oil switches and other apparatus, the removable-truck type, as an inherent feature of its design, must be made absolutely safe in order to get at any of the high-voltage parts. With the cell type the same degree of safety requires opening various separate disconnecting switches, carefully checking the same and making proper voltage tests. In short, the removable-truck type is *positively* safe, while the cell type is *possibly* safe.

3. *Facility of Installation.*—The cell type demands high-grade masonry or concrete construction. involving difficult forms and accurate template work. This requires first-class and experienced mechanics—under present labor conditions very difficult to secure in the smaller communities. After the foundation work is done, skilled electricians must be used in assembling and connecting the various operating devices which make up the board.

The removable-truck type is delivered "knocked down" as far as the compartments are concerned, but the removable trucks assembled. The exact work required is placing and leveling certain drilled channels of light section in the concrete floor and which serve as the foundation upon which the structural steel cells are erected, and two additional light channels per cell which form the tracks on which the truck panels are rolled. The high-grade fitting work and any necessary adjustment of parts to insure interchangeability of the trucks of the same type are attended to at the factory where specially trained men and the necessary jigs, templates and special tools are available for the work. The installation is thus reduced largely to assembly of fitted parts and does not require a staff of skilled mechanics to insure satisfactory results.

4. *Facility of Inspection and Maintenance.*—There is practically no choice between the cell and removable-truck types in the matter of inspection, but when inspection indicates that repairs, renewals or adjustments are needed, the removable-truck type has considerable advantage. The particular truck which requires attention is pulled out, a spare truck is substituted in the cell and service is immediately available. The truck which has been removed can be

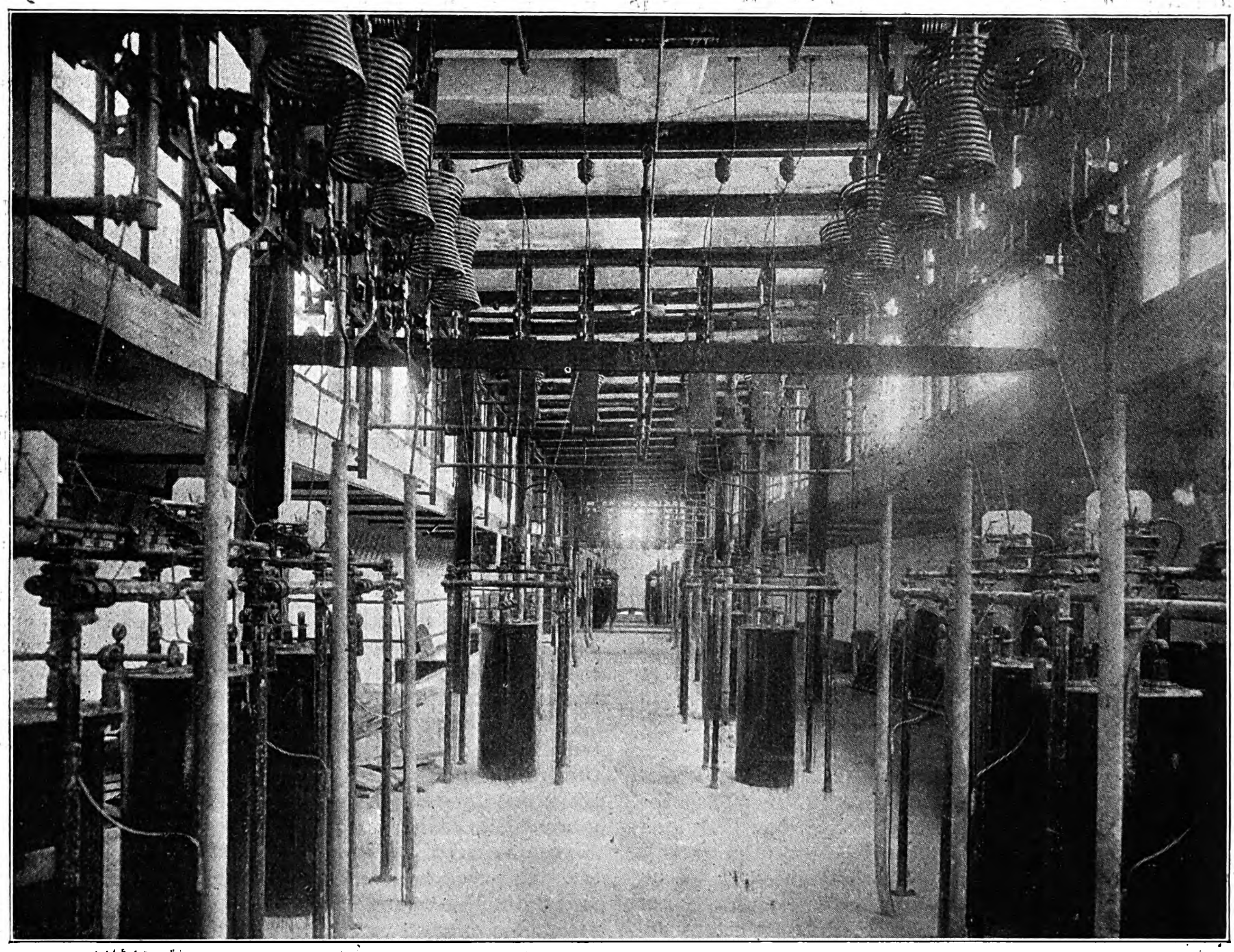


Fig. 4.—Arrangement of Disconnecting Switches and Lightning Protective Apparatus.

wheeled to a suitably equipped workshop where all operating, controlling and measuring apparatus can be inspected in detail and completely tested out. Any necessary maintenance work can be done quickly, conveniently, thoroughly and safely, and when completed the truck can either be set aside as a spare or replaced in its usual compartment.

With the cell type, the entire unit must be cut off and *kept off* until the necessary work is completed and tested. In addition, this work must be done on the various appliances, etc., at their permanent locations, with all the inconvenience due to inaccessibility of parts and the inadequate working space. In general, this means more time to do the work thoroughly and often results in doing *only what is absolutely necessary,* instead of completing *all of the work.*

5. *Economy in Operation.*—As long as regular service conditions prevail, the operating force has little to do except the periodic inspection of the indicating and controlling apparatus, but in order to provide for possible troubles or emergencies which occur with switchboard apparatus and wiring, it is essential that the operating men shall be of proper caliber to insure resumption of service in the minimum time and with the maximum safety to the plant and the consumers.

With the cell type, we would require on each shift at least one skilled operator who had exact and detailed knowledge of the switchboard and wiring and who could quickly and confidently carry out the requisite manipulations and emergency work without referring to diagrams, etc. When the service in any district is knocked out there is no time to be lost in locating and examining blueprints or diagrams or in consultation. This work demands specialized skill and training, good judgment and considerable resourcefulness and commands pay commensurate with these requirements and responsibilities.

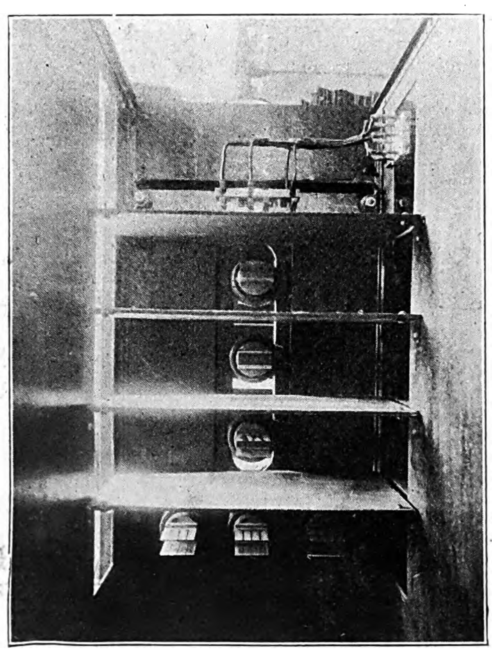


Fig. 5.—Truck Housing Showing Disconnecting Devices and Barriers.

With the truck type, we would require men of average intelligence who can be taught and be depended to observe irregular or defective operation and who can be drilled so that in case of trouble they can quickly remove the truck involved, replace it with a spare truck and resume service. The faulty truck can be wheeled out of the way and a report of the trouble made out for the chief engineer. There is no need of specialized knowledge of the apparatus and wiring nor of making any detailed investigations or tests to locate the faulty part

6. *Localization and Isolation of Trouble and Consequent Damages.*—As both cell and truck types consist of a series of separate compartments, the only question is the relative safety of masonry or concrete cells and steel. On this point we had some doubts, particularly where complete reinforced concrete cells were installed, but as our examination showed that the large-capacity generator and master truck panels were installed in cells constructed with reinforced concrete sidewalls, our fears were dissipated as far as the main truck panels were concerned. The remaining all-steel cell construction housed the feeder trucks of smaller capacity and any damage due to truck breakdown was not likely to be either serious or extensive, particularly as the energy supply to this entire feeder group was limited and protected by a master truck panel.

7. *Time Required for Resumption of Service After Any Interruptions Due to the Switchboard.*—With either type the trouble must be investigated and located. If the switching apparatus or wiring is at fault, the cell type requires that the faulty unit be cut out and repaired before service can be resumed, but with the truck type the faulty truck is pulled out and replaced by a spare truck and service resumed.

In order to obtain fair data on the time required to change trucks, tests were made with men of ordinary physique and average intelligence, but without special drilling or experience in handling the trucks. The series of operations were as follows:

A. Go to a designated faulty truck and remove that truck from its cell.

B. Go to the spare truck, remove it from its usual cell, move it into proper position to enter the faulty truck's cell, and push the truck home.

C. Close the oil switch, thereby locking the truck in place and resuming service.

The time required for the smaller feeder truck was 30 seconds, and for the main trucks 1 minute, 45 seconds.

These tests indicated clearly the great advantage of the truck type when emergency conditions must be handled quickly and surely by men of average capacity.

8. *First Cost.*—For the same number and subdivision of generating and distributing units, the cell and truck types were estimated as approximately equal in cost. The truck type cost was more certain, as its cost was determined very largely by the contract terms. The cell type cost was definite as far as the apparatus and appliances, but there was a large estimated portion which was subject to considerable doubt because of the fluctuating labor and material costs and existing uncertainties. We concluded that a cell type installation would certainly cost as much and probably would cost more than a truck type.

As a further comparison, a complete equipment of trucks and cells cost approximately one and one-third times the older standard panel type, with pipe framework in the rear and manually operated apparatus mounted thereon.

9. *Reserve Equipment Required for Proper Service.*—In order to insure reasonable continuity of service, the cell type requires sufficient reserve stock of assembled apparatus, etc., to provide for quick replacement of any damaged or defective apparatus, etc., by a complete spare. This means at least one assembled

spare for each size and type of apparatus used in the switchboard. In addition, there is required a complete supply of repair and renewal parts for the various sizes and types of apparatus.

The truck type requires as many completely equipped spare trucks as there are separate groups used in the switchboard. These spare trucks are housed in special cells, located conveniently for immediate use. The additional stock is limited to a complete supply of repair and renewal parts for each size and type of apparatus.

The truck type is on a par with the cell type as far as repairs and renewal parts are concerned, but the spare truck with complete equipment ready for immediate use is enormously more valuable from the service standpoint than any stock of spare apparatus, which must be located, mounted and connected before it is of any service value.

10. *Provision for Future Growth.*—It is assumed that the same amount of floor space will be provided regardless of the type of switchboard, and that the cell and truck units will be equal in number and capacity in the original installations and in future extensions until the floor space is taken up. Under these conditions and up to the limit of available space, there is a slight difference in favor of the truck type by reason of the lesser wall thickness of its steel compartments.

With the cell type, whether of brick or concrete, the group of cells must be torn down and a new group constructed for mounting larger capacity switches, etc. This would take considerable time, as it involves tearing down and removing the old masonry, setting up new forms, building the new masonry and waiting a sufficient time for the mortar or concrete to set properly before mounting and connecting the various apparatus. During this period of reconstruction, considerable temporary work must be done to continue service safely on the feeders or units involved, and such work is usually expensive if properly safeguarded.

With the truck type, the problem is largely one of increasing the capacity of the fixed main contacts and connections to the buses, and of replacing the smaller apparatus on the trucks with larger capacity apparatus of the same type. Service would not be interrupted, except for the short time necessary to place larger main contacts and heavier connections to the buses. No extensive reconstruction of the compartments would be required, as the dimensions are ample for the largest future units contemplated. We therefore considered the truck type particularly advantageous in handling increased capacity requirements economically.

Finally, if the capacity of future units exceeds the maximum rating of available truck panels, we can construct the necessary cell type units to take care of such larger apparatus and leave the existing truck panels which are adequate in capacity for their particular service undisturbed. From this standpoint, the truck type seemed to offer greater permanence in service and less depreciation than the cell type.

Description of the Installation.

In the foregoing analysis, we have tried to present the considerations which resulted in the selection of the truck switchboard for our entire alternating system. The complete board is installed and a description of its main features, together with the general layout of wiring, etc., from the separate panels to the overhead system, may be of interest. Your attention is particularly called to the care in designing the layout of the switchboard, wiring, regulating and protective apparatus so that all parts are readily accessible for operation and maintenance. This latter point is, in my opinion, fundamental to the reliability and continuity of service and is generally given small attention until too late to change.

The equipment of the station which the truck panels are to control consists at present of two 6600-volt, 7500-kw., three-phase generators and one 2300-volt, 2500-kw., quarter-phase generator with an ultimate capacity of 30,000 kw. These sources of power

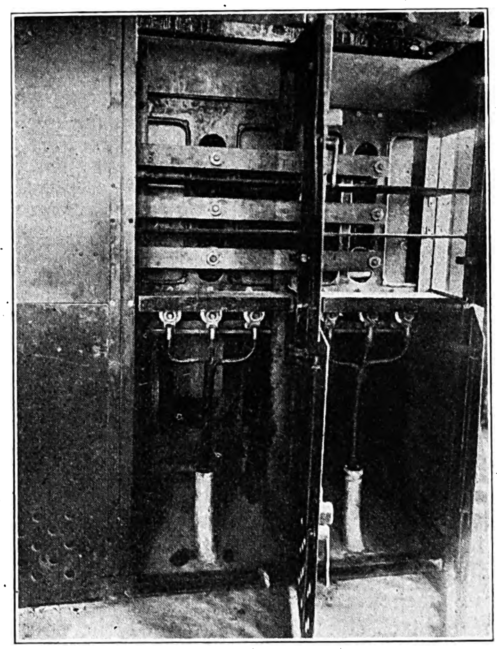


Fig. 6.—Truck Housing, Showing Bus Compartment and Method of Bringing Up Cables.

are interconnected by means of 6600-volt, three-phase and 2300-volt quarter-phase transformers.

The generators, transformers and group feeder circuits are controlled by means of safety-inclosed truck panels equipped with General Electric type FK-12 solenoid-operated oil circuit-breakers. See Fig. 1.

The 2300-volt single-phase lighting feeders and the 6600-volt three-phase feeders are controlled by means of safety-inclosed type truck panels with manually operated type FK-5 oil circuit-breakers. See Figs. 2 and 3.

The control switches for the solenoid-operated oil circuit-breakers on the trucks, together with the instruments, meters and relay equipment, are mounted on an independent slate switchboard of the standard vertical type.

Secondary instrument and control leads only are brought to this board and when the board is inclosed at the ends with grille work the installation will be provided with all the necessary features of safety.

The main control board and the truck panels are mounted on the main floor. The feeder leads from the truck panels run up to the second floor, where the feeder regulators are located, and then up to the third floor to the lightning arresters, choke coils and disconnecting switches, as shown in Fig. 4.

From the third floor the feeder circuits are carried upward through the roof of the station and then to the overhead distributing system. Figs. 5 and 6 show some of the constructional details of the safety-inclosed truck type panels as installed.

Central-Station Rates in Theory and Practice

Twenty-fourth Article — Commission Procedure in Rate Cases —Valuation for Rate-Making Purposes — Changing Attitude as to Importance of Valuation—The Different Bases of Valuation

By H. E. EISENMENGER

This series of articles, of which this is the twenty-fourth, began in the issue of July 12. The first seven articles, forming Part I, dealt with the cost of electric service. Part II contained six articles on the principles governing selection of a rate system. In the six articles of Part III were described the various systems of rates found in practice. Part IV included two articles on rate analysis, while Part V discussed accuracy of rates. The present article is the third one of Part VI on commission regulation of public utilities. Next week's article will close the series.

PART VI—PUBLIC UTILITIES AND PUBLIC REGULATION—Continued.

CONTRIBUTED BY S. F. WALKER,
Formerly Associate Editor of Rate Research.

III. PROCEDURE IN RATE CASES.

THE commissions on first taking up their responsibilities, without precedent to guide them, with little chance of pleasing both parties to a controversy and the probability of pleasing neither, sought to base their decisions upon carefully prepared data so that the justice of their orders might be proved in mathematical terms.

In rate cases the responsibility of the commission lay in securing for the public rates as low as were consistent with good service and at the same time in securing to the company a reasonable income covering all operating expenses, including allowance for the inevitable depreciation of the property and, over and above this, a reasonable rate of return.

VALUATION OF UTILITY PROPERTIES.

To determine upon just what amount the company should be permitted to base the return, the commission made extensive and detailed valuations of the properties. These were often drawn out over many months. In some of the earlier rate cases it would be two or three years after the filing of the complaint before the final rate order was entered.

When a rate case opened up, the commission's valuation engineers went out to make a valuation of the company's property, and, because a rate investigation was a new and untried experience, the company's engineers were also set to work making a separate and complete valuation and, in most cases in a city of any size, a third valuation was prepared by engineers for the city. The different interests of these three sets of engineers led to widely different results and at the hearing before the commission the different arguments were presented, substantiating the findings of the different appraisers. When it came to the writing of the commission's opinion this extensive debate was reflected in a lengthy opinion passing upon the merits and demerits of the different valuations and the arguments presented on the different values making up the total. As a matter of fact, a careful reading of the opinion would not always disclose just what had been used as the final rate base. But the practice of making these extensive valuations was continued, showing the desire of the commissions to determine mathematically the justice of the decision on rates. Arguments and counter arguments were heard, and different bases of valuations were proposed. It would appear that a valuation worth making at all would be worth making well, but the difficulty is that the whole matter is fluid—the property values do not stand still, unit prices fluctuate, depreciation goes on, improvements and extensions are necessary, new developments cause property to become obsolete.

Excessive Accuracy in Valuation Vitiates Its Timely Value.—If the rates under investigation are unnecessarily high or unreasonably low, the injustice to the public or the company is continued during the period of investigation. It is practically impossible to make refunds or adjustments over past charges, as the company's patrons are constantly changing and the transactions are numerous and involve small amounts. For this reason again the rate determinations should not be extended by needless argument over the theoretical differences of opinion. A rate investigation is more or less a disturbing factor in the company's business. The sooner settled the better, as a rule, so that the correction in rates, if a change is found to be justified, can be made promptly.

After expending time and effort to arrive at an exact valuation, the lapse of time makes it necessary to make allowances all along the line to adjust the findings to the present. After all, the new rates are not expected to be reasonable as to past conditions, but they must be reasonable for future operation.

Assuming that an absolutely perfect determination of value for rate-making purposes has been made, the commission is then met with practical difficulties in the way of fixing the rate on a strict cost-of-service basis. Perhaps the utility is still in the developmental stage and cannot be made to bring in a reasonable return immediately or some other circumstance calls for a modification of the rate finding. Competition is a factor, value of the service must be considered, and judgment must be exercised at every step of the investigation, regardless of all attempts to place rate making on an exact mathematical basis.

Changing Attitude as to Valuation.—It would seem that now after some ten years of regulation of public utilities a theory and method of procedure would be clearly mapped out, if such is possible of determination, but the subject is still in a confused state. The holdings of courts on various elements of value in taxation cases or in cases where valuations have been made to determine whether or not there has been confiscation of property, and the holdings of commissions in capitalization and purchase cases have been cited in rate proceedings without proper distinction being made. After much discussion on a certain point commissions have failed to state the final conclusion and value used. So in following precedents one comes to blind alleys, many branching off places and puzzling crossroads.

Valuation has been overemphasized, has been made an end in itself. It should be recognized that the commission is not seeking a value, but is seeking a reasonable-rate base. With a value right at hand, a commission will go out around it, add on and subtract from, in order to arrive at a base which in its judgment is proper in that case. Even if the records of a company were absolutely complete, showing the cost of the property just as it was acquired, the cost, or the first cost less depreciation, would not necessarily be taken as the base for rate making.

In the above discussion it is not intended to present an argument for the entire disregard of valuation in rate cases, but for a practical treatment of the work of making appraisals. The commission must make an investigation and get together facts upon which to base an opinion, but it would seem that, with more complete operating records before the commission and greater familiarity of the regulating commissions with the work given them to do, a more practical handling of valuation may be expected than that found in the earlier decisions.

A very marked change has in fact taken place. One advance was made by one commission which secured more co-operation between the commission's engineers and the engineers of the company and the city. The position was taken that the items of property either were or were not there and an inventory of the property was made up which was acceptable to all the parties making the appraisal. Then the proposition was asserted that the property either had a value in a rate case or did not have a value, and they sought to secure a practical co-operation of the various engineers in determining common-sense values which would appear reasonable to all parties for all practical purposes. In this way many of the differences in engineering practice were worked out before the data were presented to the commission.

In other cases, to avoid the costs of making complete duplicate appraisals, the commission's engineers, representing the neutral body, made the only complete appraisal in the case, their findings being subject to check by the city and the company. Or in still other cases the burden was on the company of showing the reasonableness of the rates complained of and a complete inventory and appraisal was required of the company, subject to check by the commission's engineers.

In the case of an application for an increase when the record showed a deficit from operation under the rates in force, the New Jersey Board prescribed new rates and ordered the company to file an appraisal of its property with the Board at a subsequent date fixed in the order, failure to file the inventory cancelling the permission to increase the rates.

More recently, during the war period, much less importance has been given to the determination of value in rate cases. This is true especially of the emergency rate increases, but it is very doubtful indeed if, even after a return to more normal times, valuation will ever be taken as seriously in a rate case as it has in the past. A number of causes have contributed to the omission of extensive appraisals from recent cases.

The rapid increase in prices has made it difficult to determine what should be considered reasonable unit prices for such valuations. There has been a marked withdrawal of engineers from valuation work to construction work or other work in connection with the demands of war. The emergency rate increases needed to meet the sudden increase in costs of operation could not be postponed for complete investigation. And still another reason lies in the fact that in many cases the commission is familiar with the company's financial standing through previous rate investigations, accounting supervision, or supervision of security issues and cases of purchase and sale. Or if not that particular company, the commission has a practical knowledge of other similar companies to serve as a guide.

Recent Opinions as to Importance of Valuation.—The attitude of the various commissions may be shown by the following excerpts from recent opinions.

In the Queens Borough Gas & Electric Co. case, in which the company applied for increases in gas and electric rates, the New York First District Commission in an opinion rendered June 3, 1918, discussed the question of whether or not a valuation of the properties should be required. Referring to the making of an inventory, the ascertainment of proper unit prices, and examination to determine the present condition of the property and the extent of depreciation, the Commission said:

"All of these matters involve controversial elements which mean delay and mean expense; and after all, proof of present reproduction cost, with or without deduction of depreciation, is not an indispensable element in ascertaining whether the quantum of net operating revenue yielded by present rates and expenses affords to the company's investors an inadequate return upon that which the law and the constitution says an adequate return must be afforded. * * * In a time of war, there should be no avoidable expenditure of money, expert skill or materials, which does not serve the purpose of integrating these local agencies in the successful conduct of the war. To require the present depleted valuation staffs of the Commission or company engineers to bend their energies for several months to a reinventory and appraisal of this company's property, at a time when unit prices for construction work and materials are so abnormally high as to be misleading and of little aid in ascertaining 'value for rate purposes,' would seem to involve unnecessary delay, unnecessary expense, and undesirable diversion of labor and skill."

The New York Second District Commission said, in the Empire Gas & Electric Co. case (decided June 11, 1918):

"All parties to the controversy are to be congratulated and commended for taking such action as will enable this Commission to fix emergency rates without a prolonged investigation involving perhaps a valuation of the company's properties in each community and which would be conducted at a time when costs are shifting so rapidly that, whatever time might be taken as the basis of the calculation, the situation would probably be materially changed while the investigation was in progress."

The Illinois Public Utilities Commission determined rates in the Galva Electric Light Co. case (decided June 4, 1918) without a detailed and exact appraisal of the property being made. The Commission said:

"The valuation of the engineering staff is based upon the original cost of the property. This valuation does not purport to be an accurate valuation of the property and was made by the engineering staff without giving detailed consideration to the costs of each individual item of property. The reason for this method of valuation appears to be the emergency nature of the case and the evident desire to render an opinion as promptly as possible and still present data which represents with reasonable accuracy the property values. The engineering staff testified to its belief that a more careful valuation would not alter the results by more than 5%."

When a large number of applications for emergency increases had to be handled promptly this Commission prepared a questionnaire form which the applicant might fill out, submitting to the Commission the facts in outline regarding the operating revenue and expenses and general condition of the business as compared with the conditions prior to the marked increase in operating costs which were the direct cause of the application for rate increase.

There were many indications of a coming change in opinion, however, before these strictly emergency cases arose.

That the changes in conditions during the time which it would take to make a complete valuation might seriously affect the accuracy of the final figures, is taken into account by the New Jersey Board of Public Utility Commissioners in the New York Telephone rate case. The Board in a decision in that case rendered Nov. 20, 1917, said:

"Since the rates to be prescribed by order are to be operative in the future, it follows that, in the exercise of the power of regulation, past conditions and experience thereunder alone cannot be taken into account. The future and the conditions under which the rates prescribed are in fact to be applied must be considered.

"As was said by Justice Harlan in Smyth vs. Ames (169, U. S. 466), 'the probable earning capacity under particular rates prescribed * * * and the sum required to meet operating expenses are * * * matter for consideration.'

"Especially is this so; where, as here, a long period of time necessarily elapsed in making the inventory and appraisement of the property and in hearings, and consequently the data which form the basis of the exercise of the power relate to a date already some time in the past. In the meantime conditions have materially changed; annual taxes have increased; special war taxes have been and will be imposed; the trend of the cost of labor and materials has been substantially upward; and the proof, in fact, shows that operating expenses have been and are on a steadily ascending scale."

The Supreme Court of Pennsylvania said:

"The ascertainment of the fair value of the property, for rate-making purposes, is not a matter of formulas, but it is a matter which calls for the exercise of a sound and reasonable judgment upon a proper consideration of all relevant facts." (Borough of Ben Avon *et al. vs.* Ohio Valley Water Co.)

After discussing the valuation data submitted in the fare case of the Chicago, North Shore & Milwaukee Railroad Co., the Illinois Commission in an opinion under date of Sept. 5, 1917, said:

"Finally, it must depend upon the good judgment and impartiality of the regulating body which has before it all facts bearing upon the matter. In all proceedings of this nature there will always be found outstanding certain points which will serve as guide-posts by which the amount shall be determined that is fair both to the corporation and its patrons. More than this cannot be expected, and justice is satisfied if this be done."

The simplifying of valuation problems through continued regulation of accounts and capitalization is illustrated by the following New York and New Jersey cases.

In the New York & North Shore Traction Co. fare case, before the New York First District Commission, the records as to investment and return were unusually free from dispute for the reason that the company had been continuously subject to commission supervision. The Commission in that case (decided Jan. 7, 1918) said:

"The compactness and convenience with which it was possible to present the petitioner's case in this proceeding, and the absence of confusion or controversy as to the accuracy or significance of the items appearing in the various exhibits submitted to the Commission, may be ascribed almost wholly to the fact that the petitioner's financing, accountancy and operations, except in respect to the sufficiency of its depreciation reserve, have been conducted in conformity to the Commission's rulings and directions. In consequence, it was possible, with little difficulty, to present the petitioner's property costs, operating statistics, revenue needs, and the like, with complete fairness and clarity."

The New Jersey case referred to above is the New Jersey Northern Gas Co. rate case (decided Dec. 19, 1917) in which the Board said:

"In lieu of an inventory and appraisal, the company submitted a table showing its issue of bonds, the net proceeds therefrom and the amount of stock issued at par, which securities were issued under the authority of this Board. It does not necessarily follow, however, that a valuation made *ex parte* for the purpose of approving an issue of securities would be conclusive for purposes of developing a schedule of rates. For the purposes of this report, however, the difference will not be such as to affect the validity of the conclusions which may be arrived at."

Valuations in Capitalization and Sale Cases.—Valuations have been made by commissions in capitalization cases and in cases involving purchase and sale of utility properties. The commissions have held in such cases that the process of valuation is not the same as in a rate case: The purpose for which the valuation is made is controlling. But it would appear that under regulation there should be little difference between the value for a rate case and value as a basis for capitalization or purchase. The earning power of a utility would ordinarily have weight in fixing a purchase price, but the earnings are subject to modification by a commission's order. If the commission approves the purchase of a property at a higher value than the value upon which the company would be allowed a return in a subsequent rate case an injustice will be done. A similar circumstance would arise if securities were issued under commission approval on a larger basis than would be used in a rate case. Provision might be made for amortization of an excess value capitalized or allowed in a purchase case, or the buyer might be willing to pay a higher price for the property, expecting to improve the property by more efficient management and the working out of economies in operation, trusting that the commission would permit him to share in the resulting benefits. But, as a rule, the approval of a different and higher value in capitalization or purchase cases than in a rate case subjects the industry to an element of instability which is unnecessary under regulation.

There may continue to be cause for uncertainty in the determination of a proper rate base in cases where the company has been established long before commission regulation was instituted, but it is of greater significance to determine the attitude of commissions toward new capital which has been invested in these properties with their approval and where the company's accounts have been open to inspection and regular reports made to the commission. Any uncertainty as to the treatment of this new capital by commissions in rate cases will be reflected in the attitude of capital toward investment in the public utility field and will have much to do with fixing the interest rate which it is necessary to offer such capital for development and extension of these industries.

BASES OF VALUATION IN RATE CASES.

Earning Value.—Commissions have pointed out that earning value cannot be considered in a rate case, for the proceeding is for the purpose of determining what earnings are reasonable.

Market Value.—Market value is not available as a base in public utility cases, as properties do not change hands very frequently as a rule, and under regulation the usual considerations affecting a purchase price are modified by the very fact that the property is under regulation.

Original Cost.—The original cost of a property determined from actual company records or an estimate of original cost built up by the use of unit prices which were probably paid at the time the property was constructed may be used as the measure of value or one of the bases of value in a rate case. When regulation was first established it was seldom possible to find actual cost records. Properties had changed hands, and perhaps the present property was the result of consolidations and original records were not available, but with regulation continued over a considerable period, in the case at least of properties more recently established, complete cost data will be on record.

Present Value.—The present value of the property may be taken as a basis, judged by present-day prices of labor and material necessary in building up the property, the possibilities of development of the business in the field, the adaptability of the property as erected to serve the demands of the community, and the depreciated condition of the property. This value should reflect appreciation as well as depreciation.

Reproduction Cost New.—Lacking exact records, the commissions have built up estimates of the cost to reproduce the property. In some cases the aim has been to determine the cost of an identical property, in other cases the cost of a property planned to meet the present needs of the community. In some cases the estimate has been made using unit prices such as might have gone into the property at the time it was constructed, in others present-day prices have been used, while in others the prices used do not belong to any definite date but are averages covering a number of years.

Actual-Performance Method.—A basis called the actual-performance method was used in a recent case purporting to bring a new angle to bear upon the question of value. The method was used by the Pacific Telephone & Telegraph Co. in presenting cases before the Washington and Oregon Commissions. The Oregon Commission discusses the method as follows:

"The utility has strongly urged the acceptance of this theory, contending it is superior to the 'reproduction-cost method,' which, we believe, all will admit has not proven entirely satisfactory in its application when considered as a determining factor of value.

"The company maintains an elaborate system of cost accounting which is of particular value in investigations of this nature, and by reason of which it is enabled to present this 'Actual-Performance' estimate. Briefly stated, this estimate was made up by an analysis of the entire cost of doing work, including supervision, general and other so-called overhead expenses, as shown by the company's cost records over a period of years, from which analysis unit costs were derived. These unit costs were then applied to the various items of property as shown by an inventory of the system. In the case of land, studies were made to determine the cost of acquisition over and above the price paid the seller, and this cost was added to the value of each parcel as determined by appraisals made by real estate dealers and land appraisers.

"The result, the company contends, is not 'Original Cost,' neither is it 'Book Value,' nor 'Reproduction Cost,' but is rather an 'Appraisement on the Basis of Actual Performance' and presents 'an array of facts as distinguished from an array of opinion, expert or otherwise, that ought to be the recourse for constructive and efficient regulation.'

"The theory commends itself to us very strongly. It embodies many features which are lacking in the reproduction theory and, in a measure, meets many of the meritorious objections to original-cost figures. Taken in connection with original-cost statements and reproduction estimates, it supplies information which is of inestimable value in arriving at a correct solution of a problem which, at best, is surrounded with uncertainties and frought with technical considerations. We do not wish to be understood, however, as accepting this theory as a substitute for the reproduction method. Neither do we think it should supplant original-cost figures. It conflicts with neither, and we are inclined to view this new presentation rather in the light of a valuable addition to those theories which have been accepted as bases for the determination of values."

(*To be concluded.*)

ANOTHER UTILITY INSTALLING WIRELESS TELEPHONES.

The Public Service Co. of Northern Illinois is installing wireless telephones at its Blue Island and Joliet stations, the intervening distance as the crow flies being only about twenty-five miles. The two stations tie-in together and also are interconnected with the Fisk and Quarry street stations of the Commonwealth Edison Co.

The wireless system will have a radial power of about 100 miles, and will be used primarily during such times as the metallic telephone lines are out of service, due to weather or high-voltage system trouble.

Modern Electric Furnace Practice in Foundries

Advantages of Electric Furnaces — Acid Type of Furnace for Foundry Work—Comparative Operating Costs—Furnaces for Malleable Iron — Abstract of Paper Before A. S. M. E.

By W. E. MOORE

UP TO the present time the electric furnace has seen its largest commercial development, first, in the manufacture of aluminum; second, in the manufacture of steel; third, in the manufacture of ferroalloys, and fourth, in the manufacture of calcium carbide. At the end of 1913 there were only 19 electric furnaces installed in the steel-making industry in America. This number had increased to 136 at the end of 1916 and to 269 at the end of 1917. Now the number of steel-making furnaces in use in various industrial countries of the world is 815, of which 290 are in the United States and 45 in Canada.

The average capacity of these furnaces in America is 0.37 tons per heat for ingot furnaces, and 1.7 tons per heat for foundry furnaces, though the 3-ton size is now most generally used in foundries. More than 99% of all the steel-making furnaces are of the arc type, less than 1% being of the induction type, which was popular in the early days of the art.

Electric furnaces are used for the following principal purposes in the metal industries:

(1) Forging steels, tool steels, alloy steels, etc.

(2) Making steel castings in foundries.

(3) Making high grades of strong cast iron for difficult or fine castings.

(4) Melting brass, bronze and other nonferrous metals.

Properties of Electric Steel.

Primarily, electric steel became popular because of its superior physical properties. While such steel can be made with a more satisfactory chemical analysis, using a given grade of raw materials, than by other processes, experience has abundantly demonstrated that when made according to the same chemical analysis electric steel will have about 15% greater tensile strength or ductility, depending upon its heat treatment, and that it is more resistant to shock and better able to receive heat treatment. The reason for this is that the steel, being made in a closed furnace and in a reducing atmosphere away from the contaminating influences of combustion gases, is more solid, freer from gases and less prone to non-metallic inclusions of slag oxides.

TABLE 1.—COMPARISON OF OPEN-HEARTH AND ELECTRIC-FURNACE STEEL.

	Open-hearth furnace.	Electric furnace.
Elastic limit, lbs. per sq. in....	41,060	64,850
Tensile strength, lbs. per sq. in.	89,100	105,140
Per cent elongation in inches..	21.5	22.0
Per cent reduction of area.....	31.74	52.37
Elastic torsion	16,750	33,700
Character of fracture..........	Granular	Silky cup

As an example, the tests in Table 1, made by R. W. Hunt & Co., Chicago, Jan. 30, 1919, for the Chicago Surface Lines, illustrate the physical properties of A. E. R. A. specification heat-treated electric-furnace axle steel. It was heated from 1450 to 1460 deg. F. held 1 hr., quenched in 65-deg. oil, drawn from 1185 to 1200 deg. F. for 1 hr. and then slowly cooled in the furnace. The open-hearth steel was also heat-treated in the same manner.

The Bureau of Standards reports regarding the superior qualities of electric steel as follows: The characteristics of electric steel are great homogeneity and freedom from segregation. It is somewhat higher in tensile strength and elastic limit than other steels, and, owing to its greater density, shows a marked resistance to fatigue.

Being absolutely "dead" when properly made and averaging lower in sulphur, electric steel in the foundry is less liable to show shrinkage cracks between ribs of castings, and, being more fluid, it is not so liable to piping, blowholes, cold shuts or misruns, and in tool steel it takes heat treatment more effectively and will stand greater abuse in heating.

The electric furnace is especially useful for making alloy steels. Since the metal is treated in a reducing atmosphere, there need be no large losses of the added elements, such as silicon, manganse, vanadium and chromium, which in the ordinary open-hearth practice are oxidized in large quantities and carried to waste in the slag, thus producing uncertain mixtures. Indeed, the added elements in open-hearth practice frequently show losses of from 30 to 50%, while in the electric furnace they will be practically nil.

With the electric furnace it is much easier to carry the finishing operation to a more exact limit in carbon and silicon content than is practicable in the case of the open-hearth furnace. Gases of solution and inclusion (oxygen and nitrogen) are eliminated.

Electric Versus Open-Hearth Furnaces.

In open-hearth furnaces it is impracticable to melt down fine scrap, such as turnings in quantity, without excessive additions of pig iron, for the reason that the oxidizing flames, which furnish the heat to the furnace, will reduce the metal when in an attenuated form to a mass of oxide before it becomes molten, whereas with the electric furnace it is entirely practicable to melt turnings exclusively, which, under ordinary market conditions, are purchasable at a price from $5 to $10 per ton lower price than that for the heavy melting grade of steel required in open-hearth practice.

In the electric furnace it is possible to obtain a heat-transfer efficiency of from 60 to 70% of the heat energy of the electric power supply put into the molten charge, whereas with open-hearth practice the efficiency ranges from 8 to 15% and in a crucible practice from 2 to 6%. The fuel-developed heat unit of the open-hearth furnace is, however, bought in a much cheaper form than the heat unit supplied by electric power, and if the electric furnace did not have the other advantages mentioned it could not at present compete against the open-hearth furnace on the basis of cost.

On account of the very intense heat of the electric arc, it is entirely feasible to melt down and refine a charge of foundry steel in 1 hr. or less which in the open-hearth furnace might require from 6 to 14 hrs. In other words, a 12-ton electric furnace may be practically equivalent to an 80-ton open-hearth furnace, so far as steel output is concerned, and involve far less installation cost.

The Arc Type of Electric Furnace.

The arc type of electric furnace is practically the only one being installed for steel making today, although induction-type furnaces are in use. The induction-type would appear to have advantages over the arc-type furnace, but practice has shown that it is in no way a competitor of a proper constructed arc furnace. In large sizes the power-factor is low, the efficiency poor, and the cost of replacing the refractories high.

Arc furnaces may be classified into long-arc and short-arc types. There are many theoretical inducements for using the long-arc furnaces. With a given energy input, the electrode is correspondingly smaller and the electrode cost therefore reduced proportionately. With the water-cooled bottom-contact type of furnace either the furnace size must be kept small or the voltage must be increased in order to keep the current low and prevent that form of contact from overheating; hence, it is the custom to operate the bottom-electrode furnace with a long arc and low current, and in small sizes only.

Arc furnaces may again be classified into single-phase, two-phase and three-phase types. The single-phase furnace is ideally simple, but is poorly adapted to modern power-plant conditions, as central-station power is universally generated and transmitted at three-phase. The long-arc single-phase furnaces have the disadvantage of operating on low power-factor, thus causing waste in transformer, line and generator capacity, which usually makes them prohibitive from the central-station man's viewpoint in any but small sizes, say, 1/8-ton to 1-ton capacity per heat.

The two-phase furnace may be operated from either a two or three-phase source of supply. When operated from the latter it is necessary to use Scott-connected transformers, which are slightly more expensive and inefficient than ordinary transformers. The two-phase furnace is usually built with four arcing electrodes and, while it gives a theoretically balanced load on the power system, it has the objection of requiring an additional electrode, which increases the electrode consumption 33% over the three-phase furnace.

For installations of moderate and large size the three-phase is the most satisfactory, fulfilling all the conditions as to balanced load and high power-factor required by the central stations, at the same time giving the minimum electrode loss and the simplest form of automatic electrode-adjusting gear.

It is possible to obtain satisfactory operation of the direct-arc-type furnace for melting nonferrous metals only where the content of metals which volatilize at low temperatures is small, as, for instance, in making bronze and low-zinc metals. Where the zinc or aluminum content is high, as in yellow brass, Muntz metal, etc., this type of furnace is unsatisfactory and results in great waste of the more volatile metals and the making of porous castings. Consequently special furnaces of the resistor, rocking, rolling, tumbling

Electric Furnaces in Foundry of Standard Steel Co., Hammond, Ind.

induction or distributer-arc types are required, the latter referring to furnaces in which the heat of the arc is transmitted by radiation alone.

Disadvantages of Crucible Furnaces.

The crucible furnace was first used for making steel castings and high-grade tool steels. However, it is now being displaced by the electric furnace, which has the advantages of rapidity of operation, reduced cost and the ability to make sounder castings and better tool and alloy steels. Due to the absorption of carbon from the crucible, it is difficult to make castings low enough in carbon to obtain the ductility desired for many purposes. Furthermore, the steel reduces the silica from the clay of the crucible, tending to run the silicon content of the product high. The overpowering objection to the crucible process, however, is the high cost of the products, due to (1) high cost of pure melting stock, as no refining is practicable; (2) high labor cost on account of the small heats handled; (3) extravagant fuel consumption, sometimes using 3 tons of coal per ton of steel; (4) high cost of crucible renewals, often averaging two to four crucibles per ton melted, and costing $9 to $11 each, or $18 to $44 per ton. For these reasons the crucible process is being discontinued for castings as well as for tool steels.

The Converter Process in Steel Founding.

During recent years the side-blow converter process has become popular in steel foundries making castings of medium and small size. This process requires high-grade, high-silicon, low-phosphorous and low-sulphur pig iron to be melted in a cupola furnace with the finest grade of coke obtainable. The advantages of the converter process are: The steel may be made fluid enough for reasonably thin castings; the heats, usually running 1 to 2 tons, are of convenient size to be poured off quickly before cooling; the fuel consumption is moderate, averaging from 400 to 600 lbs. of coke per ton; the first cost of the apparatus is low, and the process is available for intermittent service.

The disadvantages are: The metal must be handled twice in the ladle; the metal picks up sulphur and phosphorus and nitrides from contact with the fuel and the air blast; the losses in the cupola and converter are quite high, running from 16 to 24%, further concentrating and increasing the percentages of impurities in the original metal and wasting costly melting stock; the steel is full of oxides and gases and requires large quantities of expensive ferroalloys to kill; the quality of the steel physically, as well as chemically, is below par; a heat once blown too cold cannot again be brought up in heat enough to cast and must be "pigged"; only the highest grades of melting stock may be used, costing generally $15 to $25 per ton more than for the acid open-hearth furnace and $20 to $35 per ton more than for the electric furnace; and the refractory maintenance is high, as the cupola and converter linings must be repaired after each 10-hr. run. Liquid-metal costs of converter steel frequently run up to from $60 to $80 per ton.

The electric furnace is the most modern steel-producing agency and is gaining in popularity more rapidly than all others. It is the most compact furnace, and the rapidity with which it will melt down cold charges adapts it splendidly to the making of steel castings as well as forgings and tool steels. It is the cleanest and most certain method of making steel, and its small bulk makes it feasible to locate the furnace near the center of the floor where the metal need be transported short distances only.

Acid-Type Electric Furnace for Foundry Work.

The acid-type furnace is best suited for foundry work and the most popular size has a capacity of 3 tons per heat, though sometimes 1.5-ton or smaller furnaces are required. The more highly powered and rapid furnaces for such work turn out from 8 to 16 heats in 24 hrs. with a power consumption of from 500 to 650 kw-hrs. per ton of liquid steel. Taking the consumption of large turbogenerators now used in central stations at, say, 1.5 lbs. of coal per kw-hr., the fuel consumption of the acid-type electric furnace may be said to be equivalent to from 750 to 900 lbs. of coal per ton melted, and the coal need not be so high grade or low in sulphur and phosphorus as that necessary with fuel-fired furnaces. Basic furnaces require more time and power, heats ranging from four to eight per day, and since the charge is melted in a reducing atmosphere there is practically no oxidation of the metal; consequently thin scrap, light turnings or scrap of other forms that can be conveniently charged into the furnace, may be melted. Such scrap now sells for approximately from $5 to $10 per ton less than low-phosphorous, heavy melting scrap necessary with the ordinary acid open-hearth melting-furnace installation.

The furnace atmosphere, being of a reducing nature, makes it easier to refine and kill the steel, resulting in a saving amounting frequently to half of the ferroalloys necessary with converter steel, effecting a saving of, say, $2 per ton. The melting losses in the electric furnace are much the lowest of any modern process, averaging from 2 to 5 per cent as against 6 to 9 per cent in the open-hearth and from 16 to 24% in the converter process.

The electric furnace does not contaminate the metal as do fuel-heated furnaces and an acid electric will therefore readily make No. 3-U.S.A. specification steel, whereas it nowadays is practically impossible to find melting stock sufficiently pure to do so with the converter process. The saving alone in the cost of melting stock will more than pay for the entire conversion cost of electric steel. The greatest points in favor of the electric furnace are the much higher grades of steel produced and the higher percentage yield in castings and bars.

Comparative Costs of Electric and Converter Steel.

With the electric furnace, men can more readily make and check their steel to an exact percentage of carbon, manganese and silicon and can more easily keep the undesirable sulphur and phosphorus to lower limits than by any other process. The steel may be readily alloyed with nickel, chromium and vanadium to make the higher grades of steel castings to replace forgings and for special purposes such as may be required for cutting tools or parts of unusual strength and ductility. It is entirely feasible to make castings which will run up to an ultimate strength of 130,000 lbs. per sq. in., or to cast high-speed-steel milling cutters and reamers to form for grinding. The figures in Tables 2 and 3 show present-day comparative operating costs for liquid steel in the ladle under favorable conditions such as in a steel foundry under operation 24 hrs. per day.

Reports of a recent test of cupola iron shows a transverse load of 2950 lbs. with a 0.10-in. deflection in a standard arbitration test bar. After treatment for 25 mins. in an electric furnace, using 104 kw-hrs. per ton, a similar bar was cast and broke at 4400 lbs. with a 0.115-in. deflection.

Good results have been obtained with malleable iron made by treating cupola metal or by melting cold scrap in an electric furnace. The ability to refine for sulphur and phosphorus and to add ferroalloys to adjust the mixture to the proper malleabilizing formula, together with its rapid operation, give the electric furnace a decided advantage in malleable-iron foundries, particularly in working on high-phosphorous southern irons.

TABLE 2.—AVERAGE COST PER TON FOR TWO TONS OF CONVERTER STEEL DIVIDED INTO FOUR CUPOLA CHARGES.

(Two-ton Converter Charge.)

	Cost per ton of liquid steel.
Low-phosphorous pig iron	$14.09
Bessemer pig iron	7.89
Steel scrap	10.14
Silicon and spiegel	5.55
Coke, 863 lbs	1.01
Cost of material per ton of liquid steel	$38.68
Additions per ton of steel:	
10 lbs. 80% ferromanganese at 6 cts	$ 0.60
6 lbs. 50% ferrosilicon at 5 cts	0.30
2 lbs. aluminum at 30 cts	0.60
Power for blower motors	1.25
Cost of materials and power per ton of liquid steel	$41.43
Average cost of cupola and converter linings	1.20
Labor costs	3.00
Cost of converter steel per net ton in ladle	$45.63

TABLE 3.—AVERAGE COST PER TON FOR THREE-TON ACID-LINED, RAPID-TYPE, POLYPHASE, ELECTRIC FOUNDRY FURNACE STEEL.

(Three-ton Electric Furnace Charge.)

	Cost per ton of liquid steel.
Axle turnings (included above 3% losses, 200 lbs.)	$12.40
Mill scale (included above 60% losses, 60 lbs.)	0.09
Electrodes at 7 cts	1.40
1650 kw-hr. (550 per ton) at 1 ct. per kw-hrs	5.50
Losses in melting 260 lbs.:	
80% ferromanganese	0.40
50% ferrosilicon	0.25
Aluminum at 30 cts	0.15
Cost of material per ton of liquid steel	$20.19
Average cost of linings and roofs	0.40
Labor cost on furnace attendance	1.00
Cost of electric steel per net ton in ladle	$21.59

In the non-ferrous-metal industry the electric furnace has shown remarkable economies, due to the saving of cost of crucibles and the greatly reduced metal losses caused by oxidation and volatilization. For such work special types of furnaces designed to avoid localized heating are necessary.

Selection of an Electric Furnace.

As to the most suitable type of electric furnace for a given installation, if the scrap be inferior and high in sulphur and phosphorous, then the extra cost, slower operation and shorter refractory life of the basic furnace must be endured to obtain the lower limits of sulphur and phosphorous not practicable to reach with the acid furnace using poorer grades of scrap. At present the call is for acid-lined furnaces, and cheap, good scrap is available in large quantities for foundries and basic furnaces for alloy and tool steel. The acid furnace is simpler, cheaper and faster to operate and the steel casts more easily, while the basic furnace is essential for tool steels.

In any case it is recommended that a furnace be so designed and constructed that it is adaptable to basic operation. This means that the furnace shell must be of large diameter and the bath shallow and of large area. The furnace should not, it is thought, be of the long-arc type, nor of the small-diameter, deep-bath type if the best and most rapid work is contemplated. Indeed, even for acid melting there is a noticeable difference in the quality of the steel obtained from the large-diameter, shallow-bath furnaces compared with that made in the deep-bath-type furnace, for with the latter it is not feasible to obtain the same mechanical reactions from the additions put in to refine and kill the steel as when the bath is of the shallower type. Nor is it possible to deoxidize the metal so thoroughly by maintaining a reducing atmosphere in the furnace.

It is quite important that the furnace should operate at the highest practicable power-factor that can be obtained without undue disturbance of the power company's load, for by so doing the electrode, transformer, line and generator losses are maintained at a minimum. Engineering skill of a high order is required to forecast and select the best type of equipment under the many varied power-supply conditions which obtain in different localities.

By reason of the now generally acknowledged superior quality of the product, greater flexibility of operation, quicker and more convenient size of heats, and saving in alloys and in cost of melting stock, the electric furnace is rapidly coming to the front in the steel foundry and alloy- and tool-steel works wherever suitable power is available and progressive policies are in vogue. It is making possible the profitable operation of widely distributed small steel foundries to an extent not generally realized and greatly reducing the investment cost required in tool-steel works.

INVESTIGATION TO BE CONDUCTED OF FATIGUE OF METALS.

Joint Research to Be Made at Engineering Experiment Station of University of Illinois.

An investigation of fatigue phenomena in metals under repeated stress has just been started under the joint auspices of the National Research Council, Engineering Foundation, and the Engineering Experiment Station of the University of Illinois. The Engineering Foundation is providing $15,000 a year for two years for this investigation and the Engineering Division of the National Research Council is acting in an advisory capacity, largely through its Committee on Fatigue Phenomena in Metals. The experimental work is being done in the laboratories of the Engineering Experiment Station of the University of Illinois, under the immediate direction of Prof. H. F. Moore, research professor of engineering materials and chairman of the committee above mentioned.

Plans are laid for a two years' program of tests, and apparatus and material are already arriving for the tests. It is hoped to secure a considerable amount of data on tests of various metals, including a number of tests of each metal to 100,000,000 reversals of stress. It is hoped to study the various short-time physical tests which are used for metals—such as the impact test, magnetic analysis, and short-time bending tests—to see whether any of these tests give reliable indices of the ability of the metal to resist fatigue under millions of repetitions of low stress. It is hoped that some reliable commercial test for this important property may be developed by this investigation.

A test party of four or five persons is being organized and the University of Illinois is fitting up a special laboratory with about 2500 sq. ft. of floor space for the use of this investigation.

Records of Lamp Service in a Large Park System

Lamp Record System Used by the Electrical Department of Lincoln Park Proves Simple and Discloses Interesting Facts Not Only on Lamp Life But Often Also on Apparatus Trouble

By C. H. SHEPHERD

Electrical Engineer in Charge, Electrical Department, Commissioners of Lincoln Park, Chicago.

To secure satisfactory operation and maintenance of lighting systems for streets, boulevards and parks, for which large, high-efficiency lamps are used, it is necessary to keep complete service records of all lamps installed in order to check the actual average life of the lamps against the guarantee and to determine other important engineering data relating to these units in actual service.

POST No. B-69 — 4th North of Burton Pl, LAKE SHORE DRIVE — TYPE "C" RECORD

Make	Size	Filament	Location	Installed	Burnt Out	Hours Run
WH	400 C.P. 263 W.	Λ Series	L S D	1-22-15	6-10-15	1121
WH	400 C.P	" "	"	6-11-15	2-8-16	1511
GE	" "	" "	"	2-9-16	5-27-16	1015 {See Back}
GE	" "	" "	"	5-28-16	9-1-16	823
GE	400 C.P. 240 W.	V "	"	9-2-16	3-20-17	Transfered to B 52
WE	400 C.P	V "	"	3-21-17	4-1-17	133
WE	" "	" "	"	4-2-17	4-25-17	249
WH	" "	Λ "	"	4-26-17	7-30-17	811
WH	" "	" "	"	7-31-17	10-7-17	951
WE	" "	V "	"	10-8-17	4-14-18	1973
WH	" "	Λ "	"	4-15-18	11-13-18	840

Fig. 1.—Lamp Record Card for a Typical Lighting Post—Reverse Side Gives Explanatory Notes and Supplementary Data.

Close co-operation between the operating and maintenance departments is needed in order to keep such records, but if the record system is not complicated and if the entries on the records are properly systematized so that each man is required to keep only his particular part of the record, a matter that need take only a very small part of his time, the keeping of the records can be made largely automatic. The various parts of the records, although each is made out by a different man, can be easily correlated and made to fit together so that a recapitulation of the complete record can be quickly prepared at the end of each month or year or both, as desired. Each card, sheet or other part of the record system should be kept on file as a check in case any discrepancies are discovered later, but the likelihood of serious errors should be small with a system that is properly conceived.

Outdoor Lighting of the Lincoln Park System.

Before describing the lamp record system of the Electrical Department of the Commissioners of Lincoln Park, the following particulars of its outdoor lighting may be of interest. The Lincoln Park system includes Lincoln Park—the best known large park in Chicago—and five small parks (Lake Shore, Seward, Stanton, Hamlin and Welles), the total area aggregating 630 acres; besides these six parks there are over 22 miles of boulevards, including on the south the world-famous Lake Shore Drive with its connection with Michigan Boulevard, and on the north Sheridan Road connecting with the North Shore suburbs.

For outdoor lighting there are in use 1561 type C Mazda 400-cp., 15-ampere lamps, operating on 18 series, 7.5-ampere, 60-cycle circuits, each with its individual transformer and regulator. For special lighting of bathing beaches, monuments, etc., there are about 300 large-sized special multiple lamps and floodlights ranging from 1000 watts down. The inside lighting comprises about 6500 outlets of various sizes. All the lighting circuits run underground from a centrally located substation in Lincoln Park where energy is received from the hydroelectric system of the Sanitary District of Chicago.

All of the series lighting was formerly done by means of arc lamps, which were changed over to the present type beginning in 1914. The results obtained from the series incandescent units have amply justified the change, the saving in operating costs having paid the cost of the change several times over. The

THE COMMISSIONERS OF LINCOLN PARK
ELECTRICAL DEPARTMENT
DAILY TYPE C LAMP OUTAGE REPORT — DATE Feb 14 1919

Circuit	Type & Fil. of Lamp Burned Out	Type & Fil. of Lamp On	Date of Burned Out Lamp Installed	Life of Burned Out Lamp	Location
Q 80	WH Λ	WH Λ	C 4-21-18	2932	2 S Irving P W S Sher Rd
R 49	WH Λ	" " "	K 1-28-19	230	3 N Addison E S " "
R 9	" " "	" " "	K 12-9-18	939	2 N Diversey " "
Q 2		OK	cut out		2 N Extension W S L S Drive
L 23	WH Λ	WH Λ	K 11-8-18	1075	2 S Fountain E S " "
N 19	" " "	" " "	K 1-2-19	299	1 S Fullerton E S Stockton
N 31	" " "	" " "	K 9-30-18	1460	2 N " " "
N 35	" " "	" " "	K 1-2-19	299	6 S St James " "
E 54	WE V	" " "	K 10-24-18	1564	2 S North W S Dearborn
					1 WE 1564
					7 WH 7734

REMARKS South light in Ship yard
W Isle at Southport & Diversey Both lustres out
W " " Lincoln & " 1 Top "

Fig. 2.—Daily Outage Record Filled in by Patrolman and Trimmer.

records given below cover 4 years and 8 months of operation since the substitution was made.

Lamp Record System Used.

As the lamps are received from the factory they are given an individual test and all defective lamps

Recapitulation on Five Makes of Type C Mazda Series Street Lamps

Year	"A" No. of Lamps	"A" Average Hours	"B" No. of Lamps	"B" Average Hours	"C" No. of Lamps	"C" Average Hours	"D" No. of Lamps	"D" Average Hours	"E" No. of Lamps	"E" Average Hours
1915	158	1454	299	1185						
1916	546	2924	1020	1555	87	296				
1917	543	3560	768	1251	1490	987				
1918	108	6102	2218	1276	346	2651	14	4614	126	1279
8 Mos. of 1919	25	6738	403	3109	40	4662	6	1680	560	1541
Total & Average for 4 2/3 Years	1380	3315	4708	1472	1963	1317	20	3662	686	1446

Total Lamps Burned Out in 4 2/3 Years --------- 8757
Average Lamp Life in Hours ------------ 1731

Fig. 3.—Recapitulation of Life Data Covering 4 2/3 Years.

rejected, the good ones being placed in storage and drawn out as required for replacement.

When a lamp is placed in service it is designated by the location of the particular standard on which it is placed and recorded on the record card No. 1, which is shown in Fig. 1. On the face of this card is recorded information covering the location, circuit, make, size, filament and salient dates of the installation, while on the back of the card are recorded the electrical data on the compensator or transformer serving this particular lamp, including the ratio of transformation of the unit, the primary reactance, etc. This card is held on file until the lamp burns out or is replaced for any other reason, at which time the closing entries are made on the same line of the card.

All burnouts are recorded on the outage report shown in Fig. 2, which is filled out daily, first by the patrolman, who records the outage, and later by the trimmer having charge of the particular district where the burnout occurs, who records the replacement. These records are made out in duplicate, the original remaining on the operator's file, the copy being taken out in the morning by the trimmer and returned in the evening as part of his daily report. From this report, the operator completes the filling out of the record card, Fig. 1, after obtaining the data on the life of the lamp.

The figures covering the data on the life of the lamp naturally depend on the length of run of the circuit on which the lamp is operating and the length of run, in turn, depends on the time of cutting in and cutting out the circuit each day. This time is entered each day on the daily substation load record, together with such other data as may affect the question. From this record, known as No. 3, the daily length of run is entered on the monthly trimming schedule, No. 4. From the first to the last day of each month, the daily length of run is recorded and a progressive total carried through for each month on the length of run of each particular circuit. Knowing the date of installation of any lamp, and the length of run of its circuit, from that date to the time the lamp is renewed, month by month and also daily, it is apparent that it is a comparatively simple matter to figure up the life of any lamp. The date of renewal and the life of the lamp in hours are then entered on the lamp card, together with the data on the replacing lamp, after which the whole process starts all over again.

Valuable Facts Incidentally Disclosed by the Lamp Records.

While the above processes may, at first sight, appear to be more or less complicated, still the operation of this or any similar system becomes a matter of routine as the men doing the work become more accustomed to it. It has been found that the recording of the performance of each and every lamp, compensator and transformer often results in the discovery of irregularities which would otherwise result in serious losses and which might run on indefinitely before being found out. The equipment necessary to carry on such a system costs very little, the time required to carry it on is dovetailed into the work of the various men in such a way that their other duties are not injuriously affected, and the results obtained more than justify the expenditure from any point of view.

In order to illustrate the nature of the life data obtained from the actual workings of this system, there is presented herewith an annual summary, Fig.

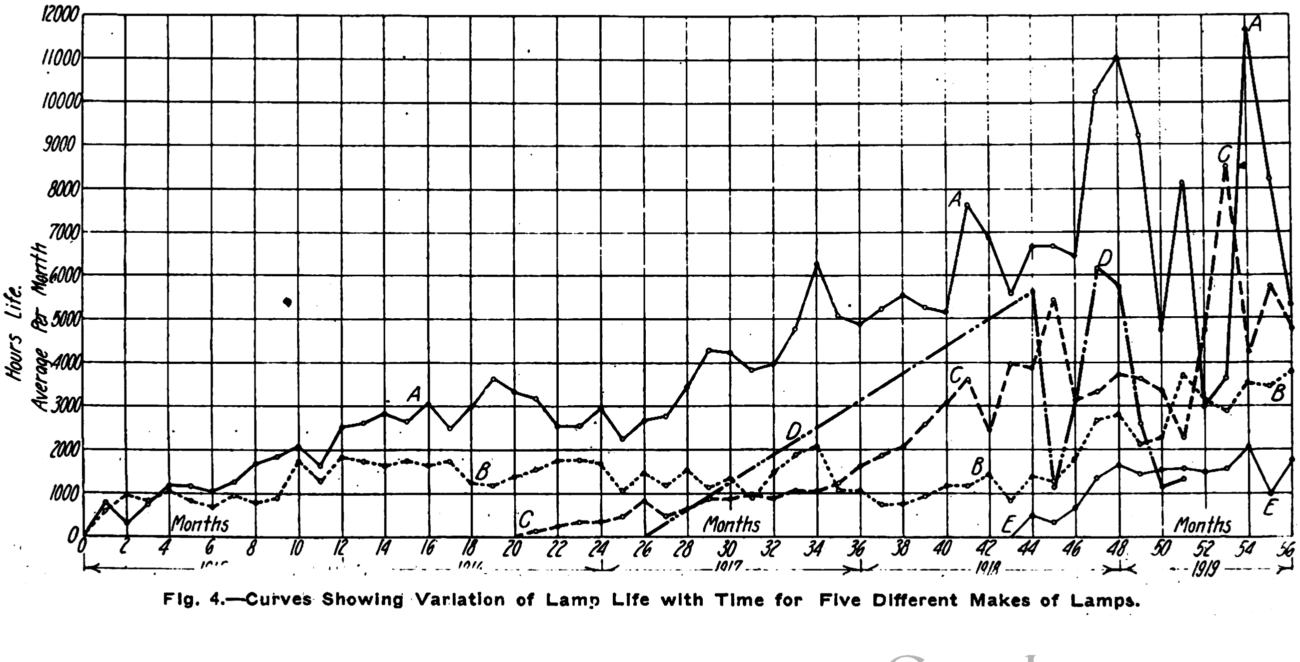


Fig. 4.—Curves Showing Variation of Lamp Life with Time for Five Different Makes of Lamps.

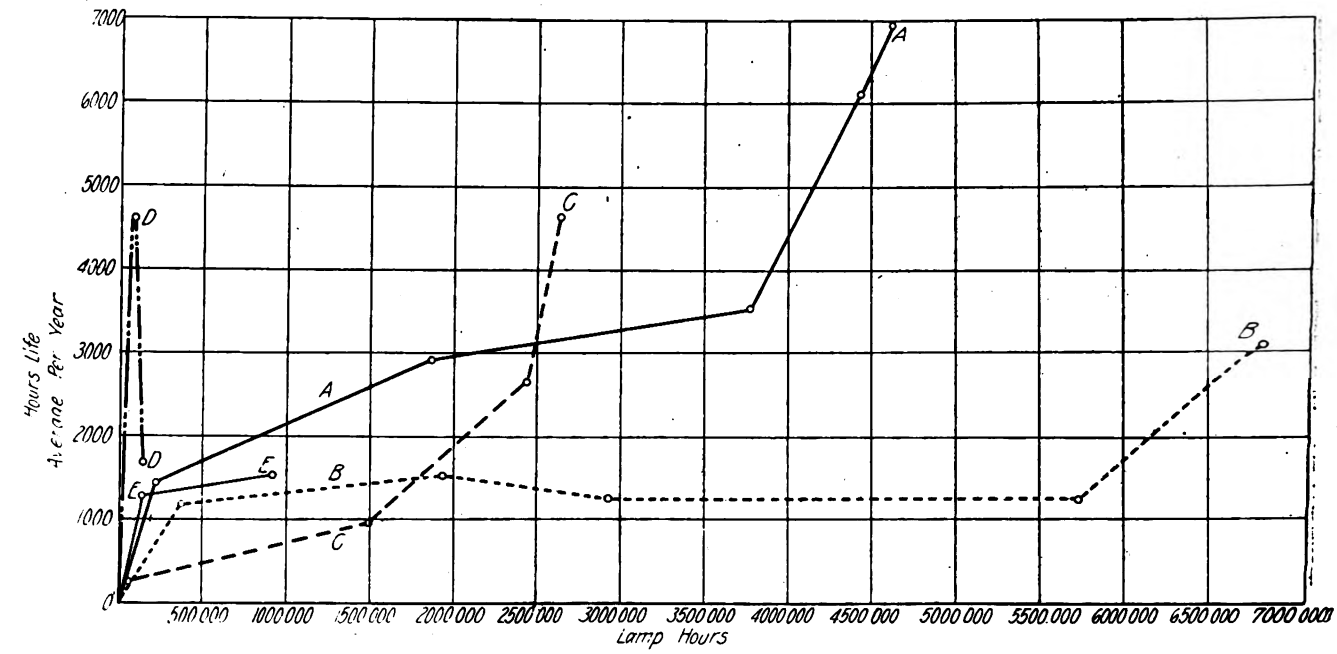


Fig. 5.—Curves Showing Variation of Lamp Life with Increase in Lamp-Hours.

3; from this and the progressive totals covering the number of lamps used, and the corresponding lamp-hours the average lamp life in hours is obtained. The various makes of lamps are designated by the letters *A, B, C, D, E.* From an inspection of the various figures it is evident that the presentation of these data in graphical form would show a number of points which might serve to further the analysis of the subject. For any given make of lamp, assuming a certain number installed and in operation, the short-life lamps of course burn out first as may be seen from the dates, average life and number of burnt out in any given period, under the same conditions. Since the lamps in question have been operated on circuits running all night, or approximately 4000 hours per year; half night, or about 2200 hours per year; and alternately all night and half night, or about 3100 hours per year, all ordinary conditions of operation are represented, all of which tend to maintain a true average. The increasing life under continued operation is also very evident, as well as the variation in periodical burnouts. The record of lamp-hours during any given period supplies a stable basis in the determination of unit costs. Knowing the cost per lamp, the calculating of unit and total costs is facilitated.

Apparatus Troubles Detected from Records—Switching Seems to Affect Lamp Life.

The keeping of apparatus records in conjunction with the lamp records offers an easy method of checking the performance of this apparatus and provides a sure and ever-present indication of any trouble occurring and, in many instances, about to occur on such equipment.

An interesting point which was discovered in analyzing the life records is that in a preponderant number of cases lamps installed on the same date on circuits operating all night, half night and alternate, will not give the same life but will burn out on approximately the same date. This would seem to indicate that the life of a lamp of this kind depends to a larger extent on the number of times the lamp is cut in and cut out perhaps than on the number of hours of actual operation.

Records of this nature are capable of extensive analysis, the amount of which depends on the time available for devotion to the subject. The fact that these records are those of actual operation, under any and every kind of operating condition, makes them especially valuable as an adjunct to the results obtained in the laboratory.

In order to illustrate the variations of lamp life with time and with lamp-hours for the five different makes of lamps used, the curves of Figs. 4 and 5 were plotted, giving a complete graphical record of operation of the units in question for a period of 4 years and 8 months. The seasonal variations are very apparent in the time curves and the plotting of lamp life against lamp-hours (Fig. 5) produces a criterion upon which true judgment of the performance of any lamp may be based. Fig. 3 gives a tabular summary of the lamp-life data of the five makes of lamps used since the beginning of 1915.

REGULATING APPARATUS FOR ELECTRIC RAILWAYS.

A meeting of the Pittsburgh Section of the American Institute of Electrical Engineers was held Dec. 9 at which a paper on "The Power Indicating and Limiting Apparatus for the Columbia and Coast Divisions of the C., M. & St. P. Railroad" was presented by B. H. Smith of the Westinghouse Electric & Manufacturing Co. The paper, which was illustrated by lantern slides, dealt with a new design of apparatus which enables the regulation of the load on 200 miles of electrified road and enables the dispatcher to read at one point the totalized power consumed.

ELECTRICAL CREDIT ASSOCIATION POSTPONES MEETING.

The twenty-fourth annual meeting of the Electrical Credit Association of Chicago, scheduled to be held at the Hotel LaSalle, Chicago, Dec. 11 and 12, was postponed indefinitely on account of conditions brought about by the coal strike. When another date is set for the meeting notices will be sent out by Frederic P. Vose, secretary of the association.

WAR DEPARTMENT'S POLICY RELATIVE TO EXPORT OF SURPLUS SUPPLIES.

Domestic Orders Being Given Preference Over Those from Abroad—Machine Tools Being Sold Here and Also Exported.

The United States War Department authorizes publication of the following statement from the office of the director of sales:

In view of concerted attempts made by certain industries to divert particular surplus stocks of war materials from the domestic to the export market, the director of sales takes this opportunity to state briefly that the sales policy that controls disposition of surplus supplies for foreign consumption.

Full and adequate opportunity is afforded the American public to acquire the surplus supply of each and every commodity and material held by the War Department before attempt is made to dispose of any part of the surplus for export purposes. The export market is developed only for those surplus stocks the supply of which exceeds the quantity that the domestic market is capable of consuming, or for which, because of the manner of manufacture, there is no demand except that existing in foreign markets.

In offering its surplus war materials for sale to foreign governments or peoples, the War Department does not extend to the foreign buyer any terms of sale which are not afforded domestic consumers, except, in a few instances, a period of credit. The exception as to credit is not made to any foreign buyer who purchases with a view to reselling at a profit, but is granted only to distributing agencies which, set up for relief purposes and acting under governmental sanction, provide a channel through which the commodities or materials may reach the ultimate consumer.

The disturbed state of labor and unseasonable weather have seriously curtailed the production of raw materials in the United States, with the result that stocks of both raw and finished products are extremely low in the nation's primary markets. As a consequence, the domestic demand for practically all of the surplus war materials held by the War Department is so strong as to make domestic offers for these stocks more attractive than those which are being received today from foreign countries.

My attention has recently been invited to the pressure that is being brought by members of the National Machine Tool Builders' Association upon members of Congress to have the legislative branch of the Government direct the War Department to attempt to market as large a part as possible of its surplus of machine tools in European countries.

The War Department has a large stock of surplus machine tools. It is attempting to market these tools to the best advantage of the Government and, with this object in view, is offering machine tools for sale both at home and abroad. By contract, dated Sept. 5, last, it sold to Belgian manufacturers, in whose interest the Belgian Government had established considerable credit through American financiers, more than 2500 machine tools, which are now being selected by Belgian representatives and put in transit; it is negotiating with the French Government for the sale of an additional large number of machine tools held by the War Department in the United States. But there is a strong demand on the part of American users of machine tools for certain types of tools of which the War Department has a stock. The American manufacturers need these tools to increase their production and enhance the wealth of the nation. They are willing to pay good prices for those which they desire to acquire. The War Department stands ready to sell its surplus stock of machine tools to these domestic users. It is filling its machine-tool orders in the sequence of their receipt. No machine tool is being held off the market to be applied upon the Belgian contract.

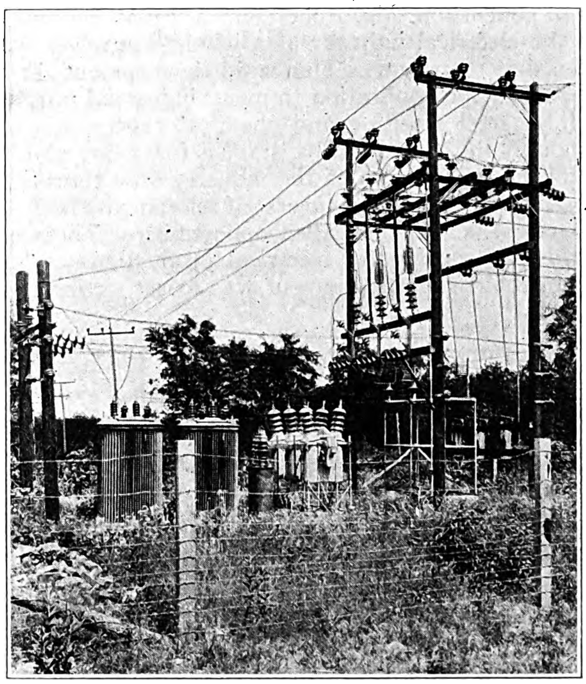
The surplus supplies held by the War Department were acquired with funds furnished by the American people; the War Department proposes to give the American people the opportunity to derive any benefits that may inure to them through the sale of these surplus stocks.

OUTDOOR SWITCHING AND SUBSTATION FOR 33,000 VOLTS.

The outdoor substation installation shown herewith taps a transmission line supplying power to a small town and also controls a 33,000-volt three-phase feeder line to another town at which point a second stepdown substation is located.

A rack near the top of the station supports the three-pole feeder switch and also a three-pole switch controlling two 200-kv-a. 33,000-2300-volt transformers connected in open delta. These switches are operated from ground level by means of an interlocked mechanism with locking type handles. The choke coils are suspended directly in the vertical bus leads, separately mounted horn-type lightning arresters being connected just ahead of the coils.

Overload protection is secured by means of an automatic oil switch and ahead of this are installed



Economical and Simple Construction for 33,000-Volt Outdoor Substation and Switching Center.

three fuses so rated that they will operate only in case of oil-switch failure. This type of installation has many advantages, as it is simple in construction and has a low cost per kilovolt-ampere.

For the above information and illustration we are indebted to H. W. Young, president, Delta-Star Electric Co., Chicago, Ill.

BRITISH ENGINEER ON THE ELECTRICAL OUTLOOK IN GREAT BRITAIN.

Expenditure of $500,000,000 for Construction of Power Stations in United Kingdom Within the Next Five Years Predicted.

J. A. Robertson, addressing the North-Western Center (Manchester, Eng.) of the Institution of Electrical Engineers, of which he is chairman, said it was likely that within the next five years a sum of not less than $500,000,000 would be expended in the United Kingdom upon the construction of new power stations and transmission lines. He said that a small fraction of this amount, say, one-fourth of 1%, expended immediately on research work would prove a thoroughly sound investment. There was still much investigation required regarding the properties of insulating materials for high-pressure cables and generating plant, the corrosion of turbine blading, protective devices for high-tension systems, switchgear to deal with pressures up to 50,000 volts, and many similar problems. Mr. Robertson gave the present cost of super-power station construction as $100 to $110, as against $35 to $40 per kilowatt installed a few years ago; a corresponding increase had taken place in cost of material for and construction of transmission lines.

Referring to legislation, the chairman described the Electricity Supply Bill, which was before the British House of Commons for three days in the last week in November, as by far the most important event in the history of the British electricity supply industry. It was bound to exercise an enormous influence on future developments.

In conclusion, Mr. Robertson said that the outlook for the electrical industry as a whole was never more promising than now. The rapid development during the war of the application to many industrial purposes such as steel smelting and chemical processes which were only in the speculative stage a few years ago had established the future of the industry on a thoroughly sound basis. Manufacturers of electrical plant and apparatus had an unrivalled opportunity. The whole world was waiting for electrical productions and the great problem of the moment was to secure increased output.

ACTIVITIES OF THE SCHOOL OF ENGINEERING OF MILWAUKEE.

The School of Engineering of Milwaukee, Wis., now has 72 members on its faculty board, or more than twice as many as a year ago. It has increased its buildings by the addition of two and its courses by the addition of three. An illustrated description of the electrical courses at this school appeared in the ELECTRICAL REVIEW of March 23, 1918.

The recently organized School of Engineering Branch of the American Institute of Electrical Engineers broke all records for attendance at its first meeting, there being 241 present. This seems to exceed all recorded attendances for initial meetings of similar branches. The school has over 100 fellow members and associates enrolled in the Institute and 257 student members in the student branch. At the meeting referred to Dean John D. Ball presided. W. M. White, consulting engineer of the Allis-Chalmers Manufacturing Co. and president of the Milwaukee Society of Engineers, delivered an address on the subject of "Hydroelectric Development in America."

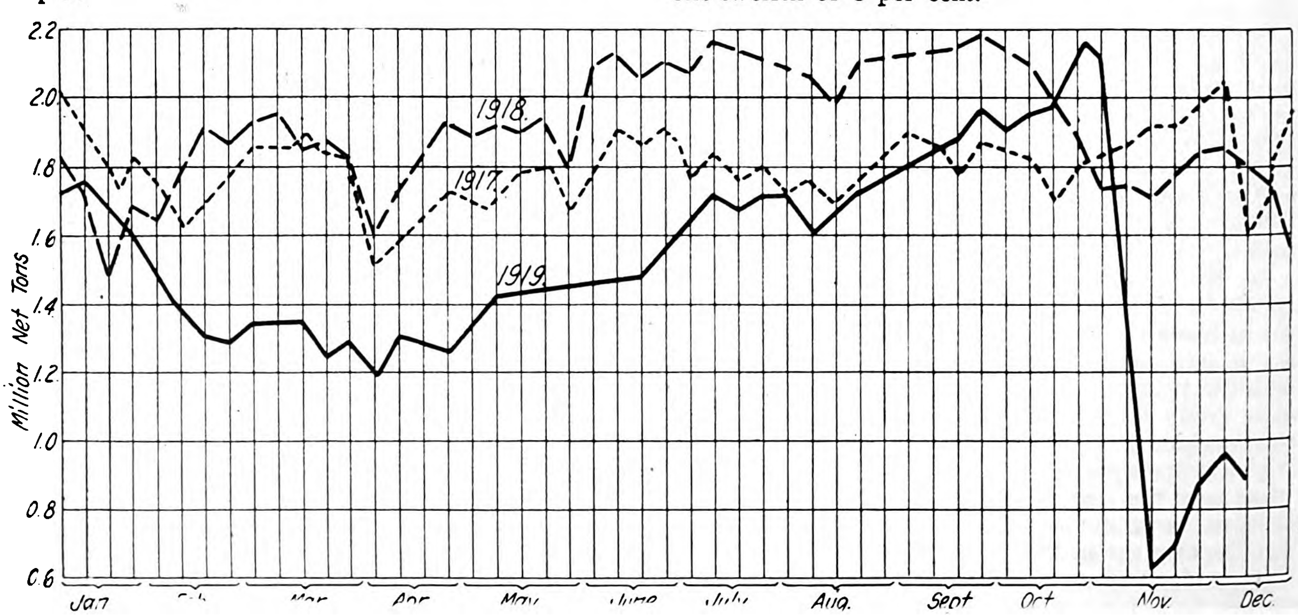
EFFECT OF STRIKE UPON BITUMINOUS COAL PRODUCTION.

The accompanying curves, prepared by C. E. Lesher, United States Geological Survey, show the effect of the strike of bituminous coal miners upon the output of bituminous coal. The annual bituminous production of coal for the years of 1918 and 1917 are also given.

Production during the first week of December—the fifth week of the strike—was 43.5% of normal. The course of the output from week to week has been as follows:

1st week (Nov. 2-8).. ..	29.6% of normal
2nd week (Nov. 9-15)..	33.3% of normal
3rd week (Nov. 16-22)..	44.5% of normal
4th week (Nov. 23-29)..	47.3% of normal
5th week (Nov. 30-Dec. 6)	43.5% of normal

The last week was thus lower than at any time since the first two weeks of the strike. Compared with the fourth week when the wage negotiations were broken off, the tonnage per working day fell off one-twelfth or 8 per cent.



Estimated Average Total Production for Working Day of Bituminous Coal, Including Coal Coked.

Editorial Comment

The End of the Coal Strike

THE great coal strike is over. After cheating themselves out of nearly six weeks' wages, inflicting needless hardship upon the whole country, defying the government and pitting their strength against that of the nation, the miners' union officials have accepted a settlement which could just as well have been accepted without any strike. Moreover, the settlement is so closely similar to the original offer of Dr. Garfield, being only more specific because time enabled it to be made so, that it may be said that the miners' union officials capitulated to the demands of the government.

For this settlement, the American people owe thanks to a few men who performed their duty without fear or favor, who refused to be stampeded by an outcry of powerful forces and who stood aloof above petty politics. Dr. Garfield frustrated a plot to grant increased wages to the miners at the expense of the coal-buying public—although we do not know how long his brave stand will serve its purpose. Attorney General Palmer and Judge Anderson upheld the supremacy of the law. President Wilson, with his gift of clear vision and direct expression, brought added pressure to bear which, with that exerted by threatened proceedings for contempt of court of the miners' officials and lack of income by the miners, combined to bring cessation of the deadlock.

It is well to remember that the strike could undoubtedly have been settled much earlier and in all probability have been prevented entirely. Meanwhile the miners are deserving of steadier work and safer working conditions. The purchase of coal during the off months will do much to bring about the former, while public opinion can do the latter if the facts are properly presented.

Stability of the Central-Station Industry

A SEVERE test has been applied to the central-station industry of the Middle West during the last few weeks, and it has come out of the ordeal not only unscathed but with renewed evidence of its virility. As the coal shortage became more acute, the light and power utilities had to appeal to the public service commissions for permission to curtail their service in less essential lines in order to conserve coal reserves as long as possible for the absolutely essential needs of the communities. On their own initiative some of the leading companies suggested measures for reducing the service and the curtailment thus effected was so severe as to seem almost suicidal to the central-station business. The public responded in full co-operative spirit, although heavy losses were involved thereby to sorekeepers, manufacturers, wage earners and business interests in general. The ffect was extremely impressive visually and depressive mentally, in many cases being more serious than anything found necessary during the war. The question therefore arose, would this depression be more or less permanent in its effect on central-station income?

Last Monday the answer came positively when utility customers, on removal of the fuel restrictions, restored their normal uses of electric lighting, heating and power service. The days of curtailed use of light, heat and power only showed the value of these services from central-station lines. Thus the industry has again shown its firm stability and marked prestige in the public's esteem.

High Tension

HIGH TENSION aptly describes the condition of the times. We are all working at high pitch, at high nervous tension. Everything is at high tension.

In the home, whether the work is done by the housewife or the maid, it is the same story—electrical appliances are taking the place of old-time ways. Things are being speeded up. Labor-saving, time-saving and more healthful ways of doing things are taking the place of manual methods. On the farm, mechanical apparatus is taking the place of man power. Thrashing, milking, plowing, nearly everything, is now being done by machines instead of by men and animals. The farms are beginning to work at higher tension.

Apparatus is being made larger and larger, and more powerful. The large turbogenerators and machines of the waterwheel type, transformers, all machines, in fact, are working at a higher rate of work per unit of weight than formerly, at a greater energy density, at higher tension. Boilers are working at higher rates of evaporation per unit of boiler heating surface than was the case a few years ago. Three and more times as much water is now being evaporated for a given heating surface than was once considered safe or possible.

As was said before, high tension aptly describes the condition of the times. But to be more specific. During the coming year and subsequent years electrical engineers and central-station engineers especially will do well to have before them at all times the term high tension. It is the keynote of many things, the solution to many problems, pressing problems of the hour.

Without high-tension transmission lines, it will never be possible, so far as present knowledge goes, to transmit energy from coal mine to central station by wire instead of transporting chemical energy as coal by rail. Without the high-tension transmission line it would not be feasible to tie-in the distant water power with the market for the electrical energy it is able to produce. The transmission line is the connecting link between water power and the industrial center. Without the high-tension transmission line it would not be practical to link up generating systems, tie-in individual plants and systems so as to co-ordinate their loads, stream flow, and so forth.

California without her high-tension transmission lines would not have been enabled to attain the industrial status she holds today. Her wealth and her prosperity would be very different if she had had to depend upon her oil and costly coal instead of being able to use her vast water power by the medium of the high-tension transmission line. The rural transmission line, at sufficiently high tension for economy —and the tension is a matter of economics at present and not one of materials or of theory or experience— holds one of the greatest promises in the way of emancipation for the farmers and the rural communities. The time may not be quite yet, but the time must come when the farm lighting outfit will be found only where the transmission line cannot go for economical reasons. When that time shall be depends upon the progressiveness or the latent conservatism of the central stations.

Railroad electrification, mine electrification, irrigation and cultivation of swamps, of deserts and waste places, the linking up of water powers, of coal mines with cities, electrification of rural communities and farms, these are some of the things that are urgently awaiting to be done. All are important, some vitally so economically. These are things that are waiting upon the electrical engineer. They are pressing problems, problems of high tension that can be solved by high tension.

Electric Furnaces and Industrial Foundries

FOUNDRIES have not been slow to appreciate the value of the electric furnace, taking into due consideration existing conservatism. They have found that the electric furnace increases the output of the foundry; produces better castings at a lower cost and from poorer quality of metal than former methods, providing the proper precautions are taken; accomplishes a certain degree of refining incident to melting as contrasted to segregating melting and refining; produces more uniform metal; lowers the loss due to variable quality and defective castings and conserves foundry floor space.

With the electric furnace it is possible to obtain a heat-transfer efficiency of from 60 to 70% of the heat energy as compared with an efficiency of 8 to 15% with open-hearth practice, and from 2 to 6% in crucible practice. Heat made other than electrically is so much cheaper than heat produced electrically, however, that the higher heat-transfer efficiency would not permit electricity to compete with other forms of heat were it not for the advantages mentioned above. Elsewhere in this issue will be found an article by W. E. Moore on the electric furnace and the foundry in which is taken up specifically the application of the electric furnace to this industry. Study of this article should prove interesting to everyone; it offers sound talking points to the power engineers seeking to place the electric furnace in the foundries adjacent to their transmission lines.

The electric furnace of the arc type, with its intense heat, is able to melt down a ton of steel and refine it in one hour and less, whereas from 6 to 14 hours would be required if using the open-hearth process. Expressed differently, a 12-ton electric furnace is the equivalent of an 80-ton open-hearth furnace so far as concerns rate of steel output. The saving in labor, in floor space, investment and other incidentals for equality of steel output are in proportion. High rates of steel production per furnace means fewer furnaces and by proper choice of size of furnace great flexibility as well as economy may be obtained by the foundry. With the electric furnace there is little delay incident to starting up for the periodic run such as occurs in the open-hearth and crucible methods of melting. Delays are a minimum, and heat may be taken off or turned on with ease. The maintenance and variation of heat is simple in the extreme.

The foundry offers almost ideal working conditions for the electric steel furnace—ideal conditions when 24-hour service obtains—where the work comprises the production of high grade castings, refining and conversion of scrap into castings. In addition there are many foundries connected with large industrial plants where the installation of an electric furnace for producing castings and melting down the scrap into ingots or castings would bring economy and a better price for junk. For such service as this an electric furnace with its operating characteristics should prove a very good investment in many large industrial plants.

We have become accustomed to look upon the electric steel furnace as apparatus for the large foundry and steel mill. And for this work the electric furnace is the furnace *par excellence.* But it should be emphasized once again, that the smaller electric furnace in the smaller foundry, the foundry of the industrial plant, in the shop of the tool maker and similar trades, opens up a vast field for the manufacturer of electric furnaces, the user of steel and the central station. This field for the smaller electric furnace is not, we believe, receiving nearly the attention it deserves from all so vitally concerned. Why not?

Current Events

Electrical and Mechanical Engineers Discuss Wide Range of Problems — Progress in Solving Inductive Interference

WESTERN ASSOCIATION OF ELECTRICAL INSPECTORS TO MEET IN ST. LOUIS.

Fifteenth Annual Convention Will Consider Varied Inspection Problems on Jan. 27 to 29.

The recently issued tentative program for the fifteenth annual meeting of the Western Association of Electrical Inspectors to be held at Planters Hotel, St. Louis, Mo., on Jan. 27 to 29, 1920, augurs well for an interesting and helpful meeting. Men prominent in the industry will discuss the hazard to life and property in the use of electricity, a matter of grave concern to electrical men generally, in view of accident and fire-loss statistics.

A practical way out of the difficulty is being sought by the association. The electrical inspector's responsibility as well as that of the other members of the electrical fraternity will be outlined as clearly and comprehensively as possible. All electrical men interested in the conservation of life and property are urged to be present and participate in the conference. The representatives of all branches of the electrical business will be welcome and extended the courtesy of the floor.

The Western Association of Electrical Inspectors has long recognized that only by co-operation can the perils of the industry be coped with successfully. Those planning to attend should make hotel reservations early. Information concerning hotel rates may be secured from James H. Fenton, Hotel Committee, Pierce building, St. Louis, Mo., or from William S. Boyd, secretary, 175 West Jackson boulevard, Chicago. Prospective exhibitors should negotiate direct with the Planters Hotel for any spaces that may be desired.

A condensed summary of the tentative program is as follows:

Jan. 27, 10 a. m.—Address of welcome by Mayor Henry W. Kiel of St. Louis; reply by Vice-President K. W. Adkins, Kansas City, Mo.; annual address by President C. K. Cregier, Chicago; reports of officers; address by Thos. J. Yeahy, St. Louis, on "The Responsibility of the Public Service Company for Safe Wiring on Consumers' Premises"; address by Chester L. Dows, Cleveland, Ohio, on "The Use of Incandescent Lamps in Dusty Places"; general subject: "Introduction of High-Voltage Current Into Buildings,"—(a) "The Underwriters' Viewpoint," by H. J. Woods, St. Louis; (b) "The Central Station's Viewpoint," by W. H. Millan, St. Louis.

Jan. 27, 2 p. m.—Address on "The Elimination of Conflicts Between the Fire and Safety National Electrical Codes," by A. Waldschmidt, Bureau of Standards, Washington, D. C.; address on "Analysis of Electrical Fire Causes," by Chas. H. Lum, of National Board of Fire Underwriters, New York City; general subject, "Regulating the Electrical Appliance Hazard,"—"The Manufacturer's Duty," by H. J. Manger, Edison Electric Appliance Co., Chicago; "The Electrical Contractor-Dealer's Duty," by A. C. Brandt, Frank Adam Electric Co., St. Louis; "The Central Station's Duty," by speaker to be chosen; "The Electrical Inspector's Duty," by H. F. Strickland, chief electrical inspector, Hydro-Electric Power Commission of Ontario, Toronto, Canada.

Jan. 28, Morning and Afternoon Sessions.—Discussion of inspectors' problems; reports of standing committees.

Jan. 29, Morning and Afternoon Sessions.—Address on "Technical Subcommittees' Work in Revising Motor, Moving-Picture Machine and Garage Wiring Rulings," by F. A. Barron, engineer, General Electric Co., Schenectady, N. Y.; reports of special committees; new business; nomination and election of officers.

A. I. E. E. MEETING DISCUSSES AUTOMATIC TELEPHONY AND SEARCHLIGHTS.

Two Papers Presented at New York by Arthur Bessey Smith and Ralph Kelly.

The 356th meeting of the American Institute of Electrical Engineers was held in New York on Dec. 12. A diversified program was presented which consisted of a paper on the "Applicability of Automatic Switching to All Classes of Telephone Service," by Arthur Bessey Smith, and one on "The Searchlight in the United States Navy," by Lieut. Ralph Kelly.

Mr. Smith's paper was more generally popular than technical. It sought to point out to the audience the practicability of the automatic telephone and the desirability of a more general use of it in these times when operating help is so scarce. The paper showed that automatic switching is uniformly fast and involves reduced mental stress to the user because the passing of the number is positive and waiting time is reduced to the minimum. The life of the automatic apparatus is a matter of speculation, inasmuch as the first automatic apparatus that was installed 15 or 20 years ago is still in service. The apparatus that has been built recently is much more durable and reliable than that in the older installations. A referendum taken among the people who have used both the automatic and the manual apparatus was very largely in favor of the automatic. The difficulty of employing large numbers of people in exchanges is entirely eliminated when the automatic apparatus is installed.

The apparatus that is now being manufactured has been so generally standardized that it is simple to operate and easy to maintain. The amount of training required for those who are employed in maintenance service is not greater than the training required for those who maintain the manual service. Certain parts of the apparatus should be inspected weekly, certain parts monthly and certain parts annually. The telephone, like any other piece of apparatus, requires proper maintenance.

The automatic telephone is adaptable to nearly any condition to which the manual telephone is adaptable. At present the automatic system is being installed in rural communities so that such service may be only a very little inferior to the service obtained in urban communities. Toll switching in an automatic exchange gives the toll operator direct dialing to the subscriber, complete control over the lines, and periodic ringing. The toll network has been improved also by applying automatic switches to intermediate points, so that the originating toll operator can set up the complete connection. Experience during the past 12 years shows that this manipulation increases the carrying capacity of toll lines at least 50 to 100%.

Lieutenant Kelly gave a brief description of the types and uses of searchlights and signaling lights on naval ships. He suggested a changed form of 12-in. incandescent light that will maintain the lamp filament at the focal point of the mirror. The present type of low-power searchlight has many faults. These faults may be corrected by supporting the carbon rigidly near the arc, the positive carbon being held at the focal point by a simple automatic control. The best size and material of carbons should be used regardless of the burning ratio.

The introduction of the high-power searchlight revolutionized the application of the searchlight to naval ships. Although great improvements have been made since the introduction, there is room for a material reduction in the number and complexity of the parts. It is believed also that there is a possibility of considerable improvement in the electrodes.

The use of the dome glass door has extended the possible uses and developments of searchlights. Before this door was used, the concussion of big guns destroyed the flat doors. Lieutenant Kelly said that he knew of no instances in which a dome glass door had been ruptured by concussion. The door enables the searchlight to operate in close proximity to large rifles without harm and makes possible the building of still larger searchlights than those now in use. Star shells have great possibilities, but it is doubtful if they will ever supersede the high-power searchlight.

AMERICAN SOCIETY OF MECHANICAL ENGINEERS HOLDS ANNUAL MEETING.

Election of Officers and Presentation of Many Papers on Many Subjects Features of Successful Meeting.

One of the most successful annual meetings ever held by the American Society of Mechanical Engineers was held in New York City Dec. 2-5. The meeting was notable, not only for the nature and number of technical papers delivered, but also because of the nontechnical aspects of some of the sessions. Instead of devoting the entire program to the discussion of purely technical papers and subjects, those who arranged the program provided a liberal supply of entertainment, opportunity to discuss the political and economic conditions of the day, several excursions, and several functions for the entertainment of the ladies. The technical and nontechnical sessions alternated. Introducing the nontechnical sessions caused an accumulation of papers at the technical sessions which was taken care of by conducting three simultaneous sessions. The most important events on Tuesday, Dec. 2, occurred in the evening, and consisted of the presidential address by M. E. Cooley, election of officers, and conferring honorary membership on two of the most widely known French engineers, Charles de Freminville and Auguste C. E. Rateau. Monsieur Freminville is consulting engineer for the Cruesot Works, and Monsieur Rateau is chairman of the Board of Directors of Rateau, Battu & Smoot Co. of France.

The officers elected are Fred J. Miller, president; John Robins Allen, Robert H. Fernald, and Edward C. Jones, vice-presidents; Elbert C. Fisher, Dexter S. Kimball, Earle F. Scott, and L. E. Strothman, managers; and William H. Wiley, treasurer.

The program for Wednesday included a business meeting in the morning, technical sessions in the afternoon, and the De Lamater-Ericsson Memorial celebration in the evening. The technical sessions of the afternoon consisted of three parallel sessions in which the subjects discussed included appraisal and valuation, aims and organization, and gas power. The appraisal and valuation section met in conjunction with the American Society of Refrigerating Engineers.

The principal matters to come up at the business meeting in the morning was the memorial to Frederick Remsen Hutton, who served as secretary of the society for 23 years. At the end of his service as secretary and coincident with the removal to the United Engineering Society's building, Professor Hutton resigned his position as secretary. He was made president for the year 1906-7. In 1908 he was elected honorary secretary, a distinction which he held until his death.

Greater efficiency in appraisal and valuation methods was urged in the session considering appraisal and valuation which met in joint session with the American Society of Refrigerating Engineers.

David H. Ray, consulting engineer, read a paper on appraisal and valuation methods in which he pointed out the unfairness of some methods of valuation of public utilities and industrial plants, and urged that better plans be adopted for allowing for fluctuating values. He cited instances of extravagance and waste in estimating the value of war plants that are being dismantled and showed how the application of common sense would reduce greatly the cost of such work and would yield satisfactory results.

Other papers read at the appraisal and valuation session included one by George E. Wells, entitled "Ice-Plant Depreciation"; one by John E. Starr, entitled "Depreciation of Insulators"; one by James Rowland Bibbins, entitled "Fundamental Principles of Rational Valuation"; one by Cecil Elmes, entitled "Price Levels and Value," and others.

In the gas power session, E. B. Blakely, of Chicago, described the new Hvid engine. Other papers read at the gas power section included one by L. T. Seaton, entitled "Kerosene as Fuel for High-Speed Engines"; one by Leon Cammen entitled "Combustion of Heavier Fuels in Engines of Constant-Volume Type and Super-Induction Type Engines"; and one by S. A. Sulentic, entitled "Oil Pipe Lines."

The evening session consisted of a joint meeting to commemorate the 80th anniversary of the beginning of Capt. John Ericsson's work in this country, and the 30th anniversary of his death; and of Cornelius H. De Lamater, founder of the De Lamater Iron Works, at which Captain Ericsson's most important work was executed.

The night session consisted of addresses by Lewis

Nixon, Public Service Commissioner of New York City; Rear-Admiral Bradley A. Fiske, and W. A. F. Ekengren, Swedish Minister at Washington; and of a musical program by the Swedish Singing Society.

The Thursday sessions consisted of a morning session in which the industrial situation was discussed, three parallel afternoon technical sessions, and a one-hour session in the evening at which matters of aviation were discussed. This discussion was followed by a social gathering and reunion for members and their guests.

The speakers at the morning session included Frederick P. Fish, chairman, National Industrial Conference Board; A. L. De Leeuw, consulting engineer; William L. Leiserson, chairman of the Labor Adjustment Board of the Rochester Clothing Industry, and Ralph E. Heilman, dean of the School of Commerce of Northwestern University, Chicago.

Frederick P. Fish, in a paper on "The Cause of Industrial Unrest," declared that on the whole and individually the efficiency and productive power of American workmen is less now than it was before the war. In one plant he found that wages had increased 110% since 1914, although the cost of living has increased only about 75%. The manager of the plant was convinced that the efficiency of the individual workman had been reduced 40% since 1914. He expressed the opinion that there could be no cure for the present evils until personal antagonism between employers and employes is eliminated and is replaced by a fair, cordial, and sympathetic co-operation. Every employer should come in personal contact with his employes or should work out a plan that would be equivalent to personal contact. The speaker said that it is of vital importance that the unions should be held to their legal obligation to carry out the agreements that they make.

A. L. De Leeuw, in his paper on "Wage Payments," called attention to the fact that the main terms in controversies between capital and labor are not satisfactorily defined or are not defined at all. The present system of wage payment provides for time given whereas it should provide for work produced.

Mr. Leiserson spoke on "Systems for Mutual Control of Industry."

Professor Heilman, who discussed the possibilities of profit sharing in industry, showed that profit sharing applies more properly to salaried men than to wage earners. He does not think that profit sharing by wage earners is feasible. His reasons for this belief are that the wage earner usually sells labor, an item that cannot be measured definitely; that the wage earner is not in a position to see the advantage of increasing production; and that wage earners are in such large numbers and of such varied degrees of productivity that any system of profit sharing would be difficult to apply. In his investigations he has found instances in which profit sharing has been abandoned in the case of wage earners but he has never found an instance of its abandonment for salaried employes.

Hon. George M. Barnes, member of the British Joint National Labor Conference, stated that within his years of experience labor had risen from a position of illiteracy to a position of well-advanced intellectual attainment.

The program for Thursday afternoon consisted of three parallel technical sessions devoted to machine design, power machinery and textiles. Charles de Fremninville opened the machine design section with a discussion about the reliability of materials and mechanism of fractures. He showed that fracture originates internally and that it flows like water or liquid. His illustrations of fractured surfaces showed waves similar to waves of water caused by disturbances in a pond.

His paper was followed by one by W. J. White describing the pumps used to dredge the inner harbor navigation canal at New Orleans. The paper was read by Professor Gregory in the absence of Mr. White. Other papers read at the machine design section included one describing a perfected high-pressure rotary compressor, by C. B. Lord; one on turbo-compressor calculations, by A. H. Blaisdell; and one describing a new type of hydraulic-turbine runner by Forest Negler. Papers read at the power machinery section included one describing the Emergency Fleet Corporation water-tube boilers for wood ships, by F. W. Dean and Henry Kreisinger; one on the flow of water through condenser tubes, by William L. De Baufre and Milton C. Stuart; one on air pumps for condensing equipment, by Frank R. Wheeler; and one on thermal conductivity of insulating and other materials, by T. S. Taylor.

Thursday evening session was limited to one hour in order to provide time for the usual social evening and dance that is arranged for the members and guests. The topic discussed at the session related entirely to aviation—two papers, one by Col. E. A. Deeds, on the future of aviation, and another by Col. Thurman H. Bane, on the present development of the military airplane.

The formal program ended on Friday noon with the close of the three parallel sessions, at one of which matters on transportation were considered, at another of which under the auspices of the subcommittee on machine-shop practice matters relating to machine shops were considered and at the third of which general technical matters were discussed. The afternoon was devoted to the council meeting, and the evening to the college reunions which have come to be an important part of the program.

Papers presented at the transportation session include one on scientific developments of the steam locomotive, by John E. Muhlfeld, and another on motor transport vehicles for the United States Army, by John Younger. Mr. Muhlfeld discussed the scientific factors that have been considered in the design and development of a new, high-power, freight locomotive for the purpose of increasing the average thermal efficiency, as well as the maximum and sustained drawbar pull and horsepower per unit of weight. These factors now are limited by the capacity of the generally adopted boiler superheater. Mr. Younger presented a discussion of the types of vehicles best adapted to various military needs. He showed that motor transport vehicles have been classified by the army into 10 general groups, ranging from the motorcycle to the 5-ton truck. He illustrated his paper with slides showing photographs and tables.

In the machine-shop section papers were read by C. H. Bierbaum, on common errors in designing and machining bearings, by H. R. Trotter, on lubrication of ball bearings; by B. F. Waterman, on thread forms for worms and hobs; and by H. L. Unland, on electric arc welding.

Papers presented at the general session included one by H. A. S. Howarth on slow-speed and other tests of Kingsbury thrust bearings; one by Alfred

Watkins on octaval notation and the measurement of binary inch fractions; one by W. E. Moore on modern electric furnace practice; and one by Alfred Musso on an investigation of strains in the rolling of metal.

Several excursions were provided for the members. These included a visit to the 74th street plant of the Interborough Rapid Transit Co., on Wednesday; an inspection of the power plant in the Equitable building on Thursday morning; one to the Brooklyn Navy Yard on Thursday afternoon; and an inspection of the Curtis aeroplane plant and flying field at Garden City, L. I., at which exhibition flights were given and an opportunity was provided for the members to make flights.

Various excursions and social functions were arranged throughout the week.

ELECTRIC POWER CLUB HOLDS SEMI-ANNUAL MEETING.

Nearly a hundred members of the Electric Power Club were present at the semiannual meeting of the organization held at Hot Springs, Va., Dec. 11-13. The sessions during the three days were occupied chiefly with reports of committees and sections.

At the meeting held last May plans were adopted for creating sections for dividing up the work of the organization according to the class of products manufactured. The reports submitted indicated the work done in establishing these sections and outlined the working plans to be used by the different sections.

James Burke, of the Burke Electric Co., Erie, Pa., president of the club and who was one of the delegates to the International Technical Commission, addressed the meeting on conditions affecting foreign trade. Mr. Burke recently returned from Europe and commented on the European demand for motors and other electrical apparatus.

W. G. Merritt, of the League for Industrial Rights, outlined the work of that organization regarding relations between employers and employes, and explained the League's plans, which were indorsed by the Electric Power Club.

Three new companies were elected to membership, these being the Union Electric Manufacturing Co., Milwaukee, Wis.; Marble-Card Electric Co., Gladstone, Mich., and Sangamo Electric Co., Springfield, Ill.

DENVER MEETING OF N. E. L. A. INDUCTIVE INTERFERENCE COMMITTEE.

The second meeting this season of the Inductive Interference Committee of the National Electric Light Association was held in Denver, Colo., on Dec. 1 to 3. The meeting was well attended by members from many parts of the country, with a specially liberal proportion of western representatives owing to the geographical location.

Some of the sessions were devoted to a continuation of the attention given at the Chicago meeting in September to organizing for the work in hand, including the establishing of a centralized agency to assist power companies to effective co-operative effort and a better understanding in meeting the difficult problems of the inductive interference situation—a situation continually increasing in proportion with the rapid multiplying of power and communication circuits.

Other sessions were given to subcommittee work in analyzing and compiling information gathered pertinent to the situation, and to consideration of requests from several localities for advice in meeting specific and active inductive-interference problems.

The discussions lent renewed emphasis to the committee's realization of its need for thorough support from the power companies, at this stage, by contributing information of their experience and methods of meeting the problems of this kind encountered.

The chairman of the committee is A. E. Silver, of the Electric Bond & Share Company, 71 Broadway, New York City.

NEW YORK ENGINEERS' CLUB DAMAGED BY FIRE.

Early in the morning of Dec. 13 fire broke out in the kitchen of the twelfth floor of the New York Engineers' Club building, 34 West 40th street, New York City, imperiling a number of employes in the servants' quarters close by, disturbing about 350 members sleeping in the guest rooms of the club, and doing damage to the furnishings, etc., estimated at about $100,000. The auditorium and library of the club were severely damaged by water and the eleventh, twelfth and thirteenth floors were badly gutted by the fire.

For a time the fire threatened the Engineering Societies' building directly back of the club and fronting at 29 to 35 West 39th street. By skillful work of the firemen, however, this structure was saved from practically any damage.

MARCONI FUND FOR ITALIAN WAR RELIEF.

In connection with the general work of the Italian War Relief Fund of America, a special fund in honor of Marconi is being raised by an electrical committee of which the members are T. C. Martin, chairman, Dr. Elihu Thomson and J. W. Lieb. Considerable success has attended this laudable effort and the Marconi Fund has already reached over $3500, and a first installment of $2500 has been forwarded to Senator Marconi in Rome for Christmastide.

In view of the fact that sore distress in Italy deepens as the winter advances, it is believed that many others in the electrical field, as well as outside it, would like to embrace this opportunity presented by the special fund. The committee therefore renews its plea for aid and co-operation.

Each subscription is accompanied by an autograph card, with the object of assembling all these cards later in a memorial album to be delivered to Mr. Marconi. Such cards can be obtained from the committee whose address is 29 West 39th street, New York City.

GOVERNMENT TO DISPOSE OF LARGE QUANTITIES OF CABLE AND WIRE.

Announcement has been made by the Director of Sales, War Department, Washington, D. C., that a total of approximately 1,710,000 ft. of telephone cable and 854,923 lbs. of copper wire, packed as originally prepared for overseas shipment, is available for purchase and that proposals for this purpose will be considered. It is understood that the greater part of the wire and cable is located in the Philadelphia Ordnance District.

Commercial Practice

Electricity in Tissue-Paper Manufacture—Central-Station Power in Great Demand—Ohio Inspection Order Rescinded

CENTRAL-STATION POWER FOR MAKING TISSUE PAPER.

Description of Processes of Manufacture and of Electrical Equipment of California Mill Supplied With Energy by Southern California Edison Co.

Within the past few years the paper manufacturing industry in the Pacific Coast states has reached important proportions. Paper manufacturers found that plants operating on the Pacific Coast have a large and growing market at its doors, while wood pulp, produced principally from spruce and hemlock and used as a base for the better grades of paper for commercial purposes, can be obtained from Oregon, Washington or British Columbia and delivered to any part along the Pacific Coast at water transportation rates.

Prior to 1917 California growers of citrus and deciduous fruits depended upon eastern manufacturers for their supplies of tissue paper for wrapping fruits. Hundreds of cars of paper were shipped into California annually for this purpose. Early in 1917 the California Tissue Mills was organized at Vernon, Cal., to manufacture tissue paper to meet the requirements of the fruit growers and for wrapping other foods such as bread and candy.

The new paper mill uses central-station service from the lines of the Southern California Edison Co. *Edison Current Topics,* the monthly publication of the company, gives the following description of the manufacturing processes and electrical equipment in the mill.

Two kinds of pulp are used—"sulphate," from which anti-tarnish and kraft papers are made, and "sulphite," from which tissues and other lightweight papers used in packing fruit are made. The wood is reduced or "digested" to a pulp by chemical process; that is, cooked under steam pressure with sulphuric acid in the case of sulphite pulp and with soda ash in the case of sulphate pulp.

The first process in the manufacture of paper from the raw pulp is "beating." The pulp is put through a vat or tub with a large roll cylinder grinding on a bed plate with horizontal knives under which the pulp passes repeatedly until it is sufficiently reduced. Coloring, if desired, is added in the beaters. The pulp is refined by passing it through three or more Jordan refining engines, which are powerful centrifugal churns, conical in shape, with knives revolving among other knives. The result of this refining is to brush out and separate each individual fiber, thus imparting additional strength to the paper.

The pulp, having been diluted with approximately 90% of water, is then flowed out onto a wire cloth conveyor. This conveyor is an endless copper screen cloth of 90 meshes to the inch, which travels from the pulp vats to the dry end of the paper-making machine. In the process of flowing on the wire conveyor, most of the water is removed by filtration and by suction pumps until at the ends of its travel the thin film of pulp remaining on the conveyor has been well formed and is ready for the pressing and drying process.

At the end of the wire conveyor the paper is delivered to a felt or woolen conveyor which takes the sheet from the wire conveyor and by means of heavy rollers under pressure squeezes the remainder of the water from the sheet of pulp and conveys it to the drying cylinders. The dryers are large horizontal cylinders, steam heated to a high temperature, over which the paper passes in much the same manner as mangles operate in a steam laundry. The paper is then passed off the paper machine, being wound up into rolls where it is ready for cutting up for waxing or printing, as the case may be.

Paper manufacture requires a heavy consumption of power. Continuity of service and constant speed are two important essentials. Electric motor drive, operated by central-station power, relieves the paper manufacturers of an investment in steam-engine equipment, together with its inherent trouble and expense. Motor drive makes higher operating speeds possible because of easier and quicker control, and higher operating speed means greater production.

The California Tissue Mills started with a 100-hp. steam engine and 160-hp. in motors operated by energy supplied by the Southern California Edison Co. In January, 1917, 232 hp. in motors were added, and in August, 1919, 361 hp. in motors were added, making a total connected load at the present time of 753 hp. During the year ending in June, 1919, the load-factor average was 77%, indicating a favorable power-factor and a heavy off-peak load.

Service is supplied from the Vernon substation over three No. 00 wires at 2400 volts, a distance of approximately 4600 ft. This line is used exclusively by the California Tissue Mills and is protected in the substation by an automatic oil switch with a time-limit device set for approximately 5 seconds at 43% overload at normal demand. A similar switch is provided on the primary side of the transformers at the mill with a time-opening device set for approximately 40% overload. Three 250-kw. transformers are used to deliver power to the California Tissue Mills board at 440 volts.

There are 15 induction motors in the mill. The four largest motors are rated at 250, 150, 100 and 75 hp. capacity each. Grid resistances are used in connection with motors where a slight variation of speed is desired.

An interruption to service stops the paper machines with paper on the drying cylinders, where it bakes and makes it necessary to wash up, a loss of over an hour for each paper machine. This circuit is watched very carefully and every effort is made to give an uninterrupted and satisfactory service, which in the past has been done with a high degree of success.

ENLARGEMENT OF CENTRAL STATIONS NECESSARY IN NEAR FUTURE.

Big Demand for Central-Station Power by Industrial Plants Taxing Capacity of Generating Stations and Calling for Extensive Construction.

A good summary of the power situation and its effect on the manufacturing and electric central-station industries is presented in a recent issue of the *Wall Street Journal,* which is noted for being exceptionally well informed on financial, industrial and public utility conditions. It reports that: "Electrical engineers say the demand for power is far in excess of capacity of central generating stations and the electric power companies of the country must add materially to their plant capacity to meet the requirements of industrial companies.

"This situation has been developing since early last summer. The slowing up in industrial activity after the armistice was reflected in a decreased power demand, but now consumption is greater than ever. Plants which were on priority lists during hostilities are now using as much electrical energy as during the war and added to this is the demand from those nonessential industries whose activities were curtailed during the war.

"The use of central-station power has grown tremendously in the last five years as manufacturers generally realize it is more economical than producing their own power. The result is that practically all new plants and most of the old ones not using central-station service want power which generating companies find impossible to supply.

"Central stations in the large industrial centers of Michigan, Ohio and Pennsylvania have experienced a rapid growth. An Ohio plant had one industrial consumer in 1912 using a 50-hp. motor. The manufacturers of the town now use 75% of the production of a 15,000-hp. plant, one factory alone consuming more power than is required for residential lighting in a city of 100,000 population. The Metropolitan Edison Co., at Reading, Pa., a subsidiary of General Gas & Electric Co., doubled its plant capacity to 50,000 kw. during the war and now finds further additions are necessary to supply the needs of its industrial consumers. In 1913 the plant's capacity of 13,500 kw. was only half used.

ORDER ON INSPECTION AND SAFETY SWITCHES HELD IN ABEYANCE.

Ohio Fire Marshal Rescinds Order Requiring Inspections Before Service Is Connected—Also Order Requiring Use of Inclosed Safety Switches.

Electrical contractors and central-station companies will be interested in a notice sent out Nov. 21 from the office of fire marshal of the state of Ohio holding in abeyance recent orders from that office requiring inspection of all wiring before current is turned on and installation of inclosed safety type main service switches.

The notice will relieve the embarrassing situation in which most of the Ohio central-station companies found themselves by reason of the former order. In very few of the municipalities is there any provision for inspection of wiring, and to place this burden on the utilities was considered unfair from the cost standpoint and dangerous from the legal standpoint of creating liability in case anything should occur after the risk is connected. If the law should be made to hold companies for fires that might occur on consumers' lines by reason of defective wiring, it would drive central-station companies in the country out of business; not that so many fires occur from this cause, but the unthinking public charges up to electric wiring every fire the origin of which is uncertain. There is no question but what some action should be taken to counteract and bring about truthful statements in this particular.

It was stated the order pertaining to service boxes would not be seriously opposed by the central-station companies if the order was made so that boxes can be easily and cheaply purchased. Companies look with suspicion and possibly opposition to devices, the cost of which will deter people from the use of electric service. Wiring is essential to the marketing of their output, but no company will object to appliances that will make such wiring safe for the consumer. The principal objection to the recent orders was the inspection, of which no company cared to assume the responsibility or cost.

KENTUCKY UTILITIES FORM BUREAU OF INFORMATION.

Utilities Get Together and Form Bureau for Giving Publicity to Utility Affairs.

The electric light, gas, telephone, traction and water utilities of Kentucky have organized the Kentucky Committee on Public Utilities Information. The purpose of this committee is to give publicity to utility affairs, and in this way bring the utilities and the public closer together and develop a better understanding. It is a combined effort to place their "after war" case directly in the hands of the public, to whom the utilities are responsible and to whom they look for existence and support. The intention is to make known to the public the facts as affecting the service and credit of the utilities and the necessity of the public supporting such utilities so as to enable them to give to the public the best service possible and equal to the needs of every community that is served.

The office of the committee is at 215 West Oak street, Louisville, Ky., and the name of the official organ is the "News Service Bulletin."

CREDITABLE PERFORMANCE OF METER INSTALLING.

Since July 1, 1067 new meters have been installed in the Long Beach district of the Southern California Edison Co. Approximately 1000 of these were installed in individual residences. On the basis of 250 working hours per month, the above is equivalent to an average of one dwelling completed every hour. Monthly gain of meters set during the past four months shows July, 237; August, 234; September, 283, and October, 312. The number of meters in operation on Oct. 31, 1915, was 12,575; in 1916, 13,443; in 1917, 13,929; in 1918, 15,489, and in 1919, 17,746.

ELECTRIC SERVICE FOR PRODUCTION OF OXYGEN.

Large quantities of oxygen are used in Detroit for welding and other purposes, as can be deduced from the report there were used from the Detroit Edison Co.'s system 8,117,850 kw-hrs. during the year from October, 1918, to October, 1919, for the commercial production of oxygen.

Operating Practice

Transmission Line Data—Rearranged Baffling Improves Boiler Operation—Data on Cleaning of Condenser Tubes

DATA ON COSTS AND LOSSES OF CANADIAN TRANSMISSION LINES.

Interesting Data on Some of Canada's Long and High-voltage Transmission Lines.

In the accompanying table is shown the costs for constructing some of the chief transmission lines in Canada. The year during which these lines were built is given in the second column of the first table, an important factor, since the cost of everything has so risen during the last few years.

In the table of line losses it is interesting to note that of the 11 transmission lines tabulated, the average length is about 52 miles and the average line loss is approximately 11.4%.

COST DATA OF TRANSMISSION LINES.

Line.	Year built.	Length, miles.	Voltage.	Cost per mile.	Remarks.
Canadian Light and Power Co., Montreal	1911	27	44,000	$11,000	2 circuits of 2-0 copper, steel towers.
Laurentian Power Co., Quebec	1916	24	50,000	6,875	2 circuits of 1-0 copper, steel towers.
Shawinigan Water & Power Co.	1902-10	550	50,000	1,500	Single circuit, aluminum, wooden poles.
				3,500	2 circuits, aluminum, steel towers.
" "	1910	94	100,000	7,500	2 circuits, aluminum, steel towers.
Sherbrooke Municipal	1917	30	45,000	2,334	Single circuit, No. 4 copper, wooden poles.
Hydro-Electric Power Commission, Niagara system	1907-13	325	110,000	14,000	2 circuits 4-0 and 3-0 copper and equivalent aluminum, steel towers.
" "	1907-13	765	26,400 and under.	2,200	Single circuit, aluminum and copper, wooden poles.
				3,000	2 circuits, aluminum and copper, wooden poles.
Muskoka system	1915	26	22,000	2,025	Single circuit, No. 2 aluminum, wooden poles.
St. Lawrence system	1913-15	60	26,400	2,458	Single circuit of 3-0 aluminum, wooden poles.
Kamloops municipal	1916	42	44,000	1,667	Single circuit of No. 2, aluminum, wooden poles.
West Kottenay Power and Light Co., Rossland, B. C.	1897-1905	170	60,000	4,000	Single circuit, 92,000 c. m. copper, wooden poles.
" "	....	32	20,000	2,000	2 circuits, No. 2 copper, wooden poles.

LINE LOSSES.

Name of company.	Termini.	Voltage at generating end.	Distance, miles.	Loss, per cent.
Shawinigan Co	Grand'mère to Montreal	100,000	94	10
Can Light & Power Co.	St. Timothée to Montreal	44,000	27	8
Laurentian Power Co.	St. Féréol to Montmorency	50,000	24	5
Sherbrooke Municipal	Weedon to Sherbrooke	45,000	30	13
Hydro-electric Power Com.	Napanee to Kingston	44,000	30	10
Toronto Power Co.	Niagara Falls to Toronto	60,000	80	20
Dom. Power & Traction Co.	Power Glen to Hamilton	44,000	33	6
Winnipeg Municipal	Pte. du Bois to Winnipeg	66,000	78	20
Calgary Power Co.	Kananaskis to Calgary.	50,000	50	7½
West Kootenay Power & Light Co.	Bonnington to Greenwood	60,000	82	10
B. C. Electric Ry. Co.	Jordan plant to Victoria	60,000	43	16

With present high prices showing every indication of remaining at the present high level, transmission lines now under construction and planned will cost considerably more than lines built under pre-war conditions. The following costs are approximately those existing in Ontario at the present time.

A main line "heavy duty" steel tower transmission line, carrying two lines at 110,000 volts, such as the latest type of line used by the Hydro-Electric Power Commission of Ontario between Niagara Falls and Toronto, with 66-ft. right-of-way, the equivalent to four No. 4/0 copper conductors, telephone service, and all items of expense, would be about $17,000 per mile.

A 110,000-volt line, single circuit, supported by wood poles, with 66-ft. right-of-way, and the equivalent of No. 1/0 copper conductors, and telephone line, would be about $8500 per mile. The cost might be reduced to about $5500 per mile if pole rights alone are secured.

A 44,000-volt, wood-pole line, with steel conductor and telephone line on same poles, could be erected for about $3000 per mile. If there were considerable rock excavation for poles, however, this cost might be doubled.

A 22,000-volt line, carrying one circuit of approximately the equivalent of No. 1 copper conductor and with telephone line, would cost about $3500 per mile.

Smaller lines for about 4000 volts, with equivalent of No. 4 copper conductors, have been built for about $2000 per mile under present conditions.

REARRANGEMENT OF BAFFLES AND SETTINGS IMPROVES OPERATION.

Four Instead of Three Passes and Rear-End Firing Banish Smoke and Increase Capacity—Excerpts from Paper Before O. E. L. A.

By W. A. Aldrich,

Cleveland Electric Illuminating Co.

The Cleveland Electric Illuminating Co. operates 70 Stirling boilers at its Lake Shore Station, averaging about 600 hp. each. All are equipped with chain grates. Some extremely interesting experiments and changes have been made on this equipment.

The first big change on our Stirling boilers was made some years ago, when after months of testing we changed them all from the standard three-pass baffling to four-pass baffling. That is, instead of using two baffles with each bank of tubes acting as a pass, we use four baffles. The first one is located between the first and second tube of the front bank. The second baffle is located between the first and second tube of the second bank. The third baffle is at the rear of the second bank and the fourth baffle is between the second and third tube from the rear of the third bank.

This arrangement gives the gases a much longer line of travel through the boiler and helps to eliminate smoke. The hot gases do not have the same tendency to shoot directly for the baffle opening at the top of the first bank of tubes and we were enabled to do away with a short sprung arch behind the flat stoker arch. Last, but not least, repairs are confined almost entirely to the first row tubes of the front bank which are very accessible.

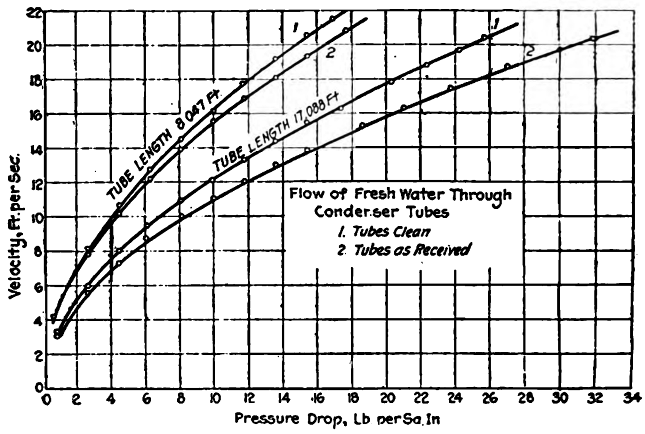
The next radical change in boiler settings was made a year ago when we installed sixteen 685-hp. Stirling boilers of the ordinary single type, four-drum boilers. These were raised up about 11 ft. higher than the standard setting, turned around, and fired from the rear end, namely, with the mud drum directly over the flat combustion arch which the company uses. The result is that the combustion space has been doubled, giving about 18 cu. ft. of combustion space per square foot grate area.

At no time since the boilers were installed has any black smoke issued from the stack which serves 16 of these boilers. The normal appearance of the stack shows a light gray haze which sometimes increases in quantity but never grows black. While as yet no very complete boiler tests have been made on this installation, it has been found feasible to operate at 12½% CO_2, and at 200% rating when desired, with all other combustion conditions satisfactory.

CLEAN CONDENSER TUBES AS AFFECTING FLOW OF WATER.

That condenser tubes become coated with a film of varying properties in course of time is known to every user of condensers. Sometimes this film is soft and slimy, sometimes hard and brittle and adheres to the surface of the tube with considerable tenacity. The rate at which these deposits are thrown down depends upon the water and foreign matter entrained and somewhat upon the velocity with which the water passes through the tubes.

Some recent experiments carried out at the U. S. Naval Engineering Experiment Station at Annapolis were described in a paper entitled "Flow of Water Through Condenser Tubes" which was presented at the December meeting in New York of the A. S. M. E. One fact brought out by the investigation, and a fact not perhaps usually appreciated by operating engineers, is that the amount of water—hence, the velocity—passing through new tubes for a given pressure may be affected considerably by the condition of the tubes as received from the manufacturer. The accompanying set of curves show the velocity of the water passing through two sets of ⅝-in. tubes, the one about 8 ft. and the other 17 ft. in length, as received from



Curves Showing Effect of Tubes as Received From the Factory and Cleaned Tubes Upon Flow of Water.

the manufacturer and after cleaning. The cleaning was done by passing a small rag soaked in kerosene through the tubes several times.

The tubes were standard ⅝-in. condenser tubes (as used for marine purposes), being of No. 18 gauge with an inside diameter of 0.522 in.

The accompanying curves are interesting because failure to clean the tubes of a new condenser preparatory to a test might give results that would be misleading and unfavorable to the manufacturer.

TWO STATION GROUNDS MAY BE SOURCE OF TROUBLE.

In substations containing apparatus for serving street railways and also a 4000-volt four-wire three-phase distribution system it appears advisable to employ the same ground for the railway negative or return that is used for the neutral or middle point of the 4000-volt system. Failure to do this, by employing two separate earths, namely, the water piping system for the railway system and an earth plate for the distribution system, may lead to trouble during times of short circuit, due to resistance drop resulting in piling up of voltage between the two station grounds.

EXTENSIVE GROUND TESTS CONDUCTED BY SOUTHERN CALIFORNIA EDISON CO.

Eleven different types of grounds have recently been made by the Southern California Edison Co. The purpose of these grounds is to enable extensive tests to be made to determine the relative efficiency of each type, its permanence during the different seasons of the year, unit cost, etc. With this data obtained, the tests are to be carried on over an extended period of time, the company will be able to know the type of ground best suited to different conditions, the constancy of the ohmic ground resistance, etc.

Contractor-Dealer

Method of Getting List of Prospects—Making Window Display Sell—Ten Commandments for Retailing Appliances

HOW TO GET A LIST OF PROSPECTS FOR VACUUM CLEANERS.

An Effective Method Used by Illinois Dealer to Obtain Names and Addresses of Prospective Customers.

It is often an easy matter to reach through their children people who do not respond readily to a direct appeal. The experience of an electrical dealer in Cairo, Ill., is a case in point. A manufacturing firm whose line of sweepers he handled had prepared an attractive little booklet entitled "The Story of a Lump o' Dirt." It was attractively illustrated and related the experiences of a lump of dirt—"just an ordinary lump o' dirt out of the road"—(to use its own designation as it writes its autobiography) in connection with a broom, a carpet sweeper and a vacuum cleaner. Here was a fairy story, with a deeper meaning, that would appeal to all.

This enterprising merchant secured a quantity of these books and then advertised in the papers: "A Modern Fairly Tale—free to all children between the ages of eight and sixteen." The advertisements went on to state that to all children who called on a certain Saturday afternoon one of these books would be given free. All that was necessary to secure a book was to sign a card containing the name and address of their parents. If any one doubted the efficacy of advertising he had only to stand near the store that day and watch the crowd of children that streamed through the door from one o'clock until closing time. Close to a thousand booklets were distributed and they found their way into homes in every section of the city. Best of all, they were read by hundreds of grownups who would never have taken the trouble to glance through the book if it had been handed or mailed to them direct. From the list of addresses mailing list was compiled, and about a week later a circular letter was mailed to the parents:

> Dear Sir (or Madam):
>
> We presume you read the little booklet brought home by your young son or daughter—and of course the story had a deeper meaning than it did to the children. Have you not often had experience in your own home with the lump of dirt that was tracked into the house and deposited on carpet or rug, becoming so imbedded that it resisted all your efforts to dislodge it?
>
> You read in this little story how the Blank suction cleaner did the work, and it ocurs to us that you might like to see this proven in your own home. Just ear off the slip at the bottom, sign your name and address, and we will be pleased to arrange for a free demonstration of the wonderful cleaning powers of this electric suction cleaner.

At the bottom was a perforated slip, requesting a free demonstration of the merits of the Blank cleaner, with space left for name and address. The demonstrations took place at the earliest date practicable, and at its conclusion full information as to the cost of the cleaner and the remarkably easy terms on which it was sold was left with the mistress of the house. The firm's efforts did not end here, as later a personal call by one of the salesmen was made, while literature on the subject was sent at regular intervals until a sale was made or intimation given that the householder was no longer interested—something that very rarely happened.

USING THE WINDOW DISPLAY TO SELL AS WELL AS SHOW.

Here's a suggestion from an electrical jobber—the Doubleday-Hill Electric Co., Pittsburgh. It's about window displays.

Every one knows that electrical devices lend themselves readily to display, not only because most of them are well appearing but because of the natural

Window Display Arranged with the Idea of Creating Sales.

curiosity that attaches to all things electrical. According to the Doubleday-Hill company, the electrical dealer can't afford to depend upon those appeals alone in planning his window displays. Instead of just "showing" some appliances, the dealer has to give some message or idea in connection with his display in order to get the window shopper's attention and interest. A few appliances in the window display space won't do. There must be something more.

To interest householders in vacuum cleaners the company recently had a display in which a vacuum cleaner was taken to pieces and the component parts were neatly arranged against a green velvet background, the idea being to show the simplicity of construction of the machine in question. Cards were used to invite those interested to go into the store to see just how the cleaner worked.

There wasn't much more to this display than one in which a few machines were just "shown," but there was enough idea and suggestion to give it good sales value. And it brings out the point that electrical goods must not only be displayed, but some distinct effort be made in the display toward selling them.

The Ten Commandments for Selling Electrical Appliances

Pertinent Rules That the Salesman Should Know and Use in Dealing with Customers in an Electrical Store

THOSE with limited experience in selling electrical appliances will find here time-tried and tested methods worthy of being followed. Older and more experienced heads may perhaps find refreshment of memory concerning some methods they learned long ago and have been neglecting to use.

For convenience in presenting and, also, making use of these helps, they are being given in the form of "The Ten Commandments of Appliance Selling."

1. *Know your appliances—what they will do and how they do it.*

When explaining the electric grill, don't stop with saying "this compartment is for broiling, this section is for frying and that one for stewing." That's too indefinite. It does not properly lead the customer to think of the service of the appliance. It's the need for the service of the appliance that has aroused the prospect's desire to possess it, rather than any interest in its constructional features.

When discussing the broiling section of the grill, for illustration, state in definite terms that it will broil steaks, chops, ham, fish, oysters, pressed meats and, if desired, vegetables such as egg plant and parsnips. That is to say, the way to bring the prospect to think of and desire the service of the appliance is to explain in detail the scope and advantages of that service. Failing to do that, you cannot hope to effect a sale.

Be able also to give, and make a point of giving, reasonably accurate figures as to the cost in cents per hour for each and every service and operation performed by the appliance you are selling. Put stress also upon the saving in time made possible by "doing it electrically." Above all else, be able to demonstrate—not merely tell—just how the appliance should be operated to insure the best results.

2. *Know your customer.*

Old hands at the selling business classify all prospective customers as either "lookers" or "listeners." By the first term they mean those who trust entirely to their own judgment and buy only those things which pass their close and critical scrutiny. They are the ones who must be shown, who demand that every little phase and feature of the thing to be bought be submitted to examination of hand and eye. They place little or no confidence in the words of the salesmen—they insist upon being shown.

The second class much prefer to be guided by the suggestions and statements of the salesmen and they will do so always, provided he can inspire them with confidence. They will listen attentively to what is told them and they will get the general sense of it all. But their first concern is to decide if they may safely trust to the judgment and sincerity of the salesman. They don't particularly desire to be shown—they want to be told, as it is only by getting the salesman to talk and analyzing his statements that they can decide whether he knows his business and is to be trusted. Once they have decided that point in his favor, they then will revert to this, that or the other feature of the appliance as explained by the salesman up to that time and desire further enlightenment or instruction regarding points they appeared to understand in the first instance but did not, because at that time they were more concerned in judging the salesman than in deciding the merits of the appliance.

Your own intelligent study of your customers will be your best guide in classifying them properly. The listeners desire to be told, and the lookers must be shown. If you are not conducting your selling talk in harmony with their preferences you will, if you are acutely alive to your opportunities, recognize your mistake very quickly and can then change over.

3. *Aim to discover and cater to the prime desire that prompts the customer to buy an appliance.*

The need behind the need, so to speak, is the one that should be catered to in effecting a sale. Man has certain basic instincts. They constitute the source of all desire. All actions, efforts and thinking is to the end of satisfying or appeasing desires occasioned by the persistent or momentary urge of one or the other of those basic instincts. If the prospect's desire is strong enough, and his belief in the thing offered for sale is well grounded, the matter of closing the sale simmers down to the operation of inciting the prospect to satisfy that desire by the action of buying and possessing that thing.

An illustration will make that principle plain: Mrs. A., for instance, is a woman in whom the desire for comfort and ease is paramount. She abominates having to arise and prepare breakfast for her husband, who departs for business at a very early hour. Her object is: "How to provide breakfast for her husband without having to sacrifice her own love of ease." An invalid friend explains how her husband prepares his own breakfast by the aid of electrical table appliances. Mrs. A. immediately develops a desire for electrical table appliances and calls upon you that she may learn more about them.

Eventually, of course, she will come to appreciate their fuel, food, time and labor-saving qualities. But for the moment her chief interest is in how they will enable her husband to prepare his own simple breakfast of eggs, toast and coffee. The arguments regarding the appliances that will work best in this instance are those relating to the ease, simplicity and reliability of their use and operation. Those are the factors that cater to her desire for ease and luxury, by enabling her to lie comfortable abed while her husband prepares his own breakfast.

Aim to discover the controlling desire which prompts the need for the appliance. There is such a basic desire in every instance. A little study of your prospect will enable you to discover it. Then conduct your selling talk accordingly.

4. *Keep away from talking watts, amperes, voltage, and so on.*

Every item brought into a sales talk about appliances which the prospect does not understand adds just one thing more, one doubtful point, which must be explained before the sale can be consummated. Such terms as watts, amperes and voltage are not understood by the average woman; and women buy most of the appliances.

Confine your talk to plain, everyday terms that all will understand. If you must employ technical terms make a point always of explaining them.

5. *Don't refer to electrical appliances as "current-consuming" devices.*

That electrical table appliances consume current is true. Nevertheless that is merely incidental to the service their use affords. They should be referred to in terms suggesting their services. They are fuel, food, time, labor and money-saving devices. Refer to them accordingly.

6. *Always refer to operating cost of appliances in terms of cents per hour.*

To refer to operating cost in terms of current is confusing to all but the technically informed. Besides, it's a lazy man's way of conveying the facts. Because when the operating cost is given in terms of current the prospect then is compelled to translate the statement into terms of cents per hour to operate.

If the translation is not made the statement only serves to confuse. It fails to further the customer's understanding. Attention which should be devoted to following the salesman's talk is distracted by the effort to understand the technical phraseology.

7. *Show appliances in actual operation.*

The power of demonstration is too well recognized to require emphasis. Telling the customer that a toaster, say, will within two minutes generate ample heat for toasting is a poor substitute for allowing the customer to place a hand near the appliance and discover by actual experience the heat radiating therefrom.

8. *Don't invite consideration of too many appliances.*

Attention must be concentrated upon one appliance before a purchase is made. The greater the number of appliances suggested the greater the number which must be eliminated from consideration before attention can be centered upon the one particular appliance it is held in mind to buy.

Decide as quickly as may be possible in your own mind which appliance will best suit the needs of the customer. Then concentrate your efforts upon selling that appliance. Make every reasonable effort to sell it before suggesting another one. That method becomes particularly desirable when you are dealing with a "listener."

9. *Aim always to display the best make of appliances first.*

In selling it is always easier to come down in the scale of quality and price than to start at the bottom and work up to the most costly. Also, a customer is always secretly flattered by being shown the most expensive article of a class first, even though it is in mind to purchase something less costly.

Frequently, too, such tactics lead to the sale of a better article than otherwise would have been so. First impressions are apt to be lasting. So aim to have that first impression truly representative of the best in quality and service possible with the class of appliances in question.

10. *Attach to appliances tags showing price and cost in cents per hour to operate.*

Many who visit your store have used electrical appliances and are thoroughly sold on their manifold advantages. Frequently they come in with minds made up to purchase a certain type of appliance and require only to be told the price. In such instances the tag makes the sale while you perhaps are busy with other customers.

There are many occasions in even the best equipped and regulated stores when customers cannot be given attention immediately they have entered. At such times, the tags will prove helpful in occupying the customer's attention.

Best of all is the service the tags perform in connection with a very generally observed human characteristics. Many folks incline to place more confidence in what they read than they do in what is told them, and the tags support the salesman's statement regarding the operating cost of the appliances.

TIMELINESS IS FEATURE OF NOVEL SALES PLAN.

California Dealers Build Up Sales Campaign Around Fact of Shortage of Sugar.

A note of timeliness is just as desirable in advertisements and selling plans as it is in window displays. Taking advantage of the recent (?) shortage of sugar, Alfred Stahel & Sons, San Diego, Cal., offered a prize each week for a period of six weeks for the best menu in which sugar substitutes were used.

Each week they advertised a different electric utensil—percolator, toaster, waffle iron, grill, etc., and alongside of it the winning menu of the previous week—coupling the two by showing how much easier it was to prepare food by the electric method. Their advertisements received wide publicity, since they were scanned by all the competitors and their friends, to see if their own particular menu had been published, while the way in which they linked the menus with electric cooking utensils brought them to the attention of scores who had never before given much thought to the wonderful efficiency of these devices.

The window display each week featured the particular electric convenience which was being advertised in the papers, and set in racks were printed cards containing some of the best menus submitted, together with the names of the originators. You may be sure that these windows received careful scanning from hundreds of feminine eyes, and as there were cards, lettered in bright colors, stating the name, use and price of the electrical merchandise shown, it was brought prominently to the attention of everybody who saw the display.

QUESTIONS AND ANSWERS

All readers are invited to submit questions and answers to this department. Anonymous communications will not be considered. Questions should relate to electrical matters of any kind. Answers contributed by readers should be submitted preferably within eight days of the date of publication of the question and should be limited, if possible, to 300 words. Payment will be made for all answers published.

Questions.

No. 475.—Pricing Motor Repair Work.—Can some of the readers through the questions and answers columns give me the best methods of pricing repair work on electric motors, armature winding, etc., and the best methods of setting the selling price of insulating materials and of magnet wire?—D. D., Indianapolis, Ind.

No. 477.—Floor Outlets in Living Rooms.—I should like to have the statements of readers as to their practice in wiring large living rooms in residences where several floor and table lamps are likely to be used and no ceiling fixtures are specified. In a particular case of this sort the architect called for six bracket fixtures and no wall or floor receptacles. I pointed out to him that on account of the size of the room (18 ft. by 22 ft. 6 ins.) any table or floor lamps would require long cords to reach the brackets unless these lamps were used quite close to the wall, in which case the lighting of the center of the room would be poor. Such long cords and few outlets would cause trouble. Therefore I recommended adding at least two floor receptacles and four baseboard receptacles. The architect objected to floor outlets as too likely to cause trouble. Was my recommendation in accord with the best practice in such cases? Has any serious objection been found to floor outlets?—J. O. B., Pittsburgh, Pa.

No. 478.—Lamp Bank for Testing.—In several repair shops I recently noticed use of a lamp bank arrangement with 0-300 ammeters for testing armatures for "opens," "shorts," etc. I would like to get through the queries column a wiring diagram for such a lamp bank arrangement that is not too complicated to make in the shop. I have tried several schemes without good results.—J. D., Detroit, Mich.

No. 479.—Boiler-Furnace Explosions.—I would like to know if anyone has had similar experiences to mine. We find since burning bituminous run-of-mine, that the fire door is often blown open with considerable force. At other times when the fire door is opened an explosion occurs and flame and coal is ejected into the boiler room. Just what are the causes of this, and how may they be overcome without changing the grade of coal?—J. R. K., Belvidere, Ill.

No. 480.—Depreciation Reserve of Utilities.—What is the present prevailing practice on the part of public service commissions as to how the depreciation reserve of public utilities shall be kept? Is this fund always kept separate and distinct from other sinking funds or reserves? Do the commissions approve lumping it in with the general reserve of the utility?—A. E. M., Little Rock, Ark.

Answers.

No. 467.—Operating Cost of Electric Household Refrigerators.—I would like to know from some reliable source what is the operating cost of the electrically operated refrigerators that are being recommended for household use. What is the experience as to their dependability?—R. H. T., New York, N. Y.

So far as the writer is able to ascertain, actual operating costs of small electrically operated refrigerators, such as are employed in small stores, residences, etc., are not available. The manufacturers of such outfits are able to give operating costs as estimated by them, but these do not cover all the actual costs, which embrace maintenance charges, interest on investment, etc.

The cost of operation depends, of course, upon the size of the refrigerator and the conditions of its use, that is the amount of ice it produces or the degree of refrigeration accomplished, the climate, the temperature maintained and the frequency with which the refrigerator is opened and closed to permit removal and replacement of the product cooled.

Of the actual operating costs, neglecting the interest upon the investment, the cost of electric power is the chief. There is also a maintenance charge, but this is usually extremely small, and is due to the periodic cleaning of the motor, cooling coils, lubrication, etc. The conditions under which the refrigerators are usually installed are such that the owner pays little attention to his cooling apparatus once it is in service. The monthly electric bill is rendered and paid, the water meter is read, the bill is rendered and paid, and so on.

The better of these refrigerating outfits appear to be reliable and to give little trouble. Where the annual consumption of ice or the amount of refrigeration is sufficient, money invested in a self-refrigerating outfit is a sound investment. But for such to be the case the total operating costs plus the interest on the investment must be less than the cost of purchasing ice. This condition practically precludes the use of small domestic refrigerating plants except by the large user of ice.—M. S. O., Detroit, Mich.

No. 476.—Colored Lighting Effects in Theater.—In producing the various changeable colored lighting effects in a theater that are now becoming so popular what is the smallest number of primary colors that will serve? Is it possible to get more pleasing gradations of color through using more sets of differently colored lamps than of primary colors alone? What is the most practical way to secure such color effects?—H. M. P., Seattle, Wash.

The best results for the polychrome lighting of theater auditoriums, etc., are most effectively produced by the use of type "C" Mazda lamps in silvered mirror glass reflectors of the proper capacities and design set in suitably ventilated holders with provision for glass or gelatine color screens or mediums. To get the most effective distribution of colored illumination it is absolutely necessary to use the best reflectors obtainable; also avoid color screens which contain opaque colored particles from which the colored light is produced by reflection. The three primary colors: red, violet and green constitute the smallest number that will serve to obtain the most pleasing effects. It is possible to get the greatest number of shades and gradations by the use of the graphite compression type dimmers, which give a greater number of variations and stand up better than the commutator contact type for this purpose. If the dimmers are driven by means of motors, the various colors can be blended into each other much more gradually than if same are worked manually. Although white lighting can be produced by the proper mixture of the three primary colors, it is the usual practice in laying out polychrome lighting installations to include white lighting in addition for efficient general illumination and for use also in fading the various colors.—A. R. L., Chicago, Ill.

SKIP-STOP MAKES PLEASING SAVING IN NEW HAVEN, CONN.

Among the traction companies adopting the skip-stop during the acute fuel shortage that occurred during the winter of 1917-1918 was the New Haven Traction Co., which serves New Haven, Conn., and adjacent territory with transportation. It is reported that the skip-stop has resulted in an annual saving of about $8000 and that both the public and the utility favor retaining the skip-stop.

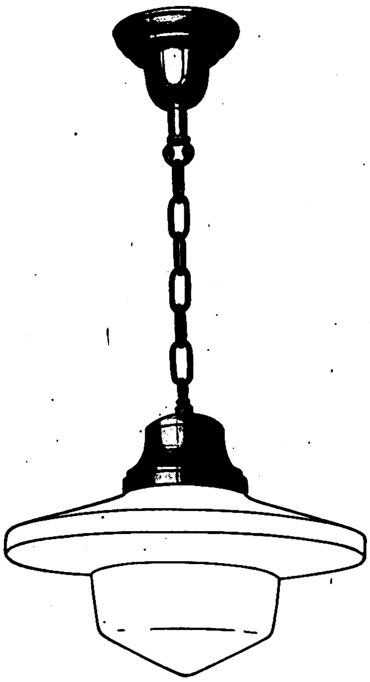
New Appliances

Commercial Fixtures Especially Designed for Glass Units—Cigarette-Making Machine Employing Electric Heater

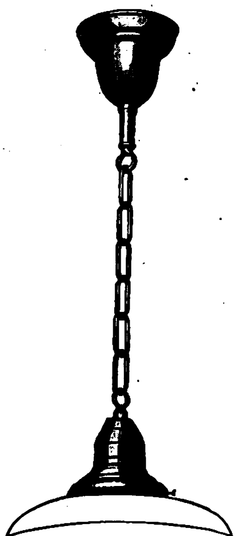
Brass Fixtures Specially Designed for Glass Commercial Lighting Units.

A series of commercial fixtures for use with the Ivanhoe "Ace," Phoenix and other recently designed glass units employed in connection with high-powered lamps, is announced by the F. W. Wakefield Brass Co., of Vermilion, Ohio. These units bear the Wakefield "Red Spot" mark, which identifies and guarantees all goods of this company's manufacture.

These Wakefield commercial fixtures are made wholly of brass and as regularly shipped, include porcelain receptacles of special patented design built into the holders. They are entirely dustproof and cannot serve as the graveyard for flocks of bugs.



Wakefield Brass Fixture Specially Designed for the Ivanhoe-Regent "Ace" Glass Unit.



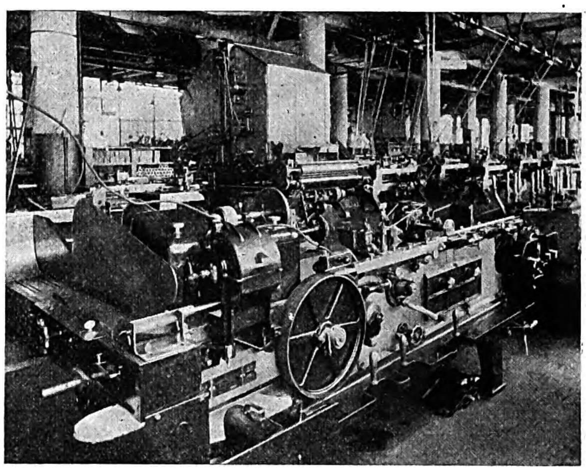
Wakefield Commercial Fixture for Glass Inclosed Unit.

Being packed one unit to the carton and plainly labeled, these fixtures are particularly convenient for the jobber and dealer to handle. The package need not be opened until the fixtures are on the job, thus there can be no possible loss of parts, injury to finish or deterioration in stock.

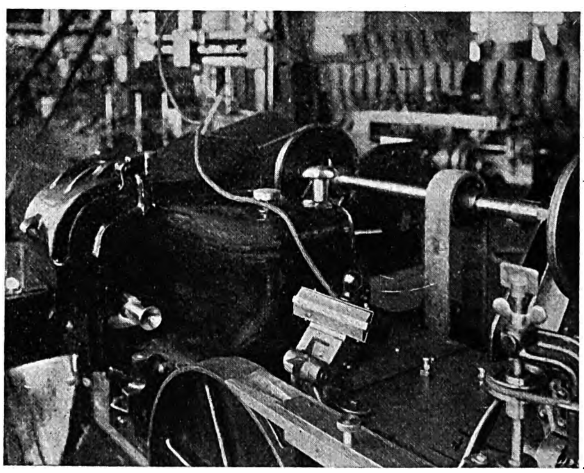
The designs of these Wakefield commercial units, as indicated by the illustrations, are such as to appeal to contractors and fixture dealers supplying equipment to the better class of stores, offices and public buildings.

Electric Heater Used in Cigarette Manufacture.

An interesting and novel use of electric heating is found in a cigarette-making machine manufactured by the American Machine & Foundry Co., Brooklyn, N. Y.



General View of Cigarette-Making Machine.



Near View of the Electric Heater Swung Up for Inspection.

Cigarettes, being now produced by the million, are of course made by automatic machines which perform the entire process. At one end of the machine is a roll of cigarette paper, and a hopper containing the tobacco. The paper goes through the machine in a long continuous strip. It first passes through a series of rolls, which print on it at the proper intervals the maker's name, etc., and then it is carried over a concave plate, several feet long, where it receives the tobacco. Then the paper strip with its load of tobacco passes under a grooved wheel which molds the tobacco into the proper shape, and next the edges of the paper are folded over. The remaining steps of the process are the application of paste to the edge of the paper, the drying of the paste by the electric heater, the cutting of the long cylinder into cigarette lengths by a circular saw, and finally the stacking of the cigarettes in the hopper at the end of the machine.

The electric heater is of an oblong shape with a long, narrow ironing surface which rests on the traveling cigarette tube and quickly drives out the moisture in the paste. It consumes about 100 watts and is of Westinghouse make. A similar heater is also used for drying the paste of labels and stamps on boxes and cans.

Trade Activities

Fairbanks-Morse To Erect Large Modern Foundry at Beloit —F. H. M. Riley Appointed Manufacturers' Representative

Edison Electric Appliance Co., 5660 West Taylor street, Chicago, is sending out announcements of an advertising campaign on Hotpoint electrical devices to be conducted in various national publications. In this connection the company is introducing the Hotpoint gift certificate idea, which consists of neatly printed certificates which may be used by dealers, who may have depleted stocks of electrical devices, to enable customers to make electrical gifts, even though deliveries cannot be made before Christmas.

Francis H. M. Riley, formerly associated with Vaughn & Meyer, Milwaukee, consulting engineers, announces his appointment as Wisconsin representative, with offices at 514-615 Security Building, Milwaukee, for the following companies: Vulcan Soot Cleaner Co., Du Bois, Pa., designer and manufacturer of Vulcan mechanical soot cleaners for all types of boilers and economizers; Vulcan Fuel Economy Co., Chicago, manufacturer of Vulcan Lastite, Vulcan-Orsat gas analyzers, Vulcan gas collectors, boiler tube cleaners, differential draft gages and smoke indicators; Green Engineering Co., East Chicago, Ind., designer and manufacturer of Green chain-grate stokers, jet ash conveyors, pressure waterbacks, Sel-flex ventilated arches and materials, transfer and storage hoppers. Mr. Riley and the organizations which he represents will render especial service and assistance to all who are interested in the effective solution of the problems of reduced fuel, power plant operation and production costs.

Benjamin Electric Manufacturing Co., Chicago, Ill., has published a book on industrial lighting that embodies much practical information for applying the principles laid down by illuminating engineers as the best practice in the lighting of buildings and areas devoted to industrial uses. The book has been prepared with a view of being helpful to anyone whose objective is the attainment of correct industrial lighting. It is a response to the demand for genuine service to all departments of industry seeking to raise standards of production, reduce accidents and spoilage and to make the task of the worker more acceptable through the application of higher lighting intensities. The considerations governing the selection of lamps and reflectors are explained in simple terms. There is a chapter on general illuminating information, with tables and definitions which reduce to simple terms the complex formula out of which correct deductions with regard to the specification of lamps and fixtures are solved. There is a table giving the foot-candle intensities desirable as worked out from a consensus of the best opinions of illuminating engineers and physicists, and a complete presentation of the electrical symbols used on architects' drawings. The catalog data relating to Benjamin industrial lighting equipment is arranged in orderly sequence, carefully indexed, and gives the reader a comprehensive idea of the material available to meet the wide range of industrial lighting requirements. A feature of unusual interest is the charts of industrial fixtures which present a study of reflector contour, light distribution diagram and lamp size so that the specification for any particular use is easily arrived at without recourse to any data other than those given in the book. Numerous examples of industrial lighting requirements, with actual photographic reproductions of results, add greatly to the usefulness of this very practical book on industrial lighting.

Fairbanks, Morse & Co., Chicago, will start next year the erection of a new plant in Beloit, Wis., which it claims will be the largest and most modern foundry in the world and will involve an expenditure of approximately $1,500,000. Many months of study have been given to this enterprise, with the result that every protection for the safety and health of the employes, every modern, scientific foundry device, improvement in the casting of gray iron, will be incorporated in the new plant. Electric cranes will carry the raw materials to and from the big cupolas. Electric grab buckets will unload the molding and core sand and coke; electromagnets will grip the raw pig iron and remove it from the cars; and electric cranes and conveyors will carry all molten metal from the cupolas to every mold, whether for giant castings of 10,000 lbs. or a few ounces. The structure will, when completed, be 900x550 ft. and will contain 495,000 sq. ft. of floor space. This building, including storage of flasks, iron, sand, etc., which will also be under the roof, will cover 11 acres of ground, and will be located directly to the north of the present house, bordering the River road. The completed structure will have an ultimate capacity of 350 to 400 tons of gray iron daily. The foundry will eventually employ 1,500 additional men; and 1,500 more men will be required in other departments of the factory to meet the increased production that will result. Although the comfort of the employe has been intensively emphasized in the construction plans, mechanical efficiency has received due consideration, provision having been made for a giant electric crane system which will distribute all materials to every part of the plant. The new foundry will allow the company not only to handle the iron now used with greater efficiency, but will increase the output greatly. Excavation work will be started as soon as weather conditions permit in the spring and construction work will be pushed rapidly.

Altorfer Company to Double Manufacturing Facilities.—The remarkable growth of the electric washing machine industry and the constantly increasing demand for this labor-saving device, is exemplified in the announcement of the Altorfer Brothers Co., Peoria, Ill., manufacturer of the "Super-electric" washing machine. Notwithstanding the fact that the company moved into a large new factory last June, it again finds its facilities wholly inadequate to meet the demand for its product and is, therefore, erecting another new structure which will increase its present output by 50%. The building will be 100x600 ft., and will provide total floor space of 200,000 sq. ft. This will be the second factory erected this year, the new building being of the same size as that occupied June 1 last. The Altorfer company, which was one of the first to enter the washing machine field, is now one of the largest producers, and the "Super-electric" washing machine which it has developed is considered one of the most efficient and most popular on the market.

Leeds & Northrup Co., 4901 Stanton avenue, Philadelphia, Pa., manufacturer of electrical measuring instruments, is distributing catalog No. 86-B which has for its title "The Optical Pyrometer," a portable instrument for works temperature measurements. This book, containing 28 pages, describes the instrument and its practical applications in gaging temperatures in the open, fuel beds, heat treating furnaces, muffle furnaces, in the rolling and forging of steel, blast furnaces, electric furnaces, of molten steel and slag, molten cast iron, molten non-ferrous metals, molten glass, ceramic furnaces, etc., for checking thermocouple pyrometers. This optical pyrometer, employing a balance method of comparising luminous radiations, measures temperatures from a dull red (1,200°F.) up to the highest known temperatures, and makes use of the most accurate method based on radiation so far developed for measuring temperatures. The bulletin is well illustrated and contains considerable data on temperature measurement with optical pyrometers.

Current News

Weekly Record of Construction Activities—Conventions

EASTERN STATES.

North Stratford, N. H. — Warner Sugar Refinery Co., 79 Wall street, New York, has awarded a contract to C. A. Ridlon, Roulette, Pa., for the erection of a 1-story power plant and barrel works, about 75x80 ft. and 64x120 ft., respectively, at North Stratford.

Rutland, Vt. — Stasa Milling Co., Castleton, Vt., is negotiating with the Rutland Railway, Light & Power Co. for the furnishing of additional power for the operation of its plant. The company will require a total of about 1500 hp.

Watertown, Mass. — Oakville Co. has recently inaugurated work on the construction of a new 1-story generator house at its plant in the Oakville district. The structure will be about 44x56 ft. The Fred T. Ley Co., Main street, Springfield, Mass., is the contractor.

Pawtucket, R. I. — In connection with the construction of the new 2 and 4-story plant of the Tubular Woven Fabric Co., to cost approximately $200,000, considerable electrical equipment for operation will be required. O. D. Purington & Co., Industrial Trust building, Providence, are the contractors.

Amenia (Dutchess County), N. Y. —Application has been filed with the Public Service Commission by the Amenia Electrical Light & Power Co., for permission to construct and operate a local electric light and power plant. The company has been granted a franchise by the municipality.

Binghamton, N. Y. — Binghamton Light, Heat & Power Co. is completing the installation of a 2500-kw. turbine unit at its plant. The company has completed the construction of a new 5-mile transmission line to the plant of the Endicott Johnson Corp., Endicott, N. Y.

Buffalo, N. Y. — City council is understood to be considering plans for the construction of a new municipal electric light and power plant.

Churchville, N. Y.—The city contemplates the installation of a new electric lighting and power systems. Bonds in the sum of $25,000 have been voted for the construction.

Hamden, N. Y.—Hamden Electric Light Co. (Delaware county), has filed application with the Public Service Commission for permission to construct and operate an electric light and power plant for local service.

New York, N. Y.—Ophuls, Hill & McCreary, Inc., 112 West 42nd street, engineer, is completing plans for the French Government, Artillery Department, Commissariat General Des Affairs de Guerre, France Americanes, 65 Broadway, New York, for the construction of a large new electric lighting plant to be located on the Isle of St. Pieppe, off the Coast of New Foundland.

Portville, N. Y. — Portville-Cattaraugus County Utilities Co., Inc., has recently filed application with the Public Service Commission for the necessary permission to erect and operate a local electric lighting plant for furnishing service to the municipality from which a franchise has been secured. The company also requests approval of the issuance of capital stock for $50,000, the proceeds to be used to cover the cost of the proposed work.

Rochester, N. Y.—Josiah Anstice Co., 220 North Water street, has had plans prepared for the construction of a new 1-story power plant and boiler house, to be located on Humboldt street, between Culver road and Coventry avenue. The structure will be of brick and steel, about 50x 100 ft. G. Morton Wolfe, 1377 Main street, Buffalo, is architect for the company.

Butler, N. J.—Borough council has authorized the lighting committee to prepare plans and specifications for the installation of a new electrically operated pumping unit for the municipal plant.

Dover, N. J.—In connection with the proposed opening of a new mine in the vicinity of Dover, the Prior Chemical Co. will utilize electric power comprising a total of about 150 hp. in motors.

Dover, N. J.—Dover Boiler Works has recently completed the installation of a quantity of new equipment at its plant, including new air compressor unit operated by a 264-hp. capacity synchronous motor, new pumping unit direct connected to a 150-hp. motor, and other apparatus. Power for operation is furnished by the New Jersey Power & Light Co.

East Orange, N. J. — Plans are under consideration by the city council for the installation of a new municipal electric lighting plant, as well as a new electric street-lighting system.

Jersey City, N. J.—Plans are under consideration by the city officials for the establishment of a new "white way" street-lighting system in lower Broadway. The Downtown Business Men's Association is interested in the proposed work. Service is furnished by the Public Service Electric Co.

Midvale, N. J.—Tri-County Electric Co., Pompton Lakes, is making rapid progress on the installation of a new electric street lighting system.

Newark, N. J.—General Laundries have had plans prepared for the construction of a new brick and reinforced concrete plant to be located at 93-97 Summer avenue and 33-41 High street, to cost about $72,000. Considerable electrical equipment will be required.

Newark, N. J. — Hochbaum-Rylander Electric Co. has filed notice of organization to operate at 539 Central avenue, for the production of electric and gas fixtures, etc. Frederick Hochbaum and Ernest J. Rylander, 15 Montrose street, South Orange, head the company.

Orange, N. J. — Central Storage Battery & Radiator Co. has filed notice of organization to operate at 353 Central avenue, Orange. The company will specialize in the repair of storage batteries. H. S. Johnson, Sr. and Jr., both of Glenwood avenle, Orange, head the company.

Beaver Falls, Pa.—Electric Service Co., Inc., operating a local plant for the repair of storage batteries, armature winding, electric welding, etc., has completed the removal of its works to its new plant at 700 3rd avenue, Pittsburgh. The new plant is a 3-story, and considerable new equipment and machinery has been installed to allow for increased operations.

Erie, Pa.—Plans are under consideration by the General Electric Co. for extensive additions to its local plant. It is understood that the plans include the erection of a large new machine shop, which will be the largest department at the local works.

Essington, Pa. — Westinghouse Electric & Manufacturing Co. is having plans prepared for the construction of a new 2-story steel and concrete addition to its local plant, about 130x500 ft., to cost, including equipment installation, close to $1,000,000. The company has completed negotiations for the sale of its land holdings on Duquesne Way, extending through to Fayette street, Pittsburgh, 66x328 ft., with 1-story steel factory building, for a consideration of about $175,000.

Philadelphia, Pa. — Considerable new electrical equipment will be required in connection with the construction of the proposed new newspaper publication plant of the Philadelphia Public Ledger Co., to be located at 6th, 7th, Chestnut and Ransom streets. The building will be a 10-story brick, about 230x385 ft., and will cost about $5,000,000.

Reading, Pa. — Reading Transit & Light Co. has recently completed work on extensive improvements in its traction system in Reading, Norristown and Lebanon.

Youngsville, Pa. — The city will

soon have its streets lighted by electricity through the public spirited action of a number of its business men. Power will be secured from the surplus power of the water plant. The new equipment will be purchased by business men.

Norfolk, Va.—Virginia Railway & Power Co. is understood to be arranging plans for its expansion program for 1920. The work will include extensive improvements to street-car and lighting facilities, plant improvements, the purchase of new rolling stock, and other work, and will cost in excess of $1,000,000.

Janelow, W. Va.—Plans are under consideration by Burton M. Davisson for the installation of new electric light and water systems.

Weyer's Cave, W. Va. — Weyer's Cave Light & Power Co. has filed notice with the Secretary of State of an increase in its capitalization to $100,000, to provide for general business expansion.

Chimney Rock, N. C. — Southern Bell Telephone & Telegraph Co. will construct a line from Asheville to Chimney Rock.

Lexington, N. C.—Lexington Telephone Co. will erect a 2-story brick building and install an automatic telephone system.

Rocky Mount, N. C.—Home Telephone & Telegraph Co. will install underground conduit system, and add additional section of switchboard. About $70,000 will be expended in improving the plant.

Denmark, S. C. — American Telephone & Telegraph Co. will erect a 3-story brick and stone building. Estimated cost from $75,000 to $100,000.

Due West, S. C. — City will construct a light plant. The sum of $16,000 in bonds has been voted. R. B. McDill, clerk.

North, S. C.—North Electric Light & Power Co. has advertised for one 50 or 75-hp. 3-phase generator, alternating current, also 1, 2 or 3 kw. exciter and switchboard complete.

Simpsonville, S. C.—Bonds to the amount of $15,000 have been voted for installing an electric light system. Address Mayor.

Summerville, S. C.—Commissioners of Public Works have approved the issuance of bonds for $40,000, the proceeds to be used for the installation of a new municipal electric light plant.

NORTH CENTRAL STATES.

Dayton, O.—About $200,000 will be expended for telephone exchange. Architect W. S. Hays, 212 Washington street, Chicago, Ill., has prepared plans. Owner, Union Central Telephone Co.

Hamilton, O. — An ordinance has passed the council providing for an issue of $50,000 in bonds to improve the municipal light plant. Address Mayor Smith.

Springfield, O. — Springfield Light, Heat & Power Co. is preparing to add equipment which will double its present capacity.

DATES AHEAD.

American Society of Civil Engineers. Annual meeting, New York City, Jan. 21-22, 1920. Secretary, Charles W. Hunt, 33 West 39th street, New York City.

Western Association of Electrical Inspectors. Annual convention, St. Louis, Mo., Jan. 27-29, 1920. Secretary, W. S. Boyd, 175 West Jackson boulevard, Chicago, Ill.

National Council of Lighting Fixture Manufacturers. Annual convention, Detroit, Mich., February, 1920. Secretary-treasurer, Charles H. Hofrichter, Cleveland, O.

Oklahoma Utilities Association. Annual convention, Oklahoma City, Feb. 10-13, 1920. Secretary, H. A. Lane, 611 State National Bank building, Oklahoma City.

Central Electric Railway Association. Annual meeting, Louisville, Feb. 26-27. Secretary, A. L. Neereamer, Indianapolis, Ind.

American Electrochemical Society. Annual convention, Boston, Mass., April 7-10, 1920. Friday, April 9, joint session with American Institute of Electrical Engineers on "Electrically Produced Alloys." Secretary, Joseph W. Richards, Bethlehem, Pa.

National Electric Light Association. Annual convention, Pasadena, Cal., May 18-21, 1920. Headquarters, Hotel Huntington. Acting secretary, S. A. Sewall, 29 West 39th street, New York City.

Northern White Cedar Association. Midsummer meeting, Lake of the Woods, Minn., June 12-17, 1920. Secretary, Norman E. Boucher, 702-3 Lumber Exchange, Minneapolis.

National Association of Electrical Contractors and Dealers. Annual convention, Baltimore, Md., Oct. 6, 1920. Secretary, W. H. Morton, 110 West 40th street, New York City.

Youngstown, O.—About $80,000 will be expended for telephone exchange. Architect W. H. Hays, assistant engineer, 2122 W. Washington street, Chicago, has prepared plans. Owner, Central Union Telephone Co.

Ashley, Mich.—The Ashley Community Association has been formed with a capital of $20,000. Electric lights are assured the village and work on the power house and plant will be started at once. Harry O. Rose, chairman.

Detroit, Mich.—Mutual Electric & Machine Co., 232 W. Fort street, will extend and remodel its 3-story plant and will cost about $12,000.

Decatur, Ind.—The contract for the General Electric Co. factory building in this city has been awarded to the Ferguson Construction Co., of Cleveland, O. The building will be 260x 360 ft. The company plans to have its Decatur branch operating by March 1. It is said that the General Electric Co. will erect another building of the same size when the first one is completed.

East Chicago, Ind. — Edwards Valve & Manufacturing Co., which had extensive war munitions contracts, has converted its shop into an electric washing machine factory.

Evansville, Ind.—Schroeder Headlight & Generator Co. has changed its name to Sunbeam Electric Manufacturing Co.

Hagerstown, Ind.—Charles Brassman, 1503 Merchants Bank building, Indianapolis, will prepare estimates for a municipal light plant.

Indianapolis, Ind.—L. H. Van Briggle Chemical Co. will erect a new factory building which will adjoin the building of the Van Briggle Motor Device Co., both of which are controlled by the same interests. It is to be of reinforced concrete construction, of the same type of architecture of the motor device plant, and will house the factory and storeroom of the chemical company.

Indianapolis, Ind. — Pittsburgh Plate Glass Co. is having plans prepared for a new power plant.

Seymour, Ind. — A high-tension line, which is being built by the Interstate Public Service Co., between its hydraulic station at Williams, Ind. and this city, will soon be completed. The system is connected at Seymour with a high-tension line between Indianapolis and Seymour, also owned by the Interstate company. When the line is in operation the Williams' station will supply a large part of the electrical energy for light and power in Greenwood, Franklin, Edinburg, Columbus and Seymour, as well as many other towns.

South Bend, Ind. — Studebaker Corp. has announced plans for the erection of 1000 homes, made necessary by the opening of its new $15,-000,000 automobile plant. A subsidiary home building company has been formed with a capitalization of $1,000,000 to carry on the building project.

Chicago, Ill.—Plans are being made for the erection of the Allerton Hotel, 16 stories, 600 rooms, 150x107 ft., to cost $1,500,000.

Chicago, Ill. — American Bond & Mortgage Co. has purchased the Unity building and will expend $450,-000 in alterations. Indirect lighting fixtures will be installed throughout the 16-story building and the entire heating and power plants will be rebuilt and modernized. Between $75,-000 and $90,000 will be expended in alterations of the bank floor, which will be occupied by new owners.

Chicago, Ill.—Mutual Tailoring Co. will build a 7-story plant, 100x120 ft., containing 84,000 sq. ft. of floor space and costing $400,000.

Grayville, Ill.—The city council will hold a special election for issuing bonds for the purchase of additional equipment at the electric power plant. It is expected the bond issue will carry, enabling the city to buy sufficient equipment for the light plant to guarantee continuous power service for a button factory which is under contract with the chamber of commerce to locate here.

Valdalia, Ill.—The question of issuing municipal light bonds will be submitted to vote. Address village clerk.

Benson, Minn.—City contemplates electric light plant improvements. Engineer W. E. Skinner, 15 South 5th street, Minneapolis, and Theo. B. Lee, superintendent, are preparing plans. Estimated cost, $40,000. I. M. Peterson, city clerk.

Duluth, Minn. — Western State Bank will erect $30,000 1-story bank building next spring.

Duluth, Minn. — Duluth Edison

Electrical Co. will install lighting system on Superior street, from 3rd Avenue East to 7th Avenue West. Eight 600-cp. incandescent lights in each block. Constructing Engineer W. S. Heald, 216 W. 1st street.

Glyndon, Minn.—A municipal light plant is under consideration. Address, M. H. Stadum.

Minneapolis, Minn. — Expenditures aggregating $300,000 for the installation of equipment for an underground pneumatic tube system in the business district, which will connect 10 downtown branches with the main Western Union offices, have been authorized by the executive committees of the Western Union Telegraph Co. L. F. Weise, manager.

Minneapolis, Minn. — Northern States Power Co. will erect a power station in southern Minnesota to take care of increased business. Plant will include 13,500-hp. steam turbine and provision will be made to install a second 20,000-hp. turbine later. R. W. Fuller, vice-president, Minneapolis General Electric Co., 610 3rd Avenue, North.

Davenport, Ia. — New machinery will be installed in the 4-story addition to the Davenport branch of the American Hominy Co., formerly the Purity Oats Co. This building is now practically completed.

Meservey, Ia.—The sum of $93,500 in bonds have been voted for an electric light system. The Iowa Falls Electric Co. will build the line and furnish the current.

Guilford, Mo. — Plans are being made for the installation of electric service from the Maryville Electric Light & Power Co.

Jasper, Mo.—Plans are being made to call a bond election to purchase and improve the light plant.

Slater, Mo. — Election carried to vote $22,500 in bonds for repairs at the city power plant. Plans are being made for the improvements.

St. Louis, Mo.—The Committee on Streets, Sewers and Wharves of the Board of Aldermen of St. Louis have approved a bill providing for the lease by the city to the Union Electric Light & Power Co. of a tract of land at the foot of Ashley street at a rental of $13,807.50 a year. The tract comprises approximately 2 acres. The lease will be for 10 years with an option to be renewed for another 10 years provided that the rental shall be on the basis of 5% per annum upon the valuation of the property.

St. Louis, Mo.—Emerson Electric Manufacturing Co. is selling $1,000,000 preferred stock, the proceeds to be used for the construction of a new factory building immediately adjoining its present St. Louis factory.

St. Louis, Mo.—Blue Bird Manufacturing Co., manufacturer of electrical washing machines, etc., a Delaware corporation, has filed notice with the Secretary of State of an increase in its capital from $500,000 to $1,000,000, to provide for general business expansion.

Burns, Kan. — Election to vote bonds in the sum of $15,000 carried. The funds will be used to build necessary transmission lines to meet the high-voltage lines of the Kansas Gas & Electric Co.

Harper, Kan.—The installation of a white way, to cost $7000, is contemplated. Miss A. E. Crocker, city clerk.

Meridan, Kan.—A petition has been submitted for electric lights.

Milton, N. D.—The committee appointed to get plans for the new electric lighting plant here has completed such plans and will soon begin to advertise for bids.

New Rockford, N. D.—The city will construct "white way" on Willard avenue, Dakota street, Lamborn avenue and Chicago street. F. H. Collins, city auditor.

SOUTH CENTRAL STATES.

Maysville, Ky. — Mason-Bracken Electrical Co., recently incorporated with a capital of $25,000, is planning for the operation of an electric light and power plant at Germantown. Plans are being prepared to furnish service to Brookville and Maysville, a transmission system to be constructed through Maysville via Germantown and Brookville. H. L. Corlis, Germantown, is president of the new company.

Pikeville, Ky.—Kentucky & West Virginia Power Co. will purchase new equipment for its plant.

Yeager, Ky. — Fork-Elkhorn Coal Co. will install electrical equipment.

Birmingham, Ala. — Birmingham Light & Power Co. will erect substations of 1000-kw. capacity, rotary converter with switchboard to supply 250-volt energy to Edison service. L. L. Newman, engineer.

Brundidge, Ala.—G. L. Beck contemplates the installation of a generating unit in the electric plant.

Montgomery, Ala. — Montgomery Light & Water Power Co. is understood to be arranging plans to double the present capacity of its hydroelectric plant. The work will include the construction of a new 44,000-volt high-tension transmission line to connect with the line of similar capacity of the Alabama Power Co., near Vida, on the Mobile & Ohio Railway, about 25 miles northwest of Montgomery. The expansion program is estimated to involve an expenditure of about $500,000. S. B. Irelan is general manager.

Roanoke, Ala. — Alabama Power Co., Birmingham, Ala., will construct a power line to Rock Mills, to furnish electric power to Wehadkee Yarn Mills.

Fort Smith Ark. — Fort Smith Light & Traction Co. is making plans to enlarge its power plant by adding an addition to cost $250,000.

Harrisburg, Ark. — Three brick buildings will be erected by the Harrisburg Light & Power Co. About $20,000 of ice machinery, $30,000 light and waterworks machinery and $20,000 of cotton gin equipment will be installed.

Dewar, Okla.—Dewar Electric Co. is arranging plans for the construction of a new electric light plant to furnish service for local and nearby operations.

El Reno, Okla.—Waterworks improvements are contemplated including pipe line extensions, reservoirs, etc., to cost $300,000. Ethel Deel, city clerk.

Lindsay, Okla. — Election to vote $75,000 in bonds to extend the water works system and $25,000 to extend the electric light system, carried.

Oklahoma City, Okla.—Oklahoma Gas & Electric Co. will construct a station in Western Oklahoma, 10,000-hp. capacity, condensing water from Arkansas river. Address H. M. Byllesby & Co., 208 La Salle street, Chicago, Ill.

Sallisaw, Okla.—About $140,000 will be expended improving the light and water system. Address city auditor.

Tahlequah, Okla.—City will install electric light plant. $1,000,000 in bonds have been voted. Address mayor.

Abilene, Tex. — American Public Service Co. plans to take over and rehabilitate the electric street railway system here. The property has not been operated for some time. Abilene Gas & Electric Co., subsidiary of the American Public Service Co., will expend about $40,000 in making improvements to the system. This company has also begun the construction of a new electric power station here which will cost about $750,000. It will build a system of transmission lines from the new plant to Cisco, Baird, Anson, Stamford, Hamlin, Merkel and other towns of central west Texas, it is announced by A. Hardgrave of Dallas, vice-president and general manager of the American Public Service Co.

Clarendon, Tex. — Texas Light & Power Co. contemplates light plant extensions and improvements. Mr. Coursen, engineer.

Donna, Tex.—Donna Light & Ice Co has increased its capital stock from $10,000 to $40,000. It plans to install new machinery and greatly enlarge the capacity of its electric light and power plant.

Gainesville, Tex. — Gainesville-Sherman Traction Co. has submitted propositions to the citizens of Gainesville, Whitesboro and Sherman looking to the construction of an interurban electric railway between Gainesville and Sherman, about 30 miles. From these three towns a total cash bonus of $175,000 and stock subscriptions to the amount of $275,000 are asked. George M. Easley of Dallas is president and Burt C. Blanton of Dallas is general manager of the company. Construction of the proposed line will be started next February.

Mineral Wells, Tex. — Two allied companies have been organized for the purpose of constructing an interurban electric railway between Fort Worth and Mineral Wells, about 60 miles, and between Mineral Wells and Breckenridge, about 55 miles, with branch lines from the latter town to Eastland, Ranger and Cisco, about 60 miles. One of these companies is the Fort Worth & Mineral

Wells railway and the other is the Fort Worth, Mineral Wells & Breckenridge railway. H. E. Robinson of Fort Worth is president of both companies. Surveys have been made and right of way obtained for the proposed lines, according to Mr. Robinson. Construction will be started early in January.

WESTERN STATES.

Buhl, Ida.—James J. Chambers of Denver, Colo., who owns power rights in Sand Springs, north of Riverside Ferry, and H. E. Lindon, engineer of the firm of Beckman & Linden, San Francisco, met with the citizens of this place recently to discuss propositions of furnishing water to this city from Sand Springs. Chambers stated that if the city would vote bonds for water system and municipal lighting system, his company will supply water and current and take compensation in municipal bonds.

Challis, Ida.—State Public Utilities Commission has granted to W. M. Adamson, authority to begin work on a hydroelectric power plant here, work to begin in 60 days.

Chehalis, Wash. — North Coast Power Co. has filed with the Public Service Commission of Washington, tariffs covering power and residential lighting current, showing increase of rates amounting in some instances to 100%. The company furnishes electric service to Centralia, Chehalis, Tenino, Bucoda, Kelso and Kalema. For supply current to municipal distributing plants, the company establishes a minimum ready-to-serve charge of $600 a month for Chehalis and $1000 a month for Centralia.

Everett, Wash.—Eclipse Mill Co. will make improvements in its plant to cost $25,000. A 2-story building will be constructed equipped throughout with electrically driven machinery.

Matlock, Wash. — District Telephone Co. has decided to extend the line to Sheldon.

Montesano, Wash.—E. H. Bishop, Bishop Lumber Mill, will construct an electrically operated lumber mill with a daily capacity of 60,000 ft.

Seattle, Wash.—Newcomb Carlton, president of the Western Union Telegraph Co., announced that a new cable line will be laid between Seattle and China by way of Japan.

Bend, Ore.—Bend Water, Light & Power Co. contemplates the construction of 2 power plants along the Tumalo river, at a cost of $220,000.

Portland, Ore. — North Portland Box Co. plant, destroyed in a recent fire with a loss of $25,000, will be rebuilt. Machinery will be electrically operated. Coast Steel & Machinery Co. of Portland has contract for a considerable portion of the machinery.

Salem, Ore.—Bend Water Light & Power Co. contemplates construction of power plants on the Tumalo river, at a cost of approximately $230,000.

Redding, Cal.—Pit River Power Co. is completing preliminary survey work in connection with the proposed power development along the Pit river above Copper City. It is said that this work will involve an expenditure in excess of $15,000,000.

FOREIGN TRADE

[Addresses of firms referred to in these trade opportunities may be obtained by writing to the Bureau of Foreign and Domestic Commerce, Washington, D. C., or its branch and local co-operative offices. Request for each opportunity should be on a separate sheet and the file number given.]

Engineering Equipment (31,407).—Engineers in England desire to secure an agency for the sale of engineering equipment (mechanical, electrical and mining). References.

Electrical Apparatus (31,464).—An engineer in the United States who is about to make a visit to Venezuela and Porto Rico, desires to secure the representation of firms for the sale in those countries of machinery, electrical apparatus, automobile trucks, power plants and anything in connection with the mechanical and electrical trades. References.

Electrical Supplies (31,474). — A trade organization in Greece desires to purchase and secure an agency for the sale of electrical supplies. Correspondence may be in English. References.

Electrical Machinery (31,496). — A firm specializing in American electrical manufactures in England desires to secure an agency or purchase electrical machinery and control gear, motors, and generators, alternating and direct current. Will purchase if agency is unobtainable. Quotations should be given c. i. f. English port. References.

Heating Appliances (31,500). — A commercial agent in Belgium desires to secure an agency for the sale of heating appliances, such as valves, radiators, boilers, and similar articles, and to buy various kinds of goods.

Electrical Apparatus (31,503).—An American exporting house which has established branches in all the principal cities of the Levant, and maintains showrooms, warehouses, and service stations, desires to represent American firms for the sale of agricultural machinery, electrical apparatus, automobiles, etc., and all spare parts and accessories thereto. References.

Motors, Compressors, Cranes, Etc. (31,516).—An agency is desired by a firm in Switzerland for the sale of stationary motors and engines driven by gasoline and kerosene; stationary motors driven by electricity, horizontal 20 to 120 h. p.; and compressors, cranes and rigs; and mining machinery. Correspondence may be in English. Reference.

Electrical and Electromechanical Products (31,519). — An importer in Belgium desires to secure an exclusive agency for the sale of electrical and electromechanical products of all sorts. Correspondence and catalogs should be in French. References.

Incandescent Lamps (31,523).—An import and export firm in Bulgaria desires to secure the exclusive agency for the sale of oil and incandescent lamps, sewing and knitting machines, adding and calculating machines, etc. References.

PROPOSALS

Light Plant.—Bids will be received Dec. 31 at Unadilla, Ga., for the erection of an electric light plant and extensions to the waterworks system, which is now being contemplated by the city council. Address mayor.

Electric Light System.—Bids will be received Jan. 5, 1920, by the clerk of the board of education, Ohio National Bank building, Columbus, O., for installing an electric lighting system at the Normal, Fleser, Franklinton, Mound Park and Spring street schools, according to the specifications of D. Riebel, architect, on file in his office, New First National Bank building, and the Builders' Exchange. Edward B. McFadden, clerk.

Rewiring of Building.—Bids will be opened in the office of the supervising architect, Treasury Department, Washington, D. C., at 3 p. m., Jan. 5, 1920, for remodeling plumbing system, rewiring, etc., in the United States Appraisers Stores, St. Louis, Mo., in accordance with the specifications and drawings, copies of which may be had at that office or at the office of the custodian, St. Louis, Mo., in the discretion of the supervising architect. James A. Wetmore, acting supervising architect.

Electric Elevators. — Bids will be opened at 3 p. m., Dec. 30, in the supervising architect's office, Treasury Department, Washington, D. C., for the installation complete of two electric elevators in the kitchen and mess hall, United States marine hospital, at New York, N. Y. (Stapleton), in accordance with the drawing and specifications, copies of which may be had at this office in the discretion of the supervising architect. James A. Wetmore, acting supervising architect.

Electric Freight Lift.—Sealed proposals will be opened in the office of the supervising architect, Treasury Department, Washington, D. C., at 3 p. m., Jan. 8, 1920, for the installation complete of electric freight lift, etc., in the United States post office at Springfield, O., in accordance with the drawing and specification, copies of which may be had at this office in the discretion of the supervising architect. James A. Wetmore, acting supervising architect.

Telephone Cable and Copper Wire.—Director of Sales, War Department, Washington, D. C., will consider proposals for 1,710,000 ft. of telephone cables and 854,923 lbs. of copper wire. This material was originally packed for overseas shipment and is now available for purchase. It is understood that the greater part of the wire and cable is in the Philadelphia Ordnance District.

Personals

C. P. Bruch Takes Charge of South American Interests, Marconi Telegraph—E. C. Jones a Vice-Pres. of A. S. M. E.

J. W. SMILEY, formerly of the securities department of the Minneapolis General Electric Co. (Northern States Power Co.) has been appointed manager of the new "investment department" of the Louisville Gas & Electric Co.

BURDETT STRYKER, formerly associated with the Chesapeake & Potomac Telephone Co., Washington, D. C., and Baltimore, Md., and later with the Bell Telephone Co. of Pennsylvania, has been appointed general manager of the Chesapeake & Potomac company, Baltimore.

PAUL P. SWEARINGEN has entered the service of the Electric Products Co. in the capacity of sales engineer, making his headquarters at the Chicago office. Mr. Swearingen built the first Liberty motor at the Thomas Morris Aircraft Corp., Ithaca, N. Y., and was transferred as supervisor to the Wright Martin plant, with the rating of captain.

P. R. MCCOMAS has been named general manager of the Illinois Central Electric Railway Co., with headquarters at Canton, Ill. Mr. McComas had had a number of years' experience in both steam and electric railway work and was formerly assistant manager of the Peoria & Pekin Union Railroad Co., Peoria, Ill.

EDWARD F. SISE, president of the Northern Electric Co., Montreal, has resigned. In 1890 Mr. Sise organized the Wire & Cable Co., of which he was managing director until its amalgamation with the Northern Electric Co., at which time he became president of that company. He is succeeded by Paul F. Sise.

J. C. MCQUISTON, manager of the Westinghouse Department of Publicity, East Pittsburgh, Pa., was elected president of the Association of National Advertisers at its annual convention held last week. J. D. ELLSWORTH, publicity manager of the American Telephone & Telegraph Co., New York, was elected a vice-president of the organization.

CLAYTON O. SMITH, the new manager of the O. S. Walker Co., Worcester, Mass., was graduated in 1892 and 1893 as mechanical and electrical engineer, respectively, from Worcester Polytechnic Institute. He then took a student course at the Westinghouse Electric & Manufacturing Co., East Pittsburgh, Pa., following which he accepted a position with the C. W. Hunt Co., Staten Island, N. Y. After 5 years' service with the Norcross Brothers Co., Worcester, in the engineering and drafting department, Mr. Smith became affiliated with the Norton Grinding Co., in its early days, being placed in charge of the drafting department. In 1902 he was promoted to superintendent, in 1905 took charge of the office and 2 years later became sales manager.

HOWARD POWER, secretary of the White Lily Manufacturing Co., Davenport, Ia., manufacturer of electric washing machines, has resigned to become associated with the H. F. Brammer Manufacturing Co., Davenport, effective Jan. 1, 1920.

EDWARD C. JONES, chief engineer of the Pacific Gas & Electric Co., San Francisco, Cal., was elected a third vice-president of the American Society of Mechanical Engineers at its annual meeting held recently. Mr. Jones has taken an active part in the Society's affairs and has been prominently identified with the gas and electric power industry for many years.

PROF. I. O. BAKER has been designated by Dean Charles R. Richards of the college of engineering of the University of Illinois to write a history of the growth and development of the engineering work at the University of Illinois. This history will include the courses in electrical, civil, mechanical, railway, architectural, ceramic and chemical engineering.

WILLIAM LEROY EMMET, consulting engineer of the General Electric Co., Schenectady, N. Y., delivered a very interesting and instructive address on "The Electrical Propulsion of Ships" at a meeting of the New York Electrical Society held on Dec. 17 at the Engineering Societies building, New York City. Mr. Emmet discussed the advantages of the adoption of this method of propulsion in ships of different types and presented valuable engineering data which have recently been developed. Lantern slides of constructions which have been produced or planned were also shown.

CHARLES P. BRUCH, until recently vice-president and director of the Postal Telegraph Co., has just been placed in charge of the interests of the Marconi Wireless Telegraph Co. in a large part of South America and is sailing immediately for Buenos Aires. Himself the son of a distinguished telegraph manager, Mr. Bruch has all his life been engaged in telegraphic operation and administration, and served in the late war as major in the Signal Section of the Officers' Reserve Corps, U. S. Army, and also as a member of the committee on Telegraphs and Telephones of the Council of National Defense. Mr. Bruch is a past-president of the Magnetic Club of New York and the Ohio Society of New York, and is president of the Society of the United States Military Telegraph Corps. He has also taken a prominent part in the affairs of various telegraphic organizations, notably the old time Telegraphers and Historical Society, New York Telegraphers' Aid Society, the Society of the U. S. Military Telegraph Corps and the Telegraph and Telephone Life Insurance Association.

WILMOT L. MATTHEWS and STEPHEN HAAS, both of Toronto, Ont., have been elected directors of the Canadian General Electric Co.

G. E. QUINLAN, chief engineer, Puget Sound Traction, Light & Power Co., Seattle, attended the meeting of the Code Committee of the National Electric Light Association at Denver, Colo.

WALTER BRINTON, general manager of the American Manganese Co., New Castle, Del., has been appointed a member of the Delaware Public Utilities Board, succeeding C. D. Garretson, resigned.

WILLIAM S. BOYD, who for a number of years has been purchasing agent of the Page Steel & Wire Co., Monessen, Pa., has become manager of the steel and iron scrap department of the Thomas D. Prosser Co. He will make his headquarters at the main office of the company at Wooster, O.

P. D. SEXTON, who for several years has occupied the office of secretary and treasurer of the Public Service Co. of Northern Illinois, has been elected an officer of a large bank in Syracuse, N. Y., and will assume his new duties in the near future. He will be succeeded by George R. Jones, assistant to Vice-President J. H. Gulick. Mr. Jones was formerly purchasing agent and was elected to the position of assistant to Vice-President Gulick a few months ago. Both Mr. Sexton and Mr. Jones are widely known and are among the most popular men in the company's organization.

ALBERT E. BERRY, division manager at Philadelphia of the Chesapeake & Potomac Telephone Co. of Philadelphia, has been elected president of the company. He was born in Washington in 1878, and after his graduation in law from Georgetown University about 20 years ago, he entered the offices of a law firm in his native city. In 1901 he entered the service of the Chesapeake & Potomac company as a salesman in the contract department. He later held positions in the office of the general manager and the rights-of-way department, following which he became special agent reporting to the general manager. He then entered the construction department as chief clerk for the Washington division. In 1908 Mr. Berry went to Philadelphia, where he was division manager and where he directed the work of the commercial department during 10 years of unprecedented telephone development.

Obituary.

CHARLES KEITH BLACKWOOD, vice-president of the Sullivan Machinery Co., Chicago, died at his home in Kenilworth, Ill., on Dec. 14. Interment was made in Detroit, Mich. Mr. Blackwood is survived by his widow.

Financial News

Indiana Telephone Companies Merge.

The Indiana Public Service Commission has before it a petition for the consolidation of 8 telephone companies in the vicinity of Seymour into the Southern Indiana Telephone & Telegraph Co. The new company requests permission to issue $300,000 common stock at par; $200,000 of 7% preferred stock at not less than 90% cent of par; and $45,000 of 7% short-time notes at not less than 94. The petition shows that the companies now being merged are worth $239,500, having net assets of $243,000 and gross assets of $300,000. Address L. C. Griffiths, Seymour, Ind.

Public Utility Bond Issues.

Notices have been filed with the Public Service Commission by a large number of public utility companies of the issuance of bonds and stock, for increased operations. Among the companies are: United Gas Improvement Co., Philadelphia, common stock, $5,550,300; Keystone Telephone Co., Philadelphia, bonds, $3,100,000; Penn Central Light & Power Co., Altoona, bonds, $129,000; Philadelphia Suburban Gas & Electric Co., Philadelphia, bonds, $45,000; Eastern Pennsylvania Railways Co., Pottsville, bonds, $42,500; Lycoming Edison Co., Williamsport, notes, $15,000; Citizens Light & Power Co., Oil City, bonds, $16,000; Lehigh Valley Light & Power Co., Allentown, preferred stock, $46,900; State-Centre Electric Co., Clearfield, preferred stock, $100,000; Citizens Traction Co., Oil City, bonds, $100,000; Lehigh Industrial Power Co., Philadelphia, bonds, $33,500; Chester Valley Electric Co., Coatesville, bonds, $630,000; and Conestoga Lawrence Light & Power Co., New Castle, common stock, $1000.

Receivers Operate Sixth of Electric Railway Lines.

"The electric railway industry nearly suffered annihilation through conditions caused by the war," said Gen. Guy Eastman Tripp, chairman of the board of directors of the Westinghouse Electric & Manufacturing Co., speaking before recent reconstruction conference of the Association of Life Insurance Presidents in New York. Life insurance men, as trustees of approximately $160,000,000 of policy holders' funds invested in street and interurban railroad securities, should, he declared, be deeply interested in the situation.

"With respect to the judgment used in making this investment," continued General Tripp, "the facts are all favorable. From the beginning to the present time street railroads have had all the fundamentals of a sound investment. They furnish now and always have furnished an indispensable service to our urban population. The very existence of modern community life depends upon this form of transportation, and, after water and sewerage, it is the most important public utility. In short, if our urban communities have made for the wealth, comfort and culture of this country, then an investment in street railway transportation is in one of the cornerstones of the structure; and, if the investment is in danger, it is not because of poor financial judgment.

"More than a sixth of the total electric railway mileage of the country is in the hands of receivers. A very large additional number of companies are on the verge of bankruptcy, some of them kept from this fate only by the financial strength of the much criticized 'holding' companies. Alone of the important industries of the nation, the electric railway industry nearly suffered annihilation through conditions caused by the war, and back of all these facts is the further and by all means the most important fact that the industry, by reason of restrictions in statute law, in ordinances and by franchises is unable to take measures to save itself from the fate which events show to be imminent.

"The restoration of credit is fundamental to the continuance of private capital and private enterprise in the public service, and the main task that confronts the country, insofar as the electric railways are concerned, is the restoration and the future preservation of that credit.

"The street railway problem has passed the stage where it is simply a concern of the owners and operators of the properties. They have lost and are losing a great many millions of dollars, and for them the situation is deplorable enough, but the communities, and through the communities you men of business, the workmen, the ordinary everyday citizens, are today threatened with the loss or demoralization of a service that is absolutely necessary if business is to continue in our large urban centers, if the health and morals and comfort and convenience of our citizens are to be preserved."

Adoption by municipalities and street railway companies of "cost and service agreements" in which the cost of maintaining the integrity of the investment is included was recommended as a means of giving the street railway financial problems by General Tripp.

Business of General Electric Company Increasing.

General Electric Co. is enjoying unprecedented prosperity explaining the stock's refusal to participate in the recent break in the general market. Goods are now being shipped at the rate of $20,000,000 monthly, a volume in excess of the highest point attained during the war period.

Business was slack in the four or five months following the signing of the armistice, but the recovery has been so rapid since that time that billings for the entire year should average $18,500,000 monthly, bringing the aggregate for 1919 to around $225,000,000, against $216,815,277 in 1918.

Bookings are now being received at an annual rate that betters the showing made in 1918 when orders aggregated $234,134,037. For the first nine months of this year the annual rate of bookings ran less than $200,000,000, but the improvement since then has been so striking that the total for 1919 should be higher than the preceding year's figure.

Applying General Electric's 1918 ratio of manufacturing costs to $225,000,000 gross indicated for 1919, earnings of $15.70 a share, after taxes, are shown for the approximately $20,000,000 stock which will be outstanding at the close of the year. This compares with $14.76 a share earned on $115,874,800 stock in 1918.

An outstanding feature of General Electric's financial position is the great strength of its working capital. Cash on hand at the close of 1918 was $34,010,024, against $21,190,675 at the start of the year. Total net quick assets as of Dec. 31, last, were $180,298,731. Excluding the $10,000,000 6% notes which were paid off Dec. 1, 1919, current liabilities as of Dec. 31, 1918, were $27,416,082. This left working capital of $152,882,649, equal to $132 a share on $115,874,800 stock outstanding at the close of last year.

Pacific Gas & Electric Earnings Show Improvement.

Report of earnings of Pacific Gas & Electric Co. for the 12 months to Oct. 31, 1919, shows considerable increase in both gross and net indicating that the fiscal year ending Dec. 31 next should be a record year. Gross earnings for the 12 months to Oct. 31 were close to the $26,000,000 mark. This does not include earnings of the Northern California Power Co. purchased by Pacific Gas & Electric Co. recently and which in 1918 reported gross earnings of $1,154,943.

Earnings report for the 12 months to Oct. 31, 1919, compared with previous 12-month period follows:

	1919.	1918.
Total gross inc. misc. inc.	$25,999,888	$22,397,899
Net after taxes	8,748,201	7,876,925
Surplus after fixed charges	4,325,871	3,570,376

There was paid out in dividends on the preferred stock $1,528,997, leaving $2,796,894 earned on the common stock. Surplus after charges of Northern California Power Co. amounting to $340,000 theoretically should be brought in, inasmuch as Pacific company owns this company and its surplus accrues directly to it.

The company during the 12 months charged off for depreciation $3,277,437, compared with $2,796,510 the previous 12 months. This does not include the special depreciation charge of $1,000,000 ordered by the California Commission for seven years. As the company is retiring bonds at the rate of this amount annually, this is not generally considered a proper charge upon earnings. On this basis, the company is earning at the rate of between $8 and $9 a share annually on the common stock. This does not include revenue to be derived from Northern California Power Co.

Water conditions this fall have not been of the best, but it is reported that rains and snow fell commencing the latter part of November, which will improve the situation.

The full effect of the acquisition of the plants and transmission lines of Sierra & San Francisco Power Co. will be in the future rather than immediately. The Sierra company in 1918 earned little more than approximately $66,000 in excess of its fixed charges, just about the amount which the company will pay for its rental during the first year. The rental of the properties will give Pacific company an opportunity to increase its hydroelectric output, which is believed to be the reason for the taking over of this system.

Dividends.

Central States Electric Corp. has declared a regular quarterly dividend of 1¾% on preferred stock, payable Dec. 31 to stock of record Dec. 10.

New York Telephone Co. has declared a semi-annual dividend of 3%, payable Jan. 1.

A quarterly dividend of 1¾% on preferred stock has been declared by the Utah Power & Light Co., payable Jan. 2 to stockholders of record Dec. 16.

Dayton Power & Light Co. has declared a quarterly dividend of 1½% on preferred stock, payable Jan. 2 to stock of record Dec. 20.

Northwest Telephone Co. has declared a semi-annual dividend of $5 per share, payable Jan. 1.

The Illinois Traction System has declared a quarterly dividend of 1½%, payable Jan. 1, 1920, to stockholders of record Dec. 15, 1919.

Electric Storage Battery Co. has declared a quarterly dividend of 2½%, also a dividend of 2½% on preferred stock, payable Jan. 2, 1920, to stock of record Dec. 15.

Manhattan Electrical Supply Co. has declared a quarterly dividend of 1%, a quarterly dividend of 1¾% on first preferred stock, and a quarterly dividend of 1¾% on second preferred stock, payable Jan. 2, 1920, to stockholders of record Dec. 30.

Eastern Texas Electric Co. has declared a cash dividend of $4 per share, also a semi-annual dividend of $3 on preferred stock, payable Jan. 2 to stock of record Dec. 15.

Niagara Falls Power Co. has declared the quarterly dividend of $1 a share on common stock and $1.75 on the preferred

For the Readjustment Period—What?

LXI.

Higher Costs Ahead

I do not think that all commodity prices have reached their peak. I base that conclusion on many facts, foremost of which is world scarcity of goods. Years will pass before world production can again become normal. Two illustrations show the widespread want of necessities. Europe has only 55 per cent of its food requirements; it needs more than four and one-half billion bushels of grain, for instance, and there is available in all the world only about one billion bushels.

Europe's shortage of coal is in excess of two hundred million tons. That means, of course, greatly decreased production, as well as intense suffering. Europe must have these necessities, and, consequently, as the law of supply and demand is ever operative—despite legislative enactments and bureaucratic decrees designed to suspend such fundamental economic laws—there is seemingly little prospect of materially reduced prices, at least for the immediate future.

And surely we cannot reasonably expect commodity prices to decrease in this country while there exists here the present epidemic of strikes, especially in such industries as coal and steel, which lower our production not only in those industries, but, by virtue of their basic character, in practically all other industries.

We cannot hope to reduce the cost of living when the individual output of American workmen has declined, on an average, from 15 to 50 per cent in the last year or two, although he has obtained—if not wholly earned—unprecedented increases in wages.

It has aptly been pointed out that the simplest mind can grasp the meaning of this deplorable situation—to wit: If a greater number of people must be employed to turn out the same quantity of goods as before, the cost of the goods must be increased. This increase comes simultaneously with increase of wages. Plainly the country is taxing itself in high prices in order that some of its inhabitants may indulge a slothful spirit.

As a concrete example, the Pennsylvania Railroad has 14 per cent more employes than before we entered the war, but gets 11 per cent less work from them. In other words, it requires 127 men today to do the work of 100 in 1917. The fact that the employes now work only eight hours a day instead of ten, as in 1917, does not account for the decrease in results, because even with a 20 per cent reduction in time, were the men to work with the same effort they did in 1917 they would be able to move 91,000 traffic units a day instead of only 89,000, the present daily average.

We cannot hope to ameliorate the tax burden very materially, and thereby lessen its power in raising costs all around, if Congress appropriates practically five billion dollars for conducting the peace time activities of the government during the coming fiscal year—which is the aggregate amount of proposed appropriations submitted to Congress by the Secretary of the Treasury a few days ago, and which is five times as large as the sum required to transact government affairs in the year immediately preceding the world war.

I do not advocate niggardliness in government expenditures, but I must assuredly declare for common sense economy, such as any large business corporation would practice, and I am a firm believer in a practical budget system for the government, which should be adopted without further delay.

FRANCIS H. SISSON, V. P.,
Guaranty Trust Co.,
New York.

stock. The former is payable Dec. 15 to stock of record Dec. 10 and the latter on Jan. 15, 1920, to stock of record Dec. 31.

Buffalo General Electric Co. has declared a dividend of 2%, payable Dec. 31 to stock of record Dec. 20.

American Power & Light Co. has declared a quarterly dividend of 1½% on preferred stock, payable Jan. 2 to stock of record Dec. 17.

Penn Water & Power Co. has declared a quarterly dividend of 1½% on common stock, payable Jan. 2 to stock of record Dec. 19.

A dividend of $2 per share has been declared by the American Telephone & Telegraph Co., payable Jan. 15, 1920, to stockholders of record Dec. 20.

The regular quarterly dividend of 1½% on preferred stock has been declared by the American Gas & Electric Co., payable Feb. 2, 1920, to stockholders of record Jan. 16, 1920.

Earnings.

ASSOCIATED GAS & ELECTRIC CO.

	1919	1918
September gross.....$	107,960	$ 96,836
Net after taxes.......	30,583	21,443
Surplus after charges	9,215	515
Twelve months gross	1,190,348	971,763
Net after taxes.......	334,524	224,291
Surplus after charges	80,692	*22,909

*Deficit.

AUGUSTA-AIKEN RAILWAY & ELEC. CORP.

	1919	1918
September gross......$	91,235	$ 86,366
Net after taxes......	32,417	38,979
Surplus after charges	2,068	10,937
Twelve months gross	1,035,203	1,064,014
Net after taxes.......	328,307	510,464
Deficit after charges.	39,120	*144,153

*Surplus.

HELENA LIGHT & RAILWAY CO.

	1919	1918
October gross.........$	29,101	$ 25,009
Net after taxes.......	4,758	2,439
Surplus after charges	495	*1,907
Twelve months gross	343,695	318,787
Net after taxes......	55,491	61,595
Surplus after charges	3,508	4,233
Balance after pfd. div.	3,508	*12,909

*Deficit.

UNITED LIGHT & RAILWAYS.

Chicago—United Light & Railways Co. reports earnings as follows:

	1919	1918
October gross.......$	10,056,109	$9,024,302
Net after taxes.....	2,913,822	2,647,610
Surp. after charges.	518,592	358,549

MANILA ELECTRIC R. R. & LIGHTING CORP.

	1919	1918
August gross.........$	194,006	$ 205,666
Net after taxes.......	42,077	95,856
Surplus after charges	6,084	67,433
Twelve months gross	2,481,308	2,095,793
Net after taxes......	963,111	973,688
Surplus after charges	556,208	633,473
Bal after dividends..	256,208	333,473

NEVADA-CALIFORNIA ELECTRIC CORP.

Combined earnings of Nevada-California Electric Corp. and subsidiaries, intercompany items eliminated, compare as follows:

	1919	1918
October gross.........$	189,261	$ 176,640
Net after taxes......	98,162	105,370
Surplus after charges	*5,778	*25,260
Ten months gross....	2,180,007	1,844,277
Net after taxes......	1,205,542	960,706
Surplus after charges	*328,673	*200,755

*After appropriation for redemption of bonds.

SOUTHERN UTILITIES CO.

	1919	1918
September gross......$	166,280	$ 129,140
Net after taxes.......	28,985	3,223
Surplus after charges	10,403	*12,034
Twelve months gross	1,832,613	1,469,835
Net after taxes.......	161,182	218,978
Deficit after charges.	51,407	§35,602
Deficit after pfd. div.	51,407	§9,002

*Deficit. §Surplus.

NATIONAL CONDUIT & CABLE.

Estimated income account of National Conduit & Cable Co., Inc., for nine months ended Sept. 30, 1919, shows deficit, after charges and taxes, of $859,188, as compared with $877,848 in the corresponding period of 1918.

Earnings for 9 months ended Sept. 30, 1919, compares as follows:

	1919	1918
Net sale...............$	7,077,046	$10,790,010
Mfg. cost and exp....	7,583,684	11,011,207
Loss from oper.....$	506,638	$ 221,197
Other income.........	104,387	66,356
Total deficit..........$	402,251	$ 154,841
Tax, int. and deprec.	*456,937	723,007
Deficit ....$	859,188	$ 877,848

*Includes depreciation and organization expense written off $190,494.

NORTHERN OHIO ELECTRIC.

Earnings of Northern Ohio Electric Corp. for October, 10 and 12 months ended Oct. 31, compares as follows:

	1919.	1918.
October gross ....$	796,765	$ 585,622
Net earnings	241,088	158,283
Surplus after charges	70,787	15,187
Balance after preferred dividend	40,787	*14,812
10 months' gross......	7,528,102	5,997,743
Net earnings	2,531,304	2,062,121
Surplus after charges	857,197	629,111
Balance after preferred dividend	557,197	329,111
12 months' gross	8,824,539	7,121,473
Net earnings	2,948,950	2,463,171
Surplus after charges	934,216	731,940
Balance after preferred dividend ...	574,216	371,940

*Deficit.

DETROIT EDISON.

	Month of Oct., 1919	Month of Oct., 1918	10 Months of 1919	10 Months of 1918
Operating Revenue:				
Commercial Electric Revenue	1,308,081.65	1,088,919.82	10,933,213.31	9,187,806.26
Municipal Electric Revenue..	29,906.07	26,640.78	289,163.72	263,841.16
Sales to Street Railways.....	89,188.21	68,241.98	811,215.89	701,738.98
Sales to Other Pub. Ser. Corp.	17,710.29	12,327.29	148,401.25	121,092.46
Miscellaneous Revenue.......	568.23	382.33	6,149.57	23,430.24
Non-Operating Revenue:				
Steam Sales..................	64,225.18	55,388.83	722,802.35	626,338.15
Other Non-Operating Revenue	29,593.18	15,888.14	219,856.63	139,711.27
Total Gross Revenue.......	1,539,272.81	1,268,289.17	13,130,801.92	11,063,958.52
Expenses:				
Operating and Non-Operating (except Renewal, Replacement and Contingent).....	1,081,470.00	822,079.47	9,074,286.17	7,546,103.38
Renewal, Replacement and Contingent (Depreciation Reserve)	101,000.00	89,695.00	701,000.00	651,090.00
Total Operating and Non-Operating Expenses..............	1,182,470.00	911,774.47	9,775,286.17	8,197,193.38
Net Income................	356,802.81	356,514.70	3,355,515.75	2,866,765.14
Deductions from Income:				
Interest on Funded and Unfunded Debt..............	148,548.67	128,257.93	1,407,830.09	1,096,262.28
Other Deductions............				
Total Deductions..............	148,548.67	128,257.93	1,407,830.09	1,096,262.28
Net	208,254.14	228,256.77	1,947,685.66	1,770,502.86

WEEKLY COMPARISON OF CLOSING-BID PRICES OF SECURITIES OF LEADING ELECTRICAL COMPANIES.

Quotations furnished by F. M. Zeiler & Co., Rookery Bldg., Chicago.

Public Utilities.	Div. rate Per cent.	Bid Dec. 9.	Bid Dec. 16.
Adirondack Electric Power of Glens Falls, common............	6	14	15
Adirondack Electric Power of Glens Falls, preferred...........	6	76	77
American Gas & Electric of New York, common..............	10+extra	124	123
American Gas & Electric of New York, preferred..............	6	39	39
American Light & Traction of New York, common..............	..	208	195
American Light & Traction of New York, preferred............	6	92	92
American Power & Light of New York, common..............	4	60	63
American Power & Light of New York, preferred.............	6	73	73
American Public Utilities of Grand Rapids, common............	..	8	8
American Public Utilities of Grand Rapids, preferred..........	7	22	21
American Telephone & Telegraph of New York	..	99¼	99⅛
American Water Works & Elec. of New York, common.........	..	3	2
American Water Works & Elec. of New York, particip.........	7	9	6
American Water Works & Elec. of New York, first preferred...	..	45	45
Appalachian Power, common..............................	..	4	3
Appalachian Power, preferred............................	7	21	20
Cities Service of New York, common..........................	+extra	405	402
Cities Service of New York, preferred........................	6	73½	72
Commonwealth Edison of Chicago, ...	8	108	107
Comm. Power, Railway & Light of Jackson, common............	..	21	20
Comm. Power, Railway & Light of Jackson, preferred...........	6	45	..
Federal Light & Traction of New York, common..............	..	7	7
Federal Light & Traction of New York, preferred.............	..	42	42
Illinois Northern Utilities of Dixon	6	..	..
Middle West Utilities of Chicago, common..................	2+extra	25	..
Middle West Utilities of Chicago, preferred................	6	48	..
Northern States Power of Chicago, common..................	..	63	63
Northern States Power of Chicago, preferred................	ex.div.7	90	89
Pacific Gas & Electric of San Francisco, common.............	..	63	60
Pacific Gas & Electric of San Francisco, preferred............	6	..	..
Public Service of Northern Illinois, Chicago, common..........	7	80	78
Public Service of Northern Illinois, Chicago, preferred........	6	85	89
Republic Railway & Light of Youngstown, common............	4	13	12
Republic Railways & Light of Youngstown, preferred.........	6	48	46
Standard Gas & Electric of Chicago, common................	..	27½	27¼
Standard Gas & Electric of Chicago, preferred...............	6	41¾	41
Tennessee Railway, Light & Power of Chattanooga, common....	..	3	2
Tennessee Railway, Light & Power of Chattanooga, preferred...	6	5	5
United Light & Railways of Grand Rapids, common............	4	41½	..
United Light & Railways of Grand Rapids, preferred...........	6	67	60
Western Power of San Francisco, common....................	..	27	21
Western Union Telegraph of New York	extra	89½	87
Industries.			
Electric Storage of Philadelphia, common	4	137	132½
General Electric of Schenectady	8	168	166
Westinghouse Electric & Mfg. of Pittsburgh, common.........	7	53½	52⅜
Westinghouse Electric & Mfg. of Pittsburgh, preferred........	7	..	..

Title page and index copy

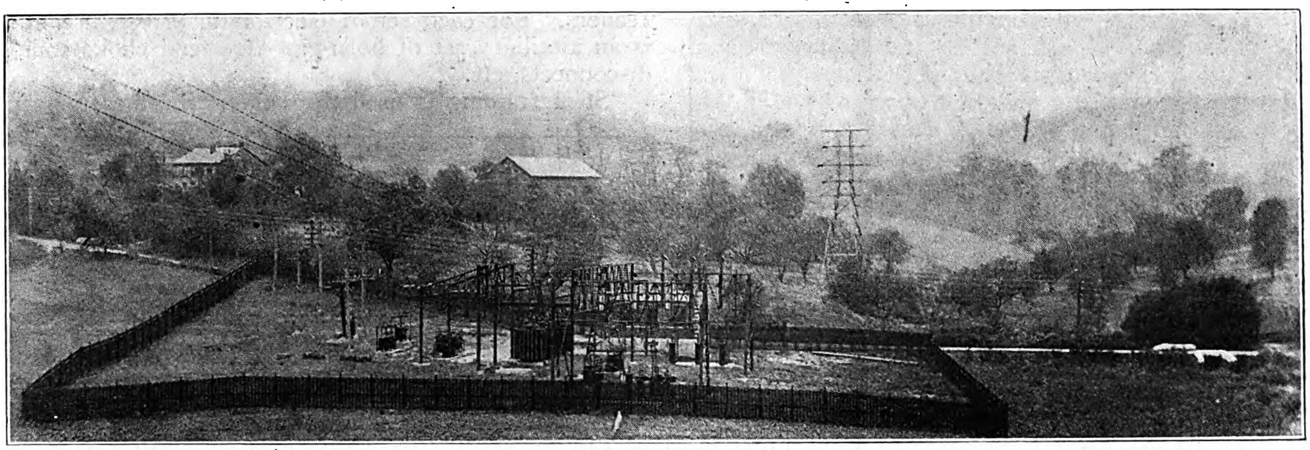
Electrical Review

Vol. 75. No. 26. CHICAGO, DECEMBER 27, 1919 Three Dollars a Year

Electrical Review

WITH WHICH IS CONSOLIDATED WESTERN ELECTRICIAN AND ELECTROCRAFT.

VOL. 75—No. 26. CHICAGO, SATURDAY, DECEMBER 27, 1919. PAGE 1045



General View of North Substation and Surroundings, Showing 66,000-Volt Tower Line in Right Background.

North Substation of Duquesne Light Company, Pittsburgh

Outdoor Substation in High-Voltage Loop Around Pittsburgh Proves Economical and Dependable—Used for Feeding 22,000-Volt Lines from 66,000-Volt Network and Sectionalizing Latter

NOTABLE among the electrical installations built for permanent service during the war is the North substation built and designed by the Duquesne Light Co., of Pittsburgh, Pa. This is an outdoor installation located in the open country a short distance north of Pittsburgh, in Ross township, Allegheny county, Pa. It forms part of a 66,000-volt transmission system which connects with substations now built and other substations to be built, all of which will form a loop around the city of Pittsburgh. This particular substation, during nearly two years of operation, has proved rugged, efficient and reliable. Its record in this regard shows that outdoor substations can be made an economical and dependable part of extensive central-station networks in suburban districts of large metropolitan cities.

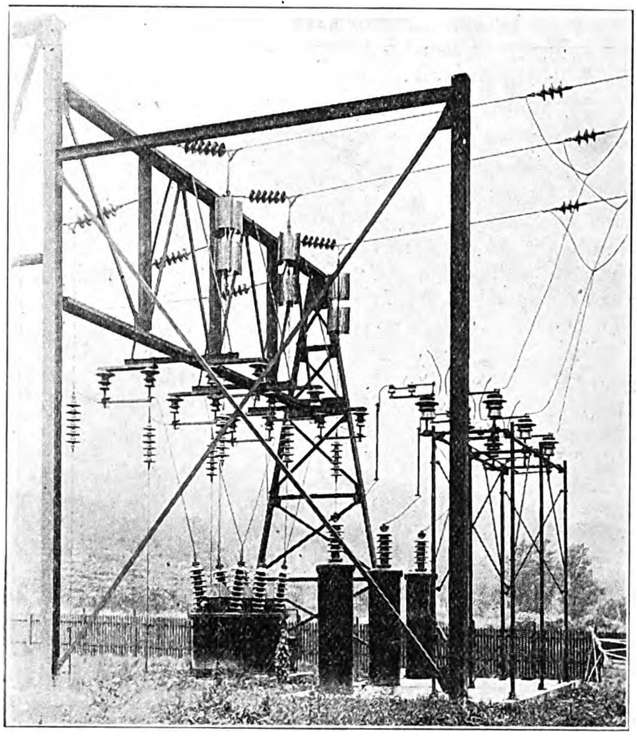
A fair idea of the topography of the district where North substation is located is gained from the two large illustrations herewith. The site was selected where at least the main part of it is fairly level and permits of easy installation of additional equipment in the future. In the initial installation provision is made for one 66,000-volt line, three main stepdown transformers and three 22,000-volt outgoing feeders. The plans provide for the ultimate installation of another 66,000-volt transmission line, three additional main transformers with a spare unit, and five other 22,000-volt feeders with necessary breakers and other auxiliaries. The complete layout, present and ultimate, is shown in the accompanying single-line diagram on which future additions are indicated by dotted lines.

Main line transformers of the self-cooled, radiator type are used. Each has a rated capacity of 4166 kv-a. and they are designed for a voltage of 66,000 on the primary side and 22,000 or 11,000 on the secondary. The secondary winding is so designed that voltages of 22,000 and 11,000 can, if desired, be supplied simultaneously. Under these conditions the transformer can give a rating of one-third normal kilovolt-amperes at 11,000 volts and two-thirds normal kilovolt-amperes at 22,000 volts.

Numerous difficulties were met in hauling the first of the three big transformers to the site from Millvale, where they had been brought by railroad. With the special haulage truck these units each weighed nearly 28 tons. Twelve heavy draft horses and the company's big electric truck had quite a task negotiating the hilly roads between Millvale and the substation site, the load lurching away from control on several occasions and sinking deep into the roadway. By means of block and tackle and the motor-driven winch on the electric truck the load was finally moved from the stalled places. Profiting from the experience gained in moving the first unit, the two others were moved without mishap.

Oil circuit-breakers of the electrically operated automatic overload type are used for the control of the power on both the 66,000 and 22,000-volt sides.

Those on the primary side are of the GA type and are mounted directly on the concrete foundations. One is used as a main-line breaker, while two others are used selectively in cutting the transformers in or out. On the secondary side, there is a breaker of the GB type



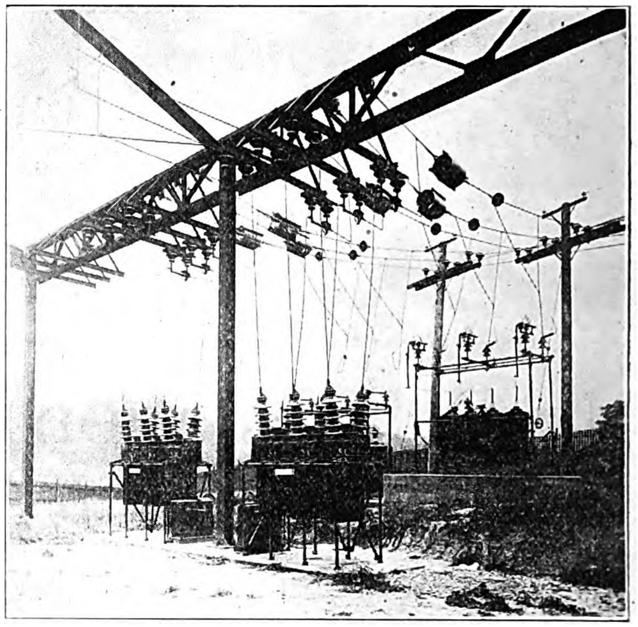
The 66,000-Volt Incoming Line With Kickoffs, Lightning Arresters, Choke Coils, Circuit-Breakers and Disconnects.

on each of the three 22,000-volt feeders, the breakers being mounted on pipe framework resting on the concrete foundation.

The substation, in addition to its transforming and distribution functions, serves as a lightning-arrester and sectionalizing station on the 66,000-volt line, the station being so connected to the line that a section of the latter forms a 66,000-volt station bus. By means of switching equipment located at each end of the bus, either the eastern or western section of the line may be disconnected from the station and the other section. One section of the high-voltage tower line comes from the company's Brunots Island generating station and the other section runs on to Cheswick.

Five sets of electrolytic lightning arresters are used, with auxiliary horn gaps, choke coils and disconnecting switches. Two sets are connected with the 66,000-volt line, one being at the east end of the 66,000-volt bus and connected with the line section at that end, and the other correspondingly located and connected at the west end. The other three electrolytic arrester sets are connected to the 22,000-volt outgoing feeders. For each set of electrolytic arresters there is an auxiliary set of horn-gap arresters, choke coils, disconnects, etc.

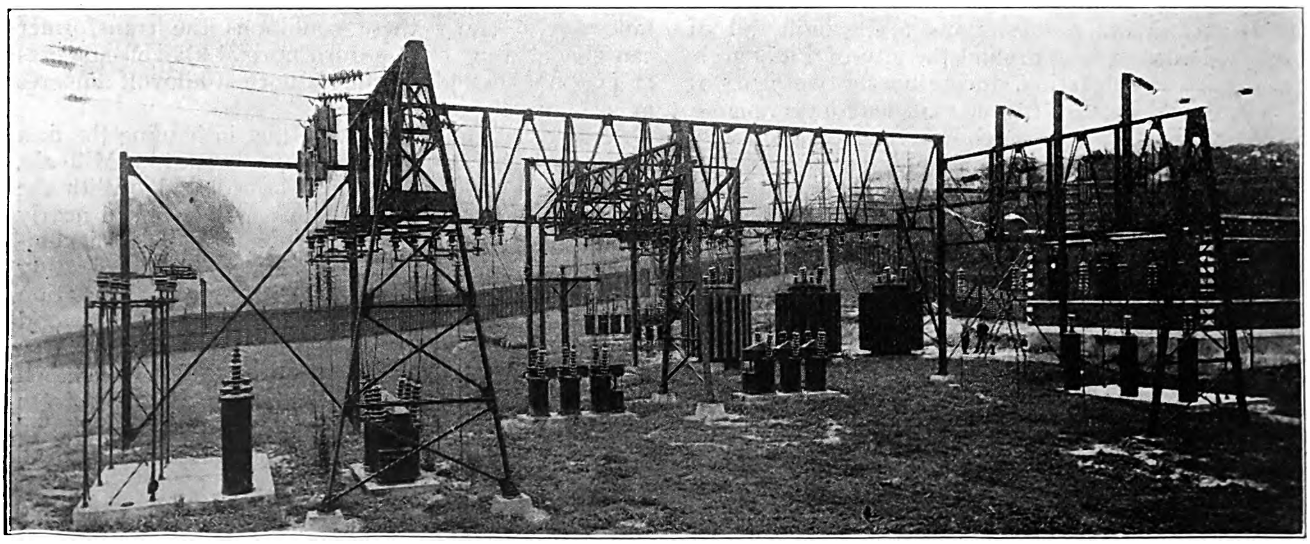
Steel framing is used throughout for the support



Control and Protective Apparatus for the 22,000-Volt Outgoing Lines.

of all overhead apparatus, ample provision having been made for anchorage and bracing. Concrete foundations are provided for the legs and main columns of the framework and for the support of all transformers, circuit-breakers and lightning arresters.

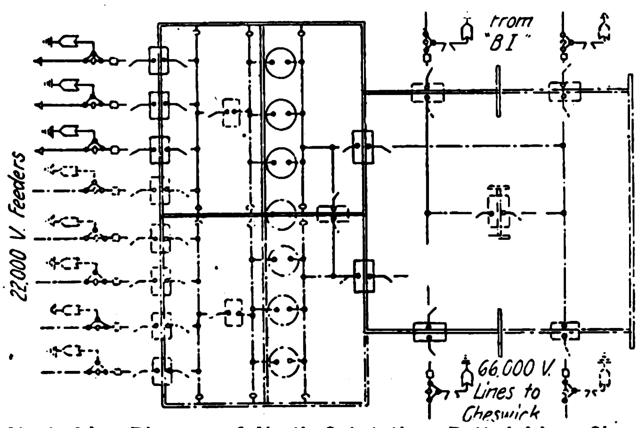
Immediately adjoining the outdoor equipment is an attractively designed small brick building for housing



Another (Nearer) General View of North Substation, Showing Initial Installation of Three of the Big Transformers and Substation Building at Right.

of the office, meters and such other accessories and equipment as must be kept indoors. A battery-operated system is installed whereby the outdoor circuit-breakers are remote-controlled.

The transformers, oil circuit-breakers and elec-



Single-Line Diagram of North Substation—Dotted Lines Show Future Extensions.

trolytic lightning arresters were furnished by the Westinghouse Electric & Manufacturing Co. Horngap arresters and certain other parts of the equipment were supplied by the Railway & Industrial Engineering Co.

THE BRITISH LAMP AND FIXTURE SITUATION.

The Illuminating Engineering Society of England at its first meeting for the season held in London on Nov. 25 had a demonstration of Pointolite lamps by P. Freedman, of the Ediswan laboratory, and an exhibition of a new form of illumination photometer by Haydn T. Harrison. The Sheringham daylight lamp was exhibited by L. C. Martin. This lamp or lamp attachment makes use of a colored reflector for correcting the distribution of energy in the spectrum of the artificial source. It was originally founded on the invention of G. Sheringham, a well-known artist who used simple colored reflectors or shades with artificial sources and found the quality of the light for painting greatly improved. The possibilities of the system have been to some extent worked out by Mr. Martin, the requisite distribution of colors being calculated on spectrophotometric measurements on opaque pigments made by means of Abney's color-patch apparatus. It is necessary in general to make use of arrangements to reflect the whole of the light from the colored surface, thus producing a type of indirect lighting unit which should have great possibilities in connection with shop-window lighting and many other commercial industrial uses.

A report was submitted to the meeting by the Committee on Progress in Lamps and Fixture Appliances, reviewing the present position of the metal-filament lamp and fittings (fixture) industry. The supply of lamps was shown to be rapidly improving after war-time difficulties and the production was now approximately equal to the consumption but it had not been possible to accumulate stocks in addition to meeting the demand. This may be possible within six months. It is anticipated that in the near future the whole of the British lamp manufacturers' requirements of glass bulbs will be met by home production, largely due to the adoption of automatic machinery for making bulbs and tubing. There are adequate supplies of drawn tungsten wire for filaments. During the war it was practically impossible to obtain argon (for the manufacture of lower wattages of gas-filled lamps) in England, but this difficulty has been overcome and adequate supplies are available.

When the new scheme of house building comes into operation the demand for metal-filament lamps will greatly increase.

The situation with reference to the supply of fittings scientifically designed has not been satisfactory, especially fittings for use in conjunction with gas-filled lamps. The manufacturers have lately been able to get to work designing and producing lanterns suitable for use with such lamps but shortage of the necessary globes was one of the chief difficulties. The committee expressed regret that there is not a supply of scientific fittings or reflectors for the smaller sizes of gas-filled lamps particularly for shop lighting. In several of the foregoing cases, it will be observed, the underproduction of glassware in England has militated against rapid progress.

WEST VIRGINIA POWER CO., TO MAKE CONSIDERABLE PLANT EXTENSIONS.

In connection with extensive construction work to be inaugurated by the Kentucky & West Virginia Power Co., 30 Church street, New York, plans are being prepared for the erection of large electric power stations at Logan, Sprigg, W. Va., and Pikeville, Ky. The work in the Logan district will, it is estimated, cost approximately $2,500,000 to extend over a period of two years, at which time the plant will have a generating capacity of 78,000 kw. The plans include extensions in the turbine room to allow for the installation of two 15,000 kw. capacity turbines with condensing equipment; the construction of a large boiler plant, etc., construction of a new 88,000-volt transmission line covering about 75 miles; as well as extensions in its 44,000- and 33,000-volt distributing systems covering about 100 miles, the 88,000-volt line to be used for tying in with the plants at Sprigg, Hazard, etc. A new 3,000-kw. turbine and surface condenser will be installed at the Sprigg plant, and plans have been prepared for the erection of a new addition to the outdoor transformer station. At Pikeville, it is proposed to install a new 10,000 kv-a. step-down transformer station, plans for which are now in process of formation. R. E. Breed, 30 Church street, New York, is president; Francis R. Weller, Hibbs building, Washington, D. C., is consulting engineer for the company in charge of the work.

LONG TRANSMISSION LINE UNDER CONSTRUCTION IN CANADA.

A transmission line from Winnipeg to Portage la Prairie is under construction at the present time. This line will be 60 miles long, will use steel towers and will have an ultimate capacity of 20,000 kw. The immediate installation is of one circuit of No. 0 aluminum cable which is estimated to carry 5000 kw. at 66,000 volts with a 3% drop in voltage at Portage la Prairie, or 10,000 kw. with 15% voltage loss. The second circuit will be installed as soon as the demand for power warrants it. The estimated cost is $4600 per mile, which includes substations at Winnipeg and Portage la Prairie. As it follows the highway, no right-of-way was purchased except at a few points where the line is on private property.

Central-Station Rates in Theory and Practice

Concluding Article—Appraisal in Rate Cases—Questions Involving Valuation of Physical and Intangible Property of the Utility—Operating Expenses, Depreciation and Rate of Return

By H. E. EISENMENGER

This is the twenty-fifth and last article of this series which began in the issue of July 12. The series has consisted of six main parts as follows: Part I—The Cost of Electric Service; Part II—The Price of Electric Service; Part III—Systems of Charging; Part IV—Rate Analysis; Part V—Accuracy of Rates; Part VI—Public Utilities and Public Regulation. There were also sixteen inserts of supplementary matter.

These articles have attracted so much favorable attention on the part of companies, individuals and commissions interested in electric light and power rates that it has been decided to republish them in book form in the near future. Detailed announcement of the book will be made in an early issue.

PART VI—PUBLIC UTILITIES AND PUBLIC REGULATION—Continued.

CONTRIBUTED BY S. F. WALKER,

Formerly Associate Editor of Rate Research.

III. PROCEDURE IN RATE CASES—CONTINUED.

INVENTORY OF THE PHYSICAL PROPERTY OF THE UTILITY.

THE first step in making an appraisal is to make a complete inventory of the physical property. In this connection a number of matters may come up for decision in determining what property to include.

Donated Property.—Often a certain part of the properties used and useful to the furnishing of the service has been donated. For example, land has been donated to induce street railways and railroads to furnish service over a certain route. The question of whether or not donated property should be included in an appraisal for rate making has been variously decided, but the rule has been, unless there are certain modifying circumstances, to include all properties however acquired that are now used and useful to the furnishing of utility service.

Service Paid For by Consumers.—When public utility companies were first established it was customary to require consumers to furnish their own service connections. Where this has been done, commissions in making valuations have sometimes held that the value of such services should not be included, that the customer having paid for the property should not be made to pay a return to the company on the value of that property. But usually the customers who furnished the property will not be the ones affected by the rates to be established in the case. The records do not always show just what services were furnished by the customer and what by the company. The commissions have usually included this property, holding that the ownership is in the company the same as in the case of gifts and the manner of its acquisition, having belonged to a period prior to regulation, is one with which the commissions are not concerned.

Discarded Property.—Discarded property, such as may be found in any utility system due to construction of a larger property than later developments in the community justified, or more often due to the consolidation of competing properties, is another matter for consideration. It has generally been conceded that such discarded property must be included until provision can be made for its gradual amortization in cases where the investment in such property has been made in good faith and with a reasonable exercise of judgment to best serve the interests of the community.

In one case where the property under investigation was the result of consolidation of a number of competing companies the Pennsylvania Public Service Commission refused to allow the value of parallel lines and duplicate equipment in the rate base, but in reviewing the Commission's decision the Supreme Court pointed out that such holding was not in public interest. The court said:

"If the utility companies in organizing into one operating plant a number of smaller ones must be deprived of a fair return on the value of the properties purchased and are also limited to the reduced cost of operation by reason of such consolidation, it is evident that the more practical way should be to permit the companies to remain separate operating concerns.

"The public is entitled to a fair benefit from every such move made by a utility concern and where they assemble a number of plants with separate overhead and operating charges into one plant with one overhead charge and one or more operating plants, while the operating plant of some of the separate units may be rendered useless, still the new concern has paid for it, and the capital was originally and is now invested on its account. Investors could not be inducd to traffic in such an unsatisfactory and unstable security, where the risk is not failure by reason of operation, but failure through confiscation. The benefit that should come to the public is through the reduced cost of operation; but the value of the dismantled plant should not be taken from the books as a capital charge until such time through sale, or other equitable arrangement, such value has been reamortized. So, too.

with respect to the parallel lines in question." (Ben Avon Borough *et al. vs.* Ohio Valley Water Co. Decision of Supreme Court of Pennsylvania, Oct. 8, 1917.)

Paving Over Mains.—In making an estimate of the cost to reproduce a property, allowance has not been made for the cost of paving over mains where the history of the plant shows that the mains were laid before the streets were paved. Such costs would, however, have to be reckoned with in a true estimate of reproduction of the property as of the present time.

Unit Prices.—To the list of properties included in the complete inventory unit prices are applied. The determination of unit prices depends upon whether the basis of the valuation is original cost, present value or some reproduction value. Usually to determine a fair value for rate-making cases, the unit prices used represent an average of prices over a period of years (in most cases five years is taken). The sudden advent of present high prices of machinery and equipment of all kinds has led commissions to postpone the making of valuations "until prices and times are normal," and in fact this marked fluctuation in unit prices has been a factor in reaching the conclusion that complete valuations are not essential in a rate case.

Overhead Charges.—To the property cost obtained by the application of prices to the item of property in the inventory is added, usually as a percentage allowance, an amount to cover overhead charges—that is, costs which are attached to the construction of the property as a whole and not included in unit prices—such costs as promotion, legal expense, engineering, incorporation and organization, interest during construction, early experimental work, contractor's profit, costs of piecemeal construction, contingencies, and allowances for possible omissions in inventory.

INTANGIBLE ELEMENTS OF VALUE.

In addition to the determination of value of tangible property, consideration must be given to intangible values, principal of which is going value.

Going Value is the value which is added to a property by the fact that it is a going concern. In some cases the commission has not made a separate determination of going value, holding that a property with an attached business is of more value than the property without such business, and stating merely that the property has been valued as a going concern.

Other commissions have made a definite addition as a percentage of the physical value or as a separate sum for this element. The estimate has been based upon the actual or estimated cost of developing the business, including costs of soliciting the business and deficits in earnings during development of the business. The objection to this method is that an unprogressive company slow in attaching business would have a greater going value than a more progressive company. Adjustments can be made to a reasonable amount, however, or an estimate may be made of the cost to reproduce the business just as an estimate is made of the cost to reproduce the physical property.

Both courts and commissions have varied widely in the treatment of this intangible element, considering it as a value in one case and as a cost in another.

Considered as a value, the authority may hold that a plant which has an established business is clearly of greater value than an identical property without an established business and where it has not been shown that it is possible to secure sufficient patronage to make a success of the undertaking. It is often added as a conclusive argument on this point that any buyer would pay more for the plant and going business than for the plant without such business.

Considered as a cost, the authorities have pointed out that a business can not be secured without expenditure of time and money. On this basis, as stated above, an allowance may be based on deficits in earnings during the period of business development, or the company may show what it costs to connect a new customer, including such costs as advertising and soliciting new business and the attention necessarily given to the prospective customer in acquainting him with the adaptability of the service to his needs, proper use of the equipment installed on the customer's premises, and similar considerations. This cost per customer is then multiplied by the number of customers attached to the going concern at the time of the valuation.

Good Will.—Going value is not the same as good will, which is recognized as an element of value in competitive undertakings where the patronage can be built up and a business given value by securing the good will of the customers. Good will has never been included in a valuation of public utility property, although the element is a factor in such undertakings. A public utility which has the good will of a community will develop faster, get more business, have less controversial expense, and to that extent be more valuable.

Franchise Value.—While the cost of securing a franchise which the company has actually borne in the form of a special tax or free service to the municipality is allowed, no intangible value attaching to the right to operate on the public streets is included in the rate base on the ground that such right is a grant of the public and should not be capitalized against a service to the public.

Working Capital.—An allowance should be made in the valuation for working capital sufficient to maintain the company's credit, permit purchases to be made at advantageous times and maintain company supplies sufficient for efficient and uninterrupted conduct of the business. The amount of working capital necessary may be determined in each case by an examination of past expenditures, consideration of the value of supplies on hand, the tendency toward increase or decrease in the cost of such supplies, and the time and frequency of the company's collection of bills for service rendered. The cash reserve and value of supplies is as much a part of the valuation as the investment in the property installed, as it represents capital used in the interest of the business of the public utility and withheld from other investment.

ELEMENTS OF VALUE GIVEN SPECIAL CONSIDERATION.

Land.—The same theory or basis of valuation followed in valuing physical property other than land is seldom applied to the value of the land. Land has perhaps most often been valued at its present value estimated by those familiar with real estate transactions in the community or judged by the value placed upon adjacent land.

The present value of the land is in many cases higher than the price paid by the company in acquiring the land. The amount of the appreciation has been considered in some instances as sufficient to cover certain overhead charges incurred in connection with the purchase of land and as reward for the exercise of good judgment in selecting a suitable location and securing property adapted to the proper development of the undertaking.

If the property is particularly well adapted to the public use to which it has been put a special value may be allowed as representing that added value to the public service, and as a reward for the exercise of the business sagacity that saw the possibilities in the unimproved land and put it to public service.

The actual purchase price of the land has been considered instead of present value in some cases where the land has depreciated in value. If the purchase price of the land is known and the property values in the community have gone down, the company has not been penalized where it appears that the investment was made in good faith and with reasonably good judgment.

Again in cases where the purchase price of land is used, the company may be denied the return on the appreciated value on the theory that the property is held in public trust and that so long as the land is held for that use the purchaser is entitled only to a return on the money actually invested. But this practice clearly prejudices property in public use as compared with property held where the owner is free to sell at an advantageous price or do what he wishes with the property to bring a return on increased real estate values.

Water-Power Rights.—Another matter which has received considerable discussion is that of value of water-power rights. Some authorities have held that such rights should be entered at the original cost of acquisition. In electric rate cases a comparison has often been made between the cost of operation of the hydroelectric property as compared with steam operation and a value found by capitalization of the saving in operation made possible by the company's water-power rights.

OPERATING EXPENSES.

Investigation to determine reasonable operating expenses, provision for depreciation and the fixing of a proper rate of return are important in any rate case and this work has often been passed over lightly where the importance of valuation has been overemphasized.

The Colorado Public Utilities Commission said: "In the opinion of the Commission the operating expense of a public utility should be as carefully considered as the amount allowed for fair value of the property of the public utility." (Suburban Light & Power Co. rate case, decided Nov. 16, 1917.)

Future operating expense, which must be provided for in the rate ordered, cannot always be judged alone by past records. Allowances must be made for the probable trend of material and labor costs.

An interesting example of rate regulation in which operating expense was made an important factor was that of the decision of the Oregon Commission in the Portland Railway, Light & Power Co. case (decided Jan. 5, 1918). The company applied for an increase in fares; the employes were asking for an increase in wages; and the city was opposed to any increase in fares.

The Commission found that the company was in need of relief and it was suggested that the city grant a modification of certain paving requirements and service exactions which were considered by the Commission to be unjustly burdensome upon the utility service. The decision of the city with respect to lightening operating expenses was obtained, and the wage disputes were submitted to arbitration before the Commission took up the matter of rate adjustments. The Commission said:

"States should so regulate that neither an increase in profits to the utility nor lower rates to the consumers will be given without considering the wages of the employes."

The reasonableness of salaries paid, the reasonableness of payments of subsidiary companies to a holding company for certain service rendered, the possibilities for instituting economies in operation, the proper maintenance and upkeep of the property, the necessity of provision for unusual expenses caused by sleet storms, ice jams, or whatever the hazard may be to which the particular utility under consideration is subject, may enter into the discussion of what are reasonable operating expenses in any rate case.

Increase in Operating Expenses.—The sudden increases in operating expenses of public utilities, due to war conditions, have emphasized the need for greater flexibility in rate systems to maintain a proper relationship between expenses of operation and the rate schedules.

Provision for the automatic variation of the rate with fluctuations in the cost of fuel became quite common during recent times. Coal clauses have been adopted by electric and gas companies and have been generally approved by commissions, which provide that the rates shall be increased or decreased each month to correspond to an increase or decrease from the price as of a certain date for coal or fuel oil as the case may be.

In at least one case, a company applied to a commission to extend this automatic adjustment of rates to provide for fluctuations in total operating expenses. The commission had made a complete investigation of the value of the company's property and operating accounts and had prescribed rates for the company's business in 1912. The company recently asked that the commission take the rates thus established as a base and provide for automatic increase or decrease in those rates corresponding to the increase or decrease in operating expenses from those of that date. The commission refused to adopt such a radical departure from former practice under the exigencies of the war period.

However, there has been at least one new adaptation of this principle which has come to the writer's notice in the form of a wage clause. Starting with the rates as of a certain date and the scale of wages as of that date, the rate supplement provides for increase or decrease in the rate for electric service corresponding to the increase or decrease in the scale of wages paid to the company's employes.

DEPRECIATION.

As soon as property is constructed depreciation must be considered. Ordinary maintenance and upkeep costs do not cover the depreciation of the property. In addition to the regular wear and tear from operation there may be special agents to be reckoned with, such as electrolysis, corrosion, incrustation or decay, which are peculiar to the equipment of the different utilities.

Obsolescence.—Aside from the wearing out of the property there is the more uncertain element of obsolescence. Machinery new or in good operating condition may be hastened on its way to the discard by the appearance on the market of a greatly superior type of machinery. The plant and system may also become inadequate to meet the demands of the community for service which may require the building of a new plant and the abandonment of much of the old.

Accrued Depreciation.—The question of whether or not the estimated first cost or reproduction cost of the property should be depreciated to correspond to the present depreciated condition of the property has received much discussion in rate cases. Where the deduction for accrued depreciation has been made it has been generally decided that the amount of the depreciation should be determined by actual inspection of the property and not on a theoretical basis considering merely the number of years the property has been in use.

It has been contended by the company in many cases, that if the property has been efficiently maintained so as to furnish 100% service no deduction should be made for depreciation. In support of this view it has been pointed out that a property which has been adjusted and in working order is of more value than an absolutely new plant from the standpoint of quality of service rendered. This claim for undepreciated value has been sustained by the regulatory commission in some cases.

It would seem that the treatment of accrued depreciation is necessarily bound up with the question of whether or not the company has, in the past, earned sufficient to provide for depreciation, and what sort of appropriation the commission will make in the rate case for future accruals to a depreciation fund.

Depreciation Funds.—Considering the inevitableness of depreciation of property, good business practice requires the building up of an adequate reserve against the day when the different portions of the plant and system must be scrapped and new equipment purchased.

Instances have arisen where large varied properties have found that replacements occur with regularity, the property having struck its gait as is said, and that no reserve fund need be carried, the depreciation allowance simply appearing as an enlarged upkeep or maintenance cost, but in most properties a depreciation reserve must be provided.

There are two methods used by commissions in creating a depreciation fund, called the straight-line method and the sinking fund method. The straight-line method calls for the setting aside annually of an amount which, at the time of the expiration of the life of the property, will be sufficient, without interest accruals, to replace the property.

Applying the other method, the sinking-fund method, the amount set aside annually is such that the amount together with interest will replace the property. Commissions have discussed the merits of these two methods and their adaptation to short-life property, a telephone property, for example, or a comparatively long-life property, such as a water utility.

No broad general rule can be deduced from the holdings of the commissions in this respect, it being a matter for determination in each case depending upon the life and present condition of the property, the treatment of depreciation by the company in the past, the maintenance and upkeep of the property taken care of in operating expenses, and the holding of the commission as to whether or not a deduction should be made for accrued depreciation in determining the amount upon which the company will be allowed to earn a return.

In determining an adequate depreciation reserve, account must be taken of the fact that the trend of prices has been upward for a number of years. Where replacements have been necessary during the war period an additional burden has been placed upon the replacement fund because of the high prices of machinery, materials, and labor prevailing. It is not always possible to delay such replacements until prices are favorable as public interest demands safety of service and continuous operation. Allowance for depreciation should be liberal so that the company may be required at all time to maintain its property in good operating condition.

RATE OF RETURN.

The rate of return which the company is to be allowed to earn in fixing rates is more than interest on invested capital. There should be a margin of profit as an inducement to capital to continue to flow into the public utility industries, and a compensation or reward for efficient management and skillful economic operation.

Other factors which have been given consideration by commissions in fixing rate of return are hazards and risks in the business, bond discounts, effect of political interference and popular whim, and the necessity for allowance to cover possible undervaluation of the property.

Attracting Capital.—Capital cannot be forced to invest in public utilities, but must be attracted in the open market by the offer of security of investment and an adequate rate of interest. During the war period, the utilities have had to compete in a restricted market with other industries offering high rewards.

The California Commission recognized the advantages accruing to the public from the adoption of a liberal policy in fixing the rate of return. The following excerpt from the Palo Alto Gas Co. case (Vol. 2, Opinions and Orders of the Railroad Commission of California, pp. 300, 317) has been cited by the Commission in subsequent decisions and may be quoted as an expression of its policy.

"The Commission in fixing a rate of return must be liberal, lest too strict a policy result in turning capital to other fields of enterprise. California needs development of public utilities, and this Commission's policy should be a broad and liberal one, so as to encourage capital to develop the state by legitimate public utility enterprises where needed. The Commission should be careful not to permit an inflation of prices in ascertaining the value of the property of a public utility used and useful for the public purposes; but should be liberal in establishing the rate of return on that value."

The Michigan Railroad Commission in the Michigan State Telephone Co. rate case, discussing the need of capital in the public utility field, said:

"It is important, therefore, to the development and extension of public service, that the exercise of the power of public regulation be such as will not discourage the investment of new capital in such enterprises. The destruction or serious impairment of the value of securities issued by such companies, by undue limitation of rates, would strongly tend to discourage such investments, and this would result in inevitable and serious public injury through the impairment of the service adequate to the constantly expanding needs of the public. The exercise of the power of public regulation should promote the confidence of the public in public service securities, rather than constitute a menace to such securities. The State does not guarantee public utilities against losses nor insure them any specific rate of return upon their investment. While costs of operation and maintenance—costs of new material and labor—fluctuate with changing conditions of production and use, there should be some margin allowed to public utilities, over bare present costs, and those happenings which can be foreseen and estimated with reasonable certainty." (Decision rendered Jan. 30, 1918.)

The Oregon Public Service Commission, in the Portland Railway, Light & Power Co. case, decided Jan. 5, 1918, said:

"If the rates fixed by the Commission, while sufficiently high to escape condemnation by the courts as confiscatory, will yield only a return insufficient to attract capital into needed public service, it is the public and not the investor who will suffer."

The Illinois Commission in the Chicago, North Shore & Milwaukee Railroad Co. fare case, decided Sept. 5, 1917, said:

"Legislation cannot compel the investment of funds in a concern, and only the opportunity to earn sufficient to attract investors will avail in obtaining support for any enterprise. Without its support the enterprise will perish and a community may thereby be deprived of a necessary service."

Business Risks and Reward to Management.—The Illinois Public Utilities Commission in the rate case of the Central Illinois Public Service Co., fixed the rate of return, "after giving due consideration to the circumstances governing this case, including the character of the service, the hazards connected with the business, and the cost of securing capital; and further taking into consideration the testimony regarding the degree of ability displayed by the management which was found to compare favorably with that shown by other small gas utilities in the state of Illinois."

The Maine Public Utilities Commission said:

"The rate of return on the value of the property in a rate case must be sufficient to compensate and attract money to such undertakings under the conditions as to business risk, etc., which existed in the beginning. If the rate of return is reduced from time to time as it appears that the risk in that particular undertaking in the light of developments was less than might reasonably have been expected, or has been eliminated by successful management, it would practically amount to a penalty for skillful administration." (Maine and New Brunswick Electrical Power Co., *et al.*, purchase case, decided Dec. 4, 1917.)

The Illinois Public Utilities Commission in the Union Gas & Electric Co. rate case, decided Jan. 16, 1918, found proof that the utility had been ably directed in its policies and efficiently managed, and the Commission said:

"Where causes of an opposite character have produced poor results the Commission has not hesitated to conclude it had cause to penalize a utility by reason of such poor management. A rule of this kind should operate both ways, and it is considered just in this case to recognize, in a substantial way, that good management should not be penalized but ought to be further encouraged. It is realized that a utility can very materially control the cost of production in more ways than one, and if the expense per unit of service is reduced by reason of an increase above the normal in the sales per customer and per capita, the company should be given some incentive to maintain its good record. Any proof that is made of excellence in the operation of a utility ought to entitle the operators, as well as the holders of the securities, to a reward for their meritorious work."

Undervaluation of the Property.—In the Addison Gas & Power Co. case, decided Feb. 28, 1918, the New York Second District Commission estimated that the rates prescribed would yield a return equal to 8.6% of the value of the property, and the Commission said: "This is not inordinate in itself, and permits a small margin to cover any possible undervaluation of the property."

Bond Discount.—In some cases commissions have allowed for bond discounts in fixing the value of the property by considering it as a necessary cost of building up the property, while in other cases bond discount has been considered as an interest charge to be taken care of in the rate of return.

The Supreme Court of Pennsylvania, in reviewing the decision of the Pennsylvania Commission in the case, Ben Avon Borough *et al. vs.* Ohio Valley Water Co., said:

"Concerning the item of brokerage, the courts and commissions of other states have held that discounts on securities should be allowed, as utilities, like other companies, are not able to make their financial arrangements without allowing such discount. The difference between the amounts derived from the sale of its bonds and the amount which the company must eventually pay on the bonds has been regarded as a part of capital charges for construction. While corporations should not be permitted to capitalize their lack of credit, still, where bonds are sold at a reasonable discount and bear a fair rate of interest, such discount should be allowed."

In the Chicago, North Shore & Milwaukee Railroad Co. fare case, decided by the Illinois Public Utilities Commission, Sept. 5, 1917, the company submitted a valuation of its property to the Commission in which an amount was included for bond discount during the construction period. The Commission said:

"It is believed, however, that a more equitable disposal of the matter of bond discount may be had by considering it as a form of interest. Doubtless, a utility, by making its interest rate sufficiently attractive could dispose of its bond securities at or above par, but this basic principle would not be vitiated should it choose to fix a lower rate of interest and thereby be compelled to dispose of its bonds at less than par. The effect has been merely to change the rate of return which it provides upon such securities. This idea is well expressed by the District of Columbia Public Utilities Commission, *in re* Potomac Electric Power Co., wherein it is said 'Bond discount, constituting a payment for the use of money, is in the nature of an interest payment; that is, it is not a proper capital charge but rather an adjustment of the interest rate to the existing market conditions and chargeable to interest account, and not capital.' The Commission is of the opinion that brokerage and bond discount are matters to be considered in connection with, and to be reflected in, the rate of return allowed; that such costs should be made up out of income by the creation of a sinking fund or reserve sufficient to cover the cost during the life of the bonds; and that, therefore, such costs should not in equity be considered a part of the cost of reproduction or of the 'fair value' to be taken as a base for the fixing of rates.

"This Commission is of the opinion that the doctrine thus enumerated is sound and affords a proper disposal of the matter of bond discount."

Surplus.—The wisdom of following a liberal policy in the fixing of a rate of return has found ample illustration under war conditions. Where the companies have been held down to a close margin hardship has been experienced under the increase in operating costs which could not be prevented entirely by emergency increases. While in the case of other properties it has been possible to tide over the period of high costs to some extent by the surplus built up under more normal conditions, commissions in granting emergency increases have held that it is impossible to maintain the rate of return earned previous to the war period and have held that the hardships must be borne jointly by the public and the utility. They have also pointed out that utility rates should not fluctuate with every rise and fall in costs. The steady rate level cannot be maintained by the company in a period of high costs unless a surplus has been built up in a preceding period, and if such surplus is not sufficient a portion of the loss in net earnings during the period of high costs may be spread over the years following a reduction of operating costs to normal.

The Oregon Commission in the Portland Railway, Light & Power Co. case, decided Jan. 5, 1918, said:

"Under state regulation of rates no utility is permitted to earn a surplus during good times by which to carry itself over the lean years which may lie ahead of it. Rates must at all times be kept down in conformity with the value and the cost of service rendered. Justice, therefore, requires that when costs go up, rates should do likewise. * * * No starved horse ever pulled a heavy load. The utilities have been deprived of the power to make unjust profits. They must also be protected against unjust losses. If a utility is driven into a position where its credit is impaired and it can obtain money for operations and extensions only at unreasonable cost, the public must share the loss."

However, some commissions have adopted a policy of providing for the building up of a surplus in the rate of return, to provide for unforseen contingencies and to guard against the necessity of adjusting the rate to correspond with every fluctuation in price. For example, in the case, City and County of San Francisco *vs.* Pacific Gas & Electric Co., decided by the California Railroad Commission, Oct. 8, 1917, the Commission said:

"In permitting this return, we do so with a frank realization that it allows a liberal margin over the cost of money. We are animated in doing so, not merely by a desire to be fair to the company, but also in part by the uncertainty as to whether the price of fuel oil will not further advance and by the desire to create a margin of profit which will take care at least for a time, of such further advance, if it occurs."

(THE END.)

NORTHWEST PLANTS FOR FIXATION OF ATMOSPHERIC NITROGEN.

The American Nitrogen Products Co., of Seattle, Wash., is now operating two plants in the Northwest for the production of nitrites and nitrates from the nitrogen of the atmosphere. The first plant, which has been in use most of the time during the last two years, was built in Nisqually canyon, at La Grande, Wash., and has a capacity of 125 tons of product per month. Electrical energy is derived from the municipal hydroelectric plant of Tacoma. The second plant, having a capacity of 100 tons per month, was built at Vancouver, B. C., and was completed in November of this year. Electric power for this plant is supplied by the British Columbia Electric Railway Co. In each case the nitrogen plant was constructed in close proximity to the power plant to obviate the expense of building and maintaining transmission lines.

Energy for the electric arc, in which nitric oxide is produced by the combination of nitrogen and oxygen of the air, is conducted into a double-tube furnace, from both ends, at 6600 volts. Air is forced into these tubes by motor-driven fans, entering at the center. This volume of air, on entering the furnace, is forced toward both ends and into the field of the electric arc in which heat is generated at 5400 deg. F. The space between the inner and outer walls of the furnace is kept full of flowing water to prevent the destruction of the tubes by intense heat. The nitric oxide product passes from the furnaces to a cooler, thence to a vat in which dissolved soda ash and the nitric oxide are combined to form a nitrite solution. This nitrite solution is held in the vats about 8 hours, after which it is drawn off into cooling trays where evaporation of the water takes place, resulting in a nitrite product, which after being dried is in the form of a white powder. In the Vancouver plant nitric acid is produced.

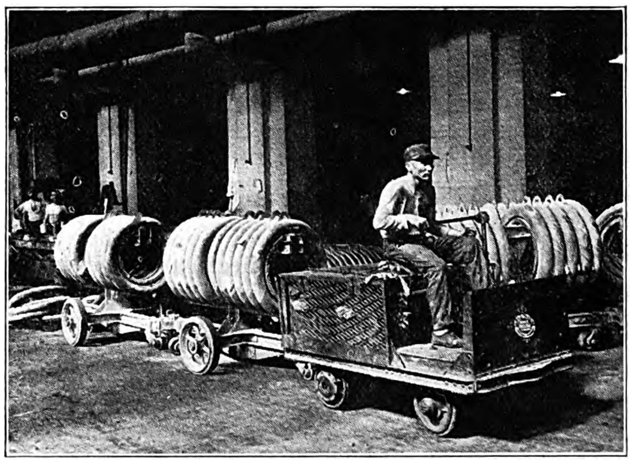
The processes by which nitrites are produced are applied, with only slight variations for the production of nitrates. But for the industries in which those products are required about 96% of the demand is said to be for the nitrite.

It is intimated that this company may erect hydroelectric plants to meet plans for a much heavier production and that water-power rights have been acquired with that purpose in view.

EXCELLENT RECORD MADE BY ELECTRIC INDUSTRIAL TRACTOR.

Herewith is an illustration of the first electric factory tractor operated at the big Akron, Ohio, plant where Goodyear tires are made. For six years this truck has been operated in Department 150B and has traveled approximately 180,000 miles.

The outfit hauls a load of 3,100 lbs. on each trip,



Electric Tractor That Has Traveled About 180,000 Miles in Hauling Tires About Large Goodyear Plant.

making a trip once every four minutes about the department. In one eight-hour shift it pulls over 200,000 lbs. of tires and cores, doing the work that it formerly took 25 men to do.

In all, there are 25 electric trucks and tractors at the Goodyear works. The three types used are the self-loading truck, the tractor and the flat freight truck.

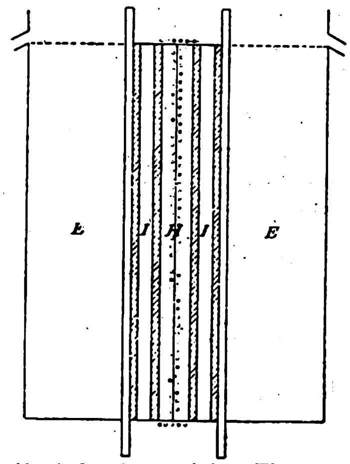
Thermal Conductivity of Insulating and Other Materials

Outline of Method of Carrying Out Tests—Tabulated Results of Thermal Conductivities—Summary of the Results

THE thermal conductivity of materials is important because it determines the ability of the materials to absorb or dissipate heat. In a paper entitled "The Thermal Conductivity of Insulating and Other Materials," presented before the New York meeting of the A. S. M. E. this month, T. S. Taylor Westinghouse Research Laboratory, described a large number of tests carried out to determine the thermal conductivity of a large number of insulating materials. The tests were very extensive and considerable effort was made to obtain accurate data. The data obtained is given in the accompanying table.

The thermal conductivity was determined by what the author terms a "thermal meter." This is shown in the diagrammatic sketch to consist essentially of an electric heater *H* constituting two hot equitemperature surfaces or sources of heat and two cooling chambers *E, E* (one on either side of the heater) or cold constant-temperature surfaces. The heat generated in *H* passed laterally through the samples *I, I,* of a given material to the cold reservoirs *E, E.* The heater was made from two disks of soapstone 9 ins. in diameter and 3/8 in. thick. Each disk had a spiral groove of 3/16-in. pitch cut in one face. A heater wire of No. 21 constantan, was wound and cemented securely in the groove of each disk and then the iron disks were cemented together with the sides containing the heater wire adjacent. The two heating elements in the two disks were joined together at the center by means of a peg in one disk being pushed into the spring contact in the other. Potential leads were brought out from each heating element at points 2 ins. from the centers. It was later found that potential leads fastened to the heating elements at the points where the wire started in the outer terminals of the spirals served equally well, since the temperature coefficient of resistance of the constantan wire is very small and furthermore the temperature of the heater was constant over its entire face. Extra turns of wire were wound around the outer edge of the heater in order to prevent the loss of the heat generated in the heating element proper through the edge of the heater. After several trials it was found that this procedure gave a heater which in use had a very constant temperature over its two faces, even up to the outer edge.

Two samples of the material to be tested were always used, each being 9 ins. in diameter and from 0.1 to 0.75 in. thick, depending upon the nature of the material. One sample was placed on each side of the heater, *I, I.* Extra disks of lagging of the same material of the sample or something else suitable were placed on each side of the sample, as shown by the shaded portions in the diagrammatic sketch of the thermal heater. This made the ultimate drop at high temperatures less than it otherwise would have been and likewise gave a wider range of mean temperature. The faces of the cold reservoirs *E, E,* constituting the cold equitemperature surfaces, were made of heavy brass having a diameter of 10 ins. The samples, heaters and cold reservoirs were held securely together by means of bolts extending between these two plates. At first strong spiral springs were used around these connecting bolts to insure uniform pressure, but it was found later that equally satisfactory results could be obtained by merely turning down the nuts on the bolts till the samples, etc., were drawn tightly together. Thermocouples of 5-mm. copper-constantan wire were inserted on each side of the samples, *I, I.* under test. Great care was taken in order to insure good contact between the sample and the thermocouple junction. Two couples were placed on each side of a sample, one at the mid-point and another about 1½ ins. from the center. The electromotive



Thermal Unit Used for Determining Thermal Conductivities.

force of the couples (the cold junction being always kept at 0 deg. C.) was measured by means of a thermocouple potentiometer. The current in the heater was likewise measured by the same potentiometer by measuring the drop through a standard resistance placed in series with the heater. The potential drop per unit length of heater wire was also measured by means of the potentiometer. This necessitated placing a high resistance in parallel with the heater and then measuring the potential drop across a small fraction of this. The current was supplied by a storage battery and consequently remained quite steady. The cold equitemperature surfaces *E, E,* were maintained so by having water from the tap circulating through them continuously. The outer edges of the samples and heater were surrounded by felt in order to prevent undue loss of heat from the edges of the heater and samples.

By putting vaseline, glycerine, glue, shellac or a similar material on the division between two surfaces the thermal drop due to such division can be largely eliminated. This is particularly true for poor conductors.

The thermal conductivity has been measured for a large number of materials both across and along the laminations. For the poor conductors the ratio of the longitudinal to the transverse conductivity varies from 2 for black bias cloth to 5½ for mica tape.

The temperature coefficient of thermal conductivity has been measured whenever the experimental results justified doing so.

Of the electrical insulating materials tested, those containing mica have in general the better thermal conductivity.

As a thermal insulator soft pine is the best of the woods tested and is but little inferior to dark-gray felt.

The transverse conductivity of iron stampings can be increased some three or four times by the insertion of some suitable material between the stampings so as to make better thermal contact. This is for a pressure of about 50 lbs. per sq. in. Nothing destroying the electrical insulation could be used, however. By using something between sheets the ratio of the longitudinal to transverse conductivity could be reduced to 20 to 25 instead of 80 to 100.

In general, the thermal conductivity of laminated products can be considerably increased by suitable impregation so as to get rid of the air film.

Oil-soaking soft fuller board increases its thermal conductivity by about 50%.

For the best thermal insulation for a given thickness it would be better to make it up of several thin

Material, thickness in in.	Thickness of sample, in.	Sp. gr.	Direction of heat flow.	Temp., deg. cent.	Cal. per cm. per deg. cent. per sec. $\times 10^{-6}$	Watts per in. per deg. cent. per sec. $\times 10^{-5}$	Temp. coef. $\times 10^{-4}$
Fish Paper..... 0.010	0.212	1.06	Trans.	20	410	435	19
				20-85	433	462	
0.010	0.748	1.06	Long.	20	1,150	1,222	19
				20-80	1,215	1,290	
0.023	0.222	1.03	Trans.	20	482	512	24
				20-85	517	548	
0.056	0.355	1.01	Trans.	20	567	602	21
Paraffined Fish Paper 0.007	0 211	1.06	Trans.	20	460	489	18
				20-80	483	513	
0.015	0.225	1.13	Trans.	20	520	553	
				20-90	525	558	
0.038	0.299	1.15	Trans.	15-30	494	525	
Fuller Board, Treated— 0.020, dark	0.230	1.39	Trans.	20	384	408	30
				20-90	418	444	
0.030, dark	0.500	1.15	Long.	20	1,450	1,540	50
				20-80	1,650	1,750	
0.056, green	0.227	1.09	Trans.	20	357	380	30
				20-100	396	421	
0.125 green	0.254	0.95	Trans.	20	339	361	16
				20-80	350	372	
Fuller Board, Untreated— 0.015	0.232	1.38	Trans.	20	640	681	
				20-80	641	682	
0.30	0.216	1.26	Trans.	20	610	649	9
				20-80	628	667	
0.30	0.500	1.28	Long.	20	1,500	1,590	17
				20-80	1,580	1,680	
0.010	0.210	1.39	Trans.	20	622	661	10
				20-90	690	735	
0.056, light grey	0.217	1.15	Trans.	20	465	495	60
				20-60	515	548	
0.056, light grey	0.500	1.15	Long.	20	1,520	1,620	26
				20-80	1,650	1,750	
0.125, light grey	0.365	1.01	Trans.	20	347	369	33
				20-80	387	412	
Fuller Board— 0.125, light grey, soaked in transformer oil	0.365	1.01	Trans.	20	507	540	16
				20-80	543	577	
0.125	0.520	1.01	Long.	20-80	1,230	1,310	
Varnished Cambric 0.009, tacky	0.263	1.17	Trans.	20	517	550	
				20-95	544	578	10
0.009, tacky	0.694	1.17	Long.	20	1,027	1,093	
				20-100	1,046	1,113	5
0.009, dry	0.275	1.24	Trans.	20	516	549	
				20-90	532	565	9
Cement Paper... 0.015, plain	0.216	0.62	Trans.	20	304	323	
				20-90	322	342	17
0.018, treated	0.211	1.02	Trans.	20	372	395	
				20-80	395	420	21
Mica Tape— 0.006	0.201	1.06	Trans.	20-80	630	670	
0.008	0.229	1.12	Trans.	20-80	630	670	
0.006	0.768	1.06	Long.	20-80	3,470	3,680	
Black Bias Cloth— 0.009	0.209	1.26	Trans.	20-100	600	621	
0.009	0.782	1.26	Long.	20	915	975	
				20-100	1,027	1,091	50
Cement Paper and Mica— No. 226	0.223	....	Trans.	20	443	472	
				20-80	462	491	14
No. 227	0.1385	....	Trans.	20	465	494	
				20-100	498	530	15
No. 247	0.225	....	Trans.	20	501	533	
				20-80	522	555	16
No. 227	0.512	....	Long.	20	2,230	2,370	
				20-80	2,360	2,510	20
Micarta Folium— No. 249	0.233	....	Trans.	20-100	553	588	
	0.569	....	Long.	20-100	2,700	2,870	
Kraft Paper and Mica— No. 312	0.220	....	Trans.	20-100	545	579	
	0.520	....	Long.	20	2,680	2,830	
				20-100	2,840	3,020	16
Fish Paper and Mica— No. 230	0.195	....	Trans.	20-100	483	514	
No. 232	0.232	....	Trans.	20-100	475	505	
No. 233	0.237	....	Trans.	20-100	451	481	
Pressed Mica Plates— 0.41 in white	0.201	2.34	Trans.	20-100	623	663	
0.41 in. yellow	0.203	2.41	Trans.	20-100	550	585	
0.032 in. white	0.1915	2.32	Trans.	20-100	675	718	
0.032 in. yellow	0.1915	2.41	Trans.	20-100	580	617	
0.025 in. white	0.1995	2.43	Trans.	20-100	725	771	
0.025 in. yellow	0.1996	2.26	Trans.	20-100	612	650	
Micarta 0.125 in.	0.247	1.36	Trans.	20	606	645	
				20-90	620	660	6
Hard Rubber	0.380	1.19	Trans.	25-50	380	404	
White Fiber	0.383	1.22	Trans.	20	663	705	
				20-80	695	728	12
Woods— White pine	0.519	0.45	Across gr.	20-120	255	271	
White pine	0.732	0.45	Along gr.	30-80	613	652	
White oak	0.516	0.60	Across gr.	20-80	455	484	18
White oak	0.754	0.60	Along gr.	40-70	944	1,003	
Maple	0.733	0.72	Along gr.	20	1,015	1,078	
Maple	0.733	0.72	Along gr.	20-80	1,037	1,100	8
Maple	0.508	0.72	Across gr.	20-80	434	462	
Asbestos— ⅜ in sheet	0.344	0.894	Trans.	22-80	395	420	
0.025 in. paper	0.306	0.98	Trans.	20	345	367	
				20-100	375	399	24
0.035	0.356	....	Trans.	20	666	708	
				20-80	685	728	14
Board	0.507	1.93	Trans.	20	1,780	1,890	
				20-90	1,950	2,080	14
Plate Glass	0.252	2.49	Trans.	20	1,785	1,900	
				20-100	1,945	2,070	18
	0.289	2.60	Trans.	20	1,905	2,024	
	0.289		Trans.	20-120	2,016	2,142	12
Soapstone	0.715	2.87	Trans.	70-130	8,000	8,500	
Sheet Steel— 0.0172 in M. A. Varnished	0.415	....	Trans.	20	1,370	1,455	
				20-80	1,430	1,520	19
Unvarnished	1.48	....	Long.	40-100	103,000	109,500	6
				40	101,300	107,700	
With asphalt paint on sheets	0.420	....	Trans.	20	4,710	5,020	
			Trans.	20-80	4,850	5.160	10
Unvarnished 0.0172 in.	0.416	....	Trans.	40	1,480	1.570	
				40-100	1,580	1,680	25
Same with asphalt paint	0.425	....	Trans.	40	6,360	6,750	
				40-100	6,520	6,930	9
W. A. Silicon Steel— 0.014 in. Varnished	0.419	....	Trans.	40-80	1,270	1,350	16
Unvarnished	1.44	....	Trans.	40-100	41,800	44,400	19
				40	39,500	42,000	
Same painted with asphaltum	0.422	....	Trans.	40-80	4.640	4.920	10
Unvarnished	0.440	....	Long.	20	1.340	1.420	
				20-100	1,470	1,560	25
Same painted as above	0.443	....	Long.	20	4.200	4.470	
				20-100	4.520	4,810	17
Sil-O-Cel Brick	0.977	0.495	Trans.	30	242	258	15
				30-150	262	279	
Powdered	0.955	0.15		30	208	222	31
				30-150	242	258	
Wool Felt— Dark grey	0.98	0.15	Trans.	40	149	159	76
				40-100	175	186	
Graphite— Solid	1.04	1.58		50	105.500	112.200	12
				50-130	110,200	117.200	
Powdered, through 20 mesh on 40 mesh	0.476	0.70		40	2.850	3.030	
				40-100	3,200	3.400	48
Powdered, through 40 mesh	0.476	0.42		40	922	980	
				40-100	1,007	1,080	40
Powdered, through 100 mesh	0.476	0.48		40	438	467	
				40-100	482	513	34
Lampblack— Eagle Brand Germantown	0.476	0.165		40	156	160	
				40-150	166	176	6
Coal Dust	0.476	0.73		30	265	282	
				30-150	298	317	23
Iron Dust and Sand	0.377	1.14		30	460	489	23
				30-150	517	550	

sheets rather than of a single sheet. This effect is more pronounced the better conductor the material is.

A layer of dust, say, coal dust, upon the surface of a body will increase its internal temperature by 1/3 deg. C. per watt flowing through unit area.

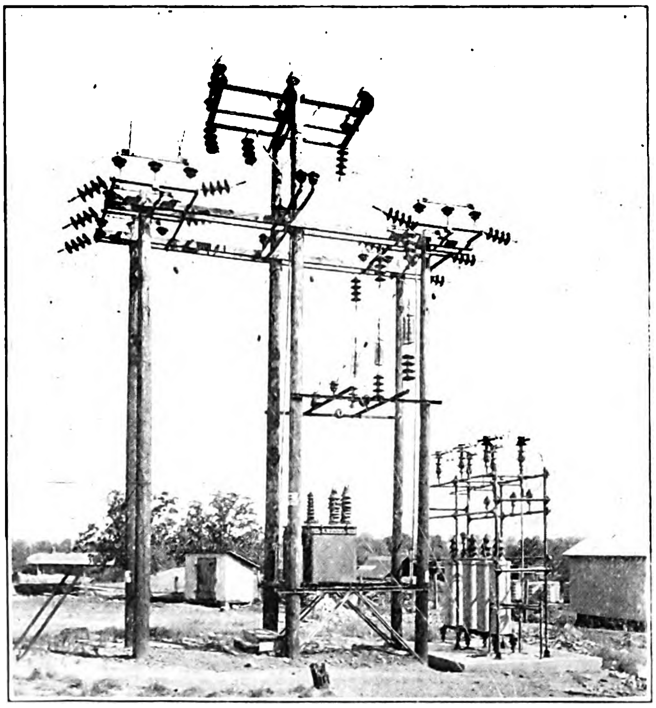
FRANCE AND BELGIUM USING ASHES AS FERTILIZER.

It has been found that the ashes from glass, iron and steel works and allied industries stimulate vegetable growth enormously through carbonic acid fertilization. The technical body working for the restoration of France and Belgium have found that plant life can be spurred by this means to unusual growth. It is proposed that ashes from the industries as above mentioned be used for refertilizing the devastated areas of Belgium and France.

NOTEWORTHY INSTALLATION OF 33,000-VOLT SWITCHING CENTER.

Features Are Simple Design and Construction, Flexible Operation and Neat Appearance.

The accompanying illustration shows a recent installation of a 33,000-volt, 3-phase outdoor switching station with one incoming line, one outgoing line and a third line to a stepdown substation which supplies power to a local load. The features of this installation are that it is free from complicated design or operation, insures flexible operation and is of good appearance.



33,000-Volt Switching Center.

An electrolytic arrester is so connected as to drain lighting disturbances from the transmission system. The metering equipment is connected to the incoming line of the transmission system, and the power taken from the high-tension side is thereby recorded; if the meter were connected on the secondary side the transformer losses would not be recorded.

The three-pole, double-break-per-phase, air-break switches are operated from ground level by means of remote-controlled interlocking mechanisms which are equipped with handles which can be locked in either open or closed position.

The arresters and metering equipment were supplied by the General Electric Co., the strain and wiring insulators by the Locke Insulator Co., and the air-break switches and choke coils by the Delta-Star Electric Co.

COAL CONSUMPTION BY UTILITIES IN CHICAGO AND SUBURBS.

Investigation carried on previous to the coal strike brought out the fact that 3,200,000 tons of coal were consumed in Chicago during the year 1918 by utilities supplying light, heat and power.

The Commonwealth Edison Co. consumed 1,962,960 tons of coal and the Public Service Co. of Northern Illinois, which supplies the outlying suburbs adjacent to Chicago, with electricity and gas, consumed 364,970 tons of coal for generating electricity and 40,290 tons for producing gas in addition to 11,601 tons of hard coal, 62,637 tons of coke and 12,033,258 gallons of fuel oil. The Peoples Gas, Light & Heat Co., which supplies the city of Chicago with gas, used 194,368 tons of soft coal, 138,979 tons of hard coal, and 302,599 tons of coke. In addition it used 89,515,690 gallons of fuel oil and 2,573,145 gallons of fuel tar in gas production.

In consuming 1,962,960 tons of coal total, the Commonwealth Edison Co. generated 1,490,000,000 kw-hrs., or an equivalent of about 2.63 lbs. of coal per kw-hr. It should be borne in mind that while this result is very good, so far as fuel economy is concerned, the actual result is really better than at first appears, for of the total coal used, not all was used for producing electricity.

VENEZUELAN GOVERNMENT TO ERECT LARGE WIRELESS STATION.

The government of Venezuela advertises for sealed bids addressed to Ministerio de Fomento de los Estados Unidos de Venezuela to be submitted before June 30, 1920, and marked (in Spanish) "Bid upon wireless telegraph."

The station is to be located in the vicinity of Caracas. It must be sufficiently strong to communicate with similar stations in the United States and Europe. It must have one installation for emission of sustained waves served by high-frequency alternators and another for the emission of damped waves to communicate with wireless stations not provided with the system of sustained waves.

Alternating, tri-phase electric current now distributed at 190 volts and 50 cycles is available, but the plant must have a reserve motor generating capacity.

Bids should show the general plan of the installation and detailed plans and cuts necessary to give a complete idea of the work; a general description of the machines and of their operation; time required to complete the work and the detailed and total cost. The government will pay quarterly, according to the progress of the work, reserving 10% of each payment until final completion. Bidders must undertake to manage and operate the plant for six months after completion. Bids should not include the cost of transmission lines for the current nor of telegraph lines to Caracas.

Editorial Comment

Lessons of Christmas Shopping

EVERYONE is agreed that this year's Christmas shopping has exceeded in magnitude everything heretofore experienced in this line in this country. After the depressing influence of the war and the uncertainties of the early months following the armistice, which reduced the volume of Christmas purchases for several years, we have found ourselves generally in quite a prosperous condition.

There has been an unusually large percentage of the more expensive gifts bought. Costliness has proven of little hindrance and in many cases it has been overcome by the plan of partial payments. Not only have phonographs, pianos, diamonds, etc., been sold on this basis, but also many electrical appliances. In fact, adoption of this plan accounts partly for the large volume of electrical sales. The chief reason for the record-breaking sales of electrical appliances, however, is the high intrinsic value of these devices.

This last feature deserves still greater emphasis in the future. An extremely large part of each year's Christmas shopping still consists of practically valueless trinkets and trivialities. The electrical industry must show how far greater appreciation of a gift is experienced when it is a useful one, such as an electric washer, cleaner, floor or table lamp, percolator, toaster, flashlight or similar device.

The Form of Public Ownership in Which We Believe

SPEAKING at the convention of investment bankers at St. Louis, O. B. Wilcox made a few statements that should serve to bring to many a different feeling toward public ownership. He said:

"About $15,000,000,000 capital, representing a considerable part of all the savings of the people of the country, are invested in public utilities. The securities representing these savings are held by thousands of investors, large and small, and by nearly every bank and financial institution of the country, and in endowment funds of churches, colleges, schools, hospitals, and in other trust funds. The integrity of these investments is of direct or indirect consequence to every citizen; and the maintenance of the service and the expansion of the time and money and labor-saving devices of public utilities is incalculably important to every man or woman with an industrial interest in the country whether as investor, employer or wage earner."

We hear so much said against the capitalist. We are hearing so many declare against private ownership as contrasted with the public ownership or ownership by municipality, state or nation. We have often pointed out before that everyone with one or more dollars in the bank is a capitalist just as is everyone with money invested in anything, whether a utility, a store or a shoe shine parlor.

When we hear demagogs damning the capitalist and the public utility and the politician calling for the revocation of franchises and operation by the people, it would be well to remember how many individuals, who, as stockholders of public utilities, are affected.

Coal Prices and Methods of Burning

IT IS a well established law that the price of any commodity is determined very largely by the supply and the demand. There are exceptions to this statement, of course, for example, the cost of electrical energy from the central station costs less the greater the demand. But in the main, however, the statement is true as the coal situation, the sugar situation and similar situations during the last few years have emphasized in an unpleasant way.

Apropos of coal, we have all seen and felt the increasing costs of all grades of coal. Many of us have encountered the rising price of some certain grade or size of coal, first finding that the cost per ton was gradually rising, and then that this same size and grade commenced to become scarcer. The explanation is as that given above—that the supply and demand are the factors that very largely determine the market price.

Screenings once were cheap. There was little demand for this size of coal because boiler-room practice had not assumed the status it has today. There was a very limited market for screenings, and the mine operators were glad to get rid of screenings at a loss rather than have large quantities of this grade of coal around. The demand was very limited, screenings were somewhat of a glut upon the market, and screenings were cheap.

Screenings being cheap, the demand for screenings increased as boiler-room practice developed and evolved efficient methods for handling and burning this size of coal. The demand for screenings increased and the price increased. Whereas formerly the mine owners had sold screenings at a loss, a loss taken care of by purchasers of other grades and sizes of coal, the mine owners found they were able to increase the price of screenings so that the sale became profitable. The supply and demand argument also offered an excuse for a still higher price for screenings. Today screenings are no longer cheap, but neither is any size or grade of coal.

The demand for screenings has grown to one of such magnitude that the large consumer of coal is already looking around for some other size of coal less generally applicable than screenings, hence one that is in less demand and therefore of lower price per ton. Just as pulverizing of coal has enabled culm and low-grade coal high in ash, sulphur and extraneous matter to be used, so has mechanical draft brought about considerable latitude as to the choice of fuel that can be burned, a latitude still further extended by the evolution of the underfeed type of stoker. Looking at the coal situation from this aspect—that of turning to lower grades of coal, and developing apparatus for burning them—one immediately realizes that much has already been done.

By means of the underfeed stoker it has been possible to increase the combustion rate, pounds of coal per square foot of grate area, several hundred per cent; in this way higher rates of evaporation have been enabled to be obtained on the one hand and lower grades of coal to be used on the other without loss of steam-making capacity. High rates of combustion have been made possible only by the employment of comparatively high draft intensities, calling for forced and sometimes induced draft as well. This has brought with it high temperatures and the formation of clinker and usually increased loss of combustible in the ash. These things have, in turn, resulted in the development of the clinker grinder, the reciprocating grate, the power dump, and the air-cooled clinker-proof furnace walls.

So it goes. New conditions arise and new apparatus is evolved to meet them. A grade of coal is plentiful and cheap because there is no demand for it and it occurs incidentally to producing other grades of coal. Apparatus is evolved for using it and the demand grows until the price becomes sufficiently high to encourage other grades of coal lacking a market to be used. The time is ripe now for power plant designers and operators to turn attention to the feasibility of using the culm banks, of mixing the various dusts now wasted in mining, the lignites, peat and briquettes. The use of some of these fuels should receive great impetus within the next few years. And this in turn will perhaps start on the way upon a large scale, the large power plant directly at the mine. If these things come out of the bituminous miners' strike, that strike may be considered after all as a blessing in disguise.

Development of Automatic Control

AUTOMATICALLY accomplishing things is undoubtedly one of the features of the times. Instances of this are legion, in the multiplicity of fields of our industrial endeavor, and every phase of our civic life. Just as machines are replacing men, *genus homo*, so are automatic features of machines taking the place of human supervision, human effort for operating and controlling these machines.

The statement was recently made by an authority that the next war will find available aeroplanes capable of flying more than one hundred miles and back and dropping bombs, both actions being automatic and controlled from a distance. And there are many more automatic features connected with war. To come closer to everyday existence, we would cite a paper presented before the A. I. E. E. early this month by A. Bessey Smith on the applicability of automatic switching to all classes of telephone service in which it is shown that the limitations have not yet been reached. Automatic telephony is making rapid headway and before another ten years have elapsed we may expect to find the telephone girl much less of a necessity than she is today.

Into many manufacturing processes automatic features of control are vital to the uniformity and quality of the product. Such industries are the treatment of steel, the preparation of many foodstuffs, and the production of many finished articles. And perhaps not the least of these is the electrical industry, the central-station industry especially.

Into the production and marketing of kilowatts automatic functioning is found at almost every step. The overspeed of steam and hydraulic turbine is automatically controlled. The circuit-breakers are usually automatically operated. Tirrill regulators maintain bus pressure or pressure at the end of a line in the smaller stations. Feeders have their voltage regulated according to load and power-factor at any specified location in the feeder. Automatic control sometimes permits loss of voltage on one line to be picked up by another. Short circuits may be automatically suppressed on long-distance transmission lines; synchronous condensers operate and correct for low power-factor miles from the generating station and miles from human supervision, and distant plants are automatically started up. Along the electric railroad, stations housing synchronous converters or motor-generators may be started up when approaching trains reach a certain stretch of track and shut down in due time, while in the coal mine and the industrial plant, on the wharf, in the steel mill, grain elevator and scores of other plants automatic electrical control is perfecting processes, cutting costs and doing better than could be done in other ways.

Electricity permits of ready control, to such an extent that water, gases, temperature, pressures and motion are often measured and controlled electrically because of the accuracy, simplicity and reliability thus obtained. Automatic control is prone to play an even more prominent part in the scheme of things as the years go on. It is electricity that makes so many automatic features possible. And it is to the manufacturers of apparatus and the manufacturers of electrical energy that one looks to hasten matters along.

Current Events

Clearing of Renewable-Fuse Status — Vacuum Cleaner Makers Organize—Conference on Industrial Safety Codes

LIGHTING FIXTURE MANUFACTURERS AND DEALERS TO MEET IN DETROIT.

Chandelier Show and Fixture Market to Be Held Throughout Week of Feb. 9, Together with Meetings of Producers and Dealers.

Special preparations are being made for making the next meeting of the National Council of Lighting Fixture Manufacturers a memorable one. The meetings of this organization will be held each morning at 9:30 o'clock from Tuesday, Feb. 10 to Saturday, Feb. 14, inclusive. Some of the sessions will be joint meetings with the Glassware Guild and with the National Lighting Fixture Dealers' Society, which will meet in Detroit during the same week. Among the topics to be discussed will be cost accounting, design protection and standardization. A luncheon with interesting talks will be given each day and the banquet will be given on Thursday evening.

During the entire week of these meetings there will be held a special exhibition to be called the Chandelier Show and Fixture Market. Each afternoon is especially reserved for this purpose. Wednesday evening will be set apart as architects' and builders' night and Friday evening as public night. This show, as well as all the meetings referred to, will be held at the Hotel Statler, Detroit, Mich. Fred R. Farmer, president of the Beardslee Chandelier Manufacturing Co., 216 South Jefferson street, Chicago, is president of the National Council of Lighting Fixture Manufacturers.

UNDERWRITERS' LABORATORIES ISSUE APPROVAL OF RENEWABLE FUSES.

Performance Records and Tests Show that Certain Fuses of Renewable Type Are Considered Standard and Satisfactory for Installations.

Removal of much of the opposition that has existed in regard to renewable fuses is indicated by the issuance of approval cards by the Underwriters' Laboratories this week covering renewable fuses manufactured by several different companies.

Following extended controversy on the subject of approval, the matter was referred to the Bureau of Standards in 1915 and the Bureau, in the capacity of arbitrator, decided that while renewable fuses appeared to be satisfactory, further performance records and tests were necessary before formal approval should be made. Specifications for standard renewable fuses were drawn by by the Underwriters' Laboratories and were issued last July after being approved by the Fuse Section of the Associated Manufacturers of Electrical Supplies and the Electrical Council of the Underwriters' Laboratories. Samples were submitted for test by the different manufacturers and such tests have resulted so far in the approval of the following:

Chicago Fuse & Manufacturing Co., Chicago. "Union," 0-600 amperes, 250 volts.

Economy Fuse & Manufacturing Co., Chicago. "Economy," 0-600 amperes, 250 volts; 0-600 amperes, 600 volts.

Federal Electric Co., Chicago. "National," 0-400 amperes, 250 volts; 0-100 amperes, 600 volts.

Trico Fuse & Manufacturing Co., Milwaukee. "Trico," 0-600 amperes, 250 volts; 0-600 amperes, 600 volts.

Samples from a number of other manufacturers are in process of test at the Underwriters' Laboratories and approval cards will be issued as soon as they are found to meet the test specifications.

This action by the Underwriters' Laboratories means that inspectors will be at liberty to pass renewable fuses and that the Electrical Committee of the National Fire Protection Association, which will meet next March for the purpose of revising the National Electrical Code, will undoubtedly revise the rules relating to fuses as a technical indorsement of the action of the Underwriters' Laboratories.

SALE OF ELECTRIC GENERATOR SETS BY WAR DEPARTMENT.

Surplus Stock of 25-kw., D-c., Gasoline Engine-Driven Sets to Be Sold.

The War Department authorizes publication of the following statement:

The director of sales announces that the Surplus Property Division, office of the quartermaster general of the Army, is offering for sale 400 gasoline-driven, electric generator sets, complete with switchboards and gasoline tanks, which have been declared surplus by the War Department and on which offers will be received at any time by the Surplus Property Division, Munitions building, Washington, D. C.

The generator is a 25-kw., direct-current, commutating-pole type. Either 115-volt, two-wire, or 230-volt, three-wire, generators can be supplied. The engine is of the closed, four-cycle, single-acting, vertical type, with four cylinders and is capable of operating the generator at full load indefinitely and at a 25% overload for two hours. The sets are high grade in every respect and combine a number of improved safety and gasoline-saving features.

These machines are designed for close regulation which makes them very desirable for small electric light and power plants, such as are required by rural stores and hotels, isolated small factories and even small towns. Owing to the continued coal shortage, these gasoline-driven generators should prove particularly useful as auxiliary or emergency lighting and power equipments in many cases.

The sets which the Government is offering for sale are new and have been carefully stored since they were purchased by the Government about a year ago. They are packed in the crates in which they were shipped from the factory. They are located at Schenectady, N. Y., and New Cumberland, Pa., and will be shipped promptly upon approval of submitted offers.

Inspection of the machines, switchboards and tanks may be made at the points of storage or complete specifications may be obtained from the Surplus Property Division, Munitions building, Washington, D. C. Information relative to the terms of sale, storage points, etc., may be obtained from the same office.

IMPORTANT COMMITTEE MEETINGS OF N. E. L. A.

Public Policy and Executive Committees to Hold Meetings with Full Attendance in January—Important Measures to Be Discussed.

Important meetings at which the enlarged program for the future activities of the National Electric Light Association is to be discussed will be held in New York City in January.

A meeting of the Public Policy Committee will be held at the headquarters in the Engineering Societies Building on Jan. 29. John A. Britton, chairman of the committee, will come from San Francisco to preside. President R. H. Ballard, of Los Angeles, will also be present. It is expected that the full membership of the committee will be present. Suggestions and advice will be requested from the committee in regard to the future activities of the association and the new program which is now being arranged.

The Executive Committee meeting will be held on Jan. 30. Action will be taken on the program for future activities and an effort will be made to settle definitely the matter of the geographic sections. In speaking of the progress which is being made in the organization of the central stations of the country into geographic section affiliation with the National Electric Light Association, M. H. Aylesworth, executive assistant to the president, said: "The outlook is very encouraging. The plan is receiving widespread favorable comment and many state organizations have shown a desire to aid in carrying it through."

COMMITTEES OF NORTHWEST ELECTRIC LIGHT AND POWER ASSOCIATION.

President Fisken Appoints Leaders of Central-Station Industry of Northwest States to Conduct Committee Work Actively.

The Executive Committee of the Northwest Electric Light and Power Association met at Portland, Ore., on Nov. 26, to mature plans for proper representation of the association at the National Electric Light Association's national convention to be held in Pasadena, Cal., next May. Another phase of the meeting was the decision to have an advisory committee to evolve a plan of co-operation among power companies, contractor-dealers, jobbers and manufacturers, and to report to the Executive Committee. It is proposed to define the work of the new sections, comprising accounting, commercial, public relations, hydroelectric and technical, and membership, for all of which the president of the association will appoint a governing committee.

The Public Policy Committee of the association, whose duties are highly important, is made up of following members appointed by President John B. Fisken: Franklin T. Griffith, president of Portland Railway, Light & Power Co., chairman; Guy W. Talbot, Portland, president Pacific Power & Light Co.; Guy C. Pierce, vice-president and general manager Northwestern Electric Co., Portland; A. W. Leonard, president Puget Sound Traction, Light & Power Co., Seattle; D. H. Huntington, president Washington Water Power Co., Spokane; F. M. Kerr, general manager Montana Power Co., Butte; W. R. Putnam, vice-president and general manager Idaho Power Co., Boise; F. T. Johnson, president Idaho Power Co., Boise; Geo. L. Myers, assistant to president of Pacific Power & Light Co., Portland; F. D. Nims, vice-president and general manager of Washington Coast Utilities, Seattle. There is also a separate public policy committee for each of the states of Oregon, Washington, Idaho and Montana.

A special effort is to be made for enlarging the membership of the association by the following Membership Committee:

Geo. L. Myers, of Pacific Power & Light Co., Portland, chairman; A. S. Moody, of General Electric Co., Portland; F. D. Nims, Washington Coast Utilities, Seattle; J. F. Farquhar, Washington Water Power Co., Spokane; J. I. Colwell, Western Electric Co., Seattle; J. F. Orr, Idaho Power Co., Payette, Idaho; T. W. Neill, Kootenai Power Co., Coeur d'Alene, Idaho; R. J. Coban, Westinghouse Electric & Manufacturing Co., Butte, Mont.

ELECTRICAL EXPORTS FOR OCTOBER UP TO AVERAGE OF YEAR.

Nearly 50% Increase in Value of Shipments Compared with October of Last Year.

Although below the record monthly total of last June, the electrical exports of the United States during last October were nearly equal to the average monthly figure of the preceding months of this calendar year. They exceeded the total value of the electrical shipment of October, 1918, by nearly 50%.

The classified figures for last October and for the corresponding month of 1918, as extracted from the monthly summary of the foreign commerce of the United States, just issued by the Bureau of Foreign and Domestic Commerce, Washington, D. C., are given in the following table:

Articles.	October 1919.	October 1918.
Batteries	$ 507,704	$ 276,730
Carbons	121,621	114,991
Dynamos or generators	452,946	254,156
Fans	79,406	15,679
Heating and cooking apparatus	164,114	86,144
Insulated wire and cables	487,444	525,031
Interior wiring supplies, including fixtures	168,902	83,656
Lamps—		
Arc	2,239	273
Carbon filament	6,075	5,758
Metal filament	334,835	191,344
Magnetos, spark plugs, etc	222,972	222,099
Meters and measuring instruments	237,077	83,674
Motors	1,007,930	1,147,159
Rheostats and controllers	63,153	30,281
Switches and accessories	347,152	124,720
Telegraph apparatus, including wireless	44,566	19,689
Telephones	388,428	148,312
Transformers	218,789	206,575
All other	2,425,310	1,324,313
Total	$7,280,663	$4,860,584

The above figures do not include electric locomotives, of which there were exported last October 13 engines valued at $51,130.

For the ten months ended Oct. 31 last, the total value of electrical exports, excepting locomotives, was $75,719,867, compared with $48,618,300 for the corresponding months of 1918, and with $44,130,615 for the similar months of 1917.

VACUUM CLEANER MANUFACTURERS' ASSOCIATION ORGANIZED.

Charles S. Beardsley, of the United Electric Co., Made Chairman of the Association.

An interesting meeting of vacuum cleaner manufacturers was held at Cleveland, Ohio, on Dec. 5. All the vacuum cleaner manufacturers in the United States were represented and the Vacuum Cleaner Manufacturers' Association was formed for the betterment of the vacuum cleaner industry which it is believed will be of decided benefit to the trade in this useful appliance.

Officers for the coming year were chosen at this meeting and Charles S. Beardsley, general manager of The United Electric Co., Canton, Ohio, was unanimously elected chairman of the association. A. J. Stecker, president of the Stecker Electric Co., Detroit, Mich., was made vice-chairman, and C. G. Frantz, general manager of the Apex Electrical Manufacturing Co., Cleveland, Ohio, was chosen secretary and treasurer.

An executive committee was appointed consisting of F. S. Hunting, general manager of the General Electric Co., at Ft. Wayne, Ind.; H. W. Hoover, general manager of the Hoover Suction Sweeper Co., North Canton, Ohio; and A. S. Phillips, of the Spencer Turbine Cleaner Co., Hartford, Conn.

ELECTRICAL CONSTRUCTION PROJECTS INCREASING.

Indications Show Increase in Building of Power Plants to Supply Demands for Electrical Energy.

That electrical construction activities are being increased is indicated by a statement recently made by G. O. Muhfeld, general director of Stone & Webster Engineering Corp., in which he said that probably never in the company's experience has so great a volume of electrical construction projects been impending at any one time. The situation is accepted as reflecting the confidence of business generally in the favorable trade outlook of the immediate future.

Among new contracts lately taken by Stone & Webster is one for the design and construction of a 20,000-kw. steam-driven electric power plant for the New Bedford Gas & Electric Co. at New Bedford, Mass. This development is in the eastern textile territory and is required to meet the growing power demands of that expanding industry. A contract for the design and construction of a 12,000-kw. steam-driven electric power plant for the Pittsburgh Plate Glass Co. is another of the new projects. This unit will be erected at Kokomo, Ind.

MAINTENANCE OF LIGHTING EQUIPMENT DISCUSSED IN CHICAGO.

Symposium on Maintenance Held by the Chicago Section of the Illuminating Engineering Society.

The importance of maintenance of lighting equipment and dependable methods of insuring proper maintenance formed the general topic of a symposium of short papers and talks before the Chicago Section, Illuminating Engineering Society, held on the evening of Dec. 18.

J. L. Stair, chief engineer, National X-Ray Reflector Co., opened the series by describing the national and local maintenance campaigns conducted by that company in the effort to get owners of its lighting installations to adopt regular cleaning schedules. A card system was developed for reminding of the need for cleaning. In Chicago a window-cleaning company was induced to organize a fixture-cleaning department that was later established as a separate company. It makes maintenance contracts, including periodic cleaning of fixtures (usually monthly), lamp renewal and replacement of broken reflectors and fixture parts. The average charge has been about 21 cents per fixture per month. This service has proven very satisfactory for offices, stores, shops, etc.

F. A. Kaup, supervisor of the service and repair department, Commonwealth Edison Co., described the maintenance service of this large central-station company, which takes care of the lighting maintenance of some 25,000 customers using rental fixtures. The organization that renders this service is quite a large one, consisting of cleaners, patrolmen, foremen and supervisors, besides many clerks and telephone operators at headquarters. The work is very systematically carried out, the men keeping in touch with the office hourly by telephone for emergency orders. Not only is the cleaning done at fairly regular intervals, but lamp and fuse renewals are made at very short notice. Among the fixtures looked after are store and factory fixtures, store-window lighting, signs and ornamental street posts. Trucks and wagons are commonly used for carrying ladders, extra lamps, globes, cleaning equipment, etc. Numerous difficulties are experienced in getting at fixtures in some factories. The experience has been that, unless such maintenance service is furnished by a specially organized crew, the customer quickly neglects his lighting equipment and then complaints become frequent and vociferous.

Henry Nixon, deputy commissioner of gas and electricity of the City of Chicago, explained the methods used by the city in maintaining its street-lighting system of some 46,000 series incandescent lamps. Patrolling is done every night on every circuit in the city and on lamps that can be lowered an effort is made to renew burnouts immediately, the patrolmen carrying a stock of lamps on their automobiles. In other cases the lamps are renewed during the following day, the remaining time of the trimmer being devoted to cleaning. On business streets the cleaning is done more frequently than on residence streets. Some difficulty has been met with the class of labor that the city has been compelled to employ, which makes the maintenance service more expensive and less reliable than it should be. All lamps are tested as received from the factory and defectives immediately rejected. With the special lamps now used the average life runs from 2200 to 3000 hours. Experiments with a sealed fixture show that the lamp temperature is not seriously affected while the dirt getting into the fixture is very much reduced, so that a higher state of cleanliness is maintained.

C. H. Shepherd, electrical engineer, Lincoln Park Commissioners, described the system of maintaining park and boulevard lamps of the Lincoln Park system. The lamps in buildings are attended to about once a week on the average, while outdoor lamps are cleaned regularly about once each fortnight. Trouble is met in cleaning the globes on lamps along the lake shore of sand flies and other insects during the summer, scouring the globe with sand being often necessary. A tower wagon or truck is used; it has a compressed-air tank for blowing out the inside of the globe, compensator, free from dust and insects. A 20-in. opal globe is used on all outdoor posts; at first there was considerable breakage of these globes till the men became skilled in handling them on top of the post. Mr. Shepherd also explained the lamp record system he described in the last issue of the ELECTRICAL REVIEW.

E. D. Tillson displayed a number of fixtures collected from various installations and showing typical instances of neglected maintenance. He also showed an ingenious type of self-cleaning fixture for foundries and other dusty places; it has a wiper that cleans off the plate-glass bottom of the fixture every time it is turned on or off. A. L. Arenberg showed a fixture that is easily cleaned by means of a feather duster. Others joining in the general discussion were J. R. Cravath, F. A. Kaup, A. C. King, J. L. Stair, F. H. Bernhard and Messrs. Lucas and Curtis.

INDUSTRIAL SAFETY CONFERENCE HELD AT BUREAU OF STANDARDS.

Condensed Report of Meeting at Washington, Dec. 8—Joint Committee on Safety Codes to Be Organized.

In the absence from Washington of the director of the Bureau, Dr. S. W. Stratton, the meeting was called to order by Dr. E. B. Rosa, who summarized at some length the events leading up to this conference and referred especially to the proceedings of the similar conference held on Jan. 15, of which this in a sense was an adjourned meeting. The discussion at that conference was summarized and reference made to its action for the appointment of a committee which has since made a printed report.

The principal subjects which came up at the January conference were the reorganization of the American Engineering Standards Committee and the question of whether the safety work of the Bureau of Standards should be conducted under the scheme of procedure laid down by that committee.

The last question was the subject of a letter ballot on Plans "A" and "B" sent out in the spring, the result of which was a decided majority in favor of procedure under the plan of the American Engineering Standards Committee. This committee has adopted since the January conference a revised constitution which opens its membership to other organizations in addition to the original five founder societies and three government departments.

Dr. Rosa also announced the appointment of a General Advisory Committee on Industrial Safety Codes for the purpose of assisting the Bureau of Standards in deciding upon policies and procedure in its work on safety codes. He said: "The Advisory Committee recently appointed by the Bureau is not the Managing Committee proposed under Plan A. It is for the present merely an advisory committee for the Bureau of Standards. After this conference is ended that committee will meet and deliberate. If this conference wishes to make any recommendation on request to that committee it can do so, or if it wishes to adopt it as a committee of this conference it can do so. Or this conference can have a different committee if it prefers, or can appoint some additional members to sit with or become a part of the Bureau's committee. We want this conference to feel entirely free to discuss the important question submitted without hindrance or restriction of any kind."

Prof. Comfort A. Adams, chairman of the American Engineering Standards Committee, then spoke on the work of that committee and its recent reorganization. Membership in that committee is now open to such organizations or groups of organizations of national scope as may be approved; there shall be no more than three members from each such organization, and the annual dues are $500 for each representative. Applications for membership must set forth the scope of their standardization interests and activities and the number of members. If such application is approved by three-fourths of the committee it is submitted to the organizations having membership on the committee, and unless disapproved by more than one-fourth of these within 90 days, it is considered to be ratified. The speaker stated that he would be superseded as chairman of the committee by A. A. Stevenson, and that the permanent secretary of the committee will be Dr. P. G. Agnew, at present in the Bureau of Standards. The headquarters of the committee will be in New York City.

The procedure to be followed in the development and adoption of American engineering standards was then outlined. Committees to formulate standards shall be organized by suitable engineering societies, government bureaus or other bodies which shall be designated as sponsors and shall be responsible for the carrying out of the work. Such a committee must include representatives of all interests concerned in the formulation of a standard, and upon completion of its work and substantial agreement upon the same, shall report to the sponsor body. If the latter adopts the standard it is forwarded to the American Engineering Standards Committee for approval, and when so approved, shall be designated as either recommended practice, tentative standard, or American standard. The Standards Committee will not itself pass judgment upon the details of the proposed standards but rather upon the composition of the committee which has formulated the standard or approved it. This committee must not be confined to the membership of the sponsor body, but must include representatives of all interests concerned in the standard.

A number of other organizations have already applied to the American Engineering Standards Committee for membership. These include the National Safety Council, American Mining Congress, insurance, utility and technical associations. To become a member an organization must be national in its scope. Thus individual state industrial commissions would not be considered eligible, but as a group they might join through their national association.

The status of industrial safety codes now existing was next discussed by Dr. M. G. Lloyd of the Bureau of Standards, Dr. L. W. Chaney of the Bureau of Labor Statistics, S. D. Collette of the American Society of Mechanical Engineers and W. S. Paine of the Aetna Life Insurance Co. Dr. Lloyd exhibited a number of charts on which it was attempted to show the scope of existing safety rules in the industrial field but exclusive of the subjects of transportation, mining and industrial hygiene. The relation of fire prevention to human safety was considered and a distinction drawn between rules for fire prevention of property and accident prevention to individuals. The regulations considered included those of state laws, commission orders, city ordinances and the rules prepared by insurance organizations, technical societies and manufacturers' organizations as well as Federal Government bureaus, the National Safety Council, etc. A knowledge of such existing rules was considered essential to the intelligent development and revision of safety regulations.

Dr. Chaney pointed out that a survey of accident records would show what hazards are greatest and consequently what industries are most in need of safety regulations. The method of administration of safety rules is of more importance than the contents of the rules themselves and good results depend upon general co-operation and efficient administration. Compensation laws have brought about an improvement in accident prevention work.

Mr. Collette referred particularly to the Boiler Code of the American Society of Mechanical Engineers and the recent work of that society in preparing an Elevator Code in co-operation with the Bureau of Standards.

Mr. Paine referred to the disadvantages of non-uniformity of temporary rules and said that to have a satisfactory code it was necessary to have the co-operation of all interested. The insurance companies had done a great deal to promote universal standards, especially through the medium of their rating bureaus and were in a position to introduce rules and apply them before they were made mandatory by law.

The symposium on Methods and Policies to Be Pursued in the Development and Introduction into Use of Safety Standards was participated in by S. J. Williams of the National Safety Council, O. B. Connelley of the Department of Labor and Industry of Pennsylvania, C. M. Talbert, director of the Department of Streets and Sewers, St. Louis, W. C. L. Eglin of the National Electric Light Association, A. C. Morrison of the International Acetylene Association, A. Rousseau of the Abrasive Wheel Manufacturers' Association, Henry Sterling of the American Federation of Labor, and Lew R. Palmer of the Equitable Life Insurance Co.

Chester C. Rausch of the Safety Institute of America introduced the following resolution which was adopted by the conference:

"Resolved: (1) That the American Engineering Standards Committee be asked to request the International Association of Industrial Accident Boards and Commissions, the Bureau of Standards and the National Safety Council to organize a Joint Committee on Safety Codes, this committee to include representatives of these bodies and such others as they may consider advisable; (2) that this Joint Committee report upon the safety codes required, priority of consideration of the codes, and sponsor bodies for their preparation; (3) that this report be put in writing and placed not later than Feb. 1, 1920, in the hands of the American Engineering Standards Committee."

Before taking the vote on this, however, another motion was passed confirming the result of the letter ballot taken last spring and expressing the decision of the conference that safety codes should be established under the procedure of the American Engineering Standards Committee.

In the discussion on this subject it was pointed out that the American Engineering Standards Committee was not primarily interested in safety matters and that the committee contemplated in the resolution of Mr. Rausch would be directly concerned in such matters and might well serve as a steering committee on safety-code work. The opinion was freely expressed that such a committee should be a permanent one, that it should contain representatives of all interests involved in safety codes and that it might well be called a National Safety Code Conference and hold annual meetings. Such a committee would be in position to co-ordinate work on safety codes, to arrange for necessary interpretations, to initiate new codes as they become necessary, and to form a central agency to insure co-operation.

At a meeting of the General Advisory Committee of the Bureau on the following day, the work of the proposed committee which the American Engineering Standards Committee has been asked to appoint was further discussed and the opinion was generally expressed that such a committee, if made a permanent organization, would render the General Advisory Committee of the Bureau of Standards unnecessary. There was also a discussion of means for introducing codes and for securing interpretations of rules in particular cases as the necessity for the same might arise. Before adjournment a motion was passed giving the Bureau of Standards a vote of thanks for taking the lead in calling these conferences and bringing the matter of engineering and safety standards to the attention of all concerned.

LECTURE ON FUNDAMENTALS OF ECONOMICS BEFORE LYNN SECTION.

Before the Lynn (Mass.) Section of the American Institute of Electrical Engineers, on Dec. 17, George E. Roberts, of the National City Bank of New York, gave a closely reasoned address on "The Fundamentals of Economics." He paid a glowing tribute to the work of the engineer who has been at his task and calling all the time for the most efficient means of investing capital in machinery and thereby adding to the general good. Capital is really physical equipment for the increase of production. Distinction was drawn between the two kinds of wealth, consumable and nonconsumable, the latter being that most useful kind of capital that is not hoarded but is put back into productive business.

About 250 attended the lecture and at its close Richard H. Rice, acting manager of the Lynn works of the General Electric Co., spoke briefly. On Jan. 7 there will be a lecture on the manufacture of steel.

SPECTACULAR ILLUMINATION PLANNED FOR ELKS' CONVENTION.

Arrangements are already being made on a big scale for the convention of the Grand Lodge of the Order of Elks which will be held in Chicago on July 5 to 10, 1920. Among the attractions for this big national gathering will be special electrical displays that will center in Grant Park on the lake front where the largest elk's head ever built will be erected and encrusted with thousands of colored lights. From this point the chain of lighting will extend to every part of the city, with special features for the Municipal Pier, the principal parks and other entertainment centers.

UNIVERSITY OF ILLINOIS TO HOLD ELECTRICAL SHOW.

The department of electrical engineering at the University of Illinois is making plans for an electrical show to be held April 8-10. Several large and successful expositions have been held at the university in the past, but they were discontinued during the war period. Tentative plans for the 1920 show indicate that it will be larger and more elaborate than those of preceding years.

Commercial Practice

Making Extensions in Rural Communities — Factors Affecting Electric Furnaces—Moving Poles from Streets

EXTENSIONS OF ELECTRIC SERVICE TO RURAL CUSTOMERS.

An Outline of Practice in Illinois Regarding Rural Service, Presented in Paper Read Before the Illinois State Electric Association.

By D. W. Snyder.

General Superintendent, Bloomington & Normal Railway & Light Co.

The exceptional prosperity of the farmers during the last few years has created a demand upon central stations for rural service, which few, if any, were prepared to meet. The result has been that an immense mileage of low-voltage rural transmission lines has been built, with little attention paid to standardization in construction, method of ownership, or to a scientific system of rate making. The continued activity in rural business, however, has awakened the Illinois Public Utilities Commission and most of the central-station managements in the state to the fact that rural business is not a negligible factor and presents some costly and intricate problems.

A number of small central stations which have allowed rural lines to be attached to their systems have discovered too late that these customers are unprofitable and quite troublesome, with the result that they are disgusted with the business and opposed to any more additions. This hostile attitude is natural, but the rural business must be served and can be developed in much the same way that the small central stations developed day service. Necessarily, there will be some initial disappointment, but with proper methods the business can be handled and at a profit.

The usual rural single-phase line is of 2300 or 6600 volts, 30-ft. cedar poles, 6 or 7-in. tops spaced 35 to 40 to the mile, with wooden cross-arms and insulator pins. No. 6 hard-drawn copper wire is used and the line built under the Commission's standard rules. A line of the above type can be built from $500 to $800 per mile and will meet the requirements of 90% of the rural business.

A quite satisfactory method of financing such a line to serve a small group of farmers is to build the line proper and divide its cost equally among the farmers and then charge each farmer in addition for the equipment, such as transformers, etc., necessary to his individual use.

The line and equipment should be maintained by the utility but the cost borne by the farmers, who retain ownership. A contract for maintenance preferably should be between the company and a responsible trustee or a committee for the farmers and must provide for proper inspection and maintenance at a cost based on material and labor. In case of the farmers failing to meet their obligations under the contract, the company should have the right, by reasonable notice, to terminate the agreement and the service. This arrangement would come under the second section of the Commission's order No. 59 and insures a line that will be kept in good operating condition.

Under this plan the only problem presented to the utility is to give adequate service at a proper rate. It has been demonstrated that such a line as has been described, equipped with lightning arrestors on each transformer, will provide good service when proper size service wires and transformer are installed, so the only remaining factor is the rate.

In the matter of rates, practically all of the companies operating in Illinois have either failed to file a rural rate or have applied their regular lighting schedule with a slightly higher minimum; in the majority of cases a $2 minimum is required. This use of established urban rates to rural customers is the reason most central stations are opposed to taking on the business.

The average farm customer not using electric power will require a 1-kw. transformer, which, in most cases, serves no other customer. The core losses on a 2300-volt 1-kw. transformer for one month will average 14 kw-hrs. Average consumption of a number of farmers, each served by a 1-kw. transformer, showed 19 kw-hrs., which, at 15 cents per kw-hr., made a gross income of $2.85 per customer. Adding the core losses to the consumption, a resultant income of 8.5 cents per kw-hr. is obtained. This rate will invariably be less than that charged for adjacent urban service, where, because of the diversity factor of a large number of customers on each transformer, the core losses are practically negligible per customer.

In the case of a small power customer, a 3-kw. transformer is usually required. The core loss will be about 23 kw-hrs. per month. An average of customers so equipped was 20 kw-hrs. per month, making a gross bill, at 15 cents per kw-hr., of $3 per month and an average return of slightly less than 7 cents per kw-hr. when the core losses are added.

The above data shows that the application of city rates with slightly higher minimum to rural service is economically unsound. The remedy is a primary charge sufficient to cover transformer core losses at a low rate plus city rates for the actual energy used. This form of rate has only one objection and that is the difficulty of making the farm customer see that the service to him is different than city service and that a charge for transformer core losses is a proper one. The Illinois Public Utilities Commission probably would approve such a rate, for in commenting on the application of the Central Illinois Public Service Co. to place certain farm-lighting customers on its standard farm rate, it said: "It would be perfectly feasible and legal to file a schedule of rates applicable to farm houses only and then if there are any industries in the locality the service to them would not come under that rate." The Central Illinois Light Co. placed in effect last August a schedule of rural rates, rules and regulations similar to the plan outlined above, but omits the primary charge covering core losses.

The Illinois Public Utilities Commission, under its general order No. 59, ordered: "If the proposed rural customers contemplate receiving service as individuals, the arrangements as to the construction and ownership of the necessary lines must be such that the title of the said lines when completed will rest in the electric public utility and that the electric public utility will be responsible for their maintenance, and it must be agreed that any other consumer along the route of the said lines will receive service, if applying for same, upon a nondiscriminatory basis."

This provision, if used by any utility serving customers at its regular rural rates, would create a condition of discrimination against the customers owning and maintaining their own lines, unless the Commission will allow a maintenance contract to be made with the individual, as is the case previously cited.

In the event of the utility accepting the gift of a half mile of line, and being obliged to maintain same, the following would be a fair representation on usual rural rate:

First cost one-half mile of line	$300.00	
3-kw. transformer and lightning protection	60.00	
Meter, service, etc.	40.00	
Total	$400.00	
Maintenance and depreciation, estimated at 10%		$40.00
Core losses at 4 cents per kw-hr		11.05
Meter reading, billing, testing, etc., estimated		6.00
Energy, 21 kw-hrs. at 6 cents per kw-hr		12.60
Total annual cost		$69.64
Annual revenue at 15-cent rate, $1.00 min		$37.80
Anual loss per customer		$31.84

The above revenue figures are actual averages from 3-kw. rural installations in a wealthy farming section of the grain raising district. This shows conclusively that even under ordinary operating conditions this type of business does not pay.

The practice of taking over and maintaining rural lines will lead to disastrous results, and immediate steps should be taken by all the operators to correct the present tendency of letting this important matter drift. The farms will never use sufficient energy to make the business remunerative unless they are made to pay for maintenance cost and core losses.

The first section of the Commission's order No. 59 reads as follows: "If the prospective rural consumers have formed a corporation for the purpose of constructing the said lines and receiving the said service, and propose to render such service to all applicants along the routes of the said lines, this corporation shall secure a certificate of convenience and necessity and file rates with the Commission, as requird by law. Any electric public utility shall refuse to connect its circuits with the circuits of such a corporation until these requirements of the law have been complied with."

This has been found to be the most satisfactory method of handling larger groups of rural service. The practice is to sell them their requirements on a kilowatt-of-demand rate and an energy charge. This, of course, places the responsibility on the rural utility, but as they usually are co-operative in that each customer owns stock, the burden falls where it belongs. Following is the rate used: $3 per month per kw. of demand for first 10 kw.; $1.50 per month per kw. of demand for all over 10 kw. The energy charge is as follows: For first 500 kw-hrs. used in any month, .04½ per kw-hr.; for next 2000 kw-hrs. used in same month, .03 per kw-hr.; for all over 2500 kw-hrs. used in same month, .017 per kw-hr. A discount of 10% for payment by the tenth of month is allowed on all bills. The resultant rate per kw-hr. at the substation switchboard has been $0.061 per kw-hr., with a load-factor of 16%.

This rate has been given to two groups of rural customers, each one comprising a small town in connection with 10 miles of 6600 and 2300-volt lines.

The widespread use of farm-lighting systems show that farmers want and are willing to pay for electric service. These systems are costly both in first cost and maintenance and are at best a substitute for central-station service. If the farmer will invest $500 to $1500 in a private lighting system and pay the high maintenance cost they should not object to contracting for their share of a line to serve them and pay an equitable rate based on actual cost of service. It is general opinion that farmers are willing to do anything that is right, and the exception is the fellow who would make the undesirable customer anyway.

The rural business is too experimental to give much concrete information concerning it. Points needing emphasis are that central stations should recognize the fact that rural communities are demanding service and their demands must be met, that one or two standard plans of rendering service must be adopted, and that the present system of rates must be corrected.

FREQUENCY FOR AND CAPACITY OF ELECTRIC FURNACES.

Twenty-five and 60 cycles are both being used for electric furnace supply. The use of 25 cycles permits of a greater power input to a given furnace than does the use of 60-cycle energy, due to the lower magnetic losses and decreased heating and inductive effects of the higher periodicity. A very much better power-factor exists with 25-cycle energy than with 60 cycles, for the same reasons, and these same factors apply to the maximum power input feasible.

At the present time the largest electric furnace operating on 60-cycle supply is rated at 15 tons of steel. Experience has shown that a furnace for melting steel can take a molten charge of about 30 tons and will require from 2000 to 2500 kw. to handle this amount of metal satisfactorily. Such a furnace can be operated from a 60-cycle supply at 60 cycles. For a three-electrode furnace about 3000 kv-a. probably represents about the limit as imposed by economy. A furnace of this size, handling molten metal, should be capable of producing from four to five thousand tons of steel per month, with an input varying between 2000 and 2500 kw.

CO-OPERATION BETWEEN UTILITIES RIDS STREETS OF POLE LINES.

The Southern California Edison Co. and the Southern Sierras Power Co. were ordered by the city council of San Bernardino to remove their pole lines from certain of the streets within the city. The two utilities got together and by mutual agreement decided to move their respective lines, one north and the other south from the street to the alley. In this way all poles and wires were removed from the main thoroughfare and services have been made at the rear of buildings. By co-operation and reciprocity the two power companies were able to save themselves time and money and bring about a pleasing conclusion to the city's demand.

Operating Practice

Hydraulic Turbine Bushings — Power-Factor Correction —Operation of Thrust Bearings — Exhaust Steam Heat

ELECTRIC HEATER FOR BRONZE AND STEEL BUSHINGS.

Method of Simplifying Installing Bushings on Hydraulic Turbine Shafts.

By R. H. Pickens.

Southern Public Utilities Co.

In installing new bronze and steel bushings, on the shafts of vertical waterwheels, some method of heating them in order that they be expanded enough to allow of their being forced to their seats upon the shafts, was found necessary. After some experimenting it was decided that some form of electric heater would be most satisfactory.

The bushings fit on the lower part of the shaft, above the turbine rotor, and serve the purpose of preventing wear on the shaft proper, where it passes through the turbine guide bearing; these bearings being of the conventional *lignum-vitae* block type of underwater bearing. The original bushings were of bronze, and it was found necessary to heat them to about 300 deg. F. in order that they might be forced upon their seats with the equipment on hand.

The bushing was first wrapped with one layer of a heavy smooth wrapping paper, put on tightly and without wrinkles. The heating element consisted of a single layer of No. 18 B. & S. black iron wire, spaced about ¼ in. between turns and wrapped tightly over the paper; no heat insulating material was used over the wire as experience showed this to be unnecessary. Fig. 1 shows the bushing in place and the connections as made when heating it.

To heat the bushing, current was taken from the exciter circuit of the plant at a voltage of 125 volts. The field leads of the alternator being disconnected from the brush holder studs, and No. 4 copper wire connected to the leads, was dropped into the wheel pit, where connection was made to the heater; field switch and rheostat of the alternator controlled the

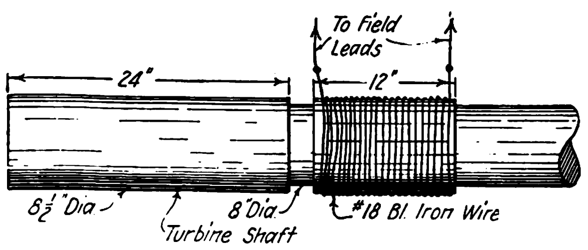


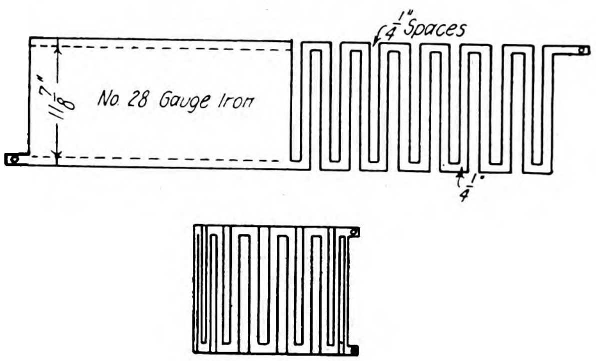
Fig. 1.

current. A current of about 60 amperes was found sufficient to expand the bushing enough to allow its being forced upon the shaft with a press made of two small screw jacks.

After experience had shown that a bushing made of cast-iron or steel gave superior service and a longer life on these underwater bearings, it was decided to install bushings made of manganese steel.

The bronze bushings were ⅜ in. in thickness and in 12-in. sections, the steel bushings were of manganese steel, without temper and in sections of the same length as the bronze ones.

In installing the steel bushings it was found that the method used in expanding the bronze was not effective, so a different type of heating element was designed. This heater was made of No. 28 gage



Figs. 2 and 3.

black iron sheet 11⅞ ins. wide and of such length as to encircle the bushing, this sheeting being cut into the form shown in Fig. 2.

Brown wrapping paper was used as the insulator between the metal and the heater as was used on the bronze bushings, the heater being placed on the bushing as in Fig. 3.

A heat insulator of sheet asbestos was placed around the outside of the bushing, covering the heating elements, and a few turns of iron wire were wrapped over the asbestos jacket in order to bind the heating element firmly against the bushing. This later type of heater proved rapid and effective in service, being superior to the original form of wire wound heater. It required about 20 minutes in each case to raise the temperature of the bushings to the proper expansion point to allow their being forced upon their seats, with the home-made press that was used.

TWO 4000-KV-A. 13,200-VOLT CONDENSERS CORRECT POWER-FACTOR.

Power-Factor Raised from 76.4 to 86% and Improved Voltage Regulation Major Advantages.

The Hydro-Electric Power Commission of Ontario is operating two 4000-kv-a., 13,200-volt synchronous condensers at its Toronto Terminal station for the express purpose of bringing up the power-factor and improving voltage regulation. Each machine obtains its excitation from its individual exciter, which is belt driven. The condensers are connected to the

13,200-volt bus, which in turn receives its energy from the incoming 110,000-volt lines through transformers. It has been found that the total kilowatt capacity of the station has been increased 12% by the use of these two synchronous condensers.

The following data was obtained during special tests soon after the machines were installed and indicate the power-factor can be raised from 76.4 to 86%, representing a reduction in wattless current of 21%, which not only increases the capacity of the transformers in the Toronto substation but likewise reduces the line loss and thereby extends the line capacity of the transmission lines and the generating capacity at the other end of the line. Voltage regulation is correspondingly improved.

	Condensers both off.	One condenser operating.	Both condensers operating.
Input to consumers, kw......	0	310.0	619.5
Input to condensers, kv-a.....	0	3450.0	7052.0
Total excitation in kw.......	0	39.41	76.15
Power-factor Toronto station load (lag)	76.4%	81.0%	86.0 %
Power-factor of total hydro load measured at Niagara.	84.9%	85.4%	88.6 %
Power-factor of condenser bus		9.0%	8.78%
Watless factor, Toronto station load	64.5%	58.5%	51.0 %

DATA UPON KINGSBURY THRUST BEARING OPERATION.

Hydraulic Turbine Characteristics, Lubrication and Bearing Loads and Friction.

The Kingsbury bearing, invented by Albert Kingsbury about 1910, is largely used for the step and thrust bearings of hydraulic turbines, for steam turbines and also centrifugal pumps. The bearing in its simplest form consists of one or more pivoted segments or shoes against which the thrust collar presses as it rotates. The bearing faces are copiously supplied with oil so that perfect film lubrication takes place with its resultant low friction coefficient. That this type of bearing may be employed when the load carried is either great or small, the speeds high or low, and the oil heavy or light, is proved by some very complete tests, which are described in a paper presented by H. A. S. Howarth before the A. S. M. E. at the New York meeting held this month.

Tests were made upon various machines, including a steam turbine driving a large passenger steamer. However, central-station operating engineers are chiefly interested in the influence of the tests upon hydraulic turbine bearings and lubrication in general. Hydroelectric units ordinarily run on light engine oils and the film thicknesses are therefore much less at any speed and load than would be the case if heavy oils were used. They have to start and stop under practically full thrust load, consequently that service may be considered as the most severe for thrust bearings. When one of these units slows down it passes gradually through the whole range of speeds from normal to the very low speed at which the oil film breaks in the thrust bearing. All this time the friction coefficient, and hence the torque required to turn the rotor, is reducing. When the film breaks up the friction coefficient immediately increases and the rotor comes to rest.

Consideration of these severe service conditions suggests the following questions: At what surface speed does the film break? What happens to the bearing if it continues to turn after the film breaks? Does the film break suddenly? These questions are of great importance.

It is known that in a given bearing carrying a known load the film thickness at a given speed is greater for a heavy oil than for a light one. Hence a heavy oil will sustain a given load at a lower speed than will a light oil. It may be assumed that the oil film breaks when it gets so thin that the high spots begin to rub. If the bearing surfaces are poorly fitted the film will break at a higher speed than otherwise. When it is said that high spots rub on each other it is not meant that the metals come into contact with no oil between them. If the high spots are wet with oil, oil will persist in remaining between them. The local pressure may be enough to cause the softer of the two spots to be "ironed off" or crowded back out of the way. If the high spots are not of great magnitude the local heating will not be sufficient to make trouble and as soon as the high spots rub they will pass and cool. The softer high spot will recede on cooling and may even fall below the general surface. If the harder surface be perfectly flat it might iron off the soft high spots and make the soft face also flat. If the harder face is not perfectly flat the softer face will gradually conform to it as far as possible.

The results of the tests already carried out indicate that the lower the speed at which the Kingsbury bearing is run continuously, the better the condition of the bearing surfaces. Speeds as low as 0.38 r.p.m. have thus far been employed and further tests will be made with yet lower speeds. The range of pressures that may be employed extend from the initial test of 132 lbs. per sq. in. and a light oil to as high as 2000 lbs. per sq. in. with a light and a heavy oil.

INTERESTING METHOD OF HANDLING EXHAUST STEAM AND ELIMINATING CLOSED HEATER.

Excerpt from Paper Before Station Operating Meeting, Ohio Electric Light Association.

By W. H. Aldrich.

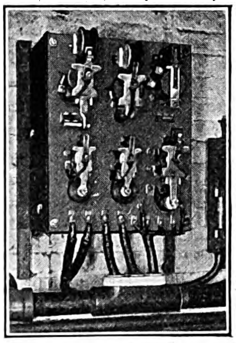
In the turbine room at the Lake Shore station of the Cleveland Electric Illuminating Co. is a system for handling the exhaust steam from the auxiliaries which I believe is rather unique. We have a separate but similar system for each turbo unit. The main feature of this system is a barometric condenser mounted above a large iron storage tank connected to the common feed pump suction header. The tank is the base of the barometric condenser tail pipe. All exhaust steam from the auxiliaries of that turbo unit are piped to this condenser, and the condensate from that turbo unit is pumped through this condenser to act as cooling or condensing water for the auxiliaries' steam. The original turbo condensate and the auxiliaries condensate, mixed together, then drop down the tail pipe into the heater tank. The results obtained are evident, for we are enabled to do away with the closed heater with its leaky tubes and repairs. There is no back pressure on the auxiliaries, and all the condensate and heat from both main unit and auxiliaries is returned to the feed water tank. A balanced relief valve is installed on the steam exhaust line to take care of the pressure when first starting up before the turbo condensate is available for condensing water.

New Appliances

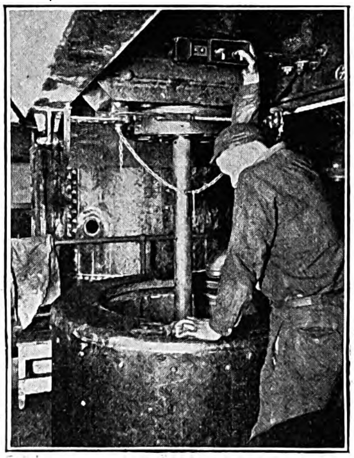
Unique and Economical Push-Button Control System—New Insulating Compound—Miniature Direct-Current Meter

Motor-Driven Centrifugal with Push-Button Control Increases Production 50%.

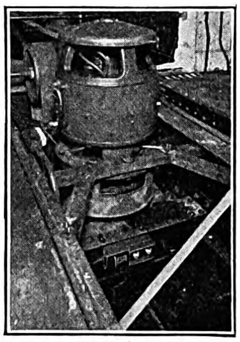
An interesting installation of a motor-driven centrifugal extractor entirely controlled by electric push buttons has recently been made at the plant of Kirkman & Sons, Brooklyn, N. Y. The centrifugal, which has a diameter of 40 ins., was built and installed by the S. S. Hepworth Co., and is direct-connected through a centrifugal clutch to a 25-hp., 220-volt vertical motor mounted on the floor above. While running at 500 r.p.m. the centrifugal is filled with 750 lbs. of glycerine salts. Four minutes are required for loading and the speed is then increased to 1000 r.p.m. for two minutes. After water has been supplied for washing the salts, the centrifugal is run for two minutes more at high speed, at which time all moisture has been thrown off, the complete cycle of operation requiring between nine and ten minutes.



Magnetic Control Panel for Two Speed Selection.



Through Convenient Push Buttons Operator Can Start or Stop Extractor and Run It Slowly or Fast Without Distracting His Attention.



Driving Motor Mounted on Floor Over Extractor.

Four push-button switches, placed convenient for the operator, allow complete and easy control of the centrifugal. Two buttons of the momentary-contact type are used for stopping and running, and the other two buttons provide the slow and fast speeds—500 and 1000 r.p.m.

The buttons open and close the circuits which actuate the magnetic contactors and relays on a special controller, manufactured by the Cutler-Hammer Manufacturing Co., Milwaukee, Wis. An explanation of the operation of the controller by means of the push buttons will illustrate how perfectly the control meets the demands required of the motor and centrifugal. To start the centrifugal and run it at slow speed for loading, first the "slow" and then the "run" button is depressed. The latter causes the main-line magnetic switch to close, starting the motor with three steps of resistance in series with the armature. As the speed of the motor increases and the armature current decreases, the three accelerating lockout switches close one by one, each switch cutting out one step of resistance. They will not close, however, until the current has fallen to a predetermined value. The final switch, which shunts out all the resistance steps, is provided with a shunt coil which keeps it from dropping out should the current drop or become reversed, due to the peculiar condition pertaining to this kind of installation. This condition is produced by a sudden drop in line voltage, which causes the motor to be driven by the rapidly revolving centrifugal and generate current back into the line. The field circuit has one step of resistance, which is instantly cut out by the closing of a field-strengthening relay when the "run" button is depressed, the relay remaining closed during the acceleration to 500 r. p. m.

When the "fast" button is depressed, the field-strengthening relay opens, placing the field resistance in circuit, and the motor commences to accelerate from 500 r.p.m. to 1000 r.p.m. However, if this resistance were left in the field circuit during the entire accelerating period, the continuous heavy armature current produced would cause undue heating of the motor and, therefore, a vibrating type of field-accelerating relay is used to alternately cut the resistance in and out of circuit until the motor has reached the maximum speed. It will be noted that the field resistance is never cut in circuit until the armature resistance has first been all cut out.

The motor can be accelerated directly from a standstill to the maximum speed by depressing the "run" button while the "fast" button is "on." Depressing the "stop" putton releases the magnetic main switch which opens the armature circuit and brings the accelerating contactors and relays back to their normal positions.

The complete and easy control obtained by the push buttons allows the operator to carefully watch each run of salts, hence the best results can be obtained. In this particular installation and in others where the manufacturing process requires two operating speeds, this type of controller has been found very desirable. It is not only an inexpensive means of securing two speed operations, but it also permits the operator to secure either the slow or fast speeds by the mere pressing of a button.

It therefore enables him to devote his entire attention to the work and does not necessitate his going to and from a field rheostat located on the control panel, or elsewhere, to secure each change in speed. Furthermore, the current is limited to a safe value, and the motor cannot be accelerated too rapidly, as is sometimes the case when speed adjustment is secured through the common type of manually operated field rheostats.

Production records at the Kirkman & Sons plant show that since this automatically controlled centrifugal has been installed, the production has been increased about 50% and only 1% of the glycerine remains in the salts, whereas with the former equipment about 8% remained.

Cumar—A New Synthetic Insulating Material.

There is now being marketed a synthetic resin known by the trade name of "Cumar," which is proving of exceptional interest to manufacturers of electrical equipment.

Cumar, otherwise known as "Paracoumarone Resin," is manufactured by a special chemical process from certain coal-tar distillates. In appearance, it resembles ordinary resin but its properties are radically different; it is unaffected by water or any of the ordinary chemicals; it is neutral in its action, and unlike resin, will not saponify. It is said to be absolutely nonoxidizing so that exposure to the air or weather will not change it. Cumar is soluble in practically all commercial solvents of insulating compounds, with the single exception of alcohol. It combines readily with vegetable oils and with many waxes.

In addition to these properties, its

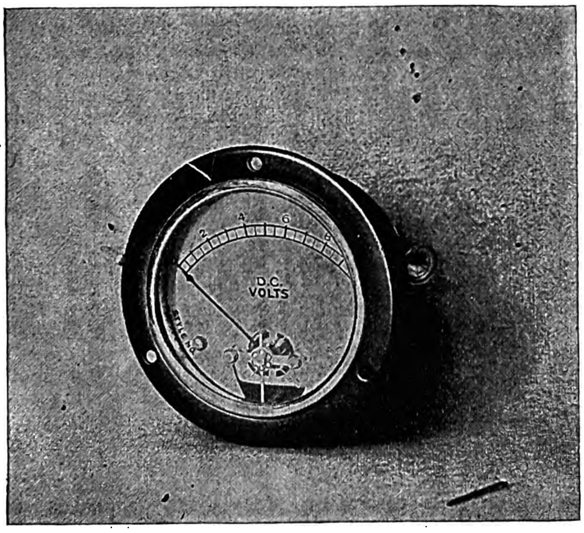
particular interest from the electrical standpoint is the fact that it has a high dielectric constant and is an excellent insulator. Resistance tests made by the Bureau of Standards on representative samples of Cumar show that in both volume and surface resistivity Cumar compares favorably with the more generally known insulating materials; in fact, the only common materials having a higher insulating power are paraffin and the ceresin waxes. A valuable property in this connection is the high surface resistivity of Cumar, particularly when exposed to moist air. In the Bureau of Standards tests, the surface resistivity dropped less than 10% when the humidity was increased from 30% to 90%. In molded insulation it is claimed that the surface resistivity is increased approximately 20% over a phenol condensation compound designed for similar uses.

The principal uses which Cumar has found so far in the electrical industry are as a base for insulating varnishes and lacquers, as a coil filler and in compositions for use in making molded insulation.

Cumar, which is manufactured by the Barrett Co., Chemical Department, 17 Battery place, New York City, is marketed in 9 different melting-point grades, ranging from a soft plastic material of melting point about 122 deg. F. to a hard brittle material with a melting point of over 302 deg. F.

Novel Type of Miniature Electrical Measuring Instruments.

With an over-all diameter of 2 9/16 in.—slightly larger than that of a gentleman's watch—and a weight of only 4 ounces, a novel type of miniature electrical instruments for the measurement of voltage and current is proving effective and reliable on small panels where economy of space, together with high accuracy and neatness of appearance, is imperative. It is especially applicable to the measurement of small direct currents, such as the filament and plate currents of radio communication sets, or those in connection with farm lighting and other small charging and lighting sets, or in use with dental and electromedical work.



Flush Type Direct-Current Voltmeter.

To meet the growing demand for instruments of small size, together with increased sensitiveness and greater accuracy, the Westinghouse Electric & Manufacturing Co. has developed this miniature type. It combines extreme delicacy of action with high sensitivity and ruggedness, and the design, construction, and materials are such that the instruments are permanently accurate.

A salient feature of design wherein these instruments differ from the other makes consists in the method of supporting the cylindrical core and movable element between the pole pieces of the magnet. Instead of providing for this purpose a casting supported at the back of the instrument independently of the magnet and pole pieces and therefore requiring, in order to secure accuracy, a high degree of machining, the new Westinghouse instruments make use of two simple, easily and inexpensively made bronze-alloy punchings securely fastened to either side of the pole pieces.

This departure makes the instrument more compact, greatly simplifies the construction, and lessens the amount of space required within the case, thereby making it practical to construct the instrument to miniature dimensions and secure at the same time a high degree of accuracy, reliability and sturdiness of design.

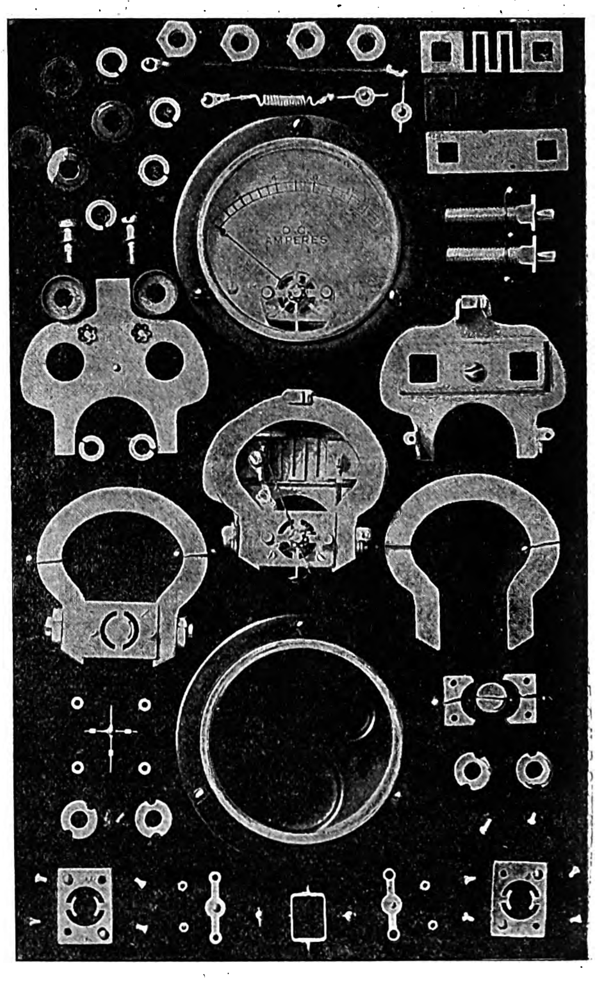
Another departure from a method in common use with other makes consists in the insulation, by oxidation instead of by paper, of the small aluminum frame which carries the coil of the movable element. The oxide of aluminum thus used is highly effective as an insulator and greatly facilitates the mounting of the coil.

The fastening of the pivot support of the movable element constitutes an additional departure from older practice. The base of the support, instead of being cemented directly to the coil, is elongated and clinched around either side of the aluminum frame of the movable coil. This gives a more accurate centering of the pivots.

By combining the millivoltmeter with a noninductive heater and thermocouple, it is made suitable for the measurement of high-frequency alternating currents, such as are encountered in radio communication. The same instrument can also be operated on alternating-current circuits of commercial frequency, provided they are not subjected to overloads.

The instruments can be furnished for mounting with the face flush with the panel, or for projection. They are arranged for rear connection. The standard finish is white dial, nickel bezel ring, and black marine case. Black-dial instruments can also be furnished, if desired.

All instruments are checked throughout their entire range for accuracy. The calibration at any point of the scale within 2% of full-scale reading on direct current and radio-frequency current of the frequencies now in use. These instruments are the smallest of the D'Arsonval (that is, moving coil and permanent magnet) type that are being regularly manufactured.



Miniature Instrument Disassembled, Showing Parts.

Trade Activities

Emerson Electric Lets Contracts for Large Factory Extension—Industrial Haulage Problems—Trade Literature

Electrical Sales Agency, with headquarters at 22 West 32nd street, New York City, would like to secure the representation of several manufacturers who are desirous of selling their product to the jobbing trade of New York, and surrounding territory. This concern would also like to entertain sole agency propositions.

Roller-Smith Co., 233 Broadway, New York, announces that its California representative, the Electrical Material Co., 589 Howard street, San Francisco, has opened a Los Angeles office in the Title Insurance building. The Los Angeles office is in charge of E. H. Bell, who has had extensive experience in marketing electrical products. The Electrical Material Co. handles the Roller-Smith lines of electrical measuring instruments, watt-hour meters and circuit breakers in California, Nevada and parts of Oregon and Idaho.

Central Electric Co., 316-326 South Wells street, Chicago, is making distribution of a new 16-page catalog dealing with Maxolite RLM standard dome diffusers, which are designed specially for use in machine shops, textile mills, woodworking plants and practically all other places where close work is done. It illustrates and describes various types of Maxolite reflectors and contains considerable technical data on industrial lighting. The Duplexalite fixture for residence ilghting, Alexalite system of illumination designed for both offices and residences, and Four-in-One lighting fixtures for store and office illumination are also illustrated and briefly described.

Hays School of Combustion, Chicago, announces that W. L. Abbott, chief operating engineer of the Commonwealth Edison Co., has associated himself with the staff of reviewing and supervising editors. Mr. Abbott is well known in the power plant field because of the responsible position he holds with the utility operating the largest power houses in the world. He ranks as one of the foremost operating and power plant engineers in the country and has contributed richly to the technical press. Mr. Abbott has always taken a keen and practical interest in young engineers and educational matters in general. For many years he was president of the board of trustees, University of Illinois, and is still on the board of trustees. He has been a prominent member of the A. I. E. E., A. S. M. E., N. E. L. A. and the W. S. E. of which latter he has been president. In matters pertaining to engineering and education, the collaborators working with Mr. Abbott are David Moffat Myers, Joseph W. Hays, Joseph Harrington, Prof. S. W. Parr, Fred Low and A. L. Rice.

Link-Belt Co., Chicago, has issued Booklet No. 421 containing an illustrated article by James Monroe on the subject, "Handling Coal and Ashes with Electric Hoists." It sets forth the marked economy in labor resulting from use of Link-Belt hoists for coal and ash handling in power plants of moderate size. In these plants many difficulties in the way of effective and economical mechanical handling were successfully overcome.

R. S. Mueller Partnership Dissolved.—The partnership of R. S. Mueller & Co., Cleveland, engaged in the manufacture of electric test clips and battery charging clips, has been dissolved as of Dec. 1, Ralph S. Mueller having purchased the interest of George G. Dusinberre. Mr. Mueller will consolidate the clip business with that of the Mueller Electric Co., and under that trade name will continue the manufacture of clips, attachment plugs, battery handles and other electric specialties.

J. L. Wolf, secretary of the Lighting Fixture Dealers Society of America, is issuing a series of letter bulletins on the advantages of carton packing for illuminating glassware and suggesting methods of putting this reform in operation. While these bulletins were prepared originally for confidential circulation to members of the fixture dealers society, it has been decided to send them on request to anyone interested in the improvement of fixture and lighting trade conditions. Copies can be secured from Mr. Wolf, care of Builder's Exchange, Rose building, Cleveland, O.

Emerson Electric Co., St. Louis, Mo., manufacturer of electric disk fans and motors, has let contracts for a new 8-story building to adjoin its present quarters, this will involve an expenditure of $600,000. The company announced about 2 weeks ago that $1,000,000 of 7% cumulative preferred stock had been issued for this purpose. The new building, which will provide employment for 1000 persons, will be equipped with an electric light and power system, a heating plant and five passenger and freight elevators. The general offices will be located on the sixth floor and the shipping rooms on the first floor. One portion of the building will contain an electric substation and there will be fireproof rooms under which will be installed gasoline and oil tanks. The remainder of the plant will be devoted to manufacturing purposes. The company has been literally inundated with orders for its products and is said to have refused orders totalin $3,000,000 during the last 4 months because its manufacturing facilities were inadequate to meet the demand for its products.

Dudlo Manufacturing Co., Fort Wayne, Ind., has recently issued a new folder, superseding all previous bulletins which includes tables giving outside diameters of its enameled, silk-covered and cotton-covered magnet wire, as well as additional data on bare copper wire.

Barkelew Electric Manufacturing Co., Middletown, O., manufacturer of Barkelew knife switches and specialties, is making distribution to the trade of a new bulletin (No. 24), 6x9 ins., giving dimensions of front connection switches for the selection of iron boxes and drilling dimensions of its knife switches. The bulletin is perforated to fit the binding strip in the back of catalog No. 22. This bulletin is also furnished in loose leaf sets, 8½x10 ins., and perforated to fit the Electrical Supply Jobbers Association binder. Any quantity of these bulletins will be furnished upon request to the company.

Lakewood Engineering Offers Unusual Inducement to Study Industrial Haulage.—As an inducement to industrial plant managers, engineers and others to study their interdepartment transportation problems and more fully realize how industrial tractors and trucks help to conserve labor and increase production, an offer of three awards for the three best analyses of the application of the new tier-lift truck is announced by the Lakewood Engineering Co., of Cleveland. To get increased production with present labor conditions is uppermost in the minds of business executives. The correct use of industrial haulage equipment will, in many cases, solve the problem. This truck is different, in every respect, from the equipment heretofore offered for plant transportation. It combines a tiering machine with a storage battery truck, thus making a load carrying unit that will, by electric power, elevate its 2-ton load to any height up to 76 ins. from the floor. Three awards—$1000, $500 and $250—are offered for the three best papers on the application of the new Lakewood tier-lift truck. The award committee, appointed by the Society of Industrial Engineers, consists of: A. Russell Bond, chairman, editor Scientific American Supplement, New York City; Professor Dexter S. Kimball, dean of the School of Engineering, Cornell University, Ithaca, N. Y., and Irving A. Berndt, president of C. E. Knoeppel & Co., New York City. All papers must be in the hands of Mr. Bond by Jan. 30, 1920. The awards will be made prior to Feb. 28, 1920. Details of the contest will be sent by the Lakewood Engineering Co., Cleveland, upon request. The contest is open to all except employes of the Lakewood Engineering Co.

Current News

Weekly Record of Construction Activities—Conventions

EASTERN STATES.

Otter Cliffe, Me.—The Bureau of Yards and Docks, Navy Department, Washington, has had plans prepared for the erection of a new radio station at this place.

North Stratford, N. H.—Warner Sugar Refinery Co., 70 Wall street, New York, has arranged for the erection of a 1-story power plant, 64x120 ft., at its local works.

Springfield, Mass.—New England Westinghouse Co., Chicopee Falls, is planning for the construction of an addition to its plant at East Springfield to cost about $150,000. The structure will be equipped for the manufacture of small motors.

Bridgeport, Conn.—Bryant Electric Co. has filed plans for the erection of a machine works and automobile service building for company cars, 1 story, 56x117 ft., to cost about $10,000.

Cranston, R. I.—United Wire & Supply Co., Auburn, will build a 2-story addition to its plant, 40x250 ft., to cost about $100,000.

Buffalo, N. Y.—Intervillage Electric Corp., Buffalo, has been merged with the Depew & Lancaster Light, Power & Conduit Co., Depew, N. Y., under the latter name.

Churchville, N. Y.—An electric power plant and transmission line will be erected by Alderman, Fairchild & Co., 367 Orchard street, Rochester.

Fillmore, N. Y.—Genesee Valley Power Co. is planning to extend its service by an electric line from Fillmore to Belmont, to allow lighting Belfast and Angelica en route. Work on the new line will begin early in the spring. The corporation now serves the villages of Fillmore and Pike.

Livingston, N. Y.—Livingston-Niagara Power Co. has increased its capital to $150,000 for proposed expansion.

Long Island City, N. Y.—Queens Electric Light & Power Co. has filed plans for the erection of a new 1-story automobile service plant for company trucks and cars, 38x200 ft., on Read street, near Jane street, to cost about $150,000, including equipment installation.

New York, N. Y.—Western Electric Co., 195 Broadway, has leased the 7-story building at 537-45 Greenwich street, 100x100 ft., for a term of years at an aggregate rental of $300,000. The company will use the structure for different features of business.

New York, N. Y.—Central & South American Cable Co. has entered into contract with the Government of Brazil for the construction of a new cable line from Rio Janeiro to Cuba. This assures a direct all-American line from the United States to Brazil.

New York, N. Y.—Vermont Hydro-Electric Co. has filed notice of authorization to operate in New York, with capitalization of $1,000,000. C. N. Wilson, 50 Pine street, is representative.

New York, N. Y.—Western Union Telegraph Co. has been granted permission by the Government of Peru to establish a new cable relay station at Pimentel, Peru, a point about midway of the projected cable line of the company, approved by the Government of Chile, on Nov. 27. Construction work will be inaugurated at an early date.

Schenectady, N. Y.—General Electric Co. is completing plans for the erection of a 6-story building at its local works, 54x219 ft., to cost about $400,000. Harris & Richards, Drexel building, Philadelphia, Pa., are architects.

Schenectady, N. Y.—Weber Electric Co. has increased its capital from $25,000 to $100,000.

Bayonne, N. J.—In connection with the erection of a large addition, the Bayonne Hospital, East 30th street, near the City Hall, will build a new power plant for service at the institution and a mechanical laundry works. The entire project is estimated to cost about $250,000.

Camden, N. J.—Eavenson & Levering, operating a wool scouring plant, have arranged for the installation of new boilers and auxiliary equipment for increased power capacity.

Dover, N. J.—Electrical and mechanical equipment will be installed by the Republic Steel Co., formerly known as the Wharton Steel Co., in connection with improvements and extensions at its blast furnaces and steel plant at Wharton. An electrically operated ore bridge will be constructed, new blast furnaces erected, coke ovens installed, and plans are under way for a new steel finishing plant and sintering works. The project is estimated to cost about $3,000,000. H. M. Roche is consulting engineer; the work will be carried out under the supervision of Arthur G. McKee & Co., Cleveland, Ohio.

Metuchen, N. J.—Large quantities of electrical apparatus have been sold by the Emergency Fleet Corp. at public sale conducted from its local warehouse. Among the different items and prices are 6000 Edison plug fuses, 4 cts. each; dry batteries, 25 cts. each; telephone line stations, $5 each. More than 1000 different items are being sold.

Newark, N. J.—New York Telephone Co. has perfected plans for the proposed extensions to its exchange plants in this vicinity to cost about $650,000. The main building at 281-285 Washington street will be increased in height from 9 to 13 stories, at a cost of about $300,000; an addition will be erected to the exchange plant at 59 Bloomfield avenue to cost $200,000; and an extension made to the exchange at 176 Avon avenue to cost $150,000.

Perth Amboy, N. J.—Considerable electrical and mechanical machinery and equipment will be required for the large addition to be constructed at the plant of the Perth Amboy Dry Dock Co., foot of Broad street. A new dry dock, mechanical and electrical shops will be constructed. Lockwood, Greene & Co., 101 Park avenue, New York, are architects and engineers.

Trenton, N. J.—Hildebrecht Ice Cream Manufacturing Co. will build a new ice and refrigerating plant to cost about $30,000. Considerable electrical equipment will be installed.

Trenton, N. J.—Crescent Insulated Wire & Cable Co., Olden and Taylor streets, has acquired additional property on Webster street for the erection of an addition to its works. The company will install oil-burning equipment in its power plant, changing from coal to such type of fuel for general operation.

Whitehouse, N. J.—The Readington Township Committee is planning for the installation of an electric light and power system in this section. A lighting district has been mapped out, and it is proposed to enter into negotiations with some of the neighboring power companies to extend their lines to this point. County Engineer Grant Davis will be in charge.

Wilmington, Del.—Plans have been filed by the Standard Kid Manufacturing Co., 4th and Monroe streets, for the erection of a new 1-story boiler plant, about 40x40 ft.

Wilmington, Del.—Unger Storage Battery Co., 12th and Madison streets, has filed plans for the erection of a 1-story addition to its plant.

Allentown, Pa.—The engine plant at the stone quarries of Herbine & Ziegenfus was destroyed by fire on Dec. 14. The plant will be rebuilt.

Allentown, Pa.—Electric Bond & Share Co., 71 Broadway, New York, has inaugurated construction work on extensions to its power stations and transmission lines in this section. The work is estimated to cost $3,000,000.

Freeburg, Pa. — Northumberland County Gas & Electric Co., Sunbury, is planning for the installation of an electric light and power system here.

It is proposed to have the new system ready for service by the coming spring.

Hazleton, Pa.—A new coal washery will be constructed at the Silver Brook mining properties, to be electrically operated. Service will be furnished by the Harwood Electric Co.

Johnstown, Pa.—To provide for its new power project, the Penn Public Service Co. has arranged for a bond issue of $4,000,000. The company has preliminary work under the way on a new steam-driven power plant at Seward, near Johnstown, to cost about $1,500,000. Operations are conducted in Cambria, Somerset, Indiana, Clearfield, Centre and Westmoreland counties and general expansion work is planned. The territory served has a population of about 400,000.

Philadelphia, Pa.—A new 1-story boiler plant, 42x66 ft., to cost about $25,000, will be constructed by the Continental Mills Co. at its plant at Armat and Lena streets.

Philadelphia, Pa. — Manufacturing Co. of America, 12th and Hamilton streets, will install new boiler equipment at its power house for increased capacity.

Philadelphia, Pa. — Construction work has been commenced on the boiler plant to be erected at the new factory of the American Preserve Co., 946 Beach street; the structure will be 50x70 ft. The entire plant is estimated to cost $400,000.

Philadelphia, Pa. — The largest shipbuilding crane ever constructed has been placed in operation at the League Island Navy Yard of the Government at Philadelphia. The crane is electrically operated throughout; it has a lifting capacity of 350 gross tons, and is equipped with an auxiliary hoist, operating on a horizontal trackway between the two main 175-ton hoist runways. It is of stationary pintle cantilever type. The crane was built by the McMyler-Interstate Co., Cleveland, Ohio, and will be used for fitting out work at the yard.

Pittsburgh, Pa.—Pittsburgh Reflector & Illuminating Co., a New Jersey corporation, has increased its capital from $15,000 to $50,000.

Pittsburgh, Pa.—Jones & Laughlin Steel Co. has filed plans for the construction of a new 1-story pumping plant on 2d avenue, near Bates street, to cost about $15,000.

Reading, Pa.—Metropolitan Edison Co. has closed a 5-year contract with the Eastern Pennsylvania Railways Co., operating at Pottsville and vicinity, for electric energy, providing for a minimum of 2000 kw. and maximum of 4500 kw.

Wilkes-Barre, Pa.—Kitsee Battery Co., 62 North Main street, will build a 1-story addition, 40x80 ft., to cost about $10,000.

Annapolis, Md.—The Bureau of Yards and Docks, Washington, has awarded a contract to the Levering & Barrigues Co., 552 West 23d street, New York, for the erection of a new power plant at the local navy yard. The contract covers the building work.

DATES AHEAD.

American Society of Civil Engineers. Annual meeting, New York City, Jan. 21-22, 1920. Secretary, Charles W. Hunt, 33 West 39th street, New York City.

Western Association of Electrical Inspectors. Annual convention, St. Louis, Mo., Jan. 27-29, 1920. Secretary, W. S. Boyd, 175 West Jackson boulevard, Chicago, Ill.

National Council of Lighting Fixture Manufacturers. Annual convention, Detroit, Mich., Feb. 9-13, 1920. Secretary-treasurer, Charles H. Hofrichter, Cleveland, O.

Oklahoma Utilities Association. Annual convention, Oklahoma City, Feb. 10-13, 1920. Secretary, H. A. Lane, 611 State National Bank building, Oklahoma City.

Central Electric Railway Association. Annual meeting, Louisville, Feb. 26-27. Secretary, A. L. Neereamer, Indianapolis, Ind.

American Electrochemical Society. Annual convention, Boston, Mass., April 7-10, 1920. Friday, April 9, joint session with American Institute of Electrical Engineers on "Electrically Produced Alloys." Secretary, Joseph W. Richards, Bethlehem, Pa.

National Electric Light Association. Annual convention, Pasadena, Cal., May 18-21, 1920. Headquarters, Hotel Huntington. Acting secretary, S. A. Sewall, 29 West 39th street, New York City.

National Association of Electrical Contractors and Dealers. Annual convention, Baltimore, Md., Oct. 6, 1920. Secretary, W. H. Morton, 110 West 40th street, New York City.

Baltimore, Md.—Consolidated Gas, Electric Light & Power Co., Lexington building, is planning for the erection of a 2-story factory, 53x100 ft., on Kloman street, to cost about $50,000. The structure will be equipped for the manufacture of gas appliances.

Salisbury, Md.—Eastern Shore Gas & Electric Co. has arranged for a preferred stock issue for general expansion. The company serves this section with electric light and power.

Bluefield, W. Va.—American Armature Engineering Co., recently incorporated with a capital of $25,000, is planning for the establishment of a local electric plant. A. A. Grant and A. D. Knight head the company.

Weston, W. Va.—Weston Milling Co. is planning for the construction of a new transmission line to Seebert to cost about $50,000. George I. Keener is president.

Weirton, W. Va.—In connection with the construction of the proposed new plant of the Weirton Steel Co., contracts for which have recently been awarded, arrangements have been made for the construction of a large extension to the blast furnace power station, providing for the installation of 5 600-hp. boilers equipped with underfeed stokers. The installation will comprise 2 7500-kw. turbogenerator units, as well as switchboard and auxiliary apparatus. Large quantities of electrical equipment will be required in connection with the construction of the mills proper, and contract has been awarded to the Westinghouse Electric & Manufacturing Co., Pittsburgh, Pa., for the furnishing of 2 4000-hp. motors; 2 1500-kw. motor-generator sets to be installed in the direct current substation at the blooming mill; contract has been let to the General Electric Co., Schenectady, N. Y., for switchboard equipment; the Power Specialty Co., New York, will supply a 600-hp. waste heat boiler equipped with super heaters; while the Vulcan Soot Cleaner Co., Chicago, has been awarded the contract for soot blower equipment. When completed, the new plant will have an annual capacity of about 400,000 tons of ingots, and the company is arranging for the completion by June, 1920.

Hertford, N. C.—The Board of Trustees has approved a bond issue of $125,000 for improvements and extensions in the municipal power plant and city water works.

Lakeview, N. C.—Electric Light & Power Co. has increased its capital from $75,000 to $300,000 and contemplates plant enlargement. J. R. McQueen is president.

Conway, S. C.—Conway Lumber Co. is in the market for a 25-kw. generator, 3-phase, 60-cycle, 240-volts, belted or direct connected.

Denmark, S. C.—American Telephone & Telegraph Co. will erect a $75,000 to $100,000 office building. It will be 3 stories high and used for lunch room, employment and operating room, etc.

NORTH CENTRAL STATES.

Dover, O.—The city voted bond issue of $100,000 to enlarge its municipal electric plant and to replace natural gas engines with steam engines.

Bad Axe, Mich.—A committee has been appointed to look into ways and means to improve water system. The committee also agreed that there are but two things in sight—either the sale of the present plant and a franchise to private parties or a new municipal plant, which it is estimated would cost at least $75,000. The committee is now working on the proposition.

Charlotte, Mich.—The city council is interested in the proposition of the advisability of installing an electrical equipment at the city water works station.

Muskegon, Mich.—Shaw Electric Crane Co. contemplates an addition to its plant which will double its capacity.

Colfax, Ind.—Colfax Electric Co. has petitioned for authority to issue $20,000 in bonds for extension to light system. Address general manager.

East Chicago, Ind.—Bates Expanded Steel Truss Co. of East Chicago and Savona, Italy, has opened its new plant at Savona. It was built by Walter Bates and is a duplicate of the one at East Chicago. The Bates company manufactures latticed steel poles and has had heavy contracts from the ministry of railways of Great Britain and from traction companies in Swedish cities. Large numbers of the poles are in use in Africa and India.

East Chicago, Ind.—In an application to the Indiana Public Service Commission for permission to issue bonds for $161,000 for the completion of its filtration plant at East Chicago, the East Chicago and Indiana Harbor Water Co. stated that construction work to date had cost $244,199. According to these figures the filtration plant when completed will cost the company $405,699. The original estimate was $225,000. The headquarters of the East Chicago and Indiana Harbor Water Co. are at Indianapolis, Ind.

Indianapolis, Ind.—Liquid Carbonic Co. of Chicago has purchased a site and will erect a plant for the manufacture of carbonic gas. J. B. Olwin, manager of the Liquid Carbonic Co. of Chicago.

Indianapolis, Ind.—The Indiana Telephone Association has been incorporated with the purpose of protecting investments in telephone properties. The organization is composed of all the telephone companies of the state. Among those interested are Claude R. Stoops, Napanee; William N. Bailey, Richmond, and Frank O. Cuppy, Lafayette.

Indianapolis, Ind.—Prest-O-Lite Co. will build a 2-story battery house, 100x400 ft. to cost $400,000.

Logansport, Ind.—The Cass County Chamber of Commerce will have a survey made of the Wabash river at Logansport with a view of using power of the river for an electric power and light plant.

Chicago, Ill.—A new plant 27x306 ft., is contemplated by the Federal Electric Co. and will involve an expenditure of $150,000.

Chicago, Ill.—The trustees of the sanitary district have decided to build a new hydro-electric plant at Lockport. Its construction will take "the major portion of two years," cost an aggregate of $2,000,000, of which the trustees agreed that $750,000 shall be spent next year, and increase the gross revenue of the district from electric energy "above $300,000 annually."

Bruce, Wis.—The sum of $12,000 in bonds has been voted for municipal lighting system. L. H. Stenson, city clerk.

Colfax, Wis. — Colfax Light & Power Co. will spend about $200,000 to increase the capacity of its hydro-electric plant.

Lancaster, Wis.—Farmers' Telephone Co. will erect telephone exchange and office building on East Maple street. The building will be 2 stories, and of brick construction. Work will be started in the spring. Estimated cost $50,000.

Milwaukee, Wis.—Mueller & Son Co. will completely electrify its plant by the installation of a large generator and 65 motors of various sizes.

Tomah, Wis.—Tomah Electric Light Co. contemplates a light plant. Louis W. Barnes, architect, Superior street. Superintendent has not yet been selected.

Waupaca, Wis.—Little Wolf Power Co. will construct power plant and dam on Little Wolf River. Dr. W. H. Finney, Clintonville, is interested. Engineer, L. A. DeGuere, Grand Rapids, Wis. Work is to start Jan. 1 and be completed June 1.

Washburn, Wis.—Wisconsin Telephone Co. has purchased the Bayfield County Telephone Co. New instruments will be installed.

Belview, Minn.—Northern States Power Co., Garrett, O. House, manager, 76 W. 3rd street, will extend its line from Belview, Minn., to Sacred Heart.

Bemidji, Minn.—A company has been formed to install Helga Twp. Telephone line from Bemidji to Helga, 13 miles southwest of here. Line will connect Northwestern Exchange line at M. & I., 2 miles southeast of here. Full metallic line. Adner Stone, secretary of the company.

Clearbrook, Minn. — Clearbrook Electrical Co. will build a power house.

Buffalo, Mo.—The proposition of installing street lights is under consideration.

Brunswick, Mo.—The sale of the Brunswick Light & Water Co.'s plant and lines to the Carrollton Water, Light & Transit Co. has been approved by the State Public Service Commission. The trade includes the sale of the local company's light and water plants here as well as the transmission lines extending from Brunswick to Dalton, Keytesville, Triplett and Mendon. In addition to the Chariton county towns, the Carrolton company will also furnish light to DeWitt, Wakenda, Bosworth, Bogard and Tina, in Carrol county. This will form one of the largest country lighting systems in the state.

Marshfield, Mo.—L. A. Reynolds and T. F. Bowers of Flat River, Mo., have made a contract to purchase the electric light plant from the city of Marshfield and in payment have agreed to furnish the city with lights for a period of 5 years which would amount to $7300.

Maryville, Mo. — Permission was granted by the county court to the Mound City Electric Light & Ice Co. to erect a transmission line from Clyde to Stanberry.

Shannondale, Mo. — Shannondale Light & Power Co. has been chartered with a capital stock of $6000.

Meridan, Kan.—A transmission line is to be rebuilt in the near future to Topeka, a distance of 15 miles. W. B. Rollins, 209 Railway Exchange building, Kansas City, Mo., consulting engineer.

Ness City, Kan.—Election to vote $50,000 bonds for the enlargement of the light plant carried at the recent election. A new 250 hp. engine and generator and other necessary equipment will be installed.

Preston, Kan.—Election to vote bonds in the sum of $31,000 for waterworks improvements is contemplated. L. C. Mosier, city clerk.

Havelock, Neb.—Omaha-Lincoln & Denver Railway will construct 3 interurban lines through the city.

McIntosh, S. D.—A new municipal light plant will be built in the spring. Address city clerk.

Ree Heights, S. D.—E. L. Hager will install 2-hour service electric light plant. L. A. Finnegan, city auditor.

Fargo, N. D.—An election was held by citizens' committee whereby it was voted to issue $150,000 in bonds for municipal lighting.

Mayville, N. D.—R. W. Richards, Western Equipment Co., 63 East 6th street, St. Paul, Minn., will submit estimates to the city council for a light plant.

SOUTH CENTRAL STATES.

Louisville, Ky.—Power and lighting plants and other utilities will be installed by the Country Home Power & Lighting Co. which applied for a charter, with a capital stock of $30,000. W. Ray, Owensboro, president.

Byron, Okla.—Bonds have been voted for an electric light plant.

Donna, Tex.—Donna Light & Ice Co. is understood to be arranging plans for the enlargement of its electric light and power plant, to increase the present capacity. The company has filed notice with the Secretary of State of an increase in its capital stock from $10,000 to $40,000, to provide for the proposed expansion.

Fort Worth, Tex.—C. O. Thorp of Fort Worth has made application to the state engineer of New Mexico for a permit to construct a reservoir and hydroelectric plant on the Pecos river about 5 miles north of the Texas line. The site of the proposed reservoir is near Red Bluff. The project will cost about $600,000.

Kennedy, Tex.—Fire on Dec. 11, which caused a loss of $75,000, destroyed the power plant of the Kennedy Light & Power Co. It is understood that the company is considering plans for immediate rebuilding.

Lufkin, Tex.—Final details are being worked out for the installation of the white way, which will begin about the first of the year, at a cost of approximately $6000.

McLean, Tex.—T. V. Webb, proprietor of the McLean Motor Co., has made arrangements to install an electric light plant of sufficient size to light the business section of the town.

Pittsburg, Tex.—Home Light & Ice Co. plans improvements to its plant involving an expediture of $30,000. Motor-driven ice-making equipment of 20-ton capacity, boilers, etc., will be installed.

Ranger, Tex.—Southwestern Telegraph & Telephone Co. will soon start the construction of a new building to cost between $50,000 and $100,000. J. A. Williams, district manager.

Rock Springs, Tex.—Rock Springs Light Co. will construct an electric light and power plant here. V. A. Brown is a stockholder.

Waco, Tex.—Central Texas Electric Co. of Waco, which plans to construct an interurban electric railway between Belton and Austin, about 50 mi., and between Waco and Temple.

about 60 mi., has appointed B. A. McCarthy, of the Central Texas Engineering & Construction Co., chief engineer. The survey for the proposed line between Belton and Austin is now being made. The project involves the construction of a large electric power station, which will be probably located at Austin.

WESTERN STATES.

Ryegate, Mont.—Montana Power Co. will erect power line to Ryegate for light and power.

Buhl, Ida.—City contemplates a bond issue for waterworks and municipal light system. James J. Chambers, Denver, Colo., interested.

Winnemucca, Nev.—George Wingfield is interested in a $200,000 hotel to be erected. The company also plans to maintain its own electric light plant in the hotel.

Ogden, Utah.—A large storage battery manufacturing plant is to be erected in this city by the Western D-G. Storage Battery Co. Estimated cost $200,000.

FOREIGN TRADE

[Addresses of firms referred to in these trade opportunities may be obtained by writing to the Bureau of Foreign and Domestic Commerce, Washington, D. C., or its branch and local co-operative offices. Request for each opportunity should be on a separate sheet and the file number given.]

Electrical Goods (31,542).—A firm of importers and general commission merchants in India desires to represent manufacturers of hardware, engineers' tools, boiler fittings, mill machinery, electrical fittings and accessories, dynamos and motors, motor cars, etc. Reference.

Material for Electrical Tramways (31,547).—An engineer in Belgium desires to secure the exclusive agency for the sale of machine tools, material for electrical tramways and for steel construction. Quotations should be given c. i. f. Antwerp. Terms, credit of 90 days. Correspondence may be in English. Reference.

Electrical Goods (31,583).—An electrical engineer in Spain desires to secure an agency for the sale in southern Spain of electrical goods, appliances and machinery. Reference.

Electric Light Apparatus (31,590).—A firm of importers in the Netherlands desires to purchase or secure an agency for the sale of automobile accessories, especially electric light apparatus, combined or not combined with electric starter. Reference.

PROPOSALS

Municipal Light Plant.—Bids will be received Jan. 5 for the construction of a $25,000 municipal electric light plant at McIntosh, S. D., to supply electric light, heat and power. L. A. Finnegan, city auditor.

Generating Equipment.—Bids will be received until Jan. 5 by C. L. Trueblood, city clerk, Whittier, Cal., for furnishing and installing 2400 tons 4-24 in. classes B and C c. i. water pipe fittings and equipment for pumping water and generating 200 kw. electric current. Alternate bids for pumping and generating will be taken as follows: (1) 12 x 36-in. high duty cross compound double acting crank and flywheel pumping engine, 2 150-hp. water-tube boilers and one 200-kw. steam turbine generator; (2) same as preceding, excepting generator; (3) 2 direct connected 2200 g.p.m. centrifugal pumps and motors.

NEW PUBLICATIONS

Determination of the Output Characteristic of Electron Tube Generators is the title of Scientific Paper No. 355 by Lewis H. Hull, assistant physicist of the Bureau of Standards, and issued by that bureau of the Department of Commerce, Washington, D. C. The author points out that owing to saturation and rectification effects in three-electrode vacuum tubes, the currents which they deliver to any type of output circuit, when used as a generator, are heavily loaded with harmonics. Experimental results indicate that the frequency of the oscillating currents generated is the natural frequency of the output circuit. Hence this circuit acts as a filter in series with the tube and the direct current power system, and the useful output current is approximately sinusoidal, whatever the distortion of the tube currents, depending in amplitude solely upon the fundamental constituents of the tube currents. General expressions are derived for the power and current output in terms of static characteristics of the generating tube, and are corroborated by experimental results obtained with a particular tube. The price of this publication is 5 cts. and copies may be obtained from the Superintendent of Documents, Government Printing Office, Washington, D. C.

INCORPORATIONS

Indianapolis, Ind.—I. V. Zelander Manufacturing Co. has been incorporated with capital of $25,000 for the manufacture of electrical supplies. The directors are I. V. Zelander, R. A. Coombs and Elmer Kidwell.

Goose Creek, Tex.—Goose Creek Light Power Co. has been incorporated here with a capital stock of $75,000, and will construct an electric light and power plant. The incorporators are W. W. Sloan, R. S. Sterling and T. D. Joiner, Jr.

Lone Star, S. C.—Lone Star Telephone Co. has been incorporated with a capital of $1000. G. Keister, president, and P. C. Way, treasurer.

Tuskegee, Ala.—Tuskegee Light & Power Co. has been incorporated with a capital of $30,000 to operate electric light and power plants and ice plant. D. E. Laslie and others interested.

New York, N. Y.—Sherwood Motor Repair Co., Inc. Capital, $25,000. To operate motor repair works, etc. Incorporators: S. H. Doughty, H. R. Croley and P. A. Zizelman, 28 Park Row, New York.

Malone, N. Y.—Pond Electric & Battery Service, Inc. Capital, $20,000. To manufacture electrical goods, batteries, etc. Incorporators: F. O. Pond, F. R. Kirk and V. E. Maher, Malone.

East Orange, N. J.—Motor Starter & Air Pump Co. Capital, $200,000. To manufacture motor starters and other motor equipment. Incorporators: Gordon Grand, East Orange; E. O. Gordon Grand, E. O. Picking and M. V. McKenzie, East Orange.

Newark, N. J.—Hochbaum-Rylander Co. Capital, $100,000. To manufacture and deal in electric fixtures, etc. Incorporators: Fred and M. Hochbaum, and Ernest Rylander, South Orange.

Wilmington, Del.—Superior Spotlight Co. Capital, $100,000. To manufacture electric flashlights and other electrical goods. Incorporators: M. E. Doto, Horace G. Eastburn and Charles P. Colton, Wilmington.

Indianapolis, Ind.—Volta Battery Co. has been incorporated with a capital of $10,000 to manufacture electric batteries.

Koshkonong, Wis. — Koshkonong Light & Power Co. has incorporated with a capital of $75,000 to erect light and power plant. A. R. Hoard, Ft. Atkinson, John Hetts, Oval, Swart, R. F. D. Ft. Atkinson, interested.

Indianapolis, Ind. — Roll-a-Rocker Co., dealers in electrical specialties, has been incorporated with capital of $15 000 by J. M. Hunter, J. H. Hornstein and Harry K. Lange.

Caroline, Wis.—Caroline Electric Co. has been incorporated with a capital of $6,000. D. F. Breed, Gust A. Radtke, Roy E. Van Behaick, C. B. Hanson, F. R. Bust.

Marion, Ky.—Marion Light, Ice & Coal Co. Capital, $40,000. To operate a local electric and ice manufacturing plant. Incorporators: S. Gugenheim, T. H. Cochran, and O. S. Denny.

New York, N. Y.—East Coast Electrical Supply Co. Capital, $15,000. To manufacture electrical supplies. Incorporators: W. J. Fisher, T. Christianson, and J. V. Schraig, Richmond Hill.

New York, N. Y.—Cellokay Manufacturing Corp. Capital, $500,000. To manufacture special machinery for motor service, etc. Incorporators: Joseph Rucker, W. H. Peck, and A. E. Atherton, 510 West 124th street.

Philadelphia, Pa.—Ward Electric Co. Capital, $30,000. To manufacture electrical goods. Incorporators: Philip H. Ward, Jr.; Ralph P. Ward, 1421 Arch street; and M. L. Brown, Philadelphia.

Personals

W. R. Molinard Resigns—C. S. Beardsley Vacuum Cleaner Manufacturers' Association President—S. P. Brown Dies

FRANK H. BETHELL, formerly vice-president of the New York Telephone Co., New York, recently resigned, was tendered a testimonial dinner at the Telephone Club by his former associates on his retirement from the company.

W. CAMERON FORBES, of Boston, at one time Governor-General of the Philippine Islands, has been elected a director of the American Telephone & Telegraph Co. His father, W. H. Forbes, was president of the first Bell telephone organization.

W. C. BRIGGS, formerly New York district manager of the Shepard Electric Crane & Hoist Co., New York, has accepted a position with the Pennsylvania Crusher Co., Philadelphia. He is succeeded in the New York office of the Shepard company by R. W. Hurst.

ERNEST W. PELTON, for the past 16 years connected with Stanley Works, New Britain, Conn., as mechanical engineer, has become manufacturing superintendent of the hardware factory. He will retain supervision of the electrical and power, as well as the engineering, mechanical and transportation departments.

H. W. GRAEBER, assistant superintendent of construction of the Oklahoma Gas & Electric Co., Oklahoma City, has been promoted to the position of superintendent of construction, effective Jan. 1. He succeeds to the position of H. W. Reilly, who will on that date assume the office as vice-president in charge of operation.

R. DE VERE HOPE, recently discharged from the United States Army, where he was stationed at Edgewood Arsenal in connection with the manufacture of mustard gases, has entered the organization of the Duratex Co., as industrial engineer. Prior to entering the army he was for a number of years connected with the engineering department of the New York Telephone Co.

F. S. MONTGOMERY, for the past 6 years advertising manager of the National Metal Molding Co., Pittsburgh, has tendered his resignation, effective Dec. 31, to become associated with the Ivan B. Nordham Co., outdoor advertising, 8 West 40th street, New York. Prior to becoming advertising manager, Mr. Montgomery was for several years district manager in charge of the Atlanta office of the company.

W. R. MOLINARD, vice-president in charge of operation of the Oklahoma Gas & Electric Co., Oklahoma City, has resigned, effective Jan. 1, and will be succeeded by H. W. Reilly, superintendent of construction for the Oklahoma properties. Mr. Molinard has served the Byllesby organization in important capacities since 1912 and leaves the company to go to California on account of private interests there.

C. F. GRAY, electrical engineer, Winnipeg, Manitoba, has been reelected mayor of that city by more than 2500 majority.

HENRY L. LIDDELL has been appointed instructor in the civil engineering department of the Massachusetts Institute of Techonology.

J. L. HARPER, chief engineer of the Niagara Falls Power Co., Buffalo, N. Y., recently tendered an interesting address at the meeting of the Builders' Exchange at the Chamber of Commerce Club Rooms, Buffalo. Mr. Harper set forth that water power, in his opinion, could never entirely replace the use of coal, and spoke in a very entertaining manner on the latest power development project at Niagara Falls, whereby an efficiency of 90% is realized from the water used, which is said to be the highest efficiency ever attained in the world.

CHARLES S. BEARDSLEY, chairman of the newly organized Vacuum Cleaner Manufacturers' Association, is

Charles S. Beardsley.

general manager of The United Electric Co., Canton, O. He became associated with the company in his present capacity about 2 years ago and in this brief period has made a notable record in his administration of the company's affairs, and has introduced many novel ideas for the merchandising of household appliances which have been profitable to the industry as a whole. He has had a broad experience in merchandising and his sound training in advertising methods, coupled with the thorough mechanical knowledge which he possesses, accounts for the prominent position The United company occupies in the industry.

Obituary.

RALPH L. SHAINWALD, president of the Standard Paint Co., New York City, manufacturer of insulating paints and compounds, died on Dec. 10.

WILLIAM F. THOMAS, for the past 21 years connected with the Public Service Corp., and more recently manager of the New Brunswick, N. J., district of the company, died on Dec. 17.

STEPHEN PEARSON BROWN, a prominent eastern engineer, died in Sebec Lake, near Dover, Me., Dec. 13. He was pulling his 9-year-old son on a sled when the ice broke under him and he sank before the boy could summon help. Mr. Brown was born in Dover, Me., April 29, 1877. He attended the Foxcroft Academy, Foxcroft, Me., the Hotchkiss School, Lakeville, Conn., and graduated from the Massachusetts Institute of Technology with a B. Sc. degree in mechanical engineering in 1900. From 1900 to 1903 he was a junior partner of Collier & Brown, consulting engineers, Atlanta, Ga., and was engaged on hydroelectric developments, mill construction, municipal steam driven electric lighting plants, waterworks, sewage systems, etc. From 1904 to 1905 he was inspector for the N. Y.. N. H. & H. R. R. From 1905 to 1909 he was with the United Engineering & Contracting Co., of New York, in various capacities. From 1909 to 1912 he was chief engineer of the Tidewater Building Co., and T. B. Bryson, building section 11-A-3 of the Fourth Avenue Rapid Transit subway in Brooklyn. In 1912 he became chief engineer of the Mount Royal Tunnel & Terminal Co., Ltd., and managing engineer for Mackenzie, Mann & Co., Ltd., having charge of both the design and construction of the terminal development in Montreal for the Canadian Northern railway. This includes a double track tunnel over three miles long, elaborate freight and passenger terminals and an elevated double track viaduct across the lower town from the tunnel to the harbor. It involves an expenditure of $15,000,000. In 1916 he was vice-president and manager of Ford, Bacon & Davies, a well-known firm of engineering contractors of New York City. He continued to act in a consulting capacity in regard to the Montreal terminal work for the C. N. R., and was expected in that city this month on business in connection with the C. N. R. enterprise. From 1915 to 1917 he was a member of the council of the Canadian Society of Civil Engineers. He was a member of the American Society of Civil Engineers, of the American Society of Mechanical Engineers, of the American Railway Engineering Association, of the Canadian Society of Civil Engineers and of the Institution of Civil Engineers (British).

Financial News

Electric Railways Best Operated by Private Capital.

Only by the use of private capital and enterprise can the electric railways of the United States be made to function properly, Bentley W. Warren, counsel for the Committee of One Hundred of the American Railway Association, declared in a brief filed with the Federal Electric Railway Commission, which will probably report the result of its investigation made last summer to President Wilson some time this month.

In connection with this statement Mr. Warren declared that legal and financial obstacles in the way of government acquisition of public utilities and the great divergence of opinion as to the desirability of the plan prevented at the present time the successful operation of public ownership.

If private capital and enterprise is to continue to be used in the local transportation field, the brief declares, it is essential that the credit of the industry be re-established, since a continuing supply of new capital is necessary to permit these utilities to keep pace with the demands of the public.

Credit Extension to European Countries a Vital Need.

The importance of wide public support in the matter of supplying European credits is emphasized in the current issue of "American Goods and Foreign Markets," the semi-monthly review of foreign trade conditions issued by the Guaranty Trust Co. of New York.

The publication says that while manufacturers and exporters are thoroughly acquainted with the implication and inevitable effects on foreign trade if the drop in exchange is not checked, "it is not quite clear that it is understood by the general public, and particularly by those who have funds for investment, that their co-operation is essential if the present situation is not to continue indefinitely.

"Yet," the review continues, "it must be evident to the casual observer that Europe cannot produce the necessities of life in sufficient quantities until the means of production are there. For five years, the normal operation of industry gave way to the highly specialized and non-productive operations of war time. The means of transportation, except along those roads needed for the moving of munitions and troops, were allowed to deteriorate. Machinery, necessary to the production of goods for the consumption of the people, wore out and was not replaced. Stocks of raw materials were used up or diverted to uses which did not go to the satisfaction of the daily wants of the people. All this continued for five years. The resultant loss was almost incalculable. In coming back into production to an extent sufficient not alone to meet the needs of her own people, but also to sell goods abroad sufficient to pay the accumulated debt of years, the countries of Europe had a task almost as difficult as that of carrying on the war. In one sense it was more difficult, for during the war the energies of the people were stimulated by fear, or patriotism, or some other emotion, which made continued and uninterrupted effort a matter of vital necessity.

"At the end of the war, Europe needed, first of all, food and clothing. That was forthcoming from the United States in short order. To send it, however, put a new burden upon the credit resources of the people, and started the exchanges on their downward path. Next, Europe needed raw materials, for the factories and mills which were in condition to begin operations. These too were forthcoming, and exchanges sagged again, for as yet Europe was not in production, and could not pay in goods the enormous balances which were being piled up against her. Finally, and most of all, however, she needed capital goods—machine tools, rails, locomotives, electrical equipment, all that great group of products which are necessary for the existence of a modern industrial nation. These are the very vitals of industry, and until they are forthcoming, Europe cannot count industrially in the world market as she counted before the war. And, by the same token, she cannot produce the consumption goods upon which her export trade depends. Until it is possible for Europe to sell for export, the shortage of consumption goods in the world will be keen, and prices for the necessities of life will be high everywhere.

"To date, the arrangements made for the supplying of credit to European industry have not been of sufficient scope to meet the needs of the situation, as the constantly sagging exchanges prove in the most graphic manner. European exports to this country and elsewhere have not been of sufficient value to offset the demands for food and raw materials, and for the few capital goods which already have been shipped. The need, therefore, for a broad scheme of credit extension is more vital than ever."

Maryland-Virginia Utility Merger Approved.

Public Service Commission of Maryland, Baltimore, Md., has handed down its approval of the merger of a number of gas, electric light and power companies located in Maryland and West Virginia. The new corporation to be known as the Potomac-Edison Gas & Power Co., with headquarters at Grafton, W. Va. The properties to be taken into the merger are as follows: Grafton Light & Power Co.; Grafton Traction Co.; oil wells, plants and pipe lines of the Eastern Oil Co., Buffalo, N. Y.; Central West Virginia Gas Co.; West Virginia & Maryland Gas Co., operating in West Virginia and Maryland; a controlling interest in the capital stock of the Hartland Power Co., as well as the power plant electric light, traction and street car lines of the Cumberland Co., Cumberland, Md. Barstow & Co., 50 Pine street, New York, are interested largely in the new consolidation. It is said that the project is the largest in the history of the states of West Virginia and Maryland.

Local Utilities Merged.

It is announced that the Maryland Public Service Commission has handed down an order authorizing the merging of a number of local and nearby utility concerns. The companies affected are the Cambridge Gas, Electric Light & Power Co.; Salisbury Light, Heat & Power Co., both of Salisbury, Md.; Idlewild Electric Light, Heat & Power Co., Federalsburg; and the Peninsular Light & Power Co. into the Eastern Shore Gas & Electric Co. The new organization will issue stock for $315,000 in exchange for the aggregate stock of like amount of the merged companies.

Merger of Kansas City Companies Requested.

Application for the issuance of $9,998,000 in common stock and the flotation of $8,000,000 worth of bonds, has been filed with Missouri Public Utilities Commission by Kansas City Power & Light Co., Kansas City, Mo. Simultaneously, another application was filed by the Standard Electric Light Co., a Kansas City, Kan., corporation, for permission to transfer its plant and other property to the Kansas City Power & Light Co.

The merging of these two concerns will place much of the lighting and power for the Kansas City, Kan., industries, and residents in the hands of the Kansas City, Mo., firm. Extensive enlargements, improvements and service extension is contemplated by the corporation, according to the filing papers.

WEEKLY COMPARISON OF CLOSING-BID PRICES OF SECURITIES OF LEADING ELECTRICAL COMPANIES.

Quotations furnished by F. M. Zeller & Co., Rookery Bldg., Chicago.

Public Utilities.	Div. rate. Per cent.	Bid Dec. 16.	Bid Dec. 23.
Adirondack Electric Power of Glens Falls, common	6	15	15
Adirondack Electric Power of Glens Falls, preferred	6	77	76
American Gas & Electric of New York, common	10+extra	123	118
American Gas & Electric of New York, preferred	6	39	38
American Light & Traction of New York, common	..	195	180
American Light & Traction of New York, preferred	6	92	91
American Power & Light of New York, common	4	63	63
American Power & Light of New York, preferred	6	73	73
American Public Utilities of Grand Rapids, common	..	8	7
American Public Utilities of Grand Rapids, preferred	7	21	21
American Telephone & Telegraph of New York	..	99⅛	..
American Water Works & Elec. of New York, common	..	2	2
American Water Works & Elec. of New York, particip	7	6	4
American Water Works & Elec. of New York, first preferred	..	45	35
Appalachian Power, common	..	3	3
Appalachian Power, preferred	7	20	20
Cities Service of New York, common	+extra	402	405
Cities Service of New York, preferred	6	72	72
Commonwealth Edison of Chicago	8	107	..
Comm. Power, Railway & Light of Jackson, common	..	20	19
Comm. Power, Railway & Light of Jackson, preferred	6	..	39
Federal Light & Traction of New York, common	..	7	7
Federal Light & Traction of New York, preferred	..	42	41
Illinois Northern Utilities of Dixon	6	..	..
Middle West Utilities of Chicago, common	2+extra	..	20
Middle West Utilities of Chicago, preferred	6	..	43
Northern States Power of Chicago, common	..	63	63
Northern States Power of Chicago, preferred	ex.div.7	89	89
Pacific Gas & Electric of San Francisco, common	..	60	60
Pacific Gas & Electric of San Francisco, preferred	6	..	..
Public Service of Northern Illinois, Chicago, common	7	78	75
Public Service of Northern Illinois, Chicago, preferred	6	89	85
Republic Railway & Light of Youngstown, common	4	12	10
Republic Railway & Light of Youngstown, preferred	6	46	40
Standard Gas & Electric of Chicago, common	..	27¼	27¼
Standard Gas & Electric of Chicago, preferred	6	41	40¼
Tennessee Railway, Light & Power of Chattanooga, common	..	2	2
Tennessee Railway, Light & Power of Chattanooga, preferred	6	5	6
United Light & Railways of Grand Rapids, common	4	..	..
United Light & Railways of Grand Rapids, preferred	6	60	57
Western Power of San Francisco, common	..	21	20
Western Union Telegraph of New York	extra	87	87⅛
Industries.			
Electric Storage of Philadelphia, common	4	132½	132
General Electric of Schenectady	8	166	169
Westinghouse Electric & Mfg. of Pittsburgh, common	7	52⅝	53⅜
Westinghouse Electric & Mfg. of Pittsburgh, preferred	7	..	..

HOWARD EHRLICH, Managing Editor.

FRANK A. MERKEL, Advertising Manager.

SUBSCRIPTION — United States, $3.00; Canada, $4.00; Foreign, $6.00 per year. Single copies, 10 cents.

NOTE — In accordance with the new zone postal regulations extra postage must be added to the regular $3.00 subscription price in accordance with the following zone schedule: 1st zone, 54c; 2nd zone, 54c; 3rd zone, 65c; 4th zone, 88c; 5th zone, 99c; 6th zone, $1.10; 7th zone, $1.33; 8th zone, $1.44

Electrical Review

The Oldest Electrical Weekly in America.

Entered as second-class matter Nov. 7, 1908, at the P. O. at Chicago, Ill., under act of Congress of March 3, 1879.

International Trade Press, Incorporated

PUBLISHER

ELECTRICAL REVIEW,
ENGINEERING WORLD,
HIGHWAY ENGINEER AND CONTRACTOR,
CONCRETE PRODUCTS,
CEMENT, MILL AND QUARRY,
BELTING,
ROAD-MAKER, EXCAVATOR AND GRADER,
LUBRICATION WORLD,
ELECTRICAL BLUE BOOK,
DIRECTORY CEMENT, GYPSUM, LIME MANUFACTURERS.

CHARLES W. PRICE
Chairman Board of Directors
C. A. TUPPER
President-Treasurer
LYMAN A. SISLEY
Vice-President-Secretary
HARRY W. WALKER
Vice-President-General Manager
JAMES E. MONTGOMERY
Assistant to President
C. W. FORBRICH
General Advertising Manager

Main Office:
53 W. Jackson Blvd.
542-553 Monadnock Block
Chicago
Phone Harrison 7195-6

New York Office:
H. W. YOUNG. Eastern Manager.
Suite 1736, 15 Park Row
Phone Barclay 8720-8721

Hartford, Conn.:
Room 414, Century Bldg.,
54 Church St.

Cleveland Office:
E. G. K. MEISTER, Manager Central District
301 Columbia Bldg.

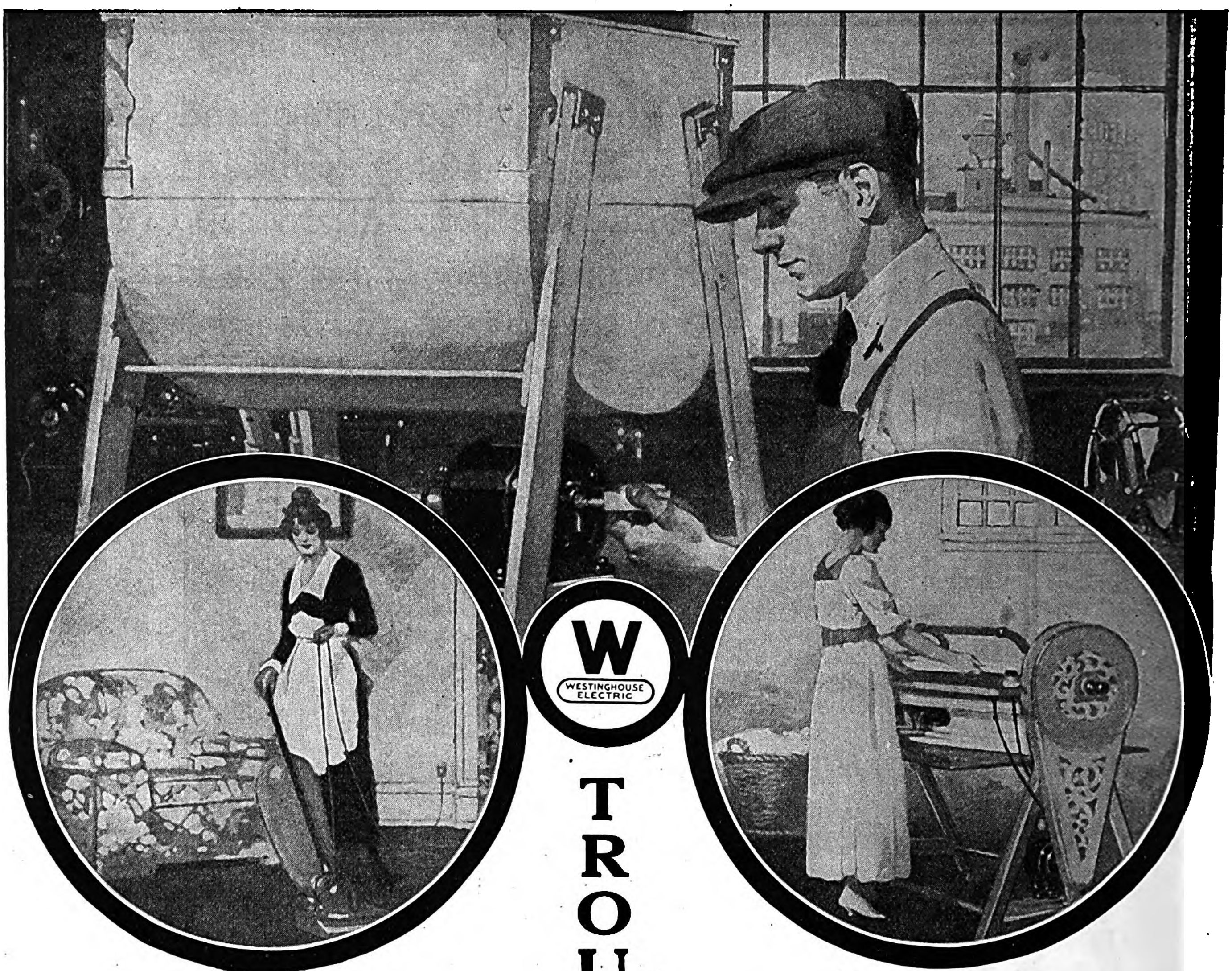
Denver Office:
403 First National Bank Bldg.

Seattle Office:
232 Burke Bldg.

London Office:
42 Old Broad St., E. C.

Vol. 75. CHICAGO, SATURDAY, DECEMBER 27, 1919. No. 26.

CONTENTS



TROUBLE PROOF

In recent advertisements we have told you WHY the Westinghouse Small Motor IS trouble-proof. These trouble-proof features were referred to as Points of Superiority in Westinghouse Small Motor Construction.

The superior points of design, combined with our familiarity with the problems usually met with in the different appliance fields, guarantees that high degree of operating dependability that every progressive appliance manufacturer must insist upon.

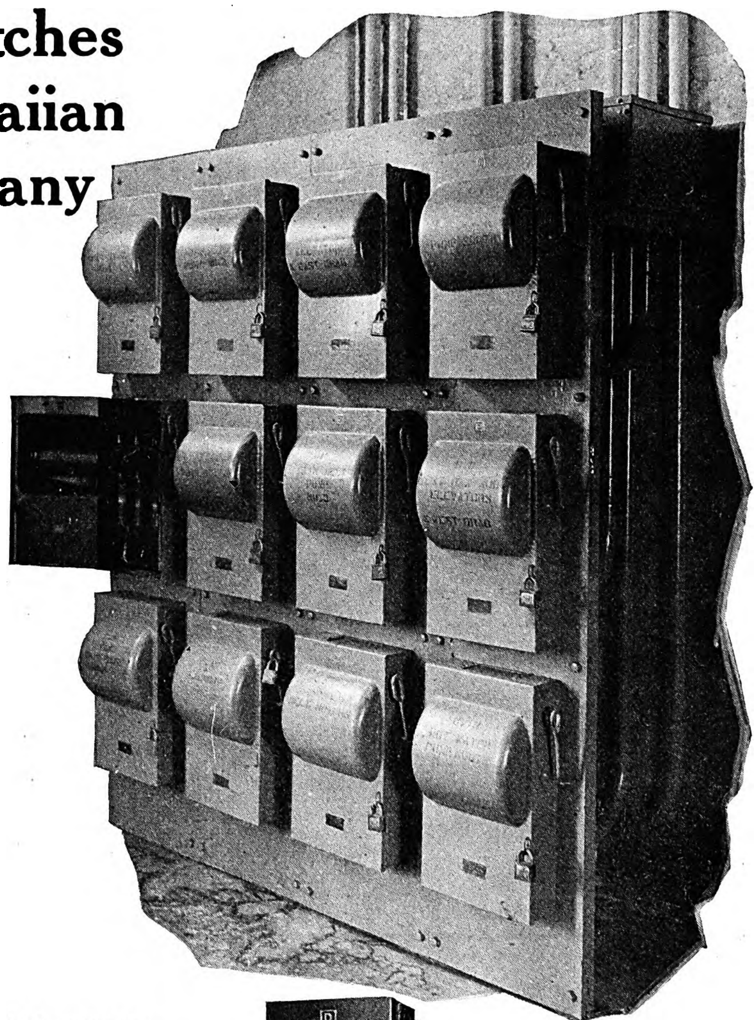
Have you a copy of our new Circular No. 7300 describing the Westinghouse Trouble Proof Motor in its various applications? If not, send us your name and address.

WESTINGHOUSE ELECTRIC & MANUFACTURING CO.
East Pittsburgh, Pa.

Westinghouse

Digitized by Google

Square D Safety Switches for California & Hawaiian Sugar Refining Company



IT is interesting to note the type of organizations that install Square D Safety Switches.

Wherever you find Square D Safety Switches, there you will find an organization that regards the safety, contentment and happiness of its employees as of vital importance. And there, too, you will find an institution that wants nothing short of the best—in safety switches as well as in any other equipment or material.

Careless or ignorant hands and arms cannot come in contact with the live parts of the Square D Safety Switch—it is completely enclosed within a pressed steel box and operated by an outside handle. Cover of switch box can be locked. And the Square D Switch can be locked in the "off" position when work is being done on the line.

Made in two-, three-, and four-pole types in standard voltages of 125, 250, 500 a.c. and 600 volts, in capacities from 30 to 1200 amperes. Over 300 types and models.

Listed as standard for fire and accident prevention by the Underwriters' Laboratories of the National Board of Fire Underwriters. Meet the requirements of the National Electrical Safety Code of the Bureau of Standards.

No matter what your connection with the electrical industry, write for literature on the Square D Safety Switch today. We will promptly send you complete information.

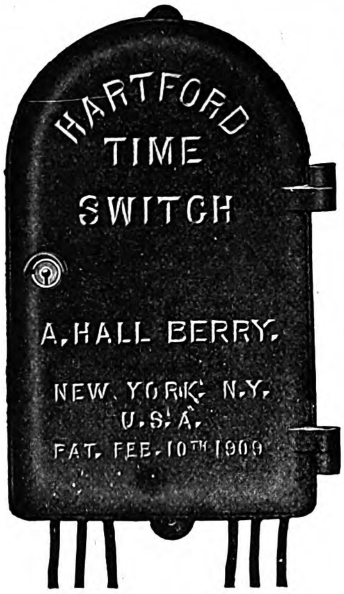
SQUARE D COMPANY, ***Detroit, Michigan***

Canadian Works: Walkerville, Ont.

New York Chicago Philadelphia Pittsburgh Atlanta St. Louis
San Francisco Portland, Ore. Cleveland Toronto, Ont.

Square D
Safety Switch

WHEN YOU INSTALL A HARTFORD TIME SWITCH



you eliminate the human element.

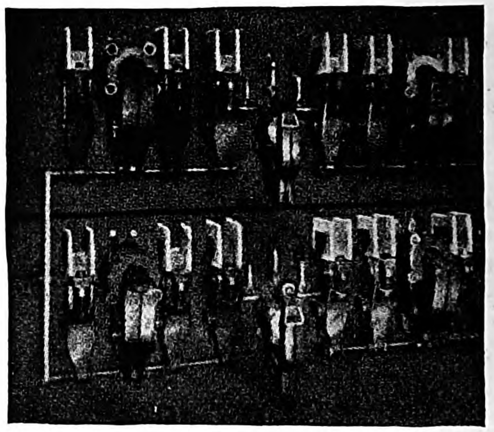
"Just wind it once a week" and your signs will be controlled as you wish.

ASK YOUR JOBBER

THE HARTFORD TIME SWITCH CO.

A. HALL BERRY
General Sales Agent

73 MURRAY ST., **NEW YORK** 2



SUNDH Can Solve Your Problem

Just As This One Was Solved

Two electrical sources were available—a main source and an emergency source. Both sources were to be used at all times for portions of the service. Provision had to be made for the utilization of one source for the total requirements in the event that the other source failed.

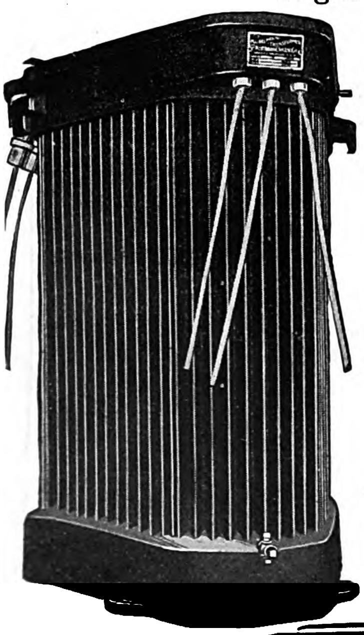
The SUNDH equipment automatically provides for the consumption of precisely the amount of Central Station energy contracted for, while also insuring the automatic switching of the entire load into either source of supply should the other source fail.

The value of such equipment cannot be overestimated.
Let SUNDH SOLVE YOUR PROBLEM.

SUNDH ELECTRIC COMPANY
Ave. C and Parkhurst St., Newark, N. J.
New York Office, 51 E. 42d St.
First National Bank, Pittsburgh, Pa.
H. J. Kaufman, Peoples Gas Bldg., Chicago, Ill.

KUHLMAN TRANSFORMERS

Rest their case not on what is claimed for them but on their magnificent actual record for the last twenty-five years.



Made by a firm of transformer specialists with an organization of specialized workmen.

The correctness of their design and thorough testing make their performance a certain quantity.

Write for the KUHLMAN bulletins.

KUHLMAN ELECTRIC CO.
Bay City, Mich.

The Motors You Buy

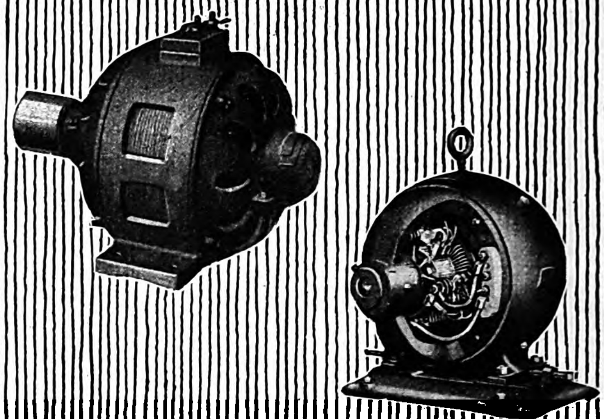
—are they fitted to their tasks?

To give satisfaction, your motors must be fitted to the particular task they perform — makeshifts never are successful.

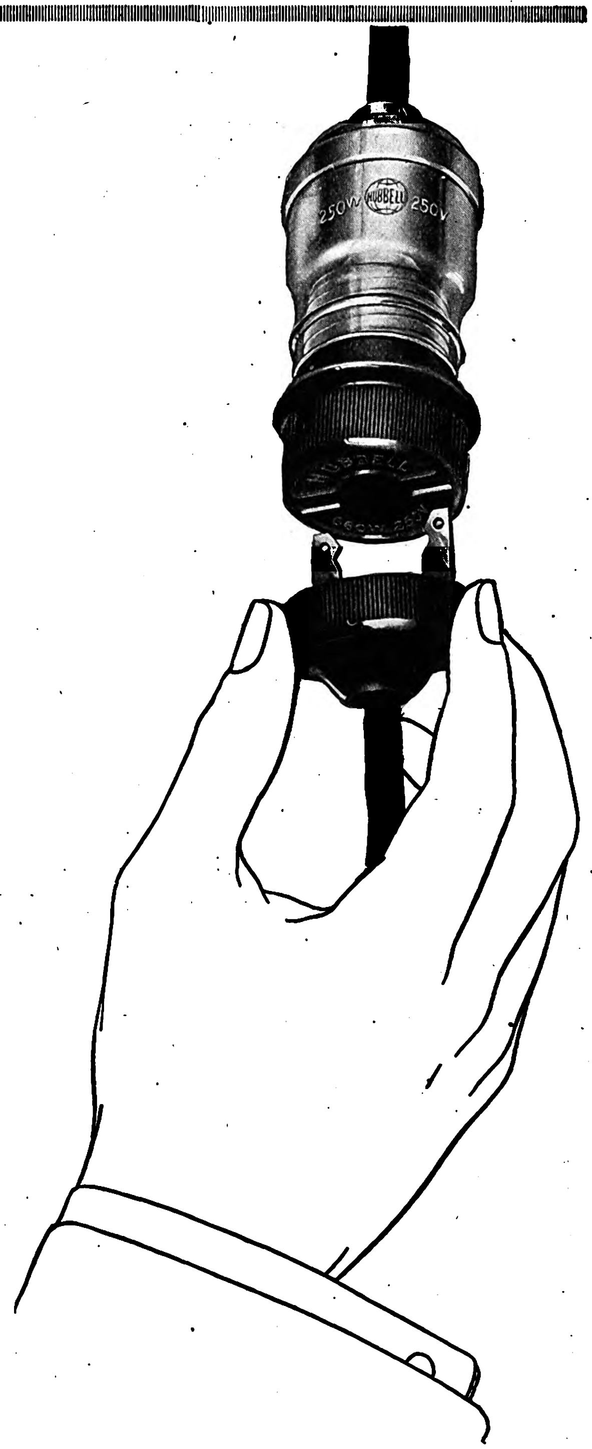
COLONIAL

Motors are made for every motor use. There is a size and type for every drive. Bulletins on request.

THE COLONIAL FAN & MOTOR CO.
WARREN, OHIO



A better plug for a double purpose:



Your machine—in the retail store. Listen!

WOMAN: "Yes, I like it very much, but will that plug fit a wall plate? My vacuum cleaner has only the twisting kind, and it's a perfect nuisance. I have to screw it into a lamp socket every time, whereas if I had the other kind of plug I could use our wall plates, you know."

SALESMAN: "I'm glad you mentioned that, madam, because it is very important. This plug is a Hubbell. It has two parts, the body which screws into any lamp socket, and the cap which plugs into any wall receptacle or current tap. You can use this in any part of the house; it's a better plug for a double purpose."

WOMAN: "Oh, I'm so glad—then I'll take the machine. And can you sell me one of those plugs? I'll have my husband put it on our vacuum cleaner. Thank you."

This is a Hubbell Composition Attachment plug No. 5467 with Edison Base. Cap has Tandem blades. Contacts are made separate arcing chambers, preventing shock or short-circuiting.

Send for the Hubbell Catalog

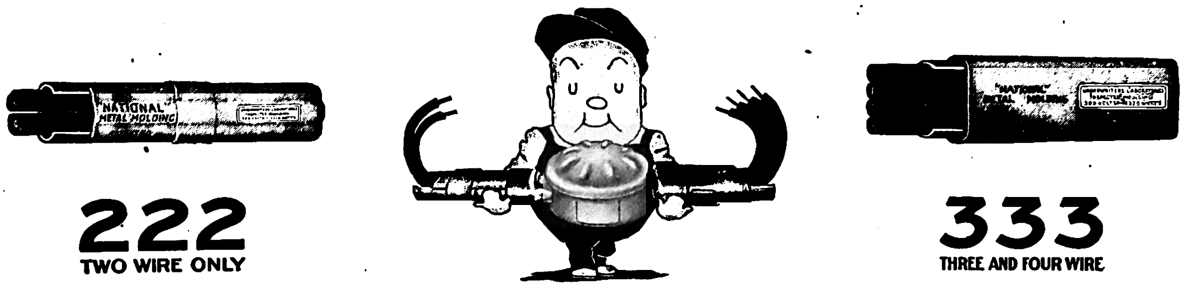
HARVEY HUBBELL INC
ELECTRICAL SPECIALTIES
BRIDGEPORT CONN., U.S.A.

HUBBELL
REG. U. S. PAT. OFF.

2035-U

"National"

Inter-connecting Metal Moldings



222
TWO WIRE ONLY

333
THREE AND FOUR WIRE

FOR YEARS THE STANDARD FOR

Surface Wiring

Economical and Easy to Install
Stocked by All Leading Jobbers

Safe and Sightly

Write for Descriptive Bulletin 101 and Installation Chart

819

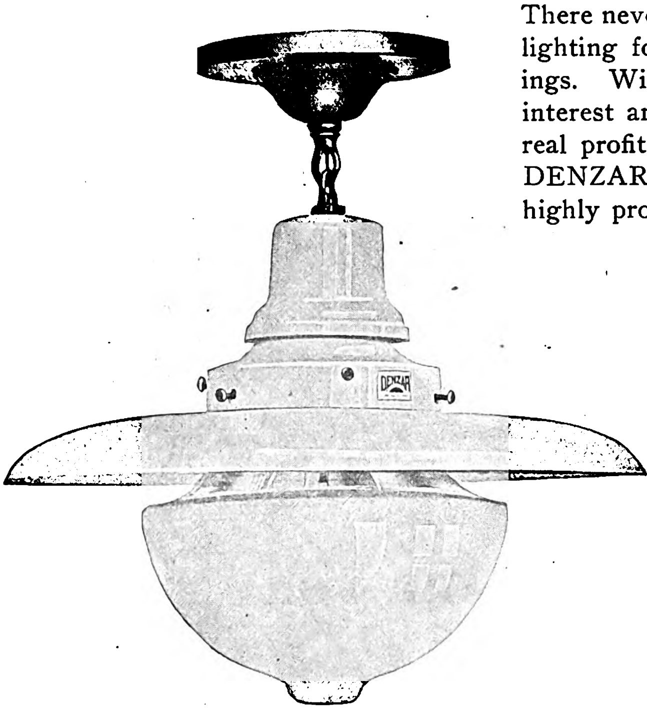
National Metal Molding Co.

1106 Fulton Building, Pittsburgh, Pa.

Atlanta	Chicago	Havana	Paris	Salt Lake City
Boston	Dallas	Los Angeles	Philadelphia	San Francisco
Buffalo	Denver	Manila	Portland	Seattle
Buenos Aires	Detroit	New York	Rio de Janeiro	St. Louis

Canadian Distributors: Canadian General Electric Co., Ltd.

You could be making a good profit on DENZAR right now, as so many other dealers are doing



There never was a time when people were so interested in better lighting for offices, stores, schools, factories and public buildings. Wise dealers are taking advantage of this widespread interest and are making it pay them a profit. And there *is* a real profit in this business. Every bit of work you put in on DENZAR brings its results—helps to build up a permanent and highly profitable business for you.

It's easy to sell DENZAR

If you haven't tried it, you'll be surprised to see how easy it is to sell DENZAR. People who are interested in securing better illumination can see its points of superiority as soon as you explain them. It sells practically on sight.

You can't afford to overlook the profits you can make on DENZAR. Write now for the DENZAR catalog and details of our very liberal terms to established dealers.

Beardslee Chandelier Mfg. Co.

Manufacturers of a Complete Line of Chandeliers for Every Lighting Requirement.

220 South Jefferson St. CHICAGO

---

40 Years of Repeat Orders Is Convincing Proof

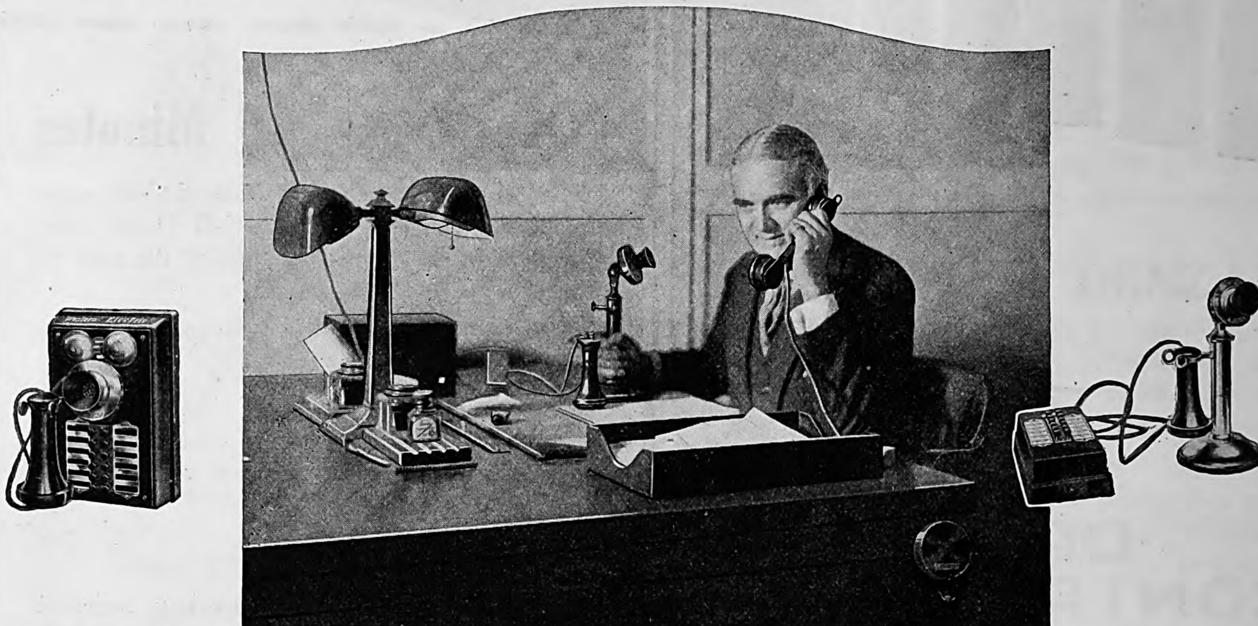
For 40 years telephone and telegraph companies have been buying Oshkosh Construction Tools. The fact that more than half of all the telephone and telegraph companies in America have been built with Oshkosh Tools is ample proof of the regard in which they are held. *Your jobber handles them.*

OSHKOSH MANUFACTURING CO.
522 Review St. OSHKOSH, WIS.

OSHKOSH

Construction Tools

Getting Full Value From Every Minute



Western Electric

INTER-PHONES

Nowadays when everyone is confronted with the necessity of getting full value out of every minute, such a time-saver as the Western Electric Inter-phone is practically indispensable to the central station, electrical manufacturer and electrical shop.

The real value of using a Western Electric Inter-phone system is that it not only saves time for you and the other executives, but that it will save many minutes each day for every member of your organization.

The Inter-phone stands for instantaneous communication. Instead of sending a messenger to find the man to whom you wish to speak and then waiting until he reaches your office, you just pick up the receiver on your Inter-phone, and press the ringing button. Instantly he replies and you can speak your message or give instructions that carry the force of your personality.

The Inter-phone is economical—neither switchboard nor operator is required since the user makes his own connection. Western Electric Inter-phone Systems are available for use in the largest plant or in the smallest shop.

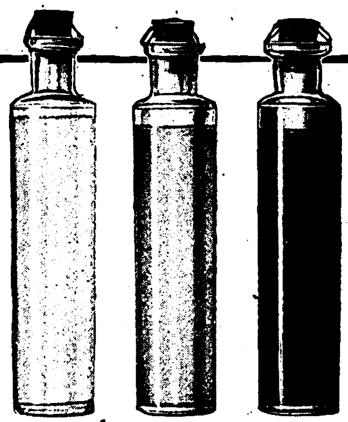
For more detailed information, consult the telephone engineers at our nearest house.

Western Electric Company

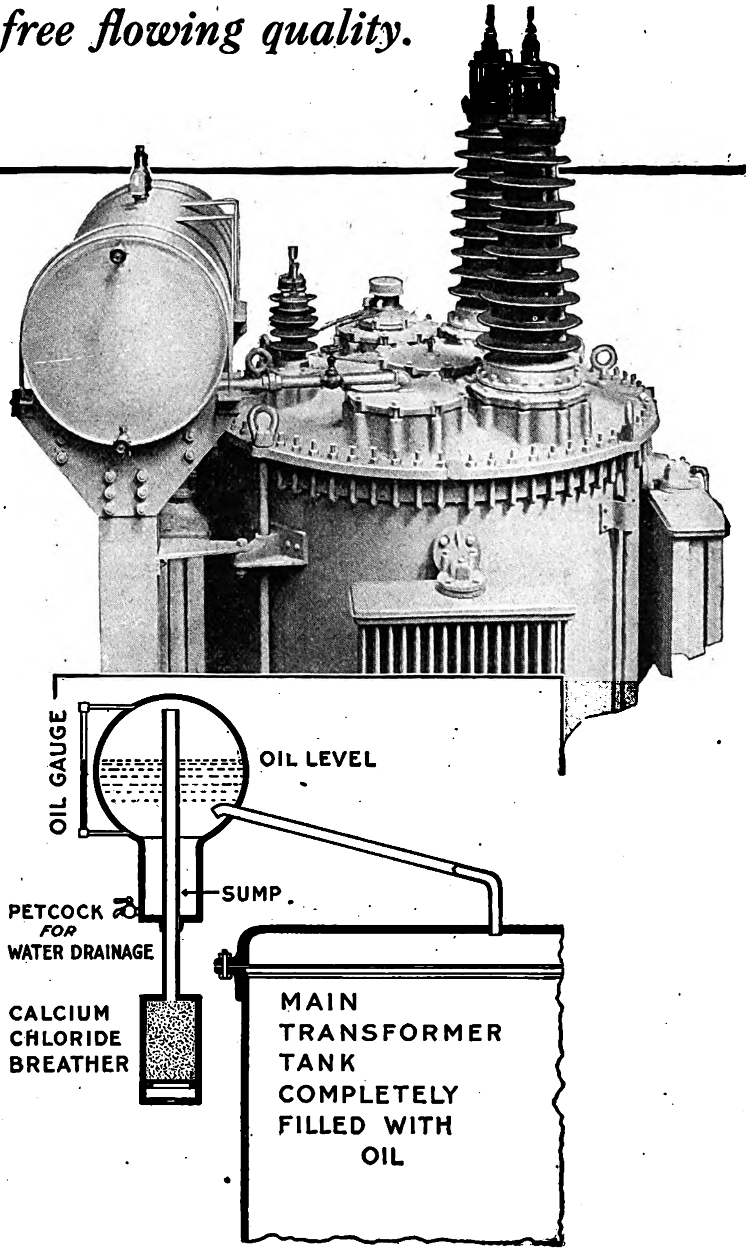
INCORPORATED

Offices in All Principal Cities

The Oil Conservator preserves the dielectric strength of transformer oil and its free flowing quality.



oil before being used — used with conservator — used without conservator



The Oil Conservator Transformer as developed by the General Electric Company consists of a main tank, containing the transformer, which is completely filled with oil, and an auxiliary tank for oil expansion. Connection between the two tanks is restricted so that there is no rapid interchange of oil and the temperature of the oil in the auxiliary tank is always relatively low. Any water that may be condensed in this auxiliary tank is collected in a "sump" and drawn off without coming in contact with the transformer, and main body of the oil.

What the Oil Conservator Transformer does

I. Eliminates "Breathing" and water condensation in main tank, thus maintaining the original insulating value of the oil.

II. Avoids the possibility of explosion by the ignition of a mixture of air and gas vapor from hot oil.

III. Practically eliminates oil decomposition or "sludging" as a result of exposure of hot oil to oxygen.

The General Electric Company offers the Oil Conservator Transformer as a standardized product with its value already fully established in the field and a factory equipment allowing of its economic application to practically all oil insulated "power" units of 500 Kv-a capacity and above.

General Electric Company

General Office Schenectady, N.Y. — Sales Offices in all large cities

51-5

UNITED STATES RUBBER COMPANY
US
RUBBER SYSTEM AND ASSOCIATED COMPANIES

Splicing —TAPE— Friction

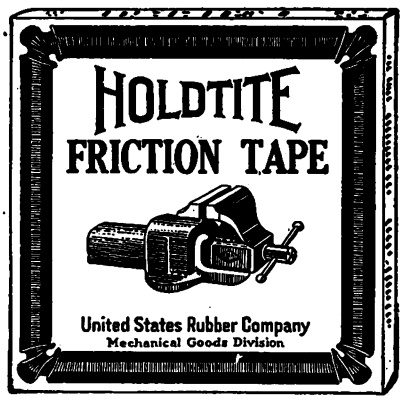
THERE is not a better or more favorably known black Friction Tape manufactured than Holdtite. It is heavily coated on both sides with a high grade compound, and is recommended for general electrical work.

Utility Friction Tape is recommended for use wherever a thin tape is desired. It is coated on both sides with a black compound. Durable for either outside or inside work, or for telephone work.

United States Friction and Splicing Tapes meet every requirement. All are highly dielectric, contain no free sulphur and keep their original good qualities.

United States Tapes
are Good Tapes

United States Rubber Company



International Clearing House

FOR SALE

POWER PLANT EQUIPMENT

(First-class Used)

BOILERS:

2—Batteries, 750 hp. each, consisting of one 500-hp. and one 250-hp. Keeler horizontal water-tube boilers, 160-lb. working pressure. Complete, including fronts, trim, grates and guyed steel stack for each battery, 500-hp. Foster superheater. Age 2½ years.
1—Battery, 820-hp., consisting of two 410-hp. Keeler boilers. Same as above. Complete, including one stack and 125° Foster superheater.
1—Battery, 1100-hp., consisting of two 550-hp. Sterling class S-28. Complete, including two guyed stacks; 60-in.x170-ft. and 125° Foster superheaters, 160-lb. pressure. Age 3 years.
1—Battery, 460-hp., consisting of two B.&W. water-tube boilers. Complete, including chain grate stokers; 150-lb. pressure. Age 12 years.
2—110-hp. Heine water-tube boilers, 175-lb. pressure. Age 10 years.
2—72x18 H.R.T. boilers, suspended type, 125 to 150 lbs., overhauled, seams butt-strapped, quad. riv. Shells ½ in. Heads 9/16 in. Firebox steel.

ELECTRIC GENERATORS:

1—1000-kw. Westinghouse Turbo-Gen. Set. 2300-v., 60-cyc., 3-ph. with LeBlanc jet condenser and auxiliaries.
2—500-kw. G. E. Vertical Turbo-Gen. Sets. 2300-v., 60-cyc., 3-ph. (condenser and auxiliaries if required). Good for standby for hydro plant. Price $2,500.00 each. Subject to prior sale.
1—500-kw. Engine Gen. Set. 2300-v., 60-cyc., 3-ph.
1—300-kw. Engine Gen. Set. 250-v., DC.
1—150-kw. Engine Gen. Set. 250-v., DC.
1—400-kw. Motor Gen. Set. 250/275-v., DC. Gen. 2300-v., 60-cyc., 3-ph. motor.
2—100 kw. Motor Gen. Set. 250/275-v., DC. Gen. 2300-v., 60-cyc., 3-ph., motor.

CONDENSERS:

2—2000 sq. ft. Worthington Surface Condensors. Complete with all pumps, dry vacuum pumps and pipe, valves and fittings. All in excellent condition.
1—LeBlanc Jet Cond. 18,750 lb. steam per hr., turbine driven.

A. C. SWITCHBOARD PANELS:

A.C. Switchboard Panels, New, 1912. Spec. Westinghouse and G. E., 2300-v., 60-cyc., 3-ph., 16 panels, 2-in. Blue Vermont Marble, each built one section 32-in.x62-in. and one section 32-in.x28-in., including latest type rding watt-meters and other standard switch-instruments; oil switches; indicating and recoswitchboard equipment, horizontal edgewise board apparatus.

Including 10 300-amp. 3 P.D.T. Oil Lu. Type "F." Form "F."
8 100-amp. 3 P.D.T. Oil Lu. Type "F." Form "F."
Several 2 P.D.T. Oil Lu.
4 200-amp. Integrating Watt-Meters.
12 25 to 80-amp. Integrating Watt-Meters.
10 Indicating Watt-Meters.

R. L. BAKER

1103 EDISON BUILDING **CHICAGO, ILL.**

International Clearing House

FOR SALE—220 VOLT D.C. GENERATORS

Kw.		Speed.
1—15	Garwood 3-wire d. c. to De Laval turbine.	
1—15	Peerless	1200
1—25	Colonial	1200
1—25	Fairbanks Morse	725
1—25	Westinghouse d. c. to Ball & Wood	
1—35	Allis Chalmers	725
1—56¼	Northern	500
1—75	Westinghouse	750
1—100	Westinghouse	650
1—100	Gen. Elec.	550

We buy for spot cash, sell, exchange, repair and rent. Largest stock in America.

GREGORY ELECTRIC CO. CHICAGO, ILLINOIS — 16th and Lincoln Sts. CHICAGO

Guaranteed Motor Company

628 W. Lake St. Chicago

New and used motors bought, sold and rented.

WHILE THEY LAST

A.C. 3 Phase, 60 cycle, 220 440 volt Electric Motors.

100—	¼ H.P. 1700 R.P.M.	$ 13.75 each
60—	¼ H.P. 1200 R.P.M.	17.75 each
32—	½ H.P. 1200 R.P.M.	26.50 each
30—	¾ H.P. 1700 R.P.M.	32.50 each
4—	1 H.P. 1700 R.P.M.	38.75 each
10—	2 H.P. 1160 R.P.M.	66.75 each
14—	2 H.P. 1700 R.P.M.	52.00 each
6—	3 H.P. 1200 R.P.M.	74.50 each
18—	3 H.P. 1700 R.P.M.	59.00 each
10—	5 H.P. 1700 R.P.M	77.50 each
15—	5 H.P. 1200 R.P.M.	105.00 each
4—	7½ H.P. 1700 R.P.M.	120.00 each
3—	7½ H.P. 1200 R.P.M.	140.00 each
5—	10 H.P. 1700 R.P.M.	140.00 each
5—	10 H.P. 1200 R.P.M.	160.00 each
4—	15 H.P. 1200 R.P.M.	190.00 each
2—	10 H.P. 850 R.P.M.	195.00 each
3—	20 H.P. 1200 R.P.M.	245.00 each
5—	25 H.P. 1200 R.P.M.	280.00 each
8—	35 H.P. 900 R.P.M.	365.00 each
4—	50 H.P. 900 R.P.M.	435.00 each

All above in G. E., Whse. Allis-Chal., Fks. Mse., Crocker-Whlr., Wagner, etc., etc. Compensators extra. Majority are brand new, used 4 months, and remember GUARANTEED FOR ONE YEAR. Some can be reconnected to 2-phase. Other sizes in proportion, A. C. or D. C.

Largest stock in America.

NATHAN KLEIN & CO.

215 Centre St., NEW YORK

MOTORS **DYNAMOS**

Motor Generator Wanted

One or two motor generators, for 110-125 volt direct current, 25 or 30 K. W., 2 phase, 4 wire, A. C. drive of 220-440 volts, Quote best cash price and state where can be seen.

Wirt Co., Germantown, Philadelphia, Pa.

Use the International Clearing House Section to Sell Your Used Equipment and Material

---

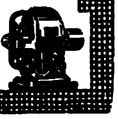
Commonwealth Edison Company

Repair Shops

Telephone Randolph 1280
38 North Market Street, Chicago

Dynamos, Motors, Transformers, Arc Lamps and Appliances

High grade machine work of all kinds



Correspondence Solicited-

STOCK SHIPMENT

DIRECT CURRENT MOTORS, 230-250 V.—All Rebuilt.

No.	PP.	RPM.	Wdg.	Type.	Make.
1	¼	975	Sh.	MP	Peerless
3	2¼	700/900	Sh.	S	Westinghouse
1	3	1200	Sh.	MP	Fidelity
1	3	580/1160	Sh.	SA	Westinghouse
1	6	750/1500	Sh.	SK	Westinghouse
1	10	1180	Cp.	S	Westinghouse
3	10	1180	Sh.	S	Westinghouse
1	15	1000	Sh.	S	Westinghouse
1	15	1000	Cp.	S	Westinghouse
1	17½	585	Sh.	A-14	Gibbs
1	20	650	Sh.	MP	Northern
1	20	650	Sh.	MP	Milwaukee
1	20	600	Sh.	P	W. E.
1	20	900	Sh.	MP	Hobart
1	20	800	Sh.	MP	Imperial
1	20	1025	Cp.	S	Westinghouse
1	20	975	Cp.	S	Westinghouse
1	25	975	Sh.	MP	Northern
1	36	925	Cp.	S	Westinghouse
1	40	675	Sh.	MP	Northwestern
1	40	920	Cp.	MP	Jenny
1	40	800	Sh.	MP	Northern
1	40	700	Sh.	RC	G. E.
1	55	575	Cp.	E6½AOR	W. E.
1	60	800	Sh.	MP	Northern
1	65	750	Sh.	S	Westinghouse

ALTERNATING CURRENT MOTORS.
All New, 3-Phase, 60-Cycle.

No.	HP.	RPM.	Volts.	Type.	Make.
3	100	720	220 or 400	AN	Allis-Chalmers
1	100	720	2200	AN	Allis-Chalmers
5	100	900	220 or 440	AN	Allis-Chalmers
1	159	720	2200	AN	Allis-Chalmers
1	150	900	220 or 440	AN	Allis-Chalmers
1	200	720	220 or 440	AN	Allis-Chalmers

ALTERNATING CURRENT MOTORS.
Slip Ring, 3-Phase, 60-Cycle.

No.	HP.	RPM.	Volts.	Type.	Make.
3	100	900	220 or 440	ANY	Allis-Chalmers
2	100	720	220 or 440	ANY	Allis-Chalmers
2	150	900	220 or 440	ANY	Allis-Chalmers
1	150	900	2200	ANY	Allis-Chalmers
3	150	720	220 or 440	ANY	Allis-Chalmers
2	150	720	2200	ANY	Allis-Chalmers
2	200	720	2200	ANY	Allis-Chalmers

"AMERICA'S BARGAIN HOUSE"

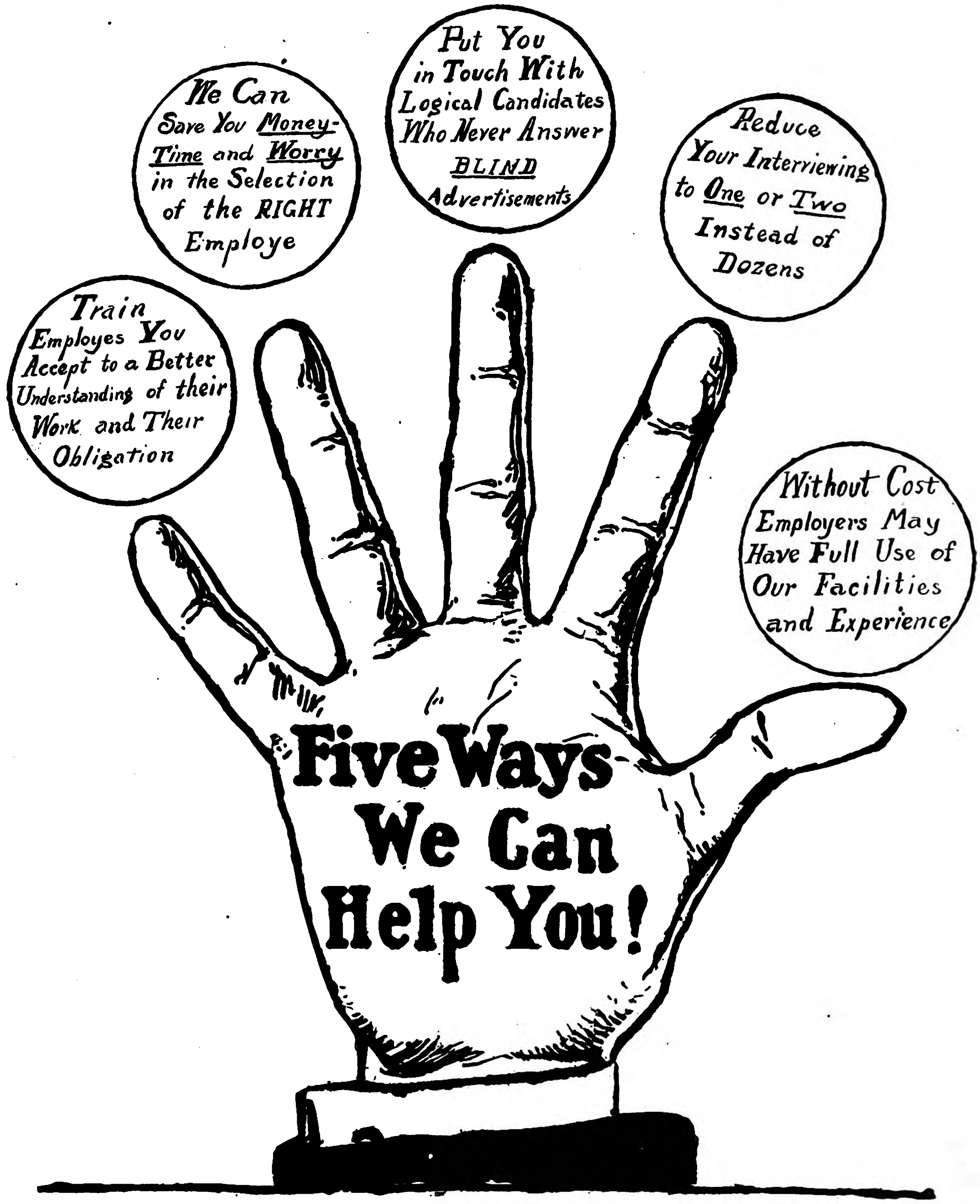
DUQUESNE ELECTRIC & MFG. CO.

New and Rebuilt Electrical Equipment

Office and Factory: PITTSBURGH PA.

Cable Address "Demco."

International Clearing House



A MESSAGE TO EMPLOYERS

In our SPECIALIZED Vocational service we endeavor to deal only with candidates who have personal equipment that is unusual because of training or experience; we come in contact with such people through confidential sources.

We can undoubtedly save you much TIME, WORRY and TROUBLE by intelligently sifting the chaff from the wheat and making it possible for you to interview ONLY LOGICAL applicants.

Our facilities are yours to command without charge or obligation to you. Let us know your wishes and we shall spare no effort to serve and please you.

ROBNETT ORGANIZATION

BUSINESS TRAINING AND ADVISORY ASSOCIATION

20 West Jackson Boulevard, CHICAGO Phone Harrison 6400

International Clearing House

POSITIONS WANTED, HELP WANTED, FOR SALE AND MISCELLANEOUS.

Advertisements will be inserted under these headings at the rate of three cents a word, minimum charge fifty cents for each insertion, payable in advance.

Tabulated or paragraphed advertisements will be charged at twenty cents a line.

If replies are in care of this office, allow five words for the address.

POSITION WANTED

ENGINEER—MARRIED, AGE 29, WITH ten years' of practical experience in installation and maintenance of all kinds of A. C. and D. C. generators and motors, high and low tension line construction, switchboards, and all kinds of light and power wiring. A man who can get results, is looking for an opportunity anywhere in the United States. Address Box 3357, % Electrical Review, Chicago, Ill.

HELP WANTED

LINEMEN—STEADY POSITION WITH utility company within 50 miles of Chicago. Address Box 3356, % Electrical Review, Chicago, Ill.

WANTED — METER DEPARTMENT manager for company with 50,000 electric consumers. Salary $100 per month. Address Box 3355, % Electrical Review, Chicago.

REPAIRS

on Electric Motors are promptly taken care of in our well equipped shop. Try us and be convinced of the quality of our workmanship.

OLSON-BOETTGER ELEC. MFG. CO.
St. Paul, Minn.

FOR SALE

On account of making room for turbine installation we offer the following machinery:

1—14x36 Heavy Duty Hamilton-Corliss Engine.

1—16x36 Heavy Duty Hamilton-Corliss Engine.

1—150 KVA. Belted, Type G. E., 2300 Volt, 600 RPM., 60 Cycle, 3 Phase Alternator.

1—180 KW. Westinghouse, 2200 Volt, 514 RPM., 60 Cycle, 3 Phase Alternator.

1 Direct Connected Engine Set, 17x21, 225 RPM., Erie City semi-Corliss Engine, direct connected to 185 KVA. G. E., 2300 Volt, 60 Cycle, 3 Phase Alternator.

All of the above apparatus is in good operating condition. For further information write the

WABASH VALLEY ELECTRIC COMPANY,
Clinton, Indiana.

LARGE PUBLIC UTILITY IN MIDDLE west requires services of electrical draftsman for power plant and substation work. State age, experience and salary desired. Address Box 3358, % Electrical Review, Chicago, Ill..

FOR SALE

D. C. GENERATORS FOR SALE—1 100 kw., 360 rpm., 125 volt, belted. 1 60 kw., 275 rpm., 125 volt, engine type. 1 60 kw., 275 rpm., 250 volt, engine type. All General Electric, in excellent condition, for immediate delivery. V. M. Nussbaum & Co., Fort Wayne, Ind.

A. C. GENERATORS FOR SALE—62½ kw., 900 rpm., 3 phase, Electric Machinery Co. 175 kw., 600 rpm., 2 phase, Allis-Chalmers. Both 2300 volt, 60 cycle, modern revolving field type. V. Nussbaum & Co., Fort Wayne, Ind.

FOR SALE

250 H.P. Slip-ring Motors, 600 R.P.M., 440 volts, 3 phase, 60 cycles. Two for immediate delivery.

NATIONAL ELECTRICAL EXCHANGE
Aurora, Ill.

MOTORS

Large stock of new and used motors and generators.

REPAIRS

For any make, size or type.

SORGEL ELECTRIC CO.
MILWAUKEE, WIS.

FOR SALE

10,000 Pounds Slightly Used Weatherproof

INSULATED WIRE

No. 2-0

In A1 Condition.
Priced very reasonably.
Located in Chicago.

Chicago Switchplate Co.
53 W. JACKSON BLVD., CHICAGO, ILL.

60 CYCLE, 3 PHASE MOTORS FOR sale. 75 hp., 720 rpm., 440 volt, G. E. 100 hp., 720 rpm., 440 volt, G. E. 100 hp., 1120 rpm., 220 volt, Westinghouse. 200 hp., 600 rpm., 2200 volt, G. E. 250 hp., 580 rpm., 2200 volt, Westinghouse. This last motor is a Type "C" and will carry a 500 hp. continuous load. V. Nussbaum & Co., Fort Wayne, Ind.

MISCELLANEOUS.

BLUEPRINTS — ELECTRICAL CONnections. 236 A.C. motor, single, two, and three-phase. Voltage, cycle, phase changing. 123 D.C. voltage changing, etc. 120 transformer connections. 150 rheostats, controllers, compensators, internal and external. 10 samples A.C. 25c. Particulars free. Charles Chittenden, Dept. K, 3024 Matthews Ave., Kansas City, Mo.

FOR SALE

125 VOLTS DIRECT CONNECTED UNITS

350 Kw. Westinghouse Generator and Fleming Four Valve Engine.
250 Kw. Westinghouse Generator and Fleming Four Valve Engine.
50 Kw. Crocker-Wheeler. Ames Engine.
25 Kw. Westinghouse. Ames Engine.

ELECTRIC MACHINERY EQUIPMENT CO.
714 Van Buren St. CHICAGO

You will surely save TIME and MONEY by sending Your

Electrical Repair Work

to

SHAEFER-GOEGLEIN CO.
Fort Wayne, Ind.

We repair or rebuild anything ELECTRICAL.
Correspondence Solicited.

PLATINUM MAGNETO POINTS BOUGHT

HIGHEST CASH PRICE

Paid for Platinum, Old Gold, Jewelry, Watches, Silver and Diamonds. Cash by return mail—Packages held 4 to 12 days for your approval of our offer, and returned at our expense if our offer is refused.

JOS. DELLAFIELD CO.
Smelters and Refiners
120 South State St., Dept. 6. CHICAGO, ILL.

Directory of Engineers

HARVEY MITCHELL ANTHONY
CONSULTING ENGINEER
Power Installation Testing
Storage Battery Engineering
Chemical Analysis
Anthony Building MUNCIE INDIANA

Appraisals Rate Investigations
COOLEY & MARVIN CO.
CHICAGO BOSTON TORONTO
Engineering Accounting

Appraisals Rate Investigations
L. V. ESTES INCORPOPATED
CHAS. W. McKAY, Chief Appraisal Engineer
Room 1514
202 South State St., CHICAGO
Plans Reports

THE ARNOLD COMPANY
ENGINEERS
CONSTRUCTORS
Electrical—Civil—Mechanical
105 S. La Salle st. CHICAGO

HUGH L. COOPER & COMPANY
GENERAL HYDRAULIC ENGINEERING
Including the Design, Financing, Construction and Management of Hydro-Electric Power Plants.
101 Park Avenue NEW YORK

L. V. ESTES INCORPORATED
INDUSTRIAL ENGINEERS
Organization Industrial Relations
Production Control Industrial Accounting
Room 1514
202 South State St. CHICAGO

WILLIAM A. BAEHR
CONSULTING ENGINEER
Gas and Electric Plants
Design, Construction and Operation
Valuations and Reports
Peoples Gas Building CHICAGO

TCE
TERRELL CROFT ENGINEERING COMPANY
UNIVERSITY CITY, ST. LOUIS
Studies, Reports, Plans, Specifications, Purchasing and Advice for Steam and Electric Plants, Power Transmission, Lighting Protection of Structures, and Lighting Systems.

FOWLE & CRAVATH
ENGINEERS
Electrical—Illuminating—Mechanical
Monadnock Block
CHICAGO
Frank F. Fowle James R. Cravath

Inventory Appraisal Evaluation Reports
E. T. BUSSELLE
CONSULTING ENGINEER
625 Market St., SAN FRANCISCO
485 State St., SALEM, ORE.
Engineering Accounting Rate Investigations

IRVIN DRYER
SALES ENGINEERING
Steam—Electric—Hydraulic
1535 Old Colony Bldg.,
CHICAGO

FULLER ENGINEERING COMPANY
ALLENTOWN, PA., U. S. A.
Designing and Constructing Engineers.
Cement Plants, Ore Roasting Plants, Lime Plants, Power Plants, Metallurgical Furnaces, Pulverized Coal Installation for all purposes.
ALLENTOWN NEW YORK CHICAGO

H. M. BYLLESBY & CO.
ENGINEERS
Chicago:
Continental and Commercial Bank Bldg.
New York: Trinity Bldg. Tacoma, Wash.

PATENTS PATENTS
Save money and time by sending your matters to me.
TRADEMARKS, DESIGNS, COPYRIGHTS.
E. S. DUVALL
Loan and Trust Building
Washington, D. C.

ILLINOIS TESTING LABORATORIES
ELECTRICAL METER-INSTRUMENT ENGINEERS
Designs, Tests, Inspection and Repairs
Special Instruments Designed and Built for Electrical Measurements
9 South Clinton Street CHICAGO

T. L. Condron. C. L. Post. A. M. Wolf
CONDRON COMPANY
ENGINEERS
DESIGNERS OF INDUSTRIAL BUILDINGS
Specialists in the Design of Modern Economical Plants for Progressive Manufacturers in the Electrical Field
632 Central Savings & Trust Bldg., AKRON, O.
1433 Monadnock Bldg., CHICAGO

ELECTRICAL TESTING LABORATORIES
Electrical and Mechanical Laboratories
Tests of Electrical Machinery, Apparatus and Supplies, Materials of Construction, Coal, Paper, etc. Inspection of Material and Apparatus at Manufactories.
80th St. and East End Ave., NEW YORK

A. C. KING
ENGINEER
8 South Dearborn Street Chicago

A Card in This Directory

insures an invitation to offer bids on Municipal, Industrial and Private Engineering Projects, Light and Heating, Power Transmission, Telephone and Telegraph, Hydro Electric Developments, Water Work, Cost Engineering, Modern Efficiency Methods, and General Civil, Mechanical and Electrical Engineering.

ADDRESS THIS PUBLICATION FOR RATES.

Directory of Engineers

Classified Index to Advertisers

ADAPTERS, Lamp.
General Electric Co.
Harvey Hubbell, Inc.
Steel City Electric Co.

ADJUSTERS, Cord and Lamp.
McGill Mfg. Co.
Trumbull Electric Mfg. Co.

AIR COMPRESSORS, Motor Driven.
Allis-Chalmers Mfg. Co.
Emerson Electric Mfg. Co.
General Electric Co.

ALTERNATORS.
Allis-Chalmers Mfg. Co.
Crocker-Wheeler Co.
Electric Machinery Co.
General Electric Co.
General Electric Co., Ft. Wayne Dept.
Ridgway Dynamo & Engine Co.
Westinghouse Elec. & Mfg. Co.

AMMETERS AND VOLTMETERS.
General Electric Co.
Norton Electrical Instrument Co.
Roller-Smith Co.
Western Electric Co.
Westinghouse Elec. & Mfg. Co.
Weston Electrical Instrument Co.

ANCHORS, Guy.
Central Electric Co.
Chance Co.
Klein & Sons, Mathias.
Oshkosh Mfg. Co.
Western Electric Co.
Westinghouse Elec. & Mfg. Co.

ANNUNCIATORS.
Central Electric Co.
Manhattan Electrical Supply Co.
Ostrander & Co., W. R.
Western Electric Co.

ARCHITECTURAL IRON.
Page Steel & Wire Co.

ARMATURES
Chattanooga Armature Works.

ARMATURE WEDGES.
White Electric Supply Co., T. C.

ATTACHMENT PLUGS.
Benjamin Electric Mfg. Co.
Central Electric Co.
Cutler-Hammer Mfg. Co.
General Electric Co.
Hubbell, Inc., Harvey.
Manhattan Electrical Supply Co.
Pass & Seymour, Inc.
Peru Electric Co.
Steel City Electric Co.
Trumbull Electric Mfg. Co.
Western Electric Co.
Westinghouse Elec. & Mfg. Co.

AUTO STARTERS (For Starting A. C. Motors.)
Allis-Chalmers Mfg. Co.
Crocker-Wheeler Co.
Cutler-Hammer Mfg. Co.
Electric Controller & Mfg. Co.
General Electric Co.
Western Electric Co.
Westinghouse Elec. & Mfg. Co.

AUTOMOBILE LIGHTING SYSTEMS.
General Electric Co.
Westinghouse Elec. & Mfg. Co.

BALLBEARINGS.
Norma Co. of America.

BANDS, PIPE.
American Bridge Co.

BATTERIES, Dry.
Central Electric Co.
Manhattan Electrical Supply Co.
National Carbon Company, Inc.
Southern Electric Co.
Western Electric Co.

BATTERIES, Medical.
Manhattan Electrical Supply Co.
National Carbon Company, Inc.
Ostrander & Co., W. R.

BATTERIES, Storage.
Edison Storage Battery Co.
Electric Storage Battery Co.
National Carbon Company, Inc.
Western Electric Co.

BATTERIES, Wet.
Central Electric Co.
Manhattan Electrical Supply Co.
National Carbon Company, Inc.

BATTERY CONNECTORS.
Belden Mfg. Co.
Sherman Mfg. Co., H. B.

BELL RINGING MOTORS.
Manhattan Electric Supply Co.
Ostrander & Co., W. R.

BELLS, Electric.
Central Electric Co.
Manhattan Electric Supply Co.
Southern Electric Co.
Western Electric Co.

BELT, Dressing
Dixon Crucible Co., Jos.

BELT FASTENERS.
Flexible Steel Lacing Co.

BELT HOOKS.
Flexible Steel Lacing Co.

BELT LACING (Steel HINGE).
Flexible Steel Lacing Co.

BENDERS, Conduit and Pipe.
Steel City Electric Co.
Thomas & Betts Co.
Western Electric Co.

BENDERS, Copper Bus.
General Devices & Fittings Co.

BINDING POSTS.
Manhattan Electric Supply Co.
Peru Electric Co.
Western Electric Co.

BLADES HACK SAW.
Atkins & Co., E. C.
Smith & Hemenway Co.

BLOWERS AND EXHAUSTERS.
Emerson Electric Mfg. Co.
General Electric Co.

BLOWERS, Organ.
Crocker-Wheeler Co.
Emerson Electric Mfg. Co.

BLOWERS, Soot.
American Steam Conveyor Corp.
Diamond Power Specialty Co.

BLUEPRINTING, ELECTRIC.
Cooper-Hewitt Electric Co.

BOILERS, Steam.
Babcock & Wilcox Co.

BOLTS, Expansion.
Condit Electrical Mfg. Co.
Steel City Electric Co.

BONDS, SHARES AND SECURITIES.
Electric Bond & Share Co.

BOOKS, Technical.
Electrical Review Pub. Co.
International Trade Press, Inc.

BOOSTERS.
Allis-Chalmers Mfg. Co.
Crocker-Wheeler Co.
General Electric Co.
Ridgway Dynamo & Engine Co.
Westinghouse Elec. & Mfg. Co.

BOXES, Conduit.
Adapti Co.
Appleton Electric Co.
Central Electric Co.
Chicago Fuse Mfg. Co.
Columbia Metal Box Co.
Cutter Co., George.
National Metal Molding Co.
Ostrander & Co., W. R.
Steel City Electric Co.
Thomas & Betts Co.
Western Electric Co.

BOXES, Manhole.
Columbia Metal Box Co.
General Electric Co.
Standard Underground Cable Co.
Steel City Electric Co.

BOXES, Service, Sheet Steel and Cast Iron Entrance Boxes and Panelboard Cabinets.
Adapti Co.
Brady Electric Mfg. Co.
Columbia Metal Box Co.
Cutter Co., George.
General Electric Co.
Palmer Elec. & Mfg. Co.
Standard Underground Cable Co.
Steel City Electric Co.
Trumbull Electric Mfg. Co.
Western Electric Co.
Westinghouse Elec. & Mfg. Co.

BOXES for Panelboard Cabinets.
Benjamin Electric Mfg. Co.
Steel City Electric Co.

BRACKETS, ARMS AND PINS (Iron).
Anderson Mfg. Co., A. & J. M.
Benjamin Electric Mfg. Co.
Brady Electric Mfg. Co.
Cutter Co., George.
Electrical Engrs. Equipment Co.
General Electric Co.
Hubbard & Co.
Nat'l Metal Molding Co.
Western Electric Co.

BRACKETS, Adjustable.
Faries Mfg. Co.

BRACKETS, Pothead.
Electrical Engrs. Equipment Co.

BRACKETS, Telephone (Adjustable).
American Electric Co.
Western Electric Co.

BRAKES, Dynamo.
Cutler-Hammer Mfg. Co.

BRAKES Electric.
Cutler-Hammer Mfg. Co.
Electric Controller & Mfg. Co.
General Electric Co.
Western Electric Co.

BRAKES, Motor.
Cutler-Hammer Mfg. Co.
Electric Controller & Mfg. Co.
Westinghouse Elec. & Mfg. Co.

BRIDGES.
American Bridge Co.

BRIDGES, Railroad and Highway.
American Bridge Co.

BRIDGES AND TOWERS, Coal Handling.
American Bridge Co.
Link-Belt Co.

BRUSHES, Carbon and Graphite.
Central Electric Co.
Corliss Carbon Company.
Dixon Crucible Co., Jos.
General Electric Co.
National Carbon Company, Inc.
Western Electric Co.
Westinghouse Elec. & Mfg. Co.

BRUSHES, Metallic.
Cutler-Hammer Mfg. Co.
General Electric Co.
Western Electric Co.
Westinghouse Elec. & Mfg. Co.

BUFFERS, Motor Driven.
Westinghouse Elec. & Mfg. Co.
Wisconsin Electric Co.

BUILDINGS, Office and Mill.
American Bridge Co.

BUNKERS AND HOPPERS.
American Bridge Co.

BURGLAR ALARMS.
Manhattan Electrical Supply Co.
Ostrander & Co., W. R.

BUS BAR SUPPORTS.
Electrical Engrs. Equipment Co.
General Devices & Fittings Co.

BUSHINGS AND LOCK-NUTS (For Conduit)
Anderson Mfg. Co., A. & J. M.
Appleton Electric Co.
General Electric Co.
National Metal Molding Co.
New Process Specialty Co.
Steel City Electric Co.
Thomas & Betts Co.

BUSHINGS, Porcelain Clamping.
General Electric Co.
New Process Specialty Co.
Pass & Seymour, Inc.

BUSHINGS, Socket.
Garfield Mfg. Co.
Hubbell, Inc., Harvey.
U. S. Rubber Co.
Western Electric Co.

BUZZERS, Mine and Office.
Benjamin Electric Mfg. Co.

CABLES.
American Electrical Works.
American Ins. Wire & Cable Co.
American Steel & Wire Co.
Anaconda Copper Mining Co.
Atlantic Inc. Wire & Cable Co.
Belden Mfg. Co.
Central Electric Co.
Chicago Ins. Wire & Mfg. Co.
Electric Cable Co.
General Electric Co.
Goodrich Co., The B. F.
Habirshaw Electric Cable Co.
Indiana Rubber & Ins. Wire Co.
Moore, Alfred F.
National Conduit & Cable Co.
Nat'l Metal Molding Co.
Okonite Co., The.
Roebling's Sons Co., John A.
Rome Wire Co.
Safety Insulated Wire & C. Co.
Simplex Wire & Cable Co.
Standard Underground Cable Co.
Western Electric Co.

CABLE BELLS.
Electrical Engrs. Equipment Co.

CABLE HANGERS.
Anderson Mfg. Co., A. & J. M.
General Devices & Fittings Co.
Hubbard & Co.
Standard Underground Cable Co.
Western Electric Co.

CABLE RACKS.
Electrical Engrs. Equipment Co.
General Electric Co.
Standard Underground Cable Co.

CABLE TERMINALS.
Sherman Mfg. Co., H. B.
Standard Underground Cable Co.
Western Electric Co.

CABLE TESTERS.
Roller-Smith Co.
Standard Underground Cable Co.

CABLES, Armored (Flexible).
National Metal Molding Co.
Standard Underground Cable Co.
Western Electric Co.
Youngstown Sheet & Tube Co.

CABLING MACHINES.
New England Butt Co.

CALIBRATORS, Meter.
General Electric Co., Ft. Wayne Dept.
Roller-Smith Co.

CANOPY INSULATORS.
General Electric Co.
Mica Insulator Co.

CARBONS, Arc Light.
Central Electric Co.
General Electric Co.
National Carbon Company, Inc.
Western Electric Co.
Westinghouse Elec. & Mfg. Co.

CARBONS, Battery.
Manhattan Electrical Supply Co.
National Carbon Company, Inc.

CAR HEATING, Electric.
Western Electric Co.

CARS, DERRICK.
American Bridge Co.

CASTINGS.
Anderson Mfg. Co., A. & J. M.
Benjamin Electric Mfg. Co.
Faries Mfg. Co.
New England Butt Co.

CEMENT MACHINERY.
Allis-Chalmers Mfg. Co.

CHANDELIERS.
Beardslee Chandelier Mfg. Co.
Central Electric Co.

CHAINS, Silent Drive.
Link-Belt Co.
Morse Chain Co.

CHANGERS, Inc. Lamp.
McGill Mfg. Co.

CHARGING OUTFITS.
Crocker-Wheeler Co.
Cutler-Hammer Mfg. Co.
General Electric Co.
Western Electric Co.
Westinghouse Elec. & Mfg. Co.

CHOKE COILS.
Anderson Mfg. Co., A. & J. M.
General Electric Co.
Schweitzer & Conrad, Inc.
Westinghouse Elec. & Mfg. Co.

CIGAR LIGHTERS.
General Electric Co.
Western Electric Co.
Westinghouse Elec. & Mfg. Co.

CIRCUIT BREAKERS, Automatic.
Automatic Reclosing Circuit Breaker Co.
Condit Electrical Mfg. Co.
Cutler-Hammer Mfg. Co.
Electric Controller & Mfg. Co.
General Electric Co.
General Electric Co., Ft. Wayne Dept.
Palmer Electric & Mfg. Co.
Roller-Smith Co.
Schweitzer & Conrad, Inc.
Western Electric Co.
Westinghouse Elec. & Mfg. Co.

CLAMPS, Cable Supporting.
Appleton Electric Co.
Electrical Engrs. Equipment Co.
General Devices & Fittings Co.
Western Electric Co.

CLAMPS, Insulator.
Electrical Engrs. Equipment Co.

CLAMPS, Pipe.
Appleton Electric Co.
General Devices & Fittings Co.

CLEATS, Fibre.
Diamond State Fibre Co.
General Electric Co.

CLEATS, Insulating.
Garfield Mfg. Co.

CLIMBERS, Linemen's.
Klein & Sons, Mathias.
Oshkosh Electric Co.
Smith & Hemenway Co.
Western Electric Co.

CLOTH, Insulating.
Mica Insulator Co.
U. S. Rubber Co.

CLUSTERS.
Benjamin Electric Mfg. Co.
Central Electric Co.
McGill Mfg. Co.
Western Electric Co.

COAL AND ASH HANDLING MACHINERY
Link-Belt Co.

COAL MINING MACHINERY.
Allis-Chalmers Mfg. Co.
General Electric Co.
Westinghouse Elec. & Mfg. Co.

COILS.
American Electrical Works.
Belden Mfg. Co.
Chattanooga Armature Works.
Crocker-Wheeler Co.
Dudlo Mfg. Co.
General Electric Co.
Ostrander & Co., W. R.
Western Electric Co.
Westinghouse Elec. & Mfg. Co.

COMMUTATORS.
Chattanooga Armature Works.

COMMUTATOR LUBRICANTS.
Allen Co., Inc., L. B.
McGill Mfg. Co.
McLennan & Co., K.

COMMUTATOR RESURFACER
Ideal Commutator Dresser Co.

COMPENSATORS.
Chattanooga Armature Works.
Union Electric Mfg. Co.

CONDENSERS, Electric.
Leeds & Northrup Co.
Western Electric Co.
Westinghouse Elec. & Mfg. Co.

CONDENSERS, Steam.
Allis-Chalmers Mfg. Co.
Westinghouse Machine Co.
Wheeler Condenser & Eng. Co.

CONDUIT, Interior.
American Circular Loom Co.
Central Electric Co.
Clifton Mfg. Co.
Enameled Metals Co.
National Metal Molding Co.
Tubular Woven Fabric Co.
Western Electric Co.
Youngstown Sheet & Tube Co.

CONDUIT, Underground, Clay, Composition, Fibre, Wood.
American Conduit Co.
American Line Materials Co.
Fibre Conduit Co.
Western Electric Co.

CONDUIT, Engineers and Contractors.
Standard Underground Cable Co.
Westinghouse Elec. & Mfg. Co.

CONDUIT FITTINGS.
Appleton Electric Co.
Chicago Fuse Mfg. Co.
Crouse-Hinds Co.
Killark Electric Mfg. Co.
V. V. Fittings Co.

CONDUIT RODS.
Standard Underground Cable Co.
Western Electric Co.

CONDUIT SEALS.
Barnes & Irving, Inc.

CONNECTORS.
Dossert & Co.
Electrical Engrs. Equipment Co.
Frankel Connector Co.
Sherman Mfg. Co., H. B.
Westinghouse Elec. & Mfg. Co.

CONSTRUCTION, Engineering.
Arnold Co.
Baehr, Wm. A.
Byllesby & Co., H. M.
Electrical Engrs. Equipment Co.
Fuller Engineering Co.
New England Butt Co.
Stone & Webster Eng. Corp.
White Companies, J. G.

CONTROLLERS.
Allis-Chalmers Mfg. Co.
Crocker-Wheeler Co.
Cutler-Hammer Mfg. Co.
Electric Controller & Mfg. Co.
General Electric Co.
Union Electric Mfg. Co.
Westinghouse Elec. & Mfg. Co.

CONVERTERS, ROTARY.
General Electric Co.
Northwestern Electric Co.

CONVEYING MACHINERY.
Link-Belt Co.

CONVEYORS, Ash and Coal.
American Steam Conveyor Corp.
Godfrey, John F.
Link-Belt Co.

CONVEYORS, COAL SIFTING.
American Steam Conveyor Corp.

CONVEYORS, PNEUMATIC.
American Steam Conveyor Corp.

CONVEYORS, SOOT.
American Steam Conveyor Corp.

COOKING DEVICES, Electric.
Cutler-Hammer Mfg. Co.
Edison Elec. Appliance Co., Inc.
General Electric Co.
Manhattan Electrical Supply Co.
Western Electric Co.
Westinghouse Elec. & Mfg. Co.

COPPERS, Battery.
Manhattan Electrical Supply Co.
Western Electric Co.

CRANE MOTORS.
Crocker-Wheeler Co.
General Electric Co.
General Electric Co., Ft. Wayne Dept.
Western Electric Co.
Westinghouse Elec. & Mfg. Co.

CRANES AND HOISTS.
Allis-Chalmers Mfg. Co.
Crocker-Wheeler Co.
Link-Belt Co.

CREOSOTE OILS.
Barrett Co.

CROSSARMS.
Western Electric Co.

CROSS ARMS (Steel).
American Bridge Co.

CROSS ARMS (Wood).
American Line Materials Co.
Lindsley Brothers Co.
Western Electric Co.

CROSS ARM BRACES.
Western Electric Co.

CURLING IRONS, Electric.
Central Electric Co.
Manhattan Electrical Supply Co.
Westinghouse Elec. & Mfg. Co.

CUT-OUTS, Enclosed Fuse, Plug, Combination Rosette, Cut-Out Bases.
Central Electric Co.
Chicago Fuse Mfg. Co.
Condit Electrical Mfg. Co.
Commonwealth Edison Co.
General Electric Co.
Hart Mfg. Co.
Manhattan Electrical Supply Co.
Pass & Seymour, Inc.
Trumbull Elec. Mfg. Co.
Western Electric Co.
Westinghouse Elec. & Mfg. Co.

CUT-OUTS, Arc Light.
Brady Electric Mfg. Co.
Cutter Co., George.
General Electric Co.
General Electric Co., Ft. Wayne Dept.

CUT-OUTS, Transformer.
Central Electric Co.
General Electric Co.
Peru Electric Co.
Schweitzer & Conrad, Inc.
Westinghouse Elec. & Mfg. Co.

DAMS, MOVABLE.
American Bridge Co.

DECORATIVE LIGHTING.
Central Electric Co.
General Electric Co.
Manhattan Electrical Supply Co.

DERRICKS.
American Bridge Co.

DIMMERS, Electric Light.
Anylite Electric Co.

DIRECT MOTOR DRIVES.
Crocker-Wheeler Co.
Electric Controller & Mfg. Co.
Electric Machinery Co.
General Electric Co.
Western Electric Co.
Westinghouse Elec. & Mfg. Co.

DOOR SWITCHES.
Cutler-Hammer Mfg. Co.

DRILLS AND BITS, Electricians'.
Hubbard & Co.

ELECTRO-PLATING MACHINERY.
Crocker-Wheeler Co.
General Electric Co.
General Electric Co., Ft. Wayne Dept.
Ideal Electric & Mfg. Co.
Westinghouse Elec. & Mfg. Co.

ENGINEERS & CONTRACTORS.
American Bridge Co.
Brady Co.
Arnold Co.
Baehr, Wm. A.
Busselle, E. T.
Byllesby & Co., H. M.
Condron Co.
Cooley & Marvin Co.
Cooper & Co., Hugh L.
Dryer, Ervin.
Estes, Inc., L. V.
Fowle & Cravath.
King, A. C.
Lyndon, Lamar.
Robinson & Co., Dwight P.
Sargent & Lundy.
Stone & Webster Eng. Corp.
Western Electric Co.
White Companies, J. G.
Woodmansee & Davidson, Inc.

ENGINES, Gas and Gasoline.
Allis-Chalmers Mfg. Co.
Westinghouse Machine Co.

ENGINES, Steam.
Allis-Chalmers Mfg. Co.
Ridgway Dynamo & Engine Co.
Westinghouse Machine Co.

FANS, Motor and Disc.
Adams-Bagnall Electric Co.
Central Electric Co.
Century Electric Co.
Colonial Fan-Motor Co.
Eck Dynamo & Motor Co.
Emerson Electric Mfg. Co.
General Electric Co.
General Electric Co., Ft. Wayne Dept.
Manhattan Electric Supply Co.
Mechanical Appliance Co.
Peerless Electric Co.
Robbins & Myers Co.
Western Electric Co.
Westinghouse Elec. & Mfg. Co.
Wisconsin Electric Co.

FAULT FINDERS, Electric.
Electric Controller & Mfg. Co.

FIBRE.
American Vulcanized Fibre Co.
Continental Fibre Co.
West Virginia Pulp & Paper Co.

FIRE ALARMS.
Palmer Elec. & Mfg. Co.

FIRE EXTINGUISHERS
Castle, Inc., James M.

FIREPLACES, Electric.
General Electric Co.
Westinghouse Elec. & Mfg. Co.

FITTINGS, Conduit Terminals, Bushings, Entrance Caps.
Adapti Co., The.
Appleton Electric Co.
Chicago Fuse Mfg. Co.
National Metal Molding Co.
Sherman Mfg. Co., H. B.

FIXTURES
Southern Electric Co.

FIXTURES, Electric and Gas.
Beardslee Chandelier Mfg. Co.
Benjamin Electric Mfg. Co.
Central Electric Co.
Faries Mfg. Co.
Luminous Specialty Co.
Luminous Unit Co.
Steel City Electric Co.
Western Electric Co.

FIXTURES, Indirect and Semi-Indirect Lighting.
Beardslee Chandelier Mfg. Co.
Benjamin Electric Mfg. Co.
Central Electric Co.
General Electric Co.
Luminous Specialty Co.
Luminous Unit Co.
Western Electric Co.

FIXTURES, Show Case.
Benjamin Electric Mfg. Co.
Central Electric Co.

FLAT IRONS, Electric.
Central Electric Co.
Cutler-Hammer Mfg. Co.
General Electric Co.
Manhattan Electrical Supply Co.
Western Electric Co.
Westinghouse Elec. & Mfg. Co.

FLOOD LIGHTS.
Crouse-Hinds Co.
General Electric Co.
Western Electric Co.

FLUXES, Soldering.
Allen Co., Inc., L. B.
Benson Co., Alex. R.
Burnley Battery & Mfg. Co.
Chicago Fuse Mfg. Co.
McGill Mfg. Co.
Manhattan Electrical Supply Co.
Western Electric Co.

FORGINGS.
American Bridge Co.
Smith & Hemenway Co.

FUSE CLIPS.
Sherman Mfg. Co., H. B.

FUSES (Enclosed).
Condit Electrical Mfg. Co.
Bussmann Mfg. Co.
Killark Electric Mfg. Co.

FUSE PLUGS.
Anderson Mfg. Co., A. & J. M.
Bussmann Mfg. Co.
Chicago Fuse Mfg. Co.
Clemens Electric Corp.
Daum, A. F.
General Electric Co.
Killark Electric Mfg. Co.
Western Electric Co.
Westinghouse Elec. & Mfg. Co.

FUSE WIRE.
Appleton Electric Co.
Bussmann Mfg. Co.
Chicago Fuse Mfg. Co.
Condit Electrical Mfg. Co.
General Electric Co.
Killark Electric Mfg. Co.
Western Electric Co.

FUSES.
Appleton Electric Co.
Bussman Mfg. Co.
Central Electric Co.
Chicago Fuse Mfg. Co.
Condit Electrical Mfg. Co.
Daum, A. F.
D. & W. Fuse Co.
Economy Fuse & Mfg. Co.
Electrical Engrs. Equipment Co.
Federal Sign System (Electric).
General Electric Co.
Johns-Manville Co., H. W.
Killark Electric Mfg. Co.
Pierce Fuse Corp.
Schweitzer & Conrad, Inc.
Western Electric Co.
Westinghouse Elec. & Mfg. Co.

GATES, HEAD.
American Bridge Co.

GEARS, Rawhide and Composition.
General Electric Co.
New Process Gear Corp.

GEARS, Silent Chain.
Link-Belt Co.
Morse Chain Co.

GENERATORS.
Allis-Chalmers Mfg. Co.
Crocker-Wheeler Co.
Eck Dynamo & Motor Co.
Electric Machinery Co.
Electro Dynamic Co.
General Electric Co.
General Electric Co., Ft. Wayne Dept.
Ideal Electric & Htg. Co.
Ridgway Dynamo & Engine Co.
Western Electric Co.
Westinghouse Elec. & Mfg. Co.

GLASSWARE, Illuminating.
Central Electric Co.
Western Electric Co.

GLOBES, Arc Light (Outer and Inner).
General Electric Co.
Western Electric Co.
Westinghouse Elec. & Mfg. Co

GRINDERS.
Western Electric Co.
Wisconsin Electric Co.

GROUND CLAMPS.
Appleton Electric Co.
Condit Electrical Mfg. Co.
General Electric Co.
Hubbard & Co.
Sherman Mfg. Co., H. B.
Thomas & Betts Co.
Western Electric Co.

GUARDS, Inc. Lamp.
Benjamin Electric Mfg. Co.
Flexible Steel Lacing Co.
Hubbell, Inc., Harvey.
McGill Mfg. Co.

GUARDS, Inc. Lamp, Portable.
Flexible Steel Lacing Co.
McGill Mfg. Co.

GUY CLAMPS.
American Steel & Wire Co.
Hubbard & Co.
Western Electric Co.

HACK SAW MACHINES
Barnes & Irving, Inc.

HANGERS, Conduit and Molding.
Appleton Electric Co.
General Devices & Fittings Co.
Western Electric Co.

HANGERS AND CLAMPS.
General Devices & Fittings Co.
Ostrander & Co., W. R.
Standard Underground Cable Co.
Steel City Electric Co.
Thomas & Betts Co.

HARDWARE Pole Line.
Columbus Handle & Tool Co.
Oshkosh Mfg. Co.
Smith & Hemenway Co.
Western Electric Co.

HEATERS, Electric.
Cutler-Hammer Mfg. Co.
General Electric Co.
Western Electric Co.
Westinghouse Elec. & Mfg. Co.

HOISTING MACHINERY, Electric Mine.
Allis-Chalmers Mfg. Co.
General Electric Co.

HYDRAULIC MACHINERY.
Allis-Chalmers Mfg. Co.

ICE MAKING MACHINERY.
Triumph Ice Machine Co.

INDUSTRIAL TRUCKS AND TRACTORS.
Baker R. & L. Co.
Elwell-Parker Electric Co.
Mercury Mfg. Co.

INSTRUMENTS.
Electric Controller & Mfg. Co.
Esterline Co.
General Electric Co.
General Electric Co., Ft. Wayne Dept.
Jewell Elec. Instrument Co.
Leeds & Northrup Co.
Manhattan Electrical Supply Co
Norton Electrical Instrument Co.
Precision Instrument Co.
Roller-Smith Co.
Sangamo Electric Co.
Uehling Instrument Co.
Western Electric Co.
Westinghouse Elec. & Mfg. Co.
Weston Electrical Instrument Co

INSULATING CEMENTS.
U. S. Rubber Co.
Westinghouse Elec. & Mfg. Co.

INSULATING MACHINERY.
Hubbell, Inc., Harvey.
New England Butt Co.

INSULATING MATERIAL.
Magnesia Assn. of America.

INSULATING PAINTS AND COMPOUNDS.
Chicago Mica Co.
Electrical Engrs. Equipment Co.
McGill Mfg. Co.
Mica Insulator Co.
Sherwin-Williams Co., The.
Standard Paint Co.
Standard Underground Cable Co
U. S. Rubber Co.

INSULATION, Fibre.
American Vulcanized Fibre Co.
Continental Fibre Co.
West Virginia Pulp & Paper Co

INSULATION, Hard Rubber, Composition Molded, Etc.
Continental Fibre Co.
Electrose Mfg. Co.
Garfield Mfg. Co.
International Insulating Corp.
Shaw Insulator Co.
Westinghouse Elec. & Mfg. Co.

INSULATORS, Arc Lamp.
Anderson Mfg. Co., A. & J. M.
Cutter Co., George.
General Electric Co.
Shaw Insulator Co.
Westinghouse Elec. & Mfg. Co.

INSULATORS, Glass.
General Electric Co.
Hemingray Glass Co.
Western Electric Co.
Westinghouse Elec. & Mfg. Co.

INSULATORS, High Voltage.
Electrical Engrs. Equipment Co.
General Devices & Fittings Co.
General Electric Co.
General Porcelain Co.
Locke Ins. & Mfg. Co.
Shaw Insulator Co.
Thomas & Son Co., The R.
Western Electric Co.
Westinghouse Elec. & Mfg. Co.

INSULATORS, Wood.
Westinghouse Elec. & Mfg. Co.

INSULATOR SUPPORTS.
General Devices & Fittings Co
Steel City Electric Co.

INSURANCE.
Utilities Indemnity Exchanges

IRONERS, CLOTHES (Motor Driven)
Apex Appliance Co.
Geyser Electric Co.
Hurley Machine Co.

IRIDIO-PLATINUM.
Baker & Co., Inc.

IRON FENCING.
Page Steel & Wire Co.

JACKS, Pole-pulling.
Templeton, Kenly & Co.

JARS, Battery (Glass).
Hemingray Glass Co.

JOINTS, Cable.
General Electric Co.

JOINTS, Copper Bus.
General Devices & Fittings Co.

JOINTS, Fixture Insulating.
Thomas & Betts Co.

LAMPS, Arc.
Adams-Bagnall Elect. Co.
Anderson Mfg. Co., A. & J. M.
Central Electric Co.
General Electric Co.
General Electric Co., Ft. Wayne Dept.
Western Electric Co.
Westinghouse Elec. & Mfg. Co.

LAMPS, Incandescent.
Central Electric Co.
Edison Lamp Works of General Electric Co.
Franklin Electric Mfg. Co.
Hubbell, Inc., Harvey.
National Lamp Works of General Electric Company, comprising the following member divisions:
American Electric Lamp Division.
Banner Electric Division.
Boston Economy Lamp Division.
Brilliant Electric Division.
Bryan-Marsh Electric Division
Buckeye Electric Division.
Colonial Electric Division.
Columbia Incandescent Lamp Division.
Economical Electric Lamp Division.
Federal Miniature Lamp Division.
Flux Miniature Lamp Division
Fostoria Incandescent Lamp Division.
General Incandescent Lamp Division.
Monarch Incandescent Lamp Division.
Munder Electric Division.
Packard Lamp Division.
Peerless Lamp Division.
Shelby Lamp Division.
Standard Electric Division.
Sterling Electric Lamp Division.
Sunbeam Incandescent Lamp Division.
Western Electric Co.
Westinghouse Lamp Co.
Whitelite Electric Co.

LAMPS, Vapor and Vacuum Tube.
Cooper-Hewitt Electric Co
General Electric Co.

LANTERNS.
Federal Sign System (Electric)
Manhattan Electrical Supply Co

LIGHTING FIXTURES, Gas and Vaporproof.
Benjamin Electric Mfg. Co.

LIGHTING FIXTURES, Industrial.
Benjamin Electric Mfg. Co.

LIGHTING PLANTS.
Crocker-Wheeler Co.
General Electric Co.
Mayhew Co.
Ridgway Dynamo & Engine Co
Western Electric Co.
Westinghouse Elec. & Mfg. Co

LINE MATERIALS.
Anderson Mfg. Co., A. & J. M
Central Electric Co.
Columbus Handle & Tool Co.
General Electric Co.
Hubbard & Co.
Schweitzer & Conrad, Inc.
Shaw Insulator Co.
Western Electric Co.
Westinghouse Elec. & Mfg. Co

LIGHTNING ARRESTERS.
Anderson Mfg. Co., A. & J. M
Central Electric Co.
General Electric Co.
Hubbard & Co.
Schweitzer & Conrad, Inc.
Shaw Insulator Co.
Westinghouse Elec. & Mfg. Co

LIGHTS, Stage.
General Electric Co.

LISTS, Mailing.
Ross-Gould List & Letter Co

LOCK WASHERS.
Smith & Hemenway Co.

LOCOMOTIVES, Electric
General Electric Co.
Westinghouse Elec. & Mfg. Co

LUBRICANTS.
Dixon Crucible Co., Jos.
Keystone Lubricating Co
Texas Co.

LUGS.
Chicago Fuse Mfg. Co.
Condit Electrical Mfg. Co.
Electrical Engrs. Equipment Co.
General Devices & Fittings Co.
General Electric Co.
Sherman Mfg. Co., H. B.
Trumbull Electric Mfg. Co.

LUMINOUS MATERIALS.
Cold Light Mfg. Co.

MACHINERY GUARDS, Perforated
Erdle Perforating Co.

MACHINERY, REBUILT
Boustead Electric & Mfg. Co.
Chattanooga Armature Works.
Davis, J. F.
Duquesne Electric & Mfg. Co.
Electric Service Engineering Co
Gregory Electric Co.
Guaranteed Motor Co.
Harris Bros. Co.
Klein & Co., Nathan.
MacGovern & Co., Inc.
National Electrical Exchange.
Nussbaum & Co., V. M.
Olson-Boettger Electric & Mfg Co.
Power Equipment Co.
Reliable Electric Motor Co.
Sachsenmaier Co., Geo.
Sorgel Electric Co.
Zelnicker Supply Co., Walter A

MAGNETIC SWITCH CONTROLLERS
Cutler-Hammer Mfg. Co.
Electric Controller & Mfg. Co.
General Electric Co.
Sundh Electric Co.
Westinghouse Elec. & Mfg. Co.

MAGNETOS, MAGNETO GENERATORS AND BELLS.
Manhattan Electrical Supply Co.
Western Electric Co.

MAGNETOS, Ignition.
General Electric Co.
Manhattan Electrical Supply Co.
Shaw Insulator Co.

MAGNETS, Electro.
Cutler-Hammer Mfg. Co.
Electric Controller & Mfg. Co.
General Electric Co.
Manhattan Electrical Supply Co.
Western Electric Co.
Cutler-Hammer Mfg. Co.
Westinghouse Elec. & Mfg. Co.

MAGNETS, Lifting.
Cutler-Hammer Mfg. Co.
Electric Controller & Mfg. Co.
Western Electric Co.

MAGNETS, Permanent.
Western Electric Co.

MANGANIN.
Baker & Co., Inc.

MARBLE.
Davis Slate & Mfg. Co.

MARINE FIXTURES.
Appleton Electric Co.
Benjamin Elec. Mfg. Co.
General Electric Co.

MAST ARMS.
Benjamin Elec. Mfg. Co.
Brady Electric Mfg. Co.
Cutter Co., George.
General Electric Co., Ft. Wayne Dept.

MEASURING MACHINES (For Wire).
New England Butt Co.

METAL CUTTERS.
Koch & Co., Paul W.

METAL STAMPINGS.
Benjamin Electric Mfg. Co.
Erdle Perforating Co.
Faries Mfg. Co.
McDowell Mfg. Co.
Peru Electric Co.

METERS, Gas and Air.
Cutler-Hammer Mfg. Co.

METERS, Recording.
Esterline Co.
General Electric Co.
Norton Elec. Instrument Co.
Sangamo Electric Co.
Weston Elec. Instrument Co.
Westinghouse Elec. & Mfg. Co.

METERS, Watthour.
Duncan Electric Mfg. Co.
General Electric Co.
Sangamon Electric Co.
Westinghouse Elec. & Mfg. Co.

MICA.
Chicago Mica Co.
Ford Mica Company.
Mica Insulator Co.

MINING MACHINERY (Motor Driven).
Allis-Chalmers Mfg. Co.
General Electric Co.
Westinghouse Elec. & Mfg. Co.

MIRRORS, for Reflectors.
National Copper Works.

MOLDED INSULATION
Cutler-Hammer Mfg. Co.
Garfield Mfg. Co.
Shaw Insulator Co.
Westinghouse Elec. & Mfg. Co

MOLDING.
Appleton Electric Co.
National Metal Molding Co
Trumbull Electric Mfg. Co.

MOTORS AND DYNAMOS.
Advance Electric Co.
Allis-Chalmers Mfg. Co.
Central Electric Co.
Century Electric Co.
Colonial Fan & Motor Co.
Crocker-Wheeler Co.
Domestic Electric Co.
Eck Dynamo & Motor Co.
Electric Machinery Co.
Electro Dynamic Co.
Emerson Electric Mfg. Co.
General Electric Co.
General Electric Co., Ft. Wayne Dept.
Howell Elect. Motor Co.
Ideal Elect. & Mfg. Co.
Mechanical Appliance Co.
Peerless Electric Co.
Ridgway Dynamo & Engine Co.
Robbins & Myers Co.
Roth Bros. & Co.
St. Louis Elect. Works.
Triumph Electric Co.
Wesche Electric Co., B. A.
Western Electric Co.
Westinghouse Elec. & Mfg. Co.
Wisconsin Electric Co.
Western Electric Co.

OHMMETERS.
Weston Electrical Instrument Co.

OZONIZERS.
General Electric Co.

PACKING (Steam).
New York Insulated Wire Co.
U. S. Rubber Co.

PAINTS, Preservative.
Standard Paint Co.
U. S. Rubber Co.

PAPER, Insulating Paper Fuller Board, Press Board.
U. S. Rubber Co.

PANEL BOARDS.
Benjamin Elec. Mfg. Co.
General Devices & Fittings Co.
Sundh Electric Co.

PASTE, Soldering.
Burnley Battery & Mfg. Co.

PATENT SOLICITORS.
Duvall, Edw. S.
Siggers, E. G.

PHOTOMETERS, Lamp Testing.
Leeds & Northrup Co.

PHOTOMETER STANDARDS.
Electrical Testing Laboratories.

PIGTAILS AND FLEXIBLE LEADS.
Belden Mfg. Co.
Rome Wire Co.

PINS AND BRACKETS, Wood.
American Line Materials Co.
Electrical Engrs. Equipment Co.
Western Electric Co.

PLATFORMS, (Pole Seats).
Hubbard & Co.
Oshkosh Mfg. Co.
Western Electric Co.

PLATINUM.
American Platinum Works.
Baker & Co., Inc.

PLIERS, Wire Cutting.
Klein & Sons, Mathias.
Smith & Hemenway Co.
Western Electric Co.

PLUGS AND RECEPTACLES, Flush.
Ajax Electric Specialty Co.
Benjamin Electric Mfg. Co.
Cutler-Hammer Mfg. Co.
General Electric Co.
Hubbell, Inc., Harvey.
Manhattan Electrical Supply Co.
Pass & Seymour, Inc.
Trumbull Electric Mfg. Co.
Western Electric Co.

PLUGS AND RECEPTACLES, Power.
Central Electric Co.

PLUGS AND RECEPTACLES, Stage.
Condit Electrical Mfg. Co.
General Electric Co.
Hubbell, Inc., Harvey.
Manhattan Electrical Supply Co.
Western Electric Co.

POLE HOLE DIGGERS.
International Earth Boring Machine Co.

POLES, Concrete.
American Steel & Wire Co.

POLES, Steel.
American Bridge Co.
Archbold-Brady Co.
Bates Expanded Steel Truss Co.

POLES, Treated.
Bell Lumber Co.
Lindsley Bros. Co.
National Pole Co.
Naugle Pole & Tie Co.
Page & Hill Co.
Partridge Lumber Co., T. M.
Valentine-Clark Co., The.
Western Electric Co.

POLES, Wood.
Barnes & Lindsley Mfg. Co.
Bell Lumber Co.
Duluth Log Co.
Fowler Co., John H.
Gilbert, Willis H.
Humbird Lumber Co.
Lindsley Bros. Co.
National Pole Co.
Naugle Pole & Tie Co.
Northern White Cedar Ass'n.
Page & Hill Co.
Partridge Lumber Co., T. M.
Torrey Cedar Co.
Valentine-Clark Co.
Western Electric Co.
Western Red Cedar Ass'n.

POLE STEPS.
American Steel & Wire Co.
Anderson Mfg. Co., A. & J. M.
Cutter Co., George.
Hubbard & Co.
Oshkosh Mfg. Co.
Western Electric Co.

PORCELAIN, Special Shapes.
Cook Pottery Co.
Findlay Electric Porcelain Co.
General Devices & Fitting Co.
General Porcelain Co.
Illinois Electric Porcelain Co.
Parker & Son, Inc., J. H.
Pass & Seymour, Inc.
Peru Electric Co.
Westinghouse Elec. & Mfg. Co.

PORCELAIN, Standard.
Cook Pottery Co.
General Devices & Fittings Co.
General Electric Co.
General Porcelain Co.
Illinois Electric Porcelain Co.
Locke Insulator Mfg. Co.
Parker & Son, Inc., J. H.
Pass & Seymour, Inc.
Peru Electric Co.
Westinghouse Elec. & Mfg. Co.
Western Electric Co.

PORTABLES, Electric Reading Lamps.
Central Electric Co.
Faries Mfg. Co.

POSTS, Lamp.
Central Electric Co.
Cutter Co., George.

POTENTIOMETERS.
Leeds & Northrup Co.

POTHEADS AND SLEEVES.
Brady Electric Mfg. Co.
Central Electric Co.
Electrical Engrs. Equipment Co.
General Electric Co.
Okonite Co., The.
Standard Underground Cable Co.

POWER HOUSE SPECIALTIES.
Electrical Engrs. Equipment Co.

PRODUCERS, Gas.
Allis-Chalmers Mfg. Co.
Westinghouse Machine Co.

PROJECTORS, Electric (Search Lights).
General Electric Co.
General Electric Co., Ft. Wayne Dept.
Western Electric Co.

PYROMETERS, Electric.
Leeds & Northrup Co.

PULLEYS, Arc Lamp.
Cutter Co., George.
General Electric Co., Ft. Wayne Dept.

PUMPS, Centrifugal.
Dayton-Dowd Co.
Wheeler Condenser & Eng. Co.

PUMPS, Vacuum.
Wheeler Condenser & Eng. Co.

PUMPS, Water.
Allis-Chalmers Mfg. Co.

PUSH BUTTONS.
Benjamin Electric Mfg. Co.
Central Electric Co.
Cutler-Hammer Mfg. Co.
Manhattan Electrical Supply Co.
Western Electric Co.

RACKS AND RINGS. Telephone Distributing.
Hubbard & Co.
Western Electric Co.

RADIATORS.
General Electric Co.

RAIL BONDS.
American Steel & Wire Co.
Anaconda Copper Mining Co.
Condit Electrical Mfg. Co.
General Electric Co.
Western Electric Co.

RAIL JOINTS.
Western Electric Co.

RAILWAY SPECIALTIES, Electric.
Anderson Mfg. Co., A. & J. M.
General Electric Co.
Western Electric Co.
Westinghouse Elec. & Mfg. Co.

RANGES, Electric.
Edison Electric Appliance Co.

RECEPTACLES, Sign.
Benjamin Electric Mfg. Co.
General Electric Co.
Pass & Seymour, Inc.

RECEPTACLES, Weatherproof.
Benjamin Electric Mfg. Co.
General Electric Co.
Hubbell, Inc., Harvey
Pass & Seymour, Inc.

RECTIFIERS.
General Electric Co.
Westinghouse Elec. & Mfg. Co.

RECTIFIERS, MERCURY.
Cooper-Hewitt Electric Co.

REELS, Wire.
Klein & Son, Mathias.
Oshkosh Mfg. Co.

REFLECTORS, Glass and Steel.
(See Shades.)

REFRIGERATING MACHINERY.
Triumph Ice Machine Co.

REGULATORS, CURRENT.
Electric Appliance Co.
Packard Electric Co.

REGULATORS, Incandescent Lamp.
Anylite Electric Co.

RELAYS.
Condit Electrical Mfg. Co.
General Electric Co.
Westinghouse Electric & Mfg. Co.

REPAIRS.
Boustead Electric & Mfg. Co.
Commonwealth Edison Co.
General Electric Co.
Olson-Boettger Elec. & Mfg. Co.
Westinghouse Elec. & Mfg. Co.

RESISTANCE, Banks and Units.
Cutler-Hammer Mfg. Co.
Dixon Crucible Co., Jos.
Electric Controller & Mfg. Co.
General Electric Co.
Western Electric Co.
Westinghouse Elec. & Mfg. Co.

RESISTANCE WIRE & RIBBON.
American Steel & Wire Co.
Belden Mfg. Co.
General Electric Co.
Moore, Alfred F.
Roebling's Sons Co., John A.

REVERSING CONTROLLERS FOR CRANES, ETC.
Cutler-Hammer Mfg. Co.
Electric Controller & Mfg. Co.
General Electric Co.
Westinghouse Elec. & Mfg. Co.

RHEOSTATS.
Allis-Chalmers Mfg. Co.
Cutler-Hammer Mfg. Co.
Erdle Perforating Co.
Electric Controller & Mfg. Co.
General Electric Co
General Electric Co., Ft. Wayne Dept.
Western Electric Co.
Westinghouse Elec. & Mfg. Co.

RODS.
Anaconda Copper Mining Co.
Page Steel & Wire Co.
Rochester Washing Mach. Corp.
Roebling's Sons Co., John A.

RUNWAYS, CRANE.
American Bridge Co.

SAWS, METAL.
Atkins & Co., E. C.

SEWING MACHINE MOTORS.
Western Electric Co.
Wisconsin Electric Co.

SHADE HOLDERS.
Appleton Electric Co.
Benjamin Electric Mfg. Co.
General Electric Co.
Hubbell, Inc., Harvey
Pass & Seymour, Inc.
Western Electric Co.

SHADES, Glass.
Beardslee Chandler Mfg. Co.
Central Electric Co.

SHADES, Metallic.
Adams-Bagnall Electric Co.
Benjamin Electric Mfg. Co.
Central Electric Co.
Cutter Co., George.
Erdle Perforating Co.
Faries Mfg. Co.
Hubbell, Inc., Harvey
Ivanhoe-Regent Works of General Electric Co.
National Copper Works.
Ostrander & Co., W. R.

SHEDS, COLD STORAGE.
American Bridge Co.

SHEDS, TRAIN.
American Bridge Co.

SHEETS, Iron and Steel.
American Sheet & Tin Plate Co.

SIGNALS, Industrial Audible.
Benjamin Electric Mfg. Co.
Federal Sign System (Electric).

SIGNS, Electric.
Federal Sign System (Electric).

SILENT CHAIN DRIVES.
Federal Sign System (Electric).
Link-Belt Co.
Morse Chain Co.

SIRENS.
Federal Sign System (Electric).

SLATE.
Davis Slate & Mfg. Co.

SLEEVES, Paper.
Standard Underground Cable Co.

SLEEVINGS.
Belden Mfg. Co.
Chicago Mica Co.
Standard Underground Cable Co.

SOCKETS AND RECEPTACLES.
Ajax Electric Specialty Co.
Benjamin Electric Mfg. Co.
Central Electric Co.
Cutler-Hammer Mfg. Co.
Federal Sign System (Electric).
General Electric Co.
Hubbell, Inc., Harvey
Ostrander & Co., W. R.
Pass & Seymour, Inc.
Peru Electric Co.
Trumbull Electric Mfg. Co.
Western Electric Co.
Westinghouse Elec. & Mfg. Co.

SOCKETS, Locking.
Cutler-Hammer Mfg. Co.
General Electric Co.
Pass & Seymour, Inc.

SOLDERING IRONS.
Clemens Electrical Corporation.
Manhattan Electrical Supply Co.
Western Electric Co.
Westinghouse Elec. & Mfg. Co.

SOLDERLESS CONNECTORS.
Dossert & Co.
Frankel Connector Co.
Westinghouse Electric Mfg. Co.

SPINNINGS.
Faries Mfg. Co.

SPRINGS.
American Platinum Works.
American Steel & Wire Co.
Manross & Sons, F. N.

SPROCKET WHEELS.
Link-Belt Co.
Morse Chain Co.

STACKS.
American Bridge Co.

STAGE LIGHTING APPARATUS.
Anderson Mfg. Co., A. & J. M.
Central Electric Co.
Sundh Electric Co.
Ward Leonard Electric Co.

CLASSIFIED INDEX OF ELECTRICAL REVIEW.

Vol. LXXV. No. 24.

STANDARD CELLS.
Leeds & Northrup Co.
Weston Electrical Instrument Co.

STATIONS, Coaling.
American Bridge Co.
Link-Belt Co.

STATIONS, Elevated Ramway.
American Bridge Co.

STEEL, Structural and Tool.
American Bridge Co.

STERILIZERS, Instrument.
Cutler-Hammer Mfg. Co.
Westinghouse Elec. & Mfg. Co.

STOKERS, Mechanical.
American Engineering Co.
Babcock & Wilcox Co.
Westinghouse Machine Co.

STOVES, Electric.
Edison Electric Appliance Co., Inc.
General Electric Co.
Manhattan Electrical Supply Co.
Westinghouse Elec. & Mfg. Co.

STRAIN INSULATORS.
Anderson Mfg. Co., Albert & J. M.
General Devices & Fittings Co.
General Electric Co.

STREET LIGHTING FIXTURES, Incandescent.
Benjamin Electric Mfg. Co.
Brady Electric Mfg. Co.
Central Electric Co.
Cutter Co., Geo.
General Electric Co.
General Electric Co., Ft. Wayne Dept.
Pittsburgh Transformer Co.

SUB-STATIONS, Outdoor.
Electrical Engrs. Equipment Co.
General Devices & Fittings Co.
Schweitzer & Conrad, Inc.

SUPPLIES, Electrical.
Benjamin Electric Mfg. Co.
Central Electric Co.
Commonwealth Edison Co.
Manhattan Electrical Supply Co.
Western Electric Co.

SWITCHBOARDS, (Switchboards and Panel Boards).
Allis-Chalmers Mfg. Co.
Condit Electrical Mfg. Co.
Electric Controller & Mfg. Co.
Electrical Testing Laboratories.
General Devices & Fittings Co.
General Electric Co.
General Electric Co., Ft. Wayne Dept.
Sundh Electric Co.
Trumbull Electric Mfg. Co.
Western Electric Co.
Westinghouse Elec. & Mfg. Co.

SWITCHBOARD SLATE.
Davis Slate & Mfg. Co.

SWITCHBOARDS, Theater.
Electrical Testing Laboratories.
Trumbull Electric Mfg. Co.

SWITCHES.
Arrow Electric Co.
Allis-Chalmers Mfg. Co.
Anderson Mfg. Co., A. & J. M.
Benjamin Electric Mfg. Co.
Central Electric Co.
Columbia Metal Box Co.
Condit Electrical Mfg. Co.
Crocker-Wheeler Co.
Cutler-Hammer Mfg. Co.
Electric Controller & Mfg. Co.
Elect. Engineers Equipment Co.
General Devices & Fittings Co.
General Electric Co.
Hubbell, Inc., Harvey
Manhattan Electrical Supply Co.
Ostrander & Co., W. R.
Palmer Elec. & Mfg. Co.
Schweitzer & Conrad, Inc.
Square D Co.
Sundh Electric Co.
Trumbull Electric Mfg. Co.
Western Electric Co.
Westinghouse Elec. & Mfg. Co.

SWITCHES (Oil).
Condit Electrical Mfg. Co.

SWITCHES, Remote Control.
Condit Electrical Mfg. Co.
General Devices & Fitting Co.
Palmer Electric & Mfg. Co.
South Bend Current Control Co.

SWITCHES, Time.
Anderson Mfg. Co., A. & J. M.
Hartford Time Switch Co.

SYNCHROSCOPES.
Weston Electrical Instrument Co.

TANKS, Oil Storage.
American Bridge Co.

TANKS, Water.
American Bridge Co.

TAPE, Insulating.
American Electrical Works.
Belden Mfg. Co.
Central Electric Co.
Chicago Mica Co.
Freydberg Bros., Inc.
General Electric Co.
Mica Insulator Co.
New York Insulated Wire Co.
Okonite Co., The
Standard Paint Co.
Standard Underground Cable Co.
U. S. Rubber Co.
Western Electric Co.
Westinghouse Elec. & Mfg. Co.

TAPS, Current.
Hubbell, Inc., Harvey.
Manhattan Electrical Supply Co.

TELEPHONES AND SWITCHBOARDS.
Central Electric Co.
Manhattan Electrical Supply Co.
Western Electric Co.

TESTING LABORATORIES.
Electrical Testing Laboratories Inc.
Illinois Testing Laboratories.
Underwriters' Laboratories.

THERMOMETERS, Electric.
Leeds & Northrup Co.

TIES, Pressed Steel.
American Bridge Co.

TIES, Wood.
Bell Lumber Co.
Naugle Pole & Tie Co.

TOGGLE BOLTS.
Cutter Co., George.
Wrigley Co., Thomas.

TOOLS, Cable Pulling.
American Steel & Wire Co.
General Electric Co.
Hubbard & Co.
Safety Ins. Wire & Cable Co.

TOOLS, Commutator Truing.
General Electric Co.
General Electric Co., Ft. Wayne Dept.

TOOLS, Linemen's.
Central Electric Co.
Hubbard & Co.
Klein & Sons, Mathias.
Oshkosh Mfg. Co.
Schweitzer & Conrad, Inc.
Smith & Hemenway Co., Inc.
Western Electric Co.

TOOLS, Portable Electric Polishers, Buffers Drills, Grinders, Hammers.
Emerson Electric Mfg. Co.
General Electric Co.
General Electric Co., Ft. Wayne Dept.
Robbins & Myers Co.
Western Electric Co.
Wisconsin Electric Co.

TORCHES AND FURNACES, Gasoline.
McGill Mfg. Co.

TOWERS, Cooling.
Wheeler Condenser & Eng. Co.

TOWERS, Electric Transmission.
American Bridge Co.

TOWERS, Steel Transmission.
American Bridge Co.

TOYS AND NOVELTIES.
Manhattan Electrical Supply Co.

TRACTORS (Industrial Electric).
Baker R. & L. Co.
Elwell-Parker Electric Co.
Mercury Mfg. Co.

TRANSFORMERS.
Adams-Bagnall Elec. Co.
Allis-Chalmers Mfg. Co.
Central Electric Co.
Condit Electrical Mfg. Co.
Duncan Electric Mfg. Co.
Enterprise Electric Co.
General Electric Co.
General Electric Co., Ft. Wayne Dept.
Kuhlman Electric Co.
Manhattan Electrical Supply Co.
Moloney Electric Co.
Pittsburgh Transformer Co.
Thordarson Electric Mfg. Co.
Western Electric Co.
Westinghouse Elec. & Mfg. Co.

TRANSFORMERS (Bell Ringing).
Killark Electric Mfg. Co.
General Electric Co.

TRANSMISSION MACHINERY.
Allis-Chalmers Mfg. Co.
Link-Belt Co.
Morse Chain Co.

TRANSMISSION MATERIAL.
General Electric Co.
Link-Belt Co.

TREE INSULATORS.
Anderson Mfg. Co., A. & J. M.

TROLLEY WHEELS.
General Electric Co.

TROLLEYS and CHAIRS.
Oshkosh Mfg. Co.

TRUCKS and TRACTORS, Industrial.
Baker R. & L. Co.
Elwell-Parker Electric Co.
Mercury Mfg. Co.

TRUSSES, Roof.
American Bridge Co.

TURBINE GOVERNORS.
Allis-Chalmers Mfg. Co.
General Electric Co.
Westinghouse Machine Co.

TURBINES, Steam.
Allis-Chalmers Mfg. Co.
De Laval Steam Turbine Co.
I. P. Morris Dept. of Wm. Cramp and Sons.

TURBINES, Vertical.
Wellman-Seaver-Morgan Co.

TURBINES, Water.
Allis-Chalmers Mfg. Co.
Wellman-Seaver-Morgan Co.

TUBING, Condenser.
Wheeler Condenser & Eng. Co.

UNDERGROUND INSTALLATIONS.
Standard Underground Cable Co.

VACUUM CLEANERS.
Apex Electrical Mfg. Co.
Central Electric Co.
Electric Vacuum Cleaner Co.
Eureka Vacuum Cleaner Co.
Federal Sign System (Electric).
Ramey Mfg. Co.
Western Electric Co.
Wisconsin Electric Co.

VARNISH, Insulating.
Chicago Mica Co.
General Electric Co.
Standard Paint Co.
Standard Underground Cable Co.
U. S. Rubber Co.
Westinghouse Elec. & Mfg. Co.

VIBRATORS.
Western Electric Co.
Wisconsin Electric Co.

VOLTMETERS.
Weston Electrical Instrument Co.

WASHERS, Clothes (Motor Driven).
Altorfer Bros. Co.
Apex Appliance Co.
Berthold Electrical Mfg. Co.
Crystal Washing Machine Co.
Federal Sign System (Electric).
Haag Bros. Co.
Home Specialty Mfg. Co.
Hurley Machine Co.
Meadows Mfg. Co.
Press Co., Wells H.
Remmert Mfg. Co.
Rochester Washing Mach. Corp.
Thistle Mfg. Co.
Voss Bros. Mfg. Co.
Wayne Mfg. Co.
Western Electric Co.
White Lily Mfg. Co.
Woodrow Mfg. Co.

WATTMETERS.
General Electric Co.
General Electric Co., Ft. Wayne Dept.
Roller-Smith Co.
Western Electric Co.
Westinghouse Elec. & Mfg. Co.
Weston Electrical Instrument Co.

WINDERS, Electro-Magnet.
Belden Mfg. Co.
Hubbard & Co.

WINDINGS.
Dudlo Mfg. Co.

WINDLASSES, Arc Lamps.
Brady Electric Mfg. Co.
Cutter Co., George.
Hubbard & Co.

WIRE, ASBESTOS COVERED.
Belden Mfg. Co.

WIRE, Bare and Insulated.
Anaconda Copper Mining Co.
American Electrical Works.
American Ins. Wire & Cable Co.
American Steel & Wire Co.
Atlantic Ins. Wire & Cable Co.
Belden Mfg. Co.
Chicago Fuse Mfg. Co.
Chicago Ins. Wire & Mfg. Co.
Dudlo Mfg. Co.
Electric Cable Co., The.
General Electric Co.
Habirshaw Electric Cable Co.
Indiana Rubber & Ins. Wire Co.
Independent Lamp & Wire Co.
Lowell Insulated Wire Co.
Marlin-Rockwell Corp.
Moore, Alfred F.
National Conduit & Cable Co.
Nat'l Metal Molding Co.
New York Insulated Wire Co.
Okonite Co., The.
Page Steel & Wire Co.
Phillips Wire Co.
Roebling's Sons Co., John A.
Rome Wire Co.
Safety Insulated Wire & Cable Co.
Simplex Wire & Cable Co.
Standard Underground Cable Co.
Western Electric Co.
Westinghouse Elec. & Mfg. Co.

WIRE, Copper Clad.
Page Steel & Wire Co.

WIRE, Enameled.
American Steel & Wire Co.
Belden Mfg. Co.
Dudlo Mfg. Co.
Moore, Alfred F.
Roebling's Sons Co., John A.
Rome Wire Co.
Westinghouse Elec. & Mfg. Co.

WIRE FENCING.
Page Steel & Wire Co.
Roebling's Sons Co., John A.

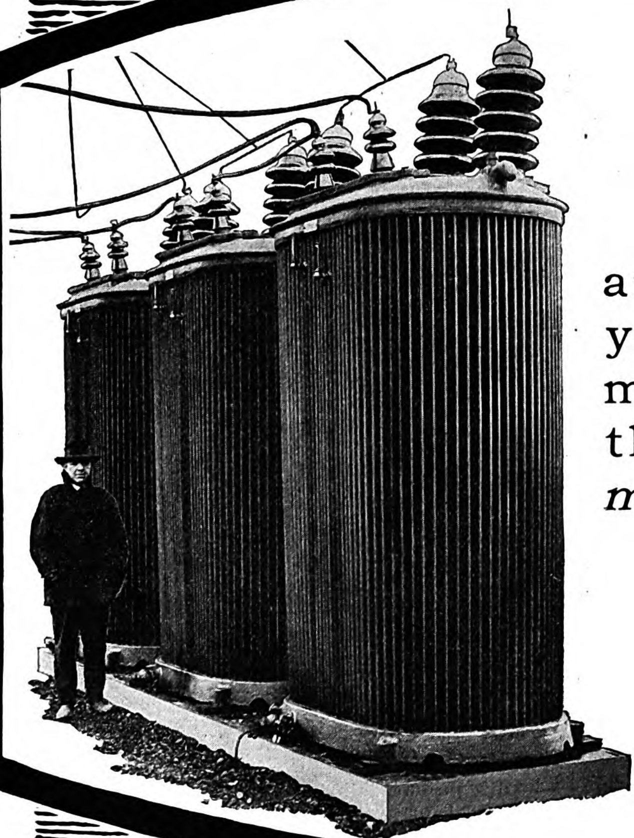
WIRE, MAGNET.
Dudlo Mfg. Co.
Roebling's Sons Co., John A.

WIRE, STEEL.
Page Steel & Wire Co.
Roebling's Sons Co., John A.

WIRE, Welding.
Page Steel & Wire Co.
Roebling's Sons Co., John A.

WIRELESS APPARATUS.
Manhattan Electrical Supply Co.

ALPHABETICAL INDEX TO ADVERTISERS



MOLONEY TRANSFORMERS

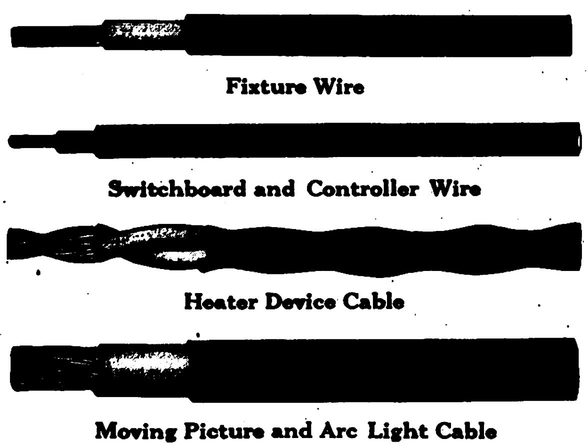
are the product of many years' experience, development and service—we know they are *good, because many users* are *satisfied.*

MOLONEY ELECTRIC CO.

St. Louis, Mo. Windsor, Can.

OFFICES:

New York	San Francisco
Pittsburgh	Los Angeles
Chicago	Seattle
Minneapolis	Salt Lake City
Rochester	Syracuse



SALAMANDER
PURE ASBESTOS INSULATED
MAGNET WIRE

The wire with the reputation in the great Central Stations. The wire that's made right and will stay right.

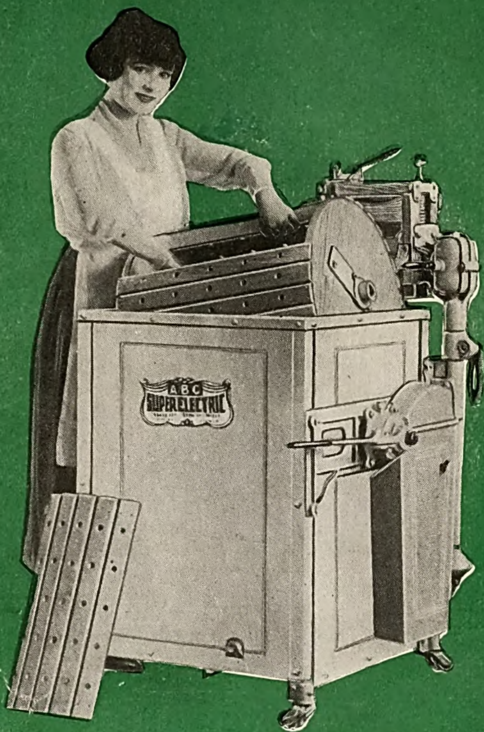
For Manufacturers and Electrical Engineers in Industry and Mines, we manufacture Asbestos Braided Solid Flexible Conductors for—Steel Mill Motor Connections, Search Lights, Controllers, Moving Picture Machines, Switch-Boards, Electric Ovens, Heaters, etc. Approved by Underwriters' Laboratory.

ENAMEL MAGNET WIRE

A new addition to the Salamander line. Highest grade. Plain or with silk or cotton covering. Write for samples and prices.

INDEPENDENT LAMP AND WIRE COMPANY, Inc.

Offices: 1737 Broadway, New York **Works: York, Pa., Weehawken, N. J.**



A-B-C
Super Electric
America's Leading Washing Machine

Starting with the issue of January 17th, A B C Electric Washing Machines will be advertised in The Saturday Evening Post in DOUBLE PAGE SPREADS.

This is in addition to our present campaign in the Leading Women's Publications, such as The Ladies' Home Journal, Woman's Home Companion, Good Housekeeping, etc.

One-half of the electrified homes in the U. S. will read A B C National Magazine Advertisements in 1920.

DEALERS: Our production facilities have been greatly enlarged by the erection of another new factory—the second this year. If you do not know of any active A B C dealer in your locality, write for particulars about the A B C Agency Franchise.

Altorfer Bros. Company
Peoria, Illinois