ELECTRICAL AGE

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ELECTRICAL AGE is 13 YEARS OLD.

INDEX TO ADVERTISERS.

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BARGAIN.

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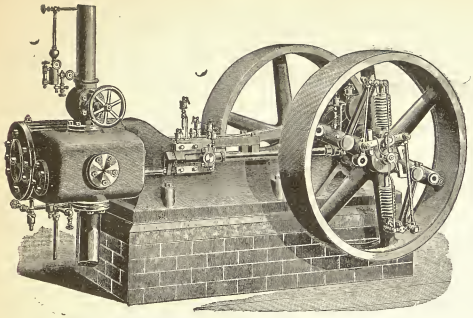

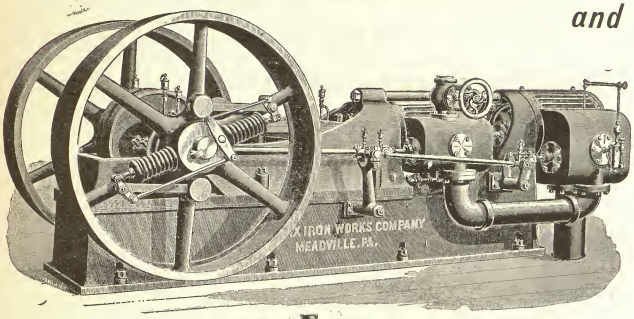

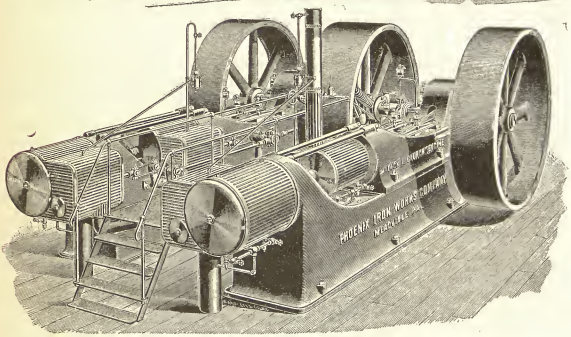

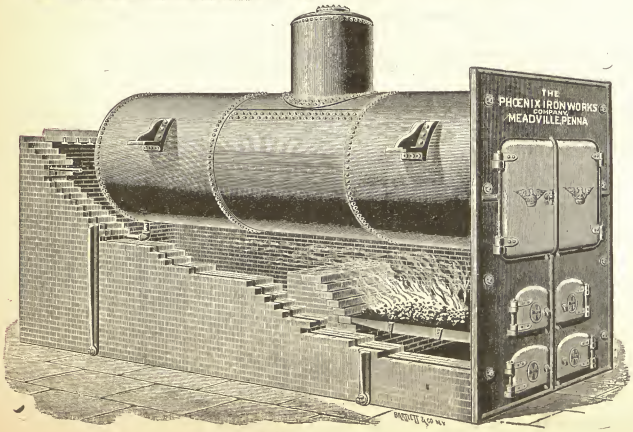

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NEW YORK, JANUARY 11, 1896.

CONTENTS.

AMERICAN PROFESSORS HONORED.

At the centenary of the Institute which was celebrated in Berlin, on January 4, Prof. Henry A. Rowland, of Johns Hopkins' University, Baltimore, was created an officer. Profs. Simon Newcomb and Alexander Agassiz were also honored in like manner, and Adolphus Hall was created a Chevalier of the Legion. All these gentlemen are corresponding members of the Academy of Sciences.

LIGHT THAT PENETRATES OPAQUE SUBSTANCES.

The New York *Sun* on January 7 published an interesting story in a special cablegram from London, to the effect that Prof. Routgen, of the Würzburg University, Vienna, had discovered a light which, for the purposes of photography, will penetrate wood, flesh and most other organic substances. The professor, the despatch states, has photographed metal weights which were inclosed in a wooden case; also a man's hand, showing only the bones, the flesh being invisible. The light used for the purpose is that emitted by a Crooke vacuum tube. "In contrast with the ordinary rays of light," the correspondent continues, "these rays penetrate organic matter and other opaque substances just as ordinary rays penetrate glass." The professor also succeeded in photographing hidden metals with a cloth thrown over the camera. The rays of light from the tube penetrated not only the wooden case containing the metals, but the fabric in front of the lens. Prof. Routgen is already using his discovery to photograph broken limbs and bullets in human bodies.

DANGER SIGNALS ON THE BRIDGE.

Undoubtedly many accidents are avoidable, especially on railroads, and it frequently happens that the utmost endeavors are not put forth to avoid an accident until after one has occurred. Then the managers, or those responsible, seem to realize that their plans were inadequate. It is not always possible, of course, to provide for every emergency; but the experience of the past has taught us a great deal, and with this experience as a guide many accidents can be guarded against. It is an open question whether the Brooklyn Bridge trustees have in the past profited by the long experience of other railroads. If they had, and they had done their whole duty, the fatal collision on the bridge a few weeks ago might not have occurred. Since then there has been a great bustle and show of anxiety on their part to adopt a reliable signal system in order to avoid such accidents in the future—all after the sacrifice of human life. During the past week or two experiments have been made, and evidently with successful results, with a telephone system by which communication can instantly be had between any train on the road and the train dispatcher, and *vice versa*. This is good as far as it goes, but we think it does not completely meet the requirements. A system that provides for the setting of a danger signal in the section behind a stalled train to immediately warn a train on that section of the danger ahead is what is needed. To telephone to the dispatcher from a train that has stopped on the road, and then for him to telephone the train behind would manifestly consume a good deal of time; a collision might occur in the interval. Mr. E. B. Dunn, of the Weather Bureau in this city, has devised a system of signals which is better than the telephone, and which, when properly developed, would, it seems to us, answer the purpose very well. We give on another page a brief description of his plan. Such a system could be made entirely automatic, and there is no more favorable situation for the operation of an automatic contrivance than on the bridge. The bridge trustees should examine the thing carefully, and, if it has the merit that it seems to have, they should adopt it forthwith.

PRINCIPLES OF DYNAMO DESIGN.

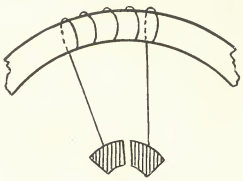
BY

Kenton Harrison E.E.

(*Continued from page 8.*)

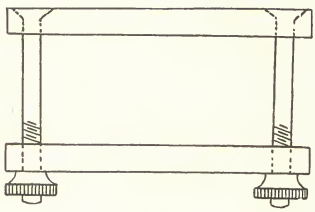
Windings.—There are two general classes of winding with which most engineers are very familiar. They are the simple drum or Siemens winding and the ring or Gramme. Of Gramme winding but little need be said, as its simplicity does not necessitate lengthy explanations.

In this type of winding there is, as a rule, one coil to each commutator section. There are, therefore, as many



GRAMME WINDING.

coils or sections on the ring as there are segments on the commutator. The construction of the ring does not always require that this should be the case, however. Two sections on the armature may be connected to only one commutator segment. The Crocker and Wheeler Co. use a toothed ring armature, with half as many slots as there are commutator segments. This requires the use of two coils in each slot, and thus simplifies the work. Where a Gramme armature is used in connection with a multipolar field a system of cross-connecting is in vogue. This may be extended to the commutator instead, and thus require as before the ordinary connections of the Gramme without any additions. The inside wire of a Gramme ring is probably inactive. It can hardly be called wasted, as its presence is as necessary as the end wire on a drum or, in fact, the connecting wires on any style of armature. Furthermore there are certain gains attendant upon the use of a ring armature which have always made it characteristic in practice. The taping of the armature core is necessary; at least its surface must be coated with an in-



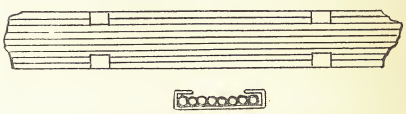
CLAMP.

sulating compound into which the wire will not sink when wound.

Stiff cotton goods well saturated with shellac and dried in a gentle heat, or a covering of oiled paper, will protect the wire wound upon the core from grounds. Stiff paper boiled in linseed oil and allowed to dry thoroughly will prove a useful substitute for tape. The coils, if wound upon a *smooth* core ring, are started by winding each within a given spacing and between two wooden or brass clamps, which limit the size of each coil. Each layer is shellacked and packed tightly and securely. Flabby or baggy winding is always a source of trouble and can never be remedied except by rewinding. Each section is filled in and separated from the next by a thin flange of vulcanized fibre, or any other appropriate means. When a toothed ring is to be wound the clamps are unnecessary, and the separate slots are flanged and taped in a thorough manner to protect from grounds. Binding wires wound over all in either two or three bands will protect the coils from flying out. A strip of mica underneath the binding wires will insulate them from the wire beneath, and small strips of tin placed under them at right angles will prove extremely beneficial if their ends are bent over the wire and solder applied.

The winding of a drum armature offers some further complications. Owing to the fact that the wire packs at the ends, several styles of winding are adopted for the purpose of eliminating as far as possible this difficulty. Were each section wound in full, layer after layer, the thickness of the winding at the ends would increase very rapidly as each section was completed. If each coil around the drum was one-half an inch thick and 12 coils were wound on it, there would be six inches of wire packed up at each end of the core.

To distribute the wire so as to reduce this swelling of the ends, and still retain the proper number of inductors in each section, is accomplished in the following manner: The shaft which passes through the centre of the core must not have one entire coil wound on *one* side of it, for that would give a thickness of wire to start with equal to the depth of the coil; and each coil as it is wound successively upon the last would in the end produce an enormous bunch at each extremity of the armature. By winding the first layer of the coil, however, upon the armature as usual, and winding the second layer so that its turns pass upon the other side of the shaft, the layers are alternated and



BINDING WIRE FOR ARMATURE.

only half the thickness of wire remains at the ends that exists in the section.

A coil one-half an inch deep would therefore occupy at the ends but one-quarter of an inch of thickness; and 12 coils one-half an inch deep, which would by the first method occupy a space of at least six inches at the ends, by this method call for little more than three inches. Allowance for insulation at the ends is necessary, as each layer is separated from the other by light canvas, cheesecloth or something equally available.

There are a variety of methods by which the end winding of a drum armature is kept reduced, and of them all the best is undoubtedly the style adopted by Crompton and Swinburne, and Eickemeyer.

The winding is either of copper strips or of separate coils pressed into form before use and then simply arranged around the armature core. A square head results at each end of the armature, and a neat and particularly compact winding is the result.

(*To be continued.*)

THE NORTH CHICAGO STREET-RAILWAY PAYS A BIG DIVIDEND.

A despatch from Chicago states that the directors of the North Chicago Street-Railway Company, on December 28, declared a dividend of 20 per cent. on the $5,500,000 capital stock of the company. Ten per cent. of this, or $550,000, will be given as a stock bonus, and 10 per cent. in six per cent. debentures of the company. The directors also voted an increase of $550,000 in the capital stock of the company, for which stockholders will be allowed to subscribe pro rata at par.

The stock sold on the same day on the Exchange at 308½, and figured on a basis of 300 the stockholders get $3,000,000 in bonuses and rights.

ELECTRICAL COMMUNICATION BETWEEN MOVING TRAINS.

M. De La Touche, the engineer of the Western Railway of France, has directed attention to the following means of securing communication between train and train as each pass on their journey, the object being to preserve a given and suitable space between those travelling on the same pair of rails. The rails are, in the first instance, electrically connected, so as to insure perfect electrical continuity, each rail, however, being maintained, as far as possible, insulated from the other. In order to effect this the rails are at their point of junction electrically bonded, or connected together. On each engine is arranged a small dynamo, A (fig. 1), driven from the axle of one pair of the wheels, as also a set of accumulators to provide the necessary current when the dynamo is still, or out of circuit.

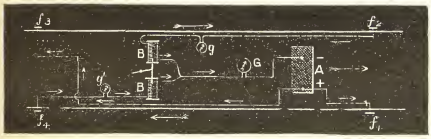


FIG. 1.

These cells, it is said, are of sufficient capacity to provide current for two hours, and the dynamo is of two horsepower. The connections are such that the dynamo, or the batteries, as the case may be, shall send a current to the rails by means of roller connections, f_1, f_2, f_3, f_4, attached to the front and rear of the locomotive. The current thus sent into the rail is employed to actuate certain apparatus in near trains, or, in conjunction with that from other near trains, the apparatus on the locomotive with which we are dealing.

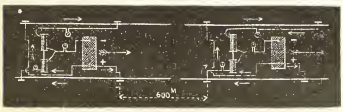


FIG. 2.

This apparatus is termed the warning apparatus, and consists of two electro-magnets or coils, which, by the aid of levers, operate the whistle or automatic brake. Three galvanometers (fig. 1), are placed in circuit. One, G, to indicate if the current is flowing; the others, g and g^1, to indicate to the driver if within the vicinity of danger. The arrangement will be made clear by reference to the diagrams. Fig. 2 represents two trains travelling in the same direction; fig. 3 two trains approaching one another. As the trains approach each other, so the current traversing the rails is augmented by the presence of the

FIG. 3.

approaching train, thereby actuating the galvanometers, g, and g^1, and indicating to the driver not only the direction in which the train is approaching, but the approximate distance it is off. It is said that a warning can thus be conveyed a distance of from 600 to 1,000 metres, and that the system is applicable to the operation of gates at level crossings, or signals. It is clear that such apparatus, placed on a locomotive engine, would be subject to very rough treatment, and we fear that the indications on the galvanometers would be liable to great fluctuations, due to the loss of current and variable connections.

THE FLEMING ALTERNATING ARC LAMP.

In design, workmanship and operation this lamp is claimed to be the best that can be produced. The mechanism has the fewest possible parts, all of which are made as strong as possible, consistent with proper proportioning of the strains. A view of the inside mechanism of the lamp is shown in Fig. 1.

The lamp is positive in its action, starting up on the normal amount of current, which prevents the flickering of incandescent lamps on the same circuit. It cannot overfeed, and will not, therefore, burn out the coil or blow

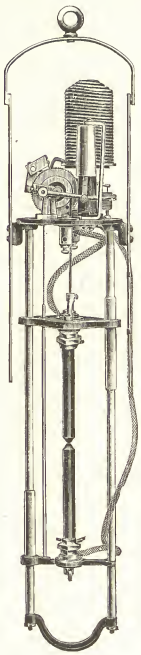


FIG. 1.

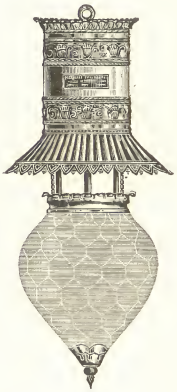


FIG. 2.

the fuse. It will burn on any current of sufficient frequency to maintain an arc without flickering.

The Fleming lamp is designed to burn on circuits of from 28 to 33 volts, and is practically noiseless in its operation. It is, besides, easily trimmed.

Fig. 2 shows a Fleming lamp of rich finish. These lamps are made in polished brass or bronze, and are excellently adapted for situations calling for lamps of ornamental design.

These lamps are made by the Fleming-Spence Electric Co., 652–660 Hudson street, New York City, and we understand they are meeting with much favor.

GOT A CHANCE TO EAT A DINNER.

The officers and directors of the Metropolitan Telephone and Telegraph Company held their "first annual dinner" last Saturday night at Madison Avenue Hotel. The affair was a great success and will probably be repeated annually.

Among those present were U. N. Bethell, general manager of the company, F. A. Baker, H. G. Bates and H. L. Webb.

DEPARTMENT OF ELEMENTARY EDUCATION.

BY THE EDITOR.

[*Note.—Any one is invited to ask questions on any point that is not made clear in these articles. Suitable explanations will be cheerfully given under the head of "Answers to Inquiries."*]

ELECTRIC BELL CIRCUITS.

(*Continued from Page 6.*)

The wiring of a finished building requires different treatment. The wires may be run perpendicularly between the walls, by dropping them from the higher point to the lower one and fishing for the dangling ends through the proposed outlet. They cannot be run horizontally in that way, of course, unless the flooring or baseboard is removed for the purpose. The fishing method is uncertain, however, and unless there is objection the wires are usually run along the baseboards, and around window and door-casings, on the outside surfaces. When wires are run in this way tacks must always be used to make a neat job, and to keep the wires in the grooves, which usually form a feature of decoration of woodwork. The object is, of course, to render the wires as unnoticeable as possible.

In order that the reader may understand how to instal a simple bell circuit, let us assume that it is desired to ring a bell by a push-button at the front door. The push-button is usually placed on the right-hand door casing. The bell should be so located that it can be heard in any part of the house. Generally it is placed at the end of the hall nearest to the kitchen, where the servants can surely hear it; or it may be placed in the kitchen. In any event it should be placed near the top of a door or window casing, or on the wall, if more convenient. It should be located high up, out of the way, as it very rarely requires any attention.

"Where shall the battery be placed?" is the next question to settle. It is important that it should be in a *dry* place, and, if possible, where it will not be subject to extreme heat or cold. But have it in a *dry* place, at all events.

It is needless to say that the battery should be out of the way. The cellar is a good place, if it is dry, and a good plan is to nail two or three boards to the floor beams at the most convenient place in the cellar. These boards form a shelf on which the battery cells may be placed, the space between the shelf and the flooring above being sufficient to accommodate the battery; such space cannot be used for anything else, and is excellent for battery purposes, providing the location is otherwise favorable. The battery in such a place is readily accessible and at the same time entirely out of the way.

Batteries are frequently placed in closets, on shelves and on the floor, but there are objections to such locations, and if it is possible to find a more appropriate place for the battery it should be done.

Of course an inflexible rule cannot be laid down for all cases; the course to be pursued in each must necessarily be determined by the existing conditions, keeping in view, however, the objects above referred to.

Having located the places for push-button, bell and battery, let us proceed to run the wires, starting, say, from the battery.

We will assume that we are to run a short, simple circuit, with one bell, on push-button and, say, two cells of battery. Such a circuit is planned in detail in Fig. 1. This diagram is very complete and illustrates many points, and we shall see as we proceed.

There being two cells of battery, one cell must be connected to the other in a certain way. The positive (carbon) pole of one cell must be connected to the negative (zinc) pole of the other by a short piece of wire. This connection between the two cells leaves the negative pole of the first cell and the positive of the second to be connected with the wires running to the bell and push-button.

In connecting up a battery it makes no difference whether the positive or negative pole is on the bell side or the push-button side—the current will flow either way; the only thing to provide is a positive pole and a negative pole for the reception of the main wires.

In case of more than two cells the same rule is followed in connecting the separate cells to form one battery; that is, connecting the zinc of the first to the positive of the second, the negative of the second to the positive of the third, the negative of the third to the positive of the fourth, and so on to the last cell.

In the diagram the positive pole of cell *A* is connected to the negative of cell *B*.

Now, starting from the positive of cell *B*, let us run our first wire, which in this case is to one of the push-button connections. In starting to run this wire the battery end must be bared of insulation and cleaned, in the same manner as before, and connected firmly to the carbon of cell *B*. The proper length of wire may be cut off from the bundle to facilitate handling. The wire is then led to the push-button, being tacked in place whenever possible, every few feet. The end of the wire is then bared and cleaned and connected to one "terminal" of the push-button, by twisting it around the screw and tightening the screw.

Now connect the first end of another length of wire (to run from the push-button to the bell, with the other terminal of the push-button and lay the wire to the bell, the end being connected firmly to one binding-post.

From the other binding-post of the bell run a wire to the zinc pole of cell *A*, and after having made all the connections good and firm the circuit is all ready for operation.

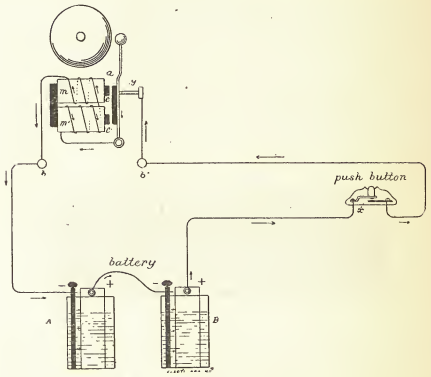


FIG. 1.—SIMPLE BELL CIRCUIT.

In most cases the wires can be run close together and parallel to each other for a greater part of their length.

Having thus outlined a bell circuit, let us consider what actions take place when we close the push-button. The current starts from the + (positive) pole of cell B and flows to the push-button, and, assuming that the push is closed (at the point X) the current flows on past binding-post b′, through the closed contact points y, through the hammer rod to the magnets, around the magnets m′ and m, past binding-post b to the — (negative) pole of cell *A*; thence through the liquid of that cell to the + pole, thence by the short wire to the — pole of cell B, thence through the liquid of that cell to the starting-point. The moment the current is turned on by closing the push-button the magnet cores c and c′ become magnetic and attract the "armature," a, towards them. This attraction causes a separation of the contact points at y, thus interrupting the flow of current. When the current stops the magnetism of the cores ceases and the armature, being no longer attracted, flies back, again closing the contact points y. This re-establishes the current; the cores again become magnetic; the armature is drawn towards them and the circuit is again broken at y, only to be closed again by the return of the armature to its original position after the magnetic

attraction has ceased. This cycle of operations is repeated very rapidly, which causes the vibration of the hammer against the bell, and in this way producing the rattling noise peculiar to electric bells. Of course, when there is no pressure on the push-button no current reaches the bell, therefore there is no ringing, but so long as the push-button is kept closed the bell will vibrate. The course of the current throughout the circuit is indicated by the arrows.

ANSWERS TO INQUIRIES.

[*Note.—This column is open to any of our readers who desire special information on any subject. In case we cannot give the desired information ourselves the inquiry will be published, in order to elicit a reply from some one of our readers. These answers will be published in due course.*

The full names of our correspondents will not be published, but for the purpose of identification their initials or other mark of identity will be substituted therefor.

Each question will be numbered for the purpose of ready reference.

All are invited to make free and liberal use of this column.]

1.—Who is the original inventor of the dynamo? L. W. T., New York.

A. As far as known Pixii was the first to construct a dynamo electric machine. This was in 1833. The currents obtained were alternating. Saxton and Clarke are also among the earliest investigators. All dynamos are, however, based upon the discovery by Faraday, in 1831, of the laws of electro-magnetic induction.

2.—Does magnetism exert any physical effect upon a bar magnet? H., Troy, N. Y.

A.—Yes; the bar is slightly lengthened by the action of the magnetism. Experiments made by Joule showed that a bar increased in length $\frac{1}{720000}$ of its length when magnetized to its maximum.

3.—What is the cause of the peculiar odor around electric machines, coils and some dynamos? R. L. G., Brooklyn.

A.—You probably refer to the ozone that is produced. It is a modified form of oxygen gas, but is more chemically active and denser than oxygen. Ozone is a powerful bleaching and disinfecting agent.

4.—There is a way of rearranging the connections of a bell so that it will strike only once when the push-button is closed, instead of vibrating. Will you please tell how this is done and oblige? W. H., New York.

A.—Starting from the binding-posts on the bell, one wire runs to and around the magnets, then to the hammer-rod, or frame. The other binding-post is connected with the contact point of the bell. Now if you disconnect this wire from the contact point and connect it with the hammer rod, you will have a "single stroke" bell. You need not disturb the regular connections at the back of the bell. Just run an extra short piece of wire (insulated) from the binding-post last referred to to the hammer rod.

5.—In your article on Bells in last week's issue you advise using plenty of battery. I have found by experience that a large battery seems to cause heavy sparking at the contact points of the bell. What is the cause of that? R., Buffalo.

A.—You use too much battery. The sparking is caused by the self-induction of the magnets of the bell. Reduce your current but provide enough to operate the bell promptly and actively. There is a "just right" point that can be determined by a little experience.

6.—What substance is the best conductor of electricity? R. H. G.—Brooklyn.

A.—Annealed silver. All other resistances are compared with it.

Mr. Newton Harrison, instructor of the New York Class of the National School of Electricity, was presented with a handsome diamond scarf-pin by his class, on December 30, as a token of their appreciation of his ability and courtesy.

E. P. GLEASON MFG. CO.

The new catalogue of the E. P. Gleason Manufacturing Company, New York, reveals some interesting and useful novelties.

For advertising and other similar purposes the incandescent reflecting letters, of which the accompanying illustration of the letter G (Fig. 1) is an example, have many excellent points.

The effect produced by this style of letter is much greater than that from any other style of letter, and only one-half

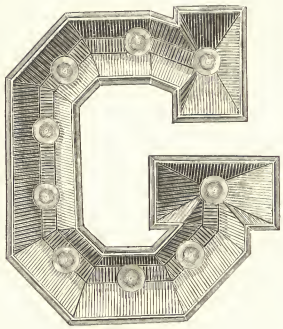


FIG. 1.

the number of lamps is required to produce this result. The saving in current and cost of lamps is therefore one-half.

These letters are made of metal and lined with silvered, corrugated glass, which gives a great many reflecting surfaces. The letters are thirty inches high and are fitted for Edison lamps.

The insulating joint (Fig. 2) has been approved by all the Boards of Fire Underwriters and is very extensively used in electric installations. The metallic parts are made

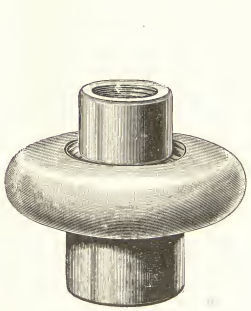


FIG. 2.

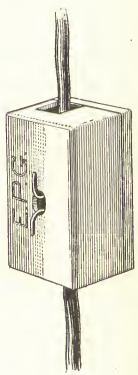


FIG. 3.

of composition brass, mica insulation being used. This joint is designed for combination fixtures, and is armored, the upper nipple being insulated from the lower one.

The Safety-Bug Cut-Out (Fig. 3) is the smallest covered bug made. It has a porcelain cover, and is a reliable little device,

The Gleason catalogue is very complete, and contains illustrations of a great variety of electrical appliances.

PRACTICAL EXPERIENCE WITH STORAGE BATTERIES IN CENTRAL STATIONS.*

BY C. L. EDGAR.

To those interested in selling electricity it is a source of great satisfaction that the storage-battery discussion has, within the past few months, especially in America, taken on an entirely new phase. It has become a question of use and not of manufacture.

For years we have all watched with great interest the various types of batteries put upon the market. We have discussed their value, at first confining ourselves as to whether they would work at all, and in later years broadening out the discussion as to how well they would work. We have watched the various companies interested in the manufacture of storage batteries fight one another in the courts, and we have wondered if it were ever to be possible to obtain a battery which did not infringe some one else's patent.

Until very recently it has not been possible to discuss from the standpoint of experience the economic merits of storage batteries, and it is particularly satisfactory to us to note that the discussion seems to have drifted away from the manufacturer to the user. To-night I am going to assume, at least for the purpose of this communication, that these perplexing questions have all been answered, and that we are finally on a par with our neighbors across the water, prepared to discuss the advantages of a commercial storage battery found ready to our hand.

Whatever may be the facts as to the existence of a commercial battery, some of us have purchased and are operating batteries which we consider satisfactory, and I will leave that part of the discussion to others, confining myself exclusively to their uses in an Edison system of circulation and distribution for lighting and power purposes in thickly settled communities. As it appears to me, their uses can be classed under four great heads, as follows :

1st. To carry the peak of the load at maximum hours.
2nd. To carry the entire load at minimum hours.
3rd. To act as an equalizer or reservoir.
4th. For the equipment of annex stations.

There are many other special uses for batteries which can be classed under one of these heads.

First, to carry the peak of the load. In all systems of lighting, whether by gas or by electricity, there is a considerable portion of the connected load which is used only for two hours per day during the three or four months in winter. We have all of us, at various times, very earnestly discussed the probability of being able to widen out this peak, as it is commonly known, and numerous schemes have been devised by which it has been made more or less of a hardship for customers to use their light at this time, special concessions being made at all other hours of the day or night. It does not seem to me that any of these will avail. We cannot get around the fact that there are, in every large city, hundreds of stores which close up at six o'clock at night. The only need which they have for light is after it becomes dark. In this section of the country darkness comes on about 4:30 in mid-winter, and these stores are bound to burn their light from 4.30 to six o'clock, and have no need of it at any other time. These are facts which are entirely outside of the question of electric lighting, and nothing which we can do will change them.

It matters not whether the company has a large motor load in the daytime or a large city contract at night. These are simply going to change the height of the curve at those hours. They are not going to alter the special shape of the curve due to the hour and a half of darkness during the business day.

This particular peak will be in some cases a much larger percentage of the total maximum output of the station than in others, but I think it is safe to assume that it is likely to vary only between one-third and one-half of the total. In the case of the company with which I am connected, we have found that if we divide our maximum load of the year into two parts, the upper half exists only for about two hours under ordinary circumstances and four hours under exceptional circumstances for the five winter months.

Computing the kilowatts in these two halves, we find that the lower half contains 90 per cent. of the K. W. hours manufactured, whereas the upper half contains only about 10 per cent. This would prove the position taken by some engineers that if an extremely large station was to be constructed, it would probably pay to equip it with two types of apparatus—50 per cent. to be of the best economy and most expensive class known to the art. This to do the 90 per cent. of the work. The other 50 per cent. to consist of crude, cheap, uneconomic but reliable apparatus, to do the 10 per cent. of the work. The saving in interest on the lesser investment in the second class would be much greater than the extra cost of running this half, due to its poor economy.

In our particular case we find ourselves in precisely this position. Our company installed in years past about 4,000 H. P. of high speed, belted, bipolar apparatus, reliable but of poor economy. Some three years ago it changed to the other extreme and commenced to equip with the highest priced and most economical apparatus to be found in the market, and today there is about 4,000 H. P. of this apparatus in use.

The data which we have for 1894 and 1895 proves the statement which I have just made. Ninety per cent. of our kilowatts have been manufactured by the vertical, triple expansion, multipolar units, and yet the total capacity of this apparatus is not over 50 per cent. of our maximum output for the winter.

The application of the storage battery to these conditions is obvious. What we need and what all companies under generally like circumstances need, is a piece of apparatus capable of doing two hours' work per day which is cheap, and which has fair economy. If storage batteries could be used under no other circumstances than these, it is, perhaps, somewhat doubtful whether it would pay to install them, but yet I am inclined to think that considering their first cost and the efficiency which we can obtain from them, it could be fairly proved that it would pay to use them rather than what I have designated as the cheap type of apparatus.

At the time our first battery was purchased, our standard unit was 650 H. P. We therefore called for a battery of 650 H. P. capacity for two hours. We eventually, under stress of circumstances, reduced this to one and a half hours, and found that it cost considerably less than a first-class steam plant.

As all apparatus has to be installed for the express purpose of taking care of the maximum load, it seemed to us very clear that if we could save in our first investment by installing storage batteries which cost less than a steam plant, we were going to be able to do a given amount of work with a less amount of capital by this means than by any other. We thus decided to install a battery to take care of the peak, even it we obtained no other advantage from it.

Second, to carry the entire load at minimum hours—I think that the nature of the load curve in America is against the use of batteries for this purpose to anything like the same extent as abroad. With us there is only about six hours of minimum load, whereas, owing to the lack of motor business in Europe, the minimum there extends some days from midnight until three o'clock in the afternoon. Our minimum is so short that we are not able to save one shift of men nor are we able to save much in the fixed boiler room expenses from drawing the fires, banking the boilers, or any of the various other expedients used when the plant is not in operation.

(*To be Continued.*)

* Topical communication presented to the Meeting of the American Institute of Electrical Engineers, New York and Chicago, November 20, 1895.

—Magnetism in iron and steel is quickly destroyed by heat.

DEATH OF COL. THOMAS W. KNOX.

Thomas W. Knox, the well-known author, died in New York on January 6, of Bright's disease. He was 65 years of age.

Col. Knox was a member of the expedition sent out many years ago by an American Company to build an overland telegraph line through Siberia. During this journey he travelled 3600 miles in sledges and 1400 in wagons, and in 1870 he described the trip in a book entitled "Overland Through Asia." In 1875 he went to Ireland and telegraphed to America the score of the international rifle match at Dollymount by means of an invention of his own, indicating by the use of the Morse code the spot in which each bullet struck the target. This he developed into a system of topographical telegraphy, which he sold to the Government for the transmission of weather maps.

TELEPHONES ON BROOKLYN BRIDGE CARS.

The Brooklyn Bridge officials experimented a few days ago with a telephone system connecting a moving train and the office of Train Despatcher Prince at the Brooklyn end of the structure. A conversation was carried on all the way over, and the train was stopped within fourteen seconds after Mr. Prince had ordered a danger signal hoisted. Superintendent Martin was favorably impressed with the results.

COPPER TELEGRAPH WIRES.

The Western Union Telegraph Company during the year ending June, 1895, added over 10,000 miles of copper wire to its extensive plant. The total wire mileage added was 11,859. The company has adopted the policy of replacing all defective iron wires with copper, the intention being to use that metal alone on all the principal lines hereafter. The advantages of saving in weight, increased capacity for electrical transmission and diminished liability to interruption from atmospheric conditions, are sufficient to make the copper wires more economical in the end, notwithstanding their greater first cost. The decision has been assisted, also, by the fact that the improvements in processes for drawing copper wire has enabled makers to furnish material well adapted for telegraphic use. The size of copper used for telegraph wires is generally No. 9 or 10 B. and S., weighing about 199 lbs. to the mile. This would require, for 10,000 miles, about 760 long tons of copper.

IMPROVED ELECTRIC SIGNAL FOR RAILROADS.

Mr. E. B. Dunn, chief of the Weather Bureau in New York City, has devised a system of electric signals for the purpose of preventing rear-end collisions on railroads. The idea suggested itself to him after the recent collision on the Brooklyn Bridge, and the plan has been submitted to the Bridge Trustees. We understand that they regard it with much favor.

Mr. Dunn's system is described as follows: A railroad is divided into sections, the length of the sections being determined by the conditions of emergency, liability to danger, etc. A series of wires, or a wire cable containing the necessary number of wires, is run along the telegraph poles and connected with the dispatcher's office. A box containing a switch and push-buttons is placed on each, or as many poles as may be found necessary, the apparatus to be used as follows: In case of a stop from any cause, or an accident, or when for any reason a train cannot leave on schedule time, a trainman goes to the nearest telegraph pole box, turns the switch, which lights up a line of red signal lights (also placed upon the poles) over the rear section, thus notifying the train following that the track ahead is not clear. A trainman of the second train repeats the operation on his section, which sets the signals on the section back of him, and thus the third train would be brought to a stop; the fourth, fifth and succeeding trains being notified and stopped in the same manner.

As soon as the first train is ready to resume its journey the trainman turns the switch back to its original position, and in so doing extinguishes the lights back of him, which indicates to the train behind that the road is again clear. All of the other section lights are extinguished in the same way and then the entire road is clear.

In connection with the turning of the switch to set the signal lights there is a wire running to the train dispatcher's office. By pressing a button in the pole signal boxes an indicator drop in the dispatcher's office notifies him that the train on section 1, 2, 3, etc., as the case may be, has been brought to a stop, and by pressing a second button in the same box a red light is shown in the dispatcher's office indicating that an accident has occurred—the red light being used for such emergencies only.

MR. STERNE'S TELEPHONE.

The temporary injunction which Simon Sterne obtained a year ago preventing the Metropolitan Telephone and Telegraph Company from removing the telephone from his office at 56 Beaver street has been made permanent by Justice Ingraham, of the Supreme Court, pending the action brought by Sterne for the same relief. He is required to give a bond to secure the company from loss of rents and damage, if it should ultimately be decided in the action that he was not entitled to the injunction.

The case is a test case, and mainly turned on whether the company has the right to fix rates arbitrarily, or whether it is a common carrier which must take business at such rates as the courts, in the absence of legislative direction, shall hold to be reasonable. Until October, 1894, Sterne had a telephone service at $125 a year, but in that month he and other subscribers were notified that owing to improvements in the service they must call and make new contracts for $240 a year. The company was to put in certain new improvements, notably the button arrangement, which was to cut off metallic induction. It was urged that the underground wiring had cost the company $3,000,000, and that it had resulted in better service. The company contended that its new rates were reasonable, and that in any event the courts could not say what it should charge its own customers, as it was a matter of private contract.

Mr. Sterne disregarded the threats of the company to remove his old telephone unless he signed a contract for the higher rates. He said that his old telephone was good enough for him. When the company finally set a day for him to sign or have the telephone removed he procured the temporary injunction from Justice O'Brien. Owing to the importance of the case it was argued very fully last February, and Justice Ingraham had since then reserved decision, having to wait a large part of the time for briefs of the counsel.

THE USE OF STORAGE BATTERIES IN ELECTRIC LIGHTING.*

BY DR. FRANCIS B. CROCKER.

(*Concluded from Page 9.*)

4. *Accumulators to aid in carrying the maximum load.*—If accumulators are substituted for a certain portion of the dynamo capacity, the question arises whether the substitution secures any advantage. In regard to first cost, authorities differ widely. These discrepancies probably arise from the confusion between K. W. and K. W. hour of output. Most accumulators have a normal time of discharge of about 10 hours, hence the cost per K. W. hour is only one-tenth of the cost per K. W. of output, and this would, of course, vary with any change in the time of discharge. In many cases it is specious and leads to mistakes to speak of K. W. hours, to appreciate which fact we have only to realize that the K. W. hour capacity of a dynamo is almost infinite, since it might run for twenty years. The actual

K.W. of output, or in short, how many lamps can be simultaneously fed, is the question in electric lighting. Moreover, in most cases, the time of discharge of an accumulator is unnecessarily long, and this is particularly true when it is used to help carry the heavy load, which usually lasts only one or two hours. In this case the remaining hours of available discharge are of little or no use. If it be attempted to discharge more rapidly, both the capacity and efficiency are reduced, and in many types the condition and very life of the battery are injuriously affected by a high rate of discharge. What is needed for the maximum load or "peak of the load diagram" is an accumulator with a normal time of discharge of two or three hours and having a correspondingly smaller first cost, bulk and weight, that is, about one-quarter of those of the ordinary forms of battery, but certain types of cell are capable of discharging at this rate. It is evident that the time of charging need not be made as short as that of discharging, if it happens to be more convenient to charge less rapidly.

The use of accumulators to enable the machinery to be stopped, which is a case already discussed, usually demands a time of discharge of from 10 to 14 hours, which agrees quite well with the normal discharge rate of the ordinary forms of battery, but even then the time is unnecessarily long, since the average rate of discharge would rarely exceed one-half of the maximum rate. Consequently the battery would either be incompletely discharged or the rate would have to be made excessive at certain times.

5. *Accumulators to maintain uniform load on the engines.*—Steam engines are very inefficient at light loads. This inefficiency, in fact, is one of the chief sources of loss in an electric lighting plant, and the principal object of the engineer who designs and operates a station should be to reduce this waste to a minimum. The accumulator is the most important means of accomplishing this result, although there are other methods, such as gas, thermal (hot water) and steam storage, all of which have been carefully compared by Mr. Nelson W. Perry, in a paper before the National Electric Light Association, February, 1895, "Storage of Energy Essential to Economy of Working Central Stations." Judicious selection of the number and sizes of the engines would enable them to be worked at a considerable fraction of their full capacity nearly all of the time, and it would seem that the same care that would be required to manage the battery might enable this to be accomplished. Nevertheless the accumulator gives more flexibility to the plant, and where introduced it often seems to considerably increase the economy of the engines by making their load more uniform and nearer their full capacity. According to the figures given by Mr. Perry in the paper cited above, an electrical horse-power costs $48.68 per annum when developed steadily, and costs $117.78 per annum with a variable load similar to that of an electric light station, that is, the latter costs about 2.4 times as much as the former. This ratio seems very high, but is borne out by statistics, which give a very large coal consumption for most electric light stations.

Under these circumstances, almost any method of making the engine loads more uniform should increase the economy of working. Doubtless an accumulator would benefit any plant in which an engine runs for any considerable portion of the time at less than half of its full power.

If a plant is so small that it contains only one engine, it may be necessary to run it a great deal of the time far below its full load. But even with two engines it is generally possible to select the sizes so that the smaller one runs economically during the periods of light load, the larger one alone is suited to medium loads, and both are used for the maximum output, the times during which any engine is very much underloaded being very short. With a greater number of units it becomes still easier to properly apportion the load, and when there are five or more engines, as is usually the case in large stations, the loss from this cause should be trifling. To be sure the waste of energy which occurs from using boilers for variable loads still remains, but according to the figures given by Mr. Perry this is less than that due to the engines, and general experience shows this to be true.

6. *Accumulators used as transformers.*—If the cells of a battery are arranged in series while being charged, and in parallel for discharging, a high voltage current will be required for charging and a low-voltage cnrrent will be given out. The total amount of energy measured in watts is the same, minus the loss of 15 or 20 per cent. which always occurs in accumulators. The result is similar to that obtained by an alternating current transformer or motor dynamo. Such a method of transformation of potential might be employed in connection with long distance transmission of energy, the current being sent over the line at high voltage and converted to low voltage by accumulators for local distribution. For potentials of several thousand volts, which are commonly employed in transmitting long distances, the number of cells required would be so great as to make this of doubtful practicability compared with the ordinary stationary or rotary transformers, but it would give uniformity in load and other advantages which may be secured by the storage of energy.

7. *Accumlators used for subdividing voltage.*—This application is similar in principle to the preceding. The most important practical case is that in which a dynamo of 220 volts charges a battery of corresponding potential, a three-wire system being supplied from the battery, the neutral wire of which is connected to the middle point of the battery. This arrangement avoids the necessity of running two dynamos and allows the battery to be placed in a substation near the districts to be supplied, so that it is only necessary to run two conductors to that point instead of three. The same principle may be applied to the five-wire system.

8. *Accumulator sub-stations.*—The plan of installing battery plants at local centres which are charged from the main station, enables some of the conductors to be saved in a three or five-wire system, as already stated. It also makes it possible to reduce the size of these conductors, because the current which flows over them can be kept practically constant, so that it is not necessary to have them large enough to carry the maximum current consumed by the lamps, which may be several tines the average value. This, of course, gives the same steady load on the generating machinery as if the battery were located near it.

The batteries at the various sub-stations may be connected and charged in series or in parallel. The former plan is similar to case 6, and would require far less copper in the conductors, since the voltage is multiplied by the number of batteries in series and the current is the same as for a single battery. On the other hand, this high difference of potential would exist between the first and the last batteries of the series, and if either of them became grounded, any person connected to the earth and touching a wire supplied by the other battery would receive a shock due to the total voltage. This would demand that the maximum difference of potential should not exceed 500 volts, or, in other words, four batteries of 110 to 125 volts each might be charged in series and could be connected to the lamp circuits at the same time. This would practically amount to a five-wire system using accumulators to subdivide the potential, as explained in case 7. If the batteries were entirely disconnected from the lamp circuits while being charged, the latter would be free from danger of the high pressure, which might therefore be 1,000 or 2,000 volts if desired, the batteries being charged during the day and supplying the lamps at night. For continuous working, two batteries would be necessary. Accumulator sub-stations not only save copper in the feeders but also reduce the cost of, and lost voltage in the distributing conductors, because the batteries can be placed near the lamps to be supplied with current.

9. *Accumulators used for two or more of the above-named purposes.*—Each of the different uses of the storage battery has been considered separately to avoid the confusion with which this subject is often beset, but as a matter of fact the employment of the accumulator for several of these purposes is the most common practice. By thus combining these different applications the plant may be

rendered not only more economical but also much more flexible. For example, the battery may be utilized to help out the generating machinery at times of heavy load or when the latter is partially or wholly disabled. It often happens that it is difficult to produce or maintain sufficient steam pressure, owing to poor draught or other circumstances, in which event a battery enables the boilers to be temporarily relieved of some or all of the drain upon them while the pressure is being raised to the proper point. It may also be necessary or desirable to shut down the machinery, or a portion of it, for a few minutes to make some repair, adjustment or change of arrangement, connection, etc.

It is also possible to feed some of the circuits from the battery, while the others may be supplied at a higher or lower voltage by the machinery. In these and many other ways an accumulator may be a very convenient adjunct to an electric-lighting system. The fact that it is so radically different from the machinery in its nature and action makes it very unlikely that the entire plant will be crippled at any one time, since the two sources of current are not exposed to the same dangers. An accident to the steam-piping, for instance, might shut down all the machinery, but it probably would not affect the battery, and *vice versa* an accident to the latter is not likely to extend to the former.

LEASE RATIFIED.

The lease of the Eighth avenue street-railway to the Metropolitan Traction Company, New York, has been ratified. It is for 99 years from January 1, 1896, at an annual rental of $215,000 in gold, payable quarterly. The lessees also agree to expend $1,000,000 in substituting other motive power than horses and in improving the equipment. In regard to the change of motive power Mr. H. H. Vreeland said :

"Our series of experiments on the Lenox avenue road are finished so far as the electricity is concerned. We know now exactly what we can do with the underground trolley. But we are looking forward to some mechanical changes in the conduits and the slots, as we do not know exactly what effect cold weather will have on our roadway. This we expect to find out this winter. In the early spring we shall push forward the construction of the 23d street underground trolley, which is now partly constructed, and embody in that all the improvements suggested by our experience in Lenox avenue this winter. Next, we shall put the underground trolley in Sixth avenue, and I may say that the plans for that work are practically complete. After that we shall go to work on Eighth avenue."

THE AMERICAN ELECTRICAL WORKS.

The *Evening Telegram*, Providence, R. I., on December 21, 1895, issued a beautifully illustrated number, giving a history of industrial Providence. Among the large interests described the American Electrical Works is given prominence. The Phillipsdale Works are excellently illustrated, and the various plants occupied by the company at different periods are also shown. The features of Messrs. Phillips, Sawyer, Hathaway and Remington are reproduced very nicely.

THE TECHNICAL JOURNAL.

The first number of *The Technical Journal*, New York, made its appearance last week. This new paper is to be published bi-monthly at 248 East 78th street, New York. Mr. Max Loewenthal is the editor; Meyer Cushner, associate editor, and Meyer S. Blumberg, business manager. *The Technical Journal* has been adopted as the official organ of "The Alumni Association of the Hebrew Technical Institute," and the principal object of its existence is the diffusion of general culture in art and science.

A. S. R. A.—We have received a copy of the minutes of the 14th annual meeting of the American Street-Railway Association, which was held in Montreal last October.

New York Notes.

Mr. Frederick Pearce, 79 John street, has obtained possession of the entire building at that number and is establishing his office and salesrooms one floor lower down. He is putting in new show-cases and other fixtures, and when his plans have been completed he will have one of the finest establishments in the country.

W. P. Freeman has moved to 106 and 108 Liberty street, city, where he has placed a line of fine machinery for experimental work.

The Barriett Armature Winding Co., 78 and 80 Cortlandt street, city, makes a specialty of winding armatures of all makes and sizes. The company is doing a good business in this line.

Possible Contracts.

LEXINGTON, KY.—The erection of an electric light plant is being considered by the city. Address the mayor.

BALTIMORE, MD.—The Edison Electric Illuminating Co. will enlarge the plant of the former Maryland Electric Co., and will also erect another plant of the same capacity.

WASHINGTON, D. C.—A building permit was taken out by Mr. F. L. Loring, of New York, for the erection of a store and office building at 1327 F Street, Northwest, to cost $25,000.

CANANDAIGUA, N. Y.—Canandaigua people are moving for a new opera house with a seating capacity of 1,000, to cost about $15,000.

NEW YORK CITY.—George H. Anderson will erect a seven-story brick office building at 508 Broome Street. Architect, A. F. Leicht, 97 Cedar Street.

NEW YORK CITY.—J. B. McElfatrick, 1402 Broadway, has prepared plans for a five-story brick theatre building to be erected at Lexington Avenue and 42d Street, for Robert and Ogden Goelet. Estimated cost, $170,000.

DETROIT, MICH.—Plans and specifications are being prepared for the erection of a $75,000 armory by the Detroit Light Board.

GREENVILLE, N. C.—The Greenville Electric Light Co., of which S. C. Hamilton, jr., is manager, is in the market for an electric light plant of 35 arc and 400 incandescent lights.

ALBANY, N. Y.—The granting of the franchise for the electric road to Greenbush has been postponed for at least two weeks, when applications will again be advertised.

CHARLESTON, W. VA.—The Charleston Street Railway will erect an electric power plant.

NEW YORK CITY.—The Bohemian Benevolent Literary Association is to have a new club-house on 73d street, near First avenue. The building will have five stories and will cost about $125,000. Plans were prepared by Architect William C. Frohne.

UNION, S. C.—The mayor can give information concerning the issuance of $40,000 worth of bonds to be used in erection of electric light plant.

KANSAS CITY, MO.—A five-story building, to cost $60,000 or more, will be erected by J. C. Rogers, of Wamego, Kan. He contemplates putting in an electric light plant, etc.

St. Louis, Mo.—An electric power plant will be erected by the Central Railway Company. Address Wm. S. Long.

Prosperity, S. C.—The Prosperity Cotton Mill Co. wants bids for an 80-arc-light electric plant, boilers, engines, etc.

Somerville, Tenn.—A. J. Rooks is in the market for storage batteries to light up a good-sized building with electricity.

Brooklyn, N. Y.—The old Smith Mansion, on Smith Street, now occupied by the New York and New Jersey Telephone Co., is to give place to a new structure, to cost in the neighborhood of $150,000, and will be eight stories in height.

New York City.—F. Nordselk will erect an eight or ten-story office building, to cost $350,000, on the south side of Rector Street. Architect Wm. B. Tuthill, 287 Fourth Avenue, prepared the plans.

Columbus, Ga.—About $50,000 will be expended by the Columbus Railroad Company to enlarge its plant.

Dublin, Ga.—An election will be held January 12 for an electric light plant and water-works. $25,000 worth of bonds proposed. Address the mayor.

Baltimore, Md.—The construction of conduit systems for underground wires is being contemplated by the city. W. S. Hill, Jr., is engineer of the subway commission. Address Alcæus Hooper, mayor.

Philadelphia, Pa.—Vandergrift & Jacobs, 1404 S. Penn square, will probably buy seven enclosed motor cars with double equipment for the trolley they are building in Charleston, W. Va.

Alexandria, La.—Bids will soon be advertised by the city for a 50-K.W. alternating dynamo, etc. Address A. C. Jones, superintendent electric light plant.

Gainesville, Fla.—New or second-hand plant of 40 2000-c. p. arc and 1000 16-c. p. incandescent lights is wanted by Gainesville Electric Co., Box C.

New York City.—D. Altman & Company, dry goods firm at Sixth avenue and 19th street, have decided to enlarge their establishment. They will also erect a large stable.

Erie, Pa.—Plans have been drawn for the erection of a six-story brick block at the northeast corner of 12th and State streets. The new building will be used for offices and stores, and owned by the Erie City Iron Works.

Frederick Potter and C. H. Kalsey, executors of the estate of Orlando B. Potter, have filed plans for a new building to be erected on the site of Arcade Building, corner of Rector street and Broadway. The new building will be 20-stories high and will cost $1,000,000.

St. Louis, Mo.—Henry Moser, C. H. Hofmeister, D. P. Shields and Jesse A. Graham have incorporated the National Automatic Car Fender Co. Capital stock, $125,000.

Richmond, Va,—Work has been begun by the Richmond Traction Company on its electric line on Broad street. J. Skelton Williams, president.

Jackson, Tenn.—Arrangements are being made by the Jackson Street-Railway Company to reconstruct its trolley line.

Washington, D. C.—The Columbia Railway Company has asked permission to extend its lines in the city.

Charleston, S. C.—A franchise has been asked for to build an electric line in the city, by Julian Fishburne and others.

Charleston, S. C.—The Carolina Mutual Telephone and Telegraph Company has been chartered with E. M. Bailey president, Moultrie Mordecai, vice-president, and R. B. Letby, secretary and treasurer. Capital stock, $30,000.

Central City, Ia.—The Bishop Telephone Exchange is a new corporation at Central City. The object of the corporation is to build and operate telephones. The first line to be completed is from Central City to Prairieburg. It is probable lines will connect Central City with Coggon, Paris and Troy Mills. Authorized capital, $30,000. President, P. G. Henderson; secretary, J. H. Davis; treasurer, I. U. Ninehart.

Knoxville, Tenn.—A line will be constructed from Chattanooga to Maryville by the People's Telephone Company.

Delphi, Ind.—A franchise has been granted the Harrison Telephone Company by Delphi, to put in an exchange in that city.

New York City.—The home of the New York Historical Society is to be deserted for a spacious and magnificer t new building on Central Park, West, with a frontage of an entire block overlooking Central Park, from 76th to 77th streets. Estimated cost of the building, $450,000. President, John Alsop King, of the society.

Quebec, Que.—The Quebec and Montmorency Electric Power Company are considering a proposal to light public buildings in Lewis, and to convey the electric current across the St. Lawrence for the purpose by means of a cable laid at the bottom of the river.

New Corporations.

Sheffield, Ala.—The Consolidated Water and Electric Light Power Co. has been organized by E. F. Enslen, C. B. Ashe, L A. May, F. V. Evans and W. R. Brown. E. F. Enslen, of Birmingham, president, and C. B. Ashe, of Sheffield, secretary and treasurer. Capital stock, $250,000.

Portland, Me.—The Boston Electric Insulated Pole Co. has been organized for the purpose of manufacturing, doing business in and erecting insulated poles upon which wires may be strung. Capital, $100,000. President, Edward E. Drew, of Boston, Mass.; treasurer, George E. Macgowan, of Portland.

Bloomfield, N. J.—The O'Brien Electrical Construction Co. Capital, $100,000. Incorporators, Philip J. and James P. O'Brien of New York, and Daniel J. O'Keefe of Bloomfield.

Cleveland, O.—Cleveland and Chagrin Falls Electric Railroad is authorized to build, equip and operate an electric railroad for the transportation of passengers, freight, mail and express between Cleveland and Chagrin Falls; to furnish heat, light and power and to own and operate pleasure resorts. Capital stock, $300,000. Incorporators, Hon. Vincent A. Taylor, F. W. Gehring, Jay E. Latimer, Hon. Joseph Black, C. G. Barkwill and Albert V. Taylor.

Harrisburg, Pa.—The Latrobe and Ligonier Electric Street Railway Co. has been chartered. The road will be 12 miles in length, and the route will be from Loyalhanna Creek, through the township of Unity and the boroughs of Youngstown and Ligonier. Capital, $72,000. Edward E. Robbins, of Greensburg, is president of the company.

Baltimore, Md.—The Rapid Transit Construction Co. has been incorporated by Wm. F. Rogers, Chas. H. Hopkins, Wm. C. Nelson, Harry C. Primrose and George N. Holloway, for the purpose of manufacturing, etc., in which electricity will be used. Capital stock, $25,000.

Baltimore, Md.—The Maryland Electric Co. and the International Telegraph District and Construction Co. have consolidated under the name of the Edison Electric Illuminating Co., with Alfred A. Glasier, president ; E. S. Webster, vice-president, and J. Frank Morrison, manager. Capital stock, $1,770,000.

Cherryfield, Me.—The articles of association of a new railroad have been filed with the railroad commissioners. The road will run from Cherryfield to Millbridge, five miles, and will be an electric one. Capital, $30,000. Directors, S. D. Leavitt, of Eastport; George A. Curran, and G. A. Murch, of Calais; G. R. Campbell, of Cherryfield, and James Mitchell, of Portland.

ROCHESTER. N. Y.—The J. E. Putnam Co., to manufacture electrical appliances. Capital, $15,000. Directors, Sylvenus A. Ellis, Joseph F. Putnam and William R. Hale, of Rochester.

ALBANY, N. Y.—The Empire City Traction Company, to construct a street surface railroad in New York City three and a quarter miles in length. Capital, $100,000. Directors, Henry L. Scheurman, Frank P. Knight, Edgar M. Johnson, Franklin Defreece, Francis W. Elder, Mark J. Katze, Henry W. Marr, of New York City; Homer R. Scoville, of Brooklyn, and Samuel S. Slatter, of Arlington, N. J.

MILLBROOK, ONT.—Millbrook Electric Light Co , incorporated. Capital, $6,500. To carry on general lighting business.

FRASERVILLE, QUE.—Fraserville Electric Power Co., applying for incorporation. Capital, $25,000. To operate telephone lines, electric light plants, etc.

CHICAGO, ILL.—Rockford Traction Co. Capital, $300,000. To construct and operate street railways in Rockford. Incorporators, C. Harry Moore, Harry L. Jewell, Wm. Foster Burns and Harry L. Jewell, 115 Dearborn street.

CHICAGO, ILL.—Brainerd Traction, Light and Power Co. Capital, $300,000. To construct and operate street railways, water-works and electric lights. Incorporators, John Campbell, Edward S. Elliott, 1103 Home Insurance Building, and William Bruce.

MONTREAL QUE.—Northern Electric and Manufacturing Co.; incorporated. Capital stock, $50,000. To manufacture brass, copper, etc.

NEW TELEPHONE COMPANIES.

FLORENCE, ALA.—The Citizens' Telephone Company has been organized with W. P. Campbell, president; M. B. Shelton, vice-president; James Burtwell, treasurer; H. B. Lee, secretary.

FORT VALLEY, GA.—The Fort Valley Telephone Company has been incorporated by W. H. Harris, B. S. Harris and W. P. Harwell, to construct telephone system. Capital stock, $5,000.

CLEVELAND, O.—The Home Telephone Co. has been incorporated. Capital, $50,000. Incorporators, Henry George, jr., Albert V. Taylor, C. W. Collister, Jay E. Latimer and Francis J. Wing.

BALTIMORE, MD.—The Southern States Telephone Co. has been incorporated by Augustus G. Davis, J. Austin Fink, and Wm. M. Winklemann, of Baltimore, and R. B. Hazlett and Charles E. Fink, of Carroll County. Capital stock, $100,000.

HARRISBURG, PA.—A charter has been granted at Harrisburg to the Citizens' Telephone Co., of Honesdale, with a capital of $5,100.

Telephone Notes.

SENECA, N. Y.—The telephone line at Seneca Falls will be extended through Seneca County south, touching Bearytown, Romulus, Willard, Ovid, Farmer Village and Trumansburg, thence to Ithaca.

MEDINA, O.—Medina citizens are considering the placing of a telephone system in town.

FLEMINGSBURG, KY.—A move is on foot to build a telephone line from Flemingsburg to Moorefield, by way of Crains, Hilltop, Sapp, Davidson and Sprout.

CENTRALIA, ILL.—The Central Union Telephone Co. is making arrangements to extend the line from Nashville to Mascoutah.

VINAL HAVEN, ME.—The people of Vinal Haven are desirous of having a system of telegraph and telephone lines.

BEEVILLE, TEX.—A company has been organized to construct a telephone line from Victoria to Tilden.

BEDFORD CITY, VA.—A telephone company has been formed by Charles R. Mosby.

TELEPHONE PATENTS ISSUED DECEMBER 31, 1895.

ELECTRIC TELEPHONE. Stephen D. Field, Stockbridge, Mass. (No. 552,173.)

DOUBLE-DIAPHRAGM TELEPHONE-TRANSMITTER. Daniel Drawbaugh, Eberly's Mill, Pa. (No. 552,469.)

TRADE NOTE.

H. Clayton Jones & Co., electrical engineers, 749 Washington street, New York, does electrical work in all its branches.

THE COLUMBIA CALENDAR.

The Pope Mfg. Co., Hartford, Conn., has issued its eleventh annual Desk-Pad Calendar for 1896. It is a very neat and handy calendar.

ELECTRICAL and STREET RAILWAY PATENTS

Issued December 31, 1895.

552,094. Automatic Electric Switch. Harry H. Blades, Detroit, Mich. Filed Sept. 14, 1895.

552,103. Multipolar Electromagnet. William P. Daniels, Cologne, Germany, assignor to the Siemens & Halske Electric Company of America, Chicago, Ill. Filed Sept. 7, 1895. Patented in Germany July 11, 1895, No. 82,855.

552,105. Apparatus for Automatically Maintaining Current upon Moving Vehicles. Harry E. Dey, assignor to Edward N. Dickerson and Ernest R. Esmond, New York, N. Y. Filed May 20, 1895.

552,162. Car-Fender. Robert Wilkinson, Philadelphia, Pa. Filed Sept. 6, 1895.

552,166. Electric Thermostat and Push-Button. Orator F. Woodward, Le Roy, New York. Filed Dec. 29, 1893.

552,172. Electromagnetic Mechanism. Stephen D. Field, Stockbridge, assignor to the American Bell Telephone Company, Boston, Mass. Filed Aug. 5, 1895.

552,173. Electric Telephone. Stephen D. Field, Stockbridge, assignor to the American Bell Telephone Company, Boston, Mass. Filed Aug. 5, 1895.

552,181. Electrical Railway Signaling Apparatus. Henry J. Hovey, Evanston, Ill. Filed Aug. 5, 1895.

552,190. Electric-Arc Light. Louis B. Marks, New York, N. Y., assignor to the Electric Arc Light Company, same place. Filed Oct. 9, 1894.

552,211. Depolarizer for Primary Batteries and Method of Making Same. Gustav W. Thurnauer, Aurora, and Milton M. Kohn, Chicago, assignors to themselves, and Siegfried M. Fischer, Chicago, Ill. Filed Feb 20, 1895.

552,218. Electric Battery. David S. Williams, Philadelphia, Pa. Filed July 19, 1895.

552,219. Electrical Battery. David S. Williams, Philadelphia, Pa. Filed Aug. 23, 1895.

552,220. Electric Battery. David S. Williams, Philadelphia, Pa. Aug. 23, 1895.

552,239. Safety Device for Electric Circuits. Paul H. D'Unger, Chicago, Ill., assignor of one-half to William Porter Verity, same place. Filed Sept. 16, 1895.

552,260. Apparatus for Transforming Alternating Currents into Unidirectional Currents. Carl Pollak, Frankfort-on-the-Main, Germany. Filed May 22, 1893. Patented in France Oct. 28, 1892, No. 225,265; in England Nov. 2, 1892, No. 19,729; in Switzerland May 26, 1893, No. 7,059; in Austria Apr. 3, 1894, No. 66,108, and in Hungary Apr. 3, 1894, No. 3,318.

552,270. Car-Fender. John H. Astruck, New York, N. Y. Filed May 1, 1895.

552,271. Electrical Bicycle. Ogden Bolton, Jr., Canton, Ohio. Filed Sept. 19, 1895.

552,279. Electric Signal for Railways. Elisha B. Cutten, New York, assignor to Arthur C. Fraser and George H. Fraser, Brooklyn, N. Y. Filed April 1, 1891.

552,281. Street-Car Fender. Frederick Fiechter, Philadelphia, Pa. Filed Jan. 23, 1895.

552,283. Car-Fender. Aaron Fryer, Bath-on-Hudson, N. Y. Filed May 19, 1895.

552,286. Street-Car Fender. John W. Harris, Columbus, Ohio. Filed October 7, 1895.

552,309. Electric Meter. John R. Tucker and Charles C. Hinckley, Aurora, Ill. Filed March 25, 1895.

552,312. Motor for Bicycles. Sumter B. Battey, N. Y., N. Y. Filed April 19, 1895.

552,313. Synchronous Single-Phase Motor. Charles E. L. Brown, Baden, Switzerland. Filed Feb. 6, 1893.

552,316. Electrical Railway Signaling System. Thomas B. Dixon, Henderson, Ky. Filed July 10, 1894.

552,322. Secondary Battery. Alvaro S. Krotz and Wilbur W. Spencer, Springfield, Ohio. Filed Jan. 31, 1895.

552,337. Electric Motor. Albert W. Smith, Washington, D. C. Filed July 23, 1895.

552,338. Electrical Rail-Fish. Victor Thélin, Geneva, Switzerland, assignor to the Compagnie de l'Industrie Électrique, same place. Filed Aug. 1, 1895.

552,341. Electric Smelting Furnace. Joseph A. Vincent and James E. Hewes, Philadelphia, Pa. Filed July 18, 1895.

552,347. Motor-Suspension for Street-Cars. George F. Card, Mansfield, Ohio. Filed Aug. 21, 1895.

552,349. Car-Fender. Samuel H. Coffee, Beverly, N. J. Filed May 17, 1885.

552,363. Insulating Joint. Elliott P. Gleason, Brooklyn, assignor to the E. P. Gleason Manufacturing Company, New York, N. Y. Filed Dec. 27, 1894.

552,369. Means for Operating Electric-Railway Vehicles. Ernst G. W. C. Hoffmann, Charlottenburg, Germany, assignor to the Siemens & Halske Electric Company of America, Chicago, Ill. Filed Sept. 3, 1895. Patented in Italy, Apr. 8, 1895, No. 38,405; in England, May 5, 1895, No. 6,007, and in France, June 20, 1895, No. 245,761.

552,371. Method of and Apparatus for Measuring Illumination. Edwin J. Houston and Arthur E. Kennelly, Philadelphia, Pa. Filed Feb. 13, 1895.

552,377. Car-Fender. Henry Kramer, Jr., New York, N. Y. Filed April 30, 1895.

552,384. Electric Gas-Lighter. Philip Meyer, Alameda, Cal. Filed Sept. 20, 1895.

552,397. Regulator for Dynamos. Charles E. Scribner, Chicago, Ill., assignor to the Western Electric Company, same place. Filed June 1, 1889.

552,425. Secondary Battery. Camille A. Faure, Paris, France, and Frank King, London, England. Filed March 6, 1895.

552,451 Electric Railway. Michael H. Smith, Halifax, England. Filed Oct. 26, 1887. Patented in England, Dec. 28, 1886, No. 17,018, and in Belgium, June 13, 1887, No. 77,792.

552,465. Burglar-Alarm Attachment for Railway-Cars. Jacob C. Bratton and Arthur B. Graham, St. Louis, Mo. Filed Aug. 19, 1895.

552,469. Double-Diaphragm Telephone-Transmitter. Daniel Drawbaugh, Eberly's Mill, assignor to G. Milton Bair, Hanover, and Calvin W. Ream, Reading, Pa. Filed Feb. 23, 1895.

552,475. Car-Fender. William T. Haugh, Waynesborough, Pa., assignor of three-fourths to John Philips and John M. Ripple, same place. Filed Aug. 21, 1895.

552,477. Rail-Bond for Electric Railways. Budd J. Jones, Chicago, Ill. Filed March 29, 1895.

552,479. Electrical Rail Bond. Minott K. Kendall, Melrose, assignor of two-thirds to Gilbert Hodges, Medford, and Ephriam Harrington, Boston, Mass. Filed Aug. 12, 1895.

552,495. Regulator for Electrical Circuits. Joseph C. Mayrhofer, New York, N. Y., assignor to Denman Thompson, West Swanzey, N. H. Filed July 5, 1895.

552,496. Electric-Lighting System. Joseph C. Mayrhofer, New York, N. Y., assignor to Denman Thompson, West Swanzey N. H. Filed July 5, 1895.

552,498. Electric-Arc Incandescent Lamp. John A. Mosher, Chicago, Ill. Filed Sept. 23, 1895.

552,501. Insulator. Charles H. Snively, Mount Carmel, Pa. Filed March 20, 1895.