ELECTRICAL AGE

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NEW YORK, JULY 7, 1894.

CONTENTS.

THREE-WIRE SYSTEM.

We present on another page an interesting article describing a method of operating a three-wire system from one dynamo, now in use in Fives-Lille, France. Manifestly, if the same results can be obtained from one machine as from two a great advantage is gained, both electrically and mechanically, and the economy of such a system is obvious. We are not aware that any special efforts have been made in this country with this particular object in view; yet it is quite likely that private experiments have been conducted behind closed doors. In any event the system referred to probably contains some features that can be taken up and improved on by enterprising American inventors.

ELECTRIC ELEVATED RAILROADS.

The Metropolitan Elevated Railway in Chicago is to be equipped with electricity, and the results of the test will be watched for with considerable interest.

There is no doubt in the minds of electrical people what the record will be, though it has been a difficult task to convince the officials of some elevated roads that it would be decidedly to their interest to substitute electricity for steam power. Of New York city roads is this true, and no doubt the managers of these roads will keep an eye on the enterprising Chicago road. The results in Chicago will likely have considerable influence as regards the changing of power on the New York lines, and while we have no doubt as to what the results will be, we hope they will be sufficiently positive to convince the New York people that electricity is far superior to steam for elevated railway service.

ELECTRIC LIGHTHOUSE.

The use of electric lights for lighthouse illumination is being practically exploited by the United States government, and the largest light of this class ever constructed is soon to be placed on Fire Island, on the Long Island shore. The light from a lighthouse, however powerful it may be, cannot be seen at sea beyond a certain distance, and on land the ultimate distance of visibility is less, on account of the intervention of various objects and other inequalities on the surface. It is calculated that the Fire Island light cannot be seen more than 24 miles away at sea, but it is thought that by reflection on the clouds it will be seen a distance many times greater. The matter of reflecting the light seems to be assuming an important bearing in such considerations, and it is due entirely to the prodigious power of the electric light that such questions have recently come to the front. The reflection theory, of course, presupposes the existence of clouds; should there be no clouds, the light, or its glow, will not be visible so far.

There is one obstacle in beacon lighting, however, that has so far baffled the ingenuity of man; it is fog. When means have been devised to penetrate a fog with a beam of light to a reasonable distance, then a great advance shall have been made. A powerful electric light is very little better in a fog than an ordinary light; indeed, it is thought by some that the oil light has greater penetrative power in foggy weather. Be that as it may, it looks yet as if fog will continue to maintain supremacy for a long time to come, and render fruitless all efforts of man to penetrate its mass by a beam of light. However, no one can gainsay the fact that electric light for lighthouses is superior to all other light in clear weather.

THREE-WIRE DISTRIBUTION FROM ONE DYNAMO.

The Fives-Lille Company, of France, has patented an arrangement which enables a system of distribution by three wires to be fed with a single dynamo, and that without the production of sparks at the attachment of the neutral wire. The system is described in the London *Electrical Review.*

Fig. 1 represents the armature of a continuous current machine, turning between the poles N and S. The brushes B_1 and B_2 are placed directly on the winding. The two lamp groups, 1 and 2, are connected by the principal conductors L_1 and L_2 to the brushes B_1 and B_2. The armature contains a bobbin, D, of high self-induction and low resistance. The high value of the self-induction may be obtained by the employment of an iron core, forming a closed magnetic circuit. This bobbin is connected to two diametrically opposite

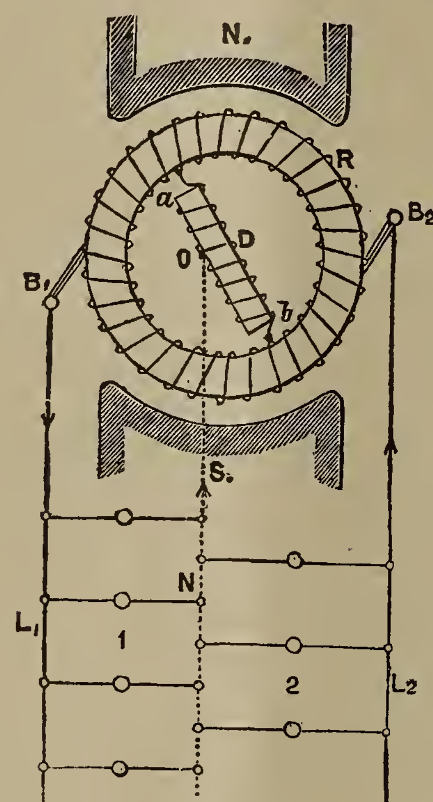


FIG. 1.

points, *a* and *b*, of the armature. Between these two points, during the motion, an alternating tension will be produced; but owing to the high value of the coefficient of self-induction, the alternating current generated in the bobbin will be very weak. The point O, the middle of the bobbin, possesses the mean of the potentials of the other parts of the winding, and not only is the potential difference a, o, equal to b, o, but at the same time the potential difference between the points B and O is equal to that between B_2 and O.

The neutral conductor N, by which groups 1 and 2 are placed in series, is now connected to point O, for instance, by means of the dynamo's axle.

If 1 and 2 contain the same number of lamps, their tensions are equal and the neutral wire remains without current when it is connected to point O. But if more lamps are introduced into group 1, there will be a greater absorption of current, and the excess will return by the neutral wire in the direction indicated by the arrow. On arriving at point O, this current will divide, and as it is continuous, it will pass without difficulty through the self-induction bobbin and come back into the armature. The result is, that the two groups of lamps are independent. When one consumes more current than the other the tensions will still remain equal, since the excess of current returns into the armature almost without any loss from resistance by the neutral conductors N and bobbin D.

Fig. 2 shows an arrangement fixing the bobbin outside the machine, where it will not be possible to make it turn with the armature, and connecting the ends by means of rings and brushes with the points a and b of the armature.

Dynamos furnished with bobbins of this nature can also be employed as tension regulators, especially in a case where the central station C (Fig. 3), is at a distance and furnishes the current under a tension equal to the total tension of two groups of lamps. In this case we

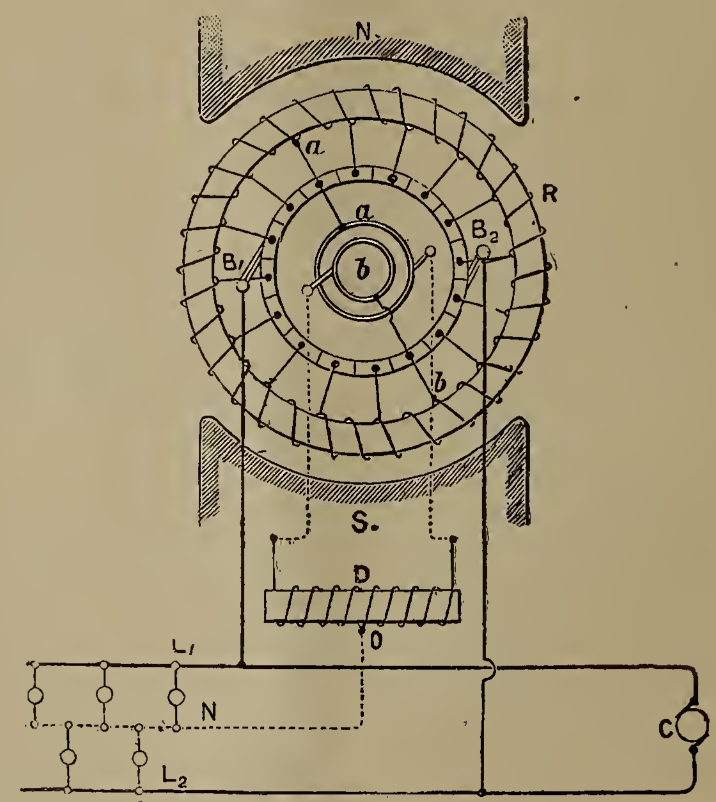


FIG. 2.

have only to introduce, near localities where the current is to be utilized, one or more of these dynamos provided with inductive bobbins receiving the current from the principal conductors into their brushes, and then starting as motors (Fig. 3.) The neutral wire has not then to be connected to the central station, which is situated at a distance, and thus a considerable saving of wire is effected.

This system can be applied to dynamos as to motors,

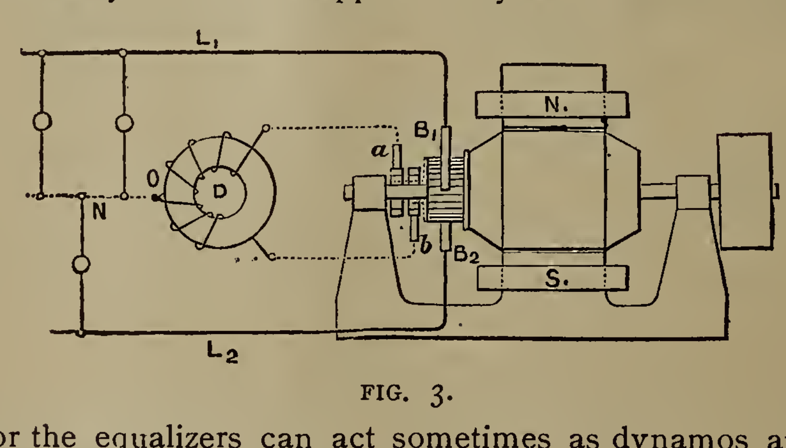


FIG. 3.

for the equalizers can act sometimes as dynamos and sometimes as motors.

Not only can this system be applied to bipolar machines, but multipolar machines can adapt it just as readily.

The Fives-Lille Company will exhibit this system at the Lyons exhibition.

MAKING CAR TRUCKS.—The Johnson Company, of Johnstown, Pa., has entered the business of making car trucks.

DEFINITION OF ELECTRICITY.—A witness in a trial for damages against the Central Pennsylvania Telephone Company, in Scranton, Pa., defined electricity as being "A God-like force which abhors all sham conductors."

A RELIABLE METHOD OF RECORDING VARIABLE CURRENT CURVES.*

BY DR. ALBERT C. CREHORE.

INTRODUCTION.

A practical problem that has in more recent years presented itself to the electrician and physicist alike is "How shall we measure the exact current which flows in a conductor at any instant of time and record all the irregular changes to which it is subject?"

The importance of the question, since the introduction and extensive use of the alternating current, has emphasized the fact that we need a "reliable method" of measuring the instantaneous values of a variable current, which is not a "method by points," but "a method which continuously records the current."

Under "a method by points" is included any method in which the current is obtained from readings (usually of an electrostatic voltmeter) due to the charge of a condenser which may be connected in at any point of time. The essential characteristic of the method is that the current is *supposed* to repeat itself exactly during successive periods, or more generally when the conditions are exactly repeated. There can be no doubt that the current *does repeat* itself under exactly similar conditions, but can we be *sure* that those conditions *are exactly repeated?* By this method a number of points are found, the time occupied being at least several minutes, and the collection of points properly arranged is a representation of the current during as short a time as the one-hundredth of a second, perhaps. Yet this method has proved to be a very useful and practical one, and has given us information concerning the currents and potentials of generators and transformers which is of paramount importance. Yet all will agree that this "method by points" is too limited in its application, and does not show us any sudden temporary change taking place in a current, which does not *repeat* itself

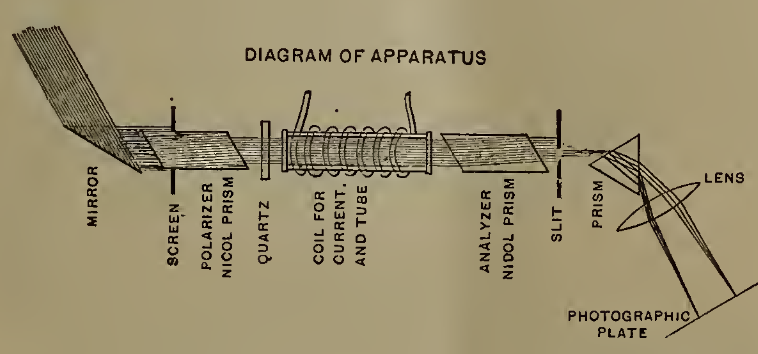


FIG. 1.

Such for instance as a sudden "make," or "break," or "change" in an alternating current, would not be easily shown by this method. The second method, previously designated "*a method which continuously records the current,*" is the one to which this paper more particularly refers. Under this head is included all methods which attempt to record the current by causing it, either directly or indirectly, to move a material something so that its displacement is some single valued function of the current. As an example of this method may be mentioned the well-known experiments of Froelich in which a telephone is used, upon the disk of which is mounted a mirror that permits a beam of light to be reflected from it. Any vibration of the disk gives an angular motion to the ray of light and this motion is in turn recorded upon a moving photographic plate. Other examples might be mentioned in illustration of this method, for instance, a wire which is deflected in a magnetic field, or stream of mercury so influenced; but it will be noticed that in all of these cases an appreciable amount of *ponderable* matter is required to be moved backward and forward during each reversal of the current. When the current reverses hundreds of times per second, the unavoidable difficulty is introduced that the forced oscillations of this ponderable matter, no matter how small in amount, become so superimposed upon those of the current which it is desired to measure that they are inseparably mixed together; and the record does not show the true current, but the resultant vibrations of the instrument. That this is the case with the method of the telephone, above referred to, has been established beyond a doubt, it seems, by experiments conducted at Cornell University by Mr. Henry Floy. The current furnished to the telephone was carefully measured by the "method by points," and care was taken to see that the current as measured by points was the same as that used in the telephone. The vibrations of the telephone did not even approximately agree with the current as measured by well-established methods.

Bearing these points in mind, and remembering the high frequency of some of the oscillations which it is desired to record, may we not with some degree of certainty predict that any of these methods requiring the rapid motion of ponderable matter will be open to precisely the same objections which are noticed in the case of the telephone? Without answering this question, probably all will agree that the difficulty may *certainly* be avoided by using as a vibrator, instead of this so-called "*ponderable matter,*" a vibrator that has *no* weight. It is to this question of finding a form of vibrator *without weight* that I invite your attention.

The idea of the weightless vibrator is perhaps already suggested in the beam of light. But how shall we cause a beam of light to have a change in direction simply by means of a current flowing in a circuit without the intervention of some moving material? A way of influencing a beam of light directly by an electric current (or more properly by its magnetic field) is that discovered long ago by Faraday. It is by means of the discovery of the rotation of the plane of polarization by an electric current that I propose a method of obtaining a weightless vibrator. The explanation will be made clearer by reference to diagram of apparatus (Fig. 1). A beam of light is passed through a polarizer (Nicol prism) so that the vibrations of the beam take place in only one plane upon emergence. If it is then passed directly through an analyzer (Nicol prism) the latter may be set at such an angle as to prevent all light from passing through it, and thus produce darkness beyond the analyzer. Faraday's discovery was that, if a beam of polarized light is passed through some *substance* in the direction of the lines of magnetization within that substance, there is a rotation of the plane of polarization in a direction which is the same as the direction of the current required to produce such a magnetic field. The direction of rotation is unaltered, therefore, whether the light beam advances in the same or the opposite direction to the magnetization, so that a beam reflected back and forth through the substance several times has its rotation increased by equal amounts each time. If the direction of the ray of light be at right angles to the lines of magnetization there is no rotation produced.

If now the light is passed through polarizer and then through a tube containing the substance used, around which is wound a coil of wire, and thence through the analyzer, an observer would find complete darkness upon looking through the analyzer when set in the crossed position. But if without moving the analyzer a current is sent through the coil on the tube, light appears to the observer. This is because the plane of polarization has been rotated by the current and practi-

* A Paper presented at the General Meeting of the American Institute of Electrical Engineers in Philadelphia.

cally the prisms are no longer crossed. Now let the analyzer be rotated while the current is still flowing, and the observer will see a series of beautiful colors through the analyzer, a different one for each position of it; but, as long as the current flows, he cannot produce darkness again by any amount of rotation of the analyzer.

This effect suggests what is known to be a fact, that the different wave-lengths composing white light are rotated by the current in different amounts, so that when the analyzer is turned to the angle corresponding to the yellow light, say, only the yellow light is prevented from passing through the analyzer. All the other rays, being rotated by different amounts, pass through the analyzer, and there being mixed together they give rise to the series of beautiful complex colors above mentioned. A different color is seen for each position of the analyzer, because in each position a different color is subtracted from white light, and the observer sees what is left or merely the complementary color. Fortunately we have substances which naturally rotate a beam of polarized light, for by means of this aid we may obviate the difficulty that the band vanishes with no current. For instance, a parallel plate cut from a crystal of quartz perpendicular to the optic axis has this property of rotating the plane of polarization. Quartz is selected for the material used because of its great transparency and high specific rotary power.

The tube upon which the coil carrying the current was wound was a glass tube of 1.4 cm. internal, and 1.8 cm. external diameter, and 70.15 cm. long. The tube was filled with carbon bisulphide, which was confined in the tube by means of two plane parallel plates of glass, each 1.3 cm. thick, fitted tightly upon the ground ends of the tube. Upon this tube was wound six layers of No. 18 double cotton copper magnet wire, occupying a length upon the tube of 61.5 cm. The wire was wound so that 100 turns occupied 12.7 cm. Thus the total number of turns, 2,900, is very large considering the size of wire.

The light used was sunlight reflected from the mirror of the heliostat.

The Nicol prisms are two fine specimens which were obtained by Dartmouth College at a time when larger specimens could be obtained than may now easily be found. The width of the slit does not need to be very narrow. A width of a quarter to a half millimeter will do better than a narrower one, because more light is admitted to the photographic plate, and in passing through so many different substances even sunlight is rendered comparatively feeble by the time it strikes the photographic plate.

A further description of the apparatus is hardly deemed to be necessary, inasmuch as no claim is made to having obtained more than the most crude of first results, which may be the results attained by apparatus arranged in a comparatively poor manner for the end sought. Yet the results obtained seem to be so promising for the future that the subject is presented to you at this early date in the experiment, in the hope that it may soon receive an impetus from other experimenters who have better facilities than those at my disposal, and thus become a fruitful source of extending our knowledge of instantaneous current flow in conductors.

HOW TO WIRE BUILDINGS.

"Is there a book published giving directions for wiring buildings for electric lighting, etc.—something in plain English?"

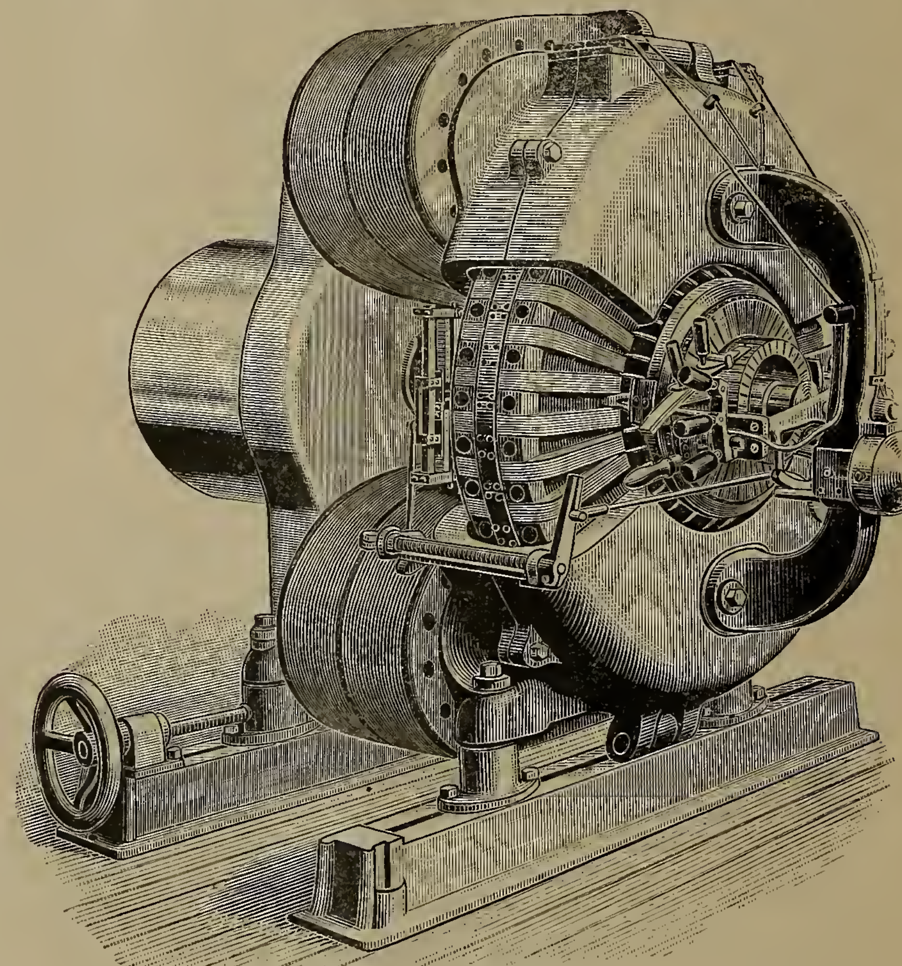
"Yes; Noll's book on 'How to Wire Buildings,' fits your case exactly. Send $1.50 with your order to the Electrical Age Publishing Co., New York, and you will get a copy of the book by return mail."

NEW EXCELSIOR DYNAMO.

The accompanying illustration gives a view of a 200-arc light dynamo designed by Mr. William Hochhausen, electrical engineer for the Excelsior Electric Company, 44 Broad street, New York city, and recently brought out by that company. It is so great an advance on machines of this class that some details of its construction will be of interest to our readers.

It will be remembered that the Excelsior Electric Co., in 1890, brought out a 100-light 2,000 c. p. machine, the invention of Mr. William Hochhausen, which exceeded the machines of that time by thirty-five per cent. in efficiency. Owing to its ingenious arrangements and desirable features the machine attracted considerable attention.

The success of this machine encouraged Mr. Hochhausen to pursue his investigations in this direction resulting in the invention of the machine herewith illustrated. This machine is capable of feeding 200 arc



NEW EXCELSIOR DYNAMO.

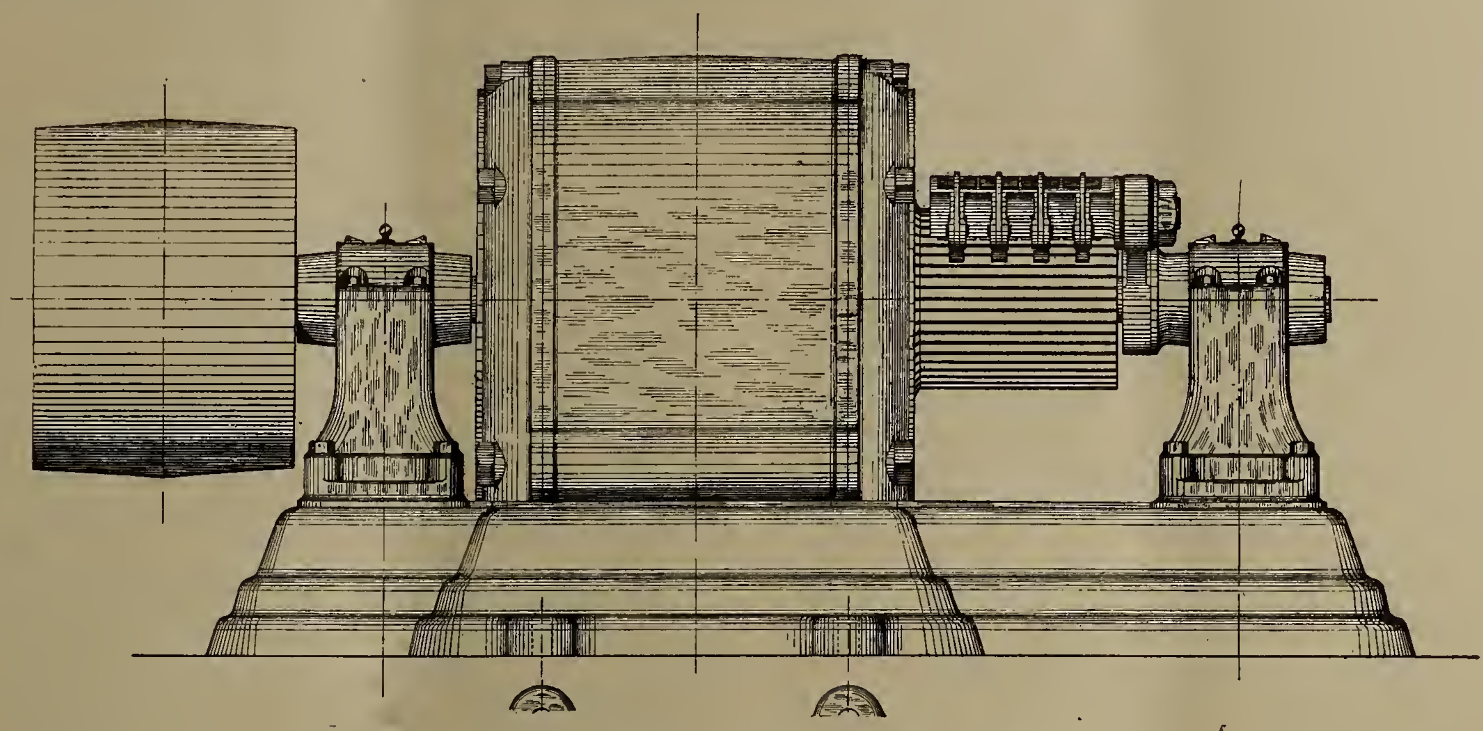
lamps of 2,000-c. p., has an e. m. f. of 10,000 volts, current of 10 amperes and speed of 265 revolutions per minute. There are forty-eight coils in the armature of 220 turns each. The diameter of the external armature-ring is 33 inches; internal, 20 inches. The weight of the magnet wires is, 1,600 pounds, and of the machine complete, eight tons.

Special precautions are observed to provide for the high potential. The pole-pieces are so hinged that they can be swung back and leave the armature and commutator free for inspection. The machine has only one interior bearing, and the regulation is effected by a small auxiliary motor placed in the hub-like enlargement of the yokes joining the pole-pieces. This little motor shifts the brushes to the proper point with every change of load, and by a set of lever arms varies a set of resistance coils which assist in regulation.

An extraordinary test was recently made of this machine. One hundred and sixty-five arc lamps, each of 50 volts, were connected to the machine, and the whole repeatedly switched on and off without at all affecting the operation of the dynamo or injuring the commutator.

FREEMAN'S NEW DIRECT CURRENT APPARATUS.

Among the electrical engineers of the present day none possess a broader knowledge of the science of electricity and its cognate arts than Walter K. Freeman, now located at 136 Liberty street, New York. Though his work in the electrical field is not generally known, it is a fact, nevertheless, that the credit due him as an explorer and worker in the development of modern electrical machinery is far greater than the average reader imagines.



END VIEW OF FREEMAN DIRECT CURRENT DYNAMO.

Prominent among his inventions is said to be the alternating current system of lighting. Before that was introduced, systems for incandescent lighting were limited to small central stations and isolated plants; but with an almost limitless means of distribution, new life was instilled in the electrical business and the transformer system made a boom throughout the whole country, although as early as the fall of 1879 he had perfected the system and the Chicago dailies had published an account of it.

During the past two years Mr. Freeman has devoted his energies to perfecting new designs for direct and alternating current apparatus, and the armored type of consequent field multipolar generators, as shown in figs. 1, 2 and 3, give a clear idea of the result of his labor in direct current apparatus.

A glance at this machine shows a radical departure from all the various designs of generators in the market.

SIDE VIEW OF FREEMAN DIRECT CURRENT DYNAMO.

In general form it consists essentially of a base, provided with integral flanges between which are located the wound fields, hinged at the bottom and secured in place by bolts; the bearings for the armature shaft resting on the bed-plate, altogether making an elegant, compact and simple piece of electrical machinery.

Within the body of the field construction are four pole-pieces. Two are wound with the necessary amount of wire to develop the required lines of force, and the other two poles are created by the mutual action of the wound fields; thus a consequent field multipolar generator is evolved from two wound fields. The armature is so made that the closest proximity exists between it and the poles, without touching the air gap, thereby being shortened to the greatest possible degree and the highest efficiency secured. This is a feature peculiarly characteristic of this mechanism, and cannot, it is claimed, be secured in other generators, because the air gap or magnetic resistance between the fields and armature is so great in them that they are of less efficiency and require higher speed.

In the disposition of the electro-magnetic active portion of the machines an unbroken magnetic circuit is maintained, so that the lines of force find a path of minimum air resistance to the armature core, which permits these machines to run continually loaded to any point within the limit of their capacity, without injury or depreciation of their efficiency. This fact alone constitutes a strong point in their favor, inasmuch as they overcome the heating effect that attend almost all other forms of generators and represents just so much non-effective energy.

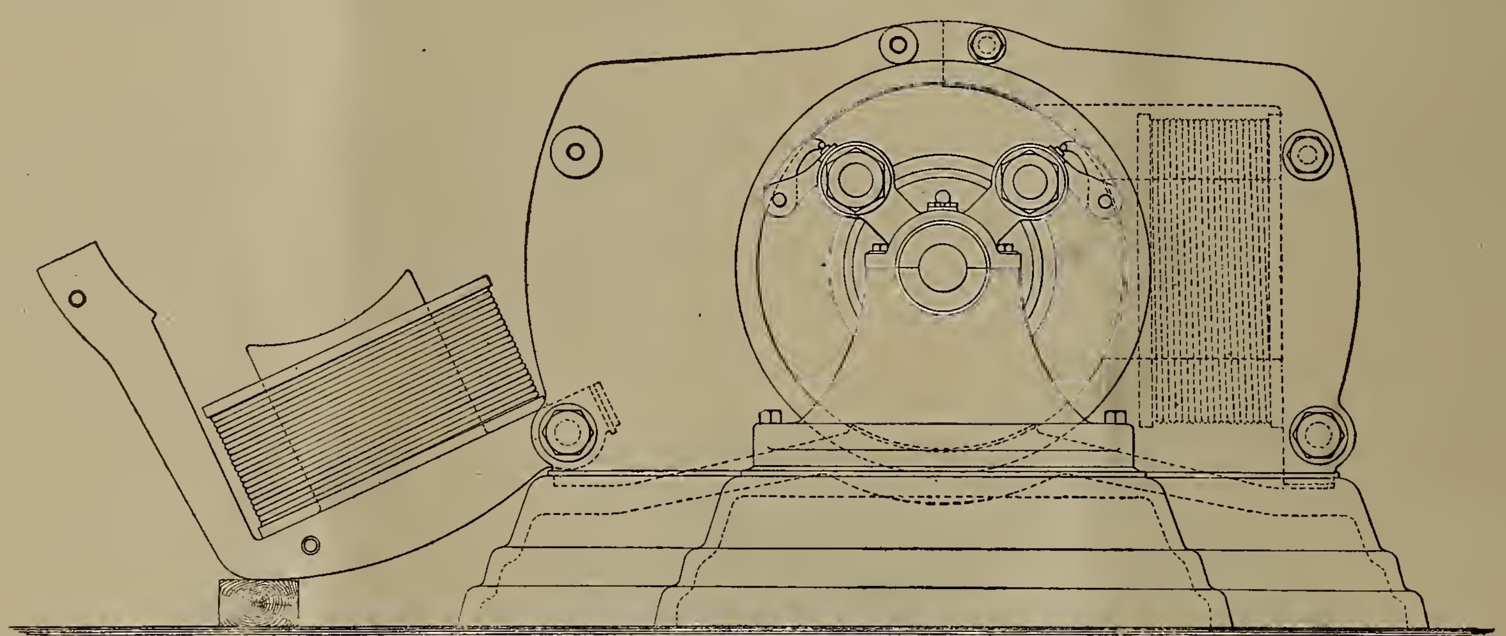
to run at an extremely low speed, and a careful examination of the details of this apparatus will convince those versed in the art that it is an exceptionally perfect design.

Notwithstanding the fact that these generators operate efficiently at a very low speed, the weight per K.W. is no greater than other types, and from a mechanical and electrical point of view these machines reach a high degree of perfection.

Generators of this type are now being made from 1 to 150-K. W. in 18 sizes, and motors from 3/4 H. P. to 175 H. P.

ECO-MAGNETO WATCHMAN'S CLOCK.

The efforts of property owners and others to protect themselves against any possible loss have resulted in the employment of watchmen, and in the use of watchmen's clocks as a check on the faithful performance of duty by the watchmen. Of the many more or less complicated watchmen's electric clocks in the market, few have fulfilled all the requirements. A clock of this kind should be simple in construction, not easy of derangement, impossible to tamper with, and easily managed by any person.



FREEMAN DIRECT CURRENT DYNAMO—REMOVED FIELD COIL.

After a series of careful tests of these machines a higher average efficiency is shown than is claimed by reliable manufacturers for their apparatus. The surfaces of the armature being perfectly smooth, with the conductors threaded through the laminated core, give that portion of the machine a very substantial advantage over the ordinary dynamo and permits, among other things, the handling of the armature without fear of injury, and also dispenses with the use of the binders or bands to hold the conductors in place. It also allows the armature to revolve very close to the fields, which secures an easy route for the lines of force to traverse.

In Mr. Freeman's new iron-clad generator there are several salient features which give it an advantage over other machines; the peculiar construction of the portion of the magnetic union that completes the fields and base permits an examination of the field coils and the armature quickly at any time; the wound fields are hinged at the bottom near the bed of the machine, on a line that allows the pole-pieces to swing outward without touching the armature. By this simple arrangement it is possible to examine the coils and put on new ones without taking the machine apart. In these machines the inventor sought to overcome imperfection of other makes of generators and reduce the air gap between the armature and fields to such a degree as to allow the machines

Until now all electric clocks have been worked by a battery, which has been a constant source of trouble and expense, but the dispensing with the battery by the introduction of a permanent magnet instead, which the watchmen uses to generate, at each station, electricity sufficient to operate the clock, enhances the value of the excellent Eco-Magneto Watchman's Clock.

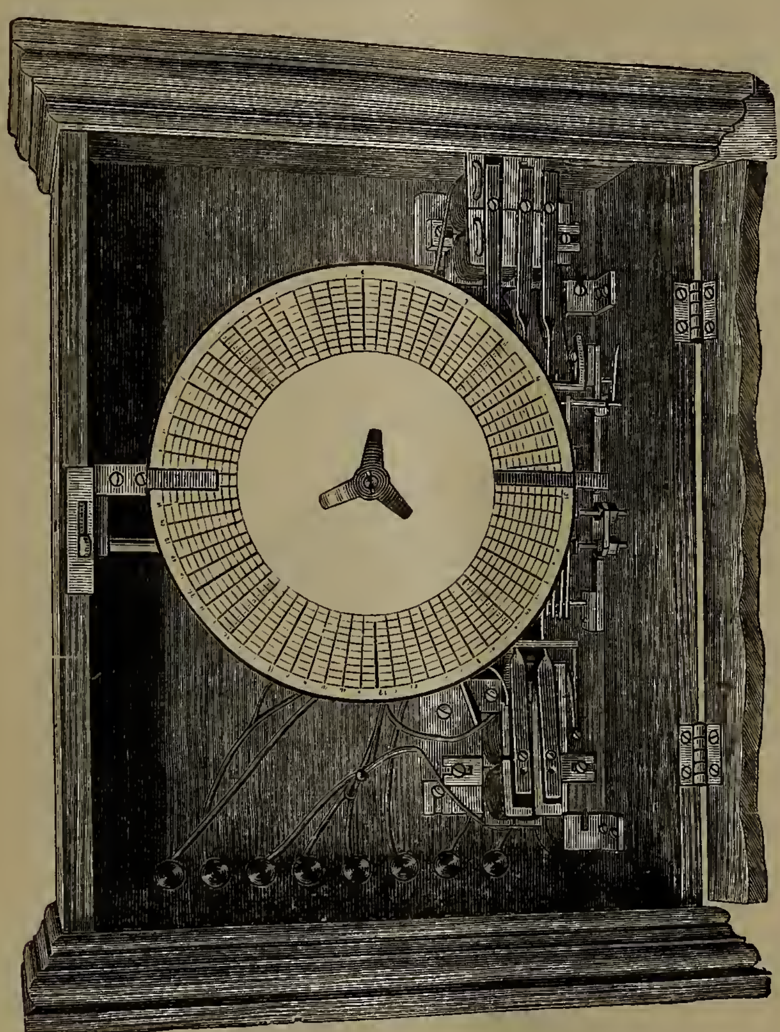
The current required for the transmission and also for exciting the electro-magnets of the apparatus is generated by means of a magneto-machine. The circular dial of paper, divided by radial lines corresponding to hours and fractions, is carried around by a clock-work in synchronism with an hour hand, in the regular manner of all electric clocks.

The record of the watchmen's visitations is made by means of the perforations in this sheet of paper by needle-points attached to the prolongation of the armatures of the electro-magnets, connected with a circuit reaching to some one of the several stations.

The station consists of a small box containing a magneto-machine; when the watchmen inserts his key in the box and turns it around once he gives a rapid revolution to the armature of the magneto, and the current thus generated is transmitted by the wires, intermittently excites the magnet and the record is made.

The unique feature about this clock is the impossibility of "manipulating" it, for the vibratory motion of the perforating needle cannot be imitated by hand even if the watchman should gain access to the clock, and as the magnets are wound so that they can not be excited except by a high tension current generated by a magneto machine, no electrical tampering by crossing or short circuiting the wires can produce the same results.

Its simplicity, perfection, regulation, dispensing of battery and economy are features that commend the system to the public Mr. C. D. Bernsee, Vanderbilt



ECO-MAGNETO WATCHMAN'S CLOCK.

Building, cor. Beekman and Nassau streets. New York, has sold a great many of these clocks, and that they give satisfaction is evident from the testimonials, press notices, and orders that are constantly being received.

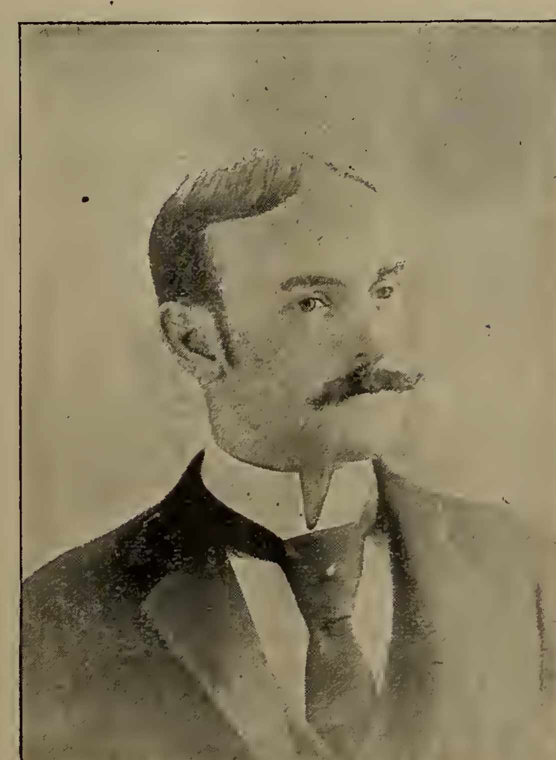
A NEW CURE.

Hackettstown, N. J., furnishes a curious case. A man named Ernest Ward, said to have, until recently, been an employé of the Edison lamp works, in Harrison, N. J., was removed to his home in a slow-dying condition, due, it was supposed, to electric shocks received at the works. The physicians said he had a tumor on the brain, but his aunt, Miss Bonely, thought that he was charged with electricity, and that if he was relieved of the excess he would be better. Ward's body was grounded by establishing, by means of a wire, a connection between the gas-pipe and his hand in which was placed a wet sponge. "The conductor was a perfect one," the story goes, and although there were no voltmeters nor ammeters at hand to measure the current as it passed out of the body, it was noticed that Ward felt a little better after the discharge. The experiments were repeated, and after the several short-circuitings the physicians say that the patient has a good chance for recovery.

HENRY B. OAKMAN.

Among the bright men brought to the surface through the medium of electrical industry, none is more favorably known than Mr. Henry B. Oakman, general eastern agent of the Wenstrom Electric Co , at 136 Liberty street, New York city. Mr. Oakman's career commenced in the office of the old Electrical Supply Co.; when located at 17 Dey street, New York city. His whole attention, since he left his school books at an early age, has in one way or another been connected with electrical subjects. By a strict observance of business principles, he advanced in quick succession from one position to another, finally to head salesman, resigning in January, 1891, to connect himself with the Edison General Electric Co., first in New York city, then in charge of the New England business, located at New Haven, and finally to represent that company in Buffalo and handle their trade for northern and western New York.

While Mr. Oakman was in charge of this business for the Edison Co., his office was at 41 Niagara street, Buffalo. He made an enviable record for himself of the largest sale that had then been recorded in the Edison



HENRY B. OAKMAN.

interest. His tenacious disposition and sterling integrity make him an able salesman. Although a young man, he enjoys the acquaintance of many and the confidence of all with whom he has dealings, and as general eastern agent of the Wenstrom Electric Co. he will doubtless make a market for that company's apparatus through the force of his arguments, based upon the confidence he has in the advantages claimed for the Wenstrom dynamos. His host of friends predict for him great success in his new field of labor.

THE BEST FIRE DEPARTMENT.—It is stated that the members of an Italian fire brigade are so quick in responding to a fire call that, in one instance, where a house had been struck by lightning, the firemen arrived before the flash had disappeared.

TELEGRAPHING WITH THE BIG SEARCH-LIGHT.

The tests recently made by the Board of Ordnance at Sandy Hook, to determine whether the Schuckert search-light is of practical value for coast defence purposes and signalling, have been very successful and prove the light capable of doing all that is required of it.

The light is of 200,000,000 candle power and stands on a wooden tower 150 feet high on the point of the Hook near the telegraph office. It is contained in a round box sixty inches in diameter and four feet in depth. Two carbons, one one and a half inches in diameter and the other one inch, are set in iron frames six inches from the reflector. The feature, which it is claimed, makes this light more effective than others, is the reflector, which is parabolic instead of oval, and projects the beams outward in parallel lines.

The box is mounted so that the rays of light can either be projected upwards or in the surrounding circle.

On the night of June 25, the light was tested as a means of transmitting signals, communication having been had by flashes with New York. Elias B. Dunn, the clerk of the weather office, was on the roof of the Equitable building and when the proper position of the light was determined signals were transmitted in the Morse code, by screening the light. Sergeant Dunn made his return signals by colored lights placed on the coping of the building. The tests proved that the search-light could easily be used to transmit signals to a distance of at least 18 miles.

POWERFUL LIGHT FOR FIRE ISLAND.

The arrangements for the most powerful beacon in the world, to replace the beacon on Fire Island, N. Y., are rapidly nearing completion. The United States, last fall, purchased the famous Le Paute lens for $10,000, and experiments are now being made with it at Tompkinsville, S. I. The strength of this light is 250,000,000 candle-power, which is 50,000,000 greater than the Sandy Hook search-light. It is estimated that under favorable conditions its range will be visible for 100 miles around Fire Island. The lens, which is a two-sided bivalve, weighs 70,000 pounds. The major axis is nine feet; the minor axis six feet. The sides of the base are about six feet apart, and in the centre will be a powerful arc light. The beacon will revolve six times a minute, and consequently every ten seconds it will flash out from an elevation of 168 feet with an intensity which will throw the beams beyond Montauk Point.

NEW BOOKS.

Electricity One Hundred Years Ago and Today. With copious Notes and Extracts. By Edwin J. Houston. New York: The W. J. Johnston Co., Ltd., 199 pages. Illustrated. Price, $1.00.

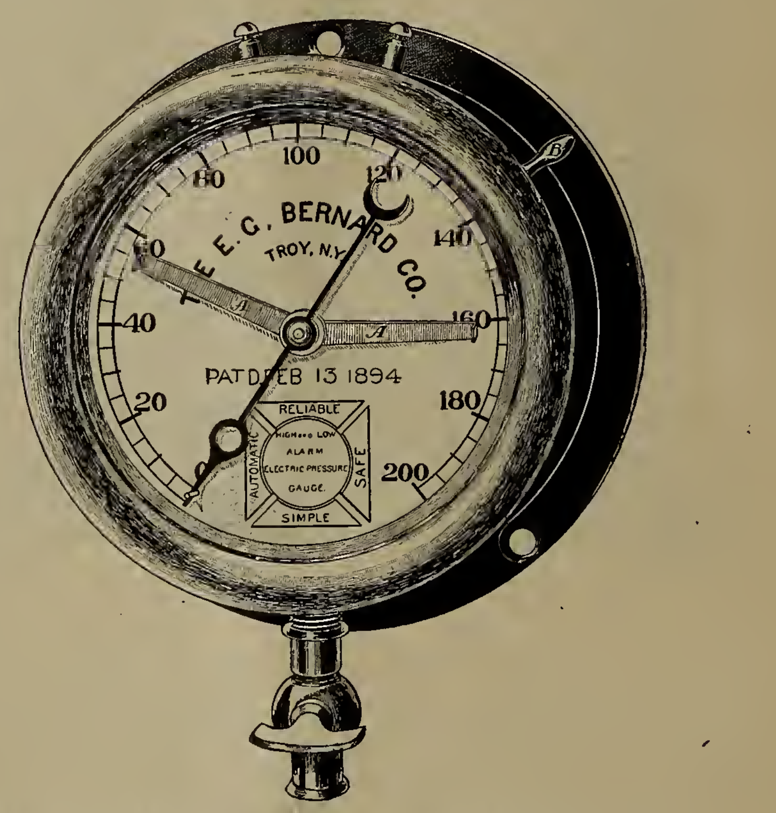
The author completely reviews the electrical science of the last century up to date, giving clear and concise explanations of various electrical phenomena, researches and discoveries, in language which fortunately will enable the non-electrical reader also to enjoy. The numerous extracts and foot-notes in this book alone exhaust, as far as the limited space permits, this great subject The unique feature of this book is the publication of the original papers of the investigators, which enhances the value of the book and are in themselves a most desirable property.

ELECTRIC ALARM AND PRESSURE GAUGE.

The object of this invention is to provide an electric alarm signal, for high or low pressure, that can be attached to all forms of pressure gauges. At the same time it is provided with a simple means of testing the gauge to see if it is in working condition at all times, and also at the same time test the signal bell or recorder. It can be attached to both the signal bell and to the recording clock, thereby giving at all times a record of the pressure when it exceeds certain limits either high or low.

The accompanying illustration shows a view of the face of the common form of pressure gauge, provided with our attachments. The small handle or finger, "B," by being pressed either up or down, will test the gauge in either direction for high or low alarms, thus showing that both the gauge spring and the electric signal apparatus are in perfect order, and thus doing away entirely with any distrust of the apparatus.

This gauge is of special value on the sprinkler systems. On the wet system of automatic sprinklers it is of the utmost importance and can be set within one



BERNARD'S ELECTRIC ALARM AND PRESSURE GAUGE.

pound, if desired, of the pressure which is normally carried, thus indicating a leak at once.

In dry systems it is of equal importance. The gauge is so arranged that as soon as the head is opened and the air commences to escape, it will ring a bell long before the water will come through the pipes.

This gauge is also valuable for use on a steam boiler. The attention of the engineer or fireman is frequently diverted for a short time, and in that time the steam either raises or falls, particularly in small plants and house-heating apparatus.

With this alarm gauge the expense of repairs caused by water escaping at the safety valves is entirely avoided. It can be adjusted so as to give both high and low alarms between any two points desired.

To sum up its advantages, this gauge is first, absolutely reliable; second, it is extremely simple; third, it is very low in price; and fourth, the entire apparatus is made of the best material and by skilled labor, and is guaranteed perfect and free from any inherent defect.

It is made by the E. G. Bernard Co., Troy, N. Y.

STREET RAILWAY NEWS.

WIRES MAY GO IN THE BROADWAY CABLE CONDUIT.

In our last issue we referred briefly, editorially, to the decision of Justice Ingraham, on June 26, in the case of the Empire City Subway Company against the Broadway and Seventh Avenue Railroad Company. As this is an important as well as interesting case, we give a few more facts. The question involved the right of the Broadway Railroad Company to use the conduit running along its line of road from the Battery to Fifty-first street, for the use of wires and electrical conductors, in order to signal to any portion of the road in the event of accident or otherwise.

Justice Ingraham gave a decision holding that the Empire City Subway Company has no right to maintain an action to enjoin the railroad company from maintaining electrical conductors in its conduit for the necessary and proper operation of its road, upon the ground that the subway company has no exclusive right to maintain the subways in the streets, and the railroad company has not infringed upon the franchise owned by the subway company.

The subway company, which claims the exclusive right to the opera'ion of the subways in the city, held that the railroad company should have applied to the Board of Electrical Control for permission to lay wires. Justice Ingraham says it could not have been the intention to authorize the company to operate a railroad by means of a cable and then not allow it to make such provisions for signalling for the stoppage of the cable as is necessary to prevent the operation of the road from becoming dangerous to its passengers and to the public use of the roadway.

Justice Ingraham holds that the license of the Empire City Subway Company is not an exclusive right to maintain subways in this city, and that its complaint must be dismissed. He states that the subway company would have a cause of action against the railroad company if it allowed the subways along its line of road to be used by others to the injury of the subway company, but that no such injury will result by the use of the subway by the railroad company for the orderly and proper operation of its railroad.

ELECTRIC ELEVATED RAILROAD IN CHICAGO.

A dispatch from Schenectady, N. Y., on June 28, says the General Electric Co. has secured a large contract from the Metropolitan Elevated Railway Co., of Chicago, which is about to make a change in its motive power from steam to electricity. The contract calls for 110 motors of the new, large railway type, two fifteen hundred and two seven hundred and fifty kilowatt generators, and all the apparatus necessary to run the road according to the new plans.

The system that will be used will be the same as that in use upon surface cars, with the exception that instead of a wire running overhead the electricity will be carried along a centre rail.

—A young lady, in alighting from an electric car, asked the conductor if she would receive a shock if she put her foot on the track. "Not unless you put your other foot on the trolley wire," was the reply.

Big Verdicts Affirmed.—The General Term of the City Court in Brooklyn has affirmed the judgments against the street railroads named in suits for damages, as follows: Janes Arnasen against the Brooklyn City Railroad for $15,000; Mrs. Annie Connor against the same company for $12,500; Moses D. Kindade against the Atlantic Avenue Company for $10,000.

ELECTRICAL TABLES AND FORMULÆ.

The accompanying illustration shows the exact size of Thompson's Electrical Tables and Memoranda—a work that everyone in the electrical trades should have. It can be carried easily in the vest pocket, and is thus

always at hand for reference. It has 128 pages and is illustrated. The formulæ and tables are very valuable. Price of book 50 cents. Sent free by mail on receipt of price. Address Electrical Age Publishing Co., New York.

NEW YORK NOTES.

Office of the Electrical Age,
First Floor, World Building,
New York, July 2, 1894.

The Commercial Cable Company has issued a very handy card for registering special telephone calls. It is intended to be hung up at the telephone for ready use. It is a bright idea.

Hatzel & Buehler, electrical engineers, 114 Fifth ave., city, have been reaping a harvest through all these hard times. Among the few contracts closed recently are the following: American Express Co., No. 63 and 65 Broadway, a complete plant consisting of 55-K. W. Siemens & Halske generator direct connected to a McIntosh & Seymour engine; wiring outfit for 1,200 16-c. p. lamps (specifications for this contract were drawn by Mr. Chas. K. Clark, E. E., being the most satisfactory of those presented.) Wiring for 890 16-c. p. lamps at the Hoffman House Annex; electric light, bell and burglar alarm equipment of residence of G. G. Howland, No. 37 East 35th street; complete electrical equipment of residence of Dallas P. Pratt, No. 45 West 48th street; complete construction of electric road for Franklin Street Railway Co., Franklin Pa. Among the contracts to be finished by July 1 are, Bloomingdale Asylum plant; New Chambers Street Hospital, complete plant; residence of Commodore Elbridge T. Gerry, complete plant. Hustle is the word with this firm.

The signal system of the Broadway cable road is now in practical operation. There are 45 signal boxes along the line between Houston street and South Ferry, and between 36th and 59th streets there are nine boxes, all in communication with the power stations. Besides the signals to stop and start the cables, which are transmitted automatically by pulling a handle, provision is made for the attachment of a portable telephone in case circumstances require that verbal communication be carried on. The introduction of this system cost the company $26,000, and it would have been put into operation sooner had not the injunction proceedings of the Empire City Subway Co. interfered until a few days ago, when the case was dismissed by Judge Ingraham.

An insane man named William Moizen was arrested one day last week for annoying Mrs Thos. A. Edison. The man wrote Mrs. Edison a letter in which he charged her, with others, with conspiring to have him confined in the Insane Asylum. No attention being paid to the letter he went to the residence of Mr. Edison, in Llewellyn Park, Orange, N. J., and demanded an answer, when he was arrested, and pronounced insane.

The executive committee of the Interior Conduit and Insulation Co., 44 Broad street, has recommended to the Board of Directors that a dividend of 5 per cent. be declared on outstanding stock, payable in scrip. This scrip will be convertible into capital stock when arrangements for the increase of the capital stock of the company are completed. W.T.H.

POSSIBLE CONTRACTS.

The Cumberland Electric Light and Power Co., Nashville, Tenn., is preparing to enlarge its plant.

Address the Town Clerk of Mount Carroll, Ill., for information concerning an electric light plant to be established there.

The town of Oshkosh, Wis., will erect a municipal electric light plant. Address the City Clerk.

The recently burned electric railway station, Sherman, Texas, is to be rebuilt at once.

The Hess Storage Battery Co., Springfield, Ohio, will establish a plant to construct the Hess battery.

The Mayor of Huntsville, Ala., can give information concerning the proposed purchase of an electric fire-alarm system.

The Mount Airy-Dobson Telephone Co., Mount Airy, N. C., will construct a telephone line to Dobson, twelve miles distant.

The Record Manufacturing Co, Bel Air, Md., will construct an electric light plant to light the town. The plant will be installed two miles from the place, and operated by water power.

The recently incorporated Hillsboro Investment and Electric Co., Hillsboro, Texas, intends to erect an electric light plant, and is in the market for the necessary machinery.

The Citizens' Electric Light and Power Co., has given out the contract for the erection of buildings, and is now in the market buying the necessary equipment.

NEW CORPORATIONS.

The Monterey Power Co., Monterey, Cal., for generating and distributing electric power, light, etc.; capital stock, $100,000.

The Florida Engineering and Construction Co., Chicago, Ill., to construct railway and telegraph lines, electric lighting and power plants ; capital stock, $150,000.

The La Grange Automatic Telephone Co., La Grange, Ill.; capital stock, $40,000.

The Eagle Grove Electric Co., Eagle Grove, Iowa, to furnish electric light, heat and power ; capital stock, $30,000.

The Council Bluffs and Lake Manawa Electric Railway Co., Council Bluffs, Iowa; capital stock, $50,000.

The Charter Oak Telephone Co., Charter Oak, Iowa; capital stock, $5,000.

The Drawbaugh Telephone and Telegraph Co., Boston, Mass.; capital stock, $10,000,000.

The Fredericktown Electric and Manufacturing Co., Fredericktown, Mo.; capital stock, $5,000.

The Solar Arc Lamp Co., New York, N. Y., to manufacture lamps and electrical appliances; capital stock, $25,000.

The Tremont and Pinegrove Electric Light, Heat and Power Co., Pinegrove, Pa.; capital stock, $23,000.

The Sweet Electric and Manufacturing Co., Grand Rapids, Mich., to manufacture machinery and electrical appliances ; capital stock, $100,000.

The Gordon, Bnrnham Battery Co., Portland, Me.; capital stock, $1,000,000.

The Goliad Water Power Co., Goliad, Texas, to furnish electric light and heat; capital stock, $30,000.

The Coroapolis Electric Light Co., Coroapolis, Pa., by W. H. Guy; capital stock, $5,000.

The Rogers Park Lighting Co., Chicago, Ill., by Henry Heistand and others; capital stock, $30,000.

The Streator Mutual Telephone Co., Streator, Ill., by A. D. Holland and others; capital stock, $15,000.

The Emmons Electric Co., Chicago, Ill., by C. P. Emmons and others ; capital stock, $50,000.

The Northwestern Milling and Power Co., Spokane, Wash., to operate mills, electric lines, etc.; capital stock, $750,000.

The Ellicott Electric Heating Co, Buffalo, N. Y., to manufacture apparatus for utilizing electricity for heating and power purposes; capital stock, $25,000.

The Darriett Electric Motor and Dynamo Co., New York, N. Y., by J. R. Anderson, of Montclair, N. J., and others, to manufacture electric motors and dynamos; capital stock, $20,000.

The Electric Boiler Co., Rochester, N. Y., by J. Henry Howe and others, to manufacture boilers and steam heating apparatus ; capital stock, $50,000.

The Hercules Electric Power Co., Salt Lake City, Utah.

The Humphrey Manufacturing and Plating Co., Kalamazoo, Mich.; capital stock, $15,000.

The Johnson Electric Service Co., Milwaukee, Wis.; capital stock, $150,000.

The Kansas City Electric Railway Co., Kansas City, Kan., by E. L. Enzgrow, Ozone Park, N. Y.; F. B. Wilcox, Kansas City, Mo.; Louis Hummer, West Chester, Pa.; J. H. Parrott, R. A. Kope and P. F. Spickler, of Kansas City ; capital stock, $1,000,000.

The Mount Airy Telephone Exchange, Mount Airy, N. C., with T. Fawcett, president and J. R. Paddison, secretary.

The Ocala Telephone Co., Ocala, Fla., by J. B. Carlisle and others, to construct a telephone system ; capital stock, $10,000.

TRADE NOTES.

A copiously illustrated catalogue has been issued by the Peru Electric Mfg. Co., Peru, Ind., which describes their successful productions They make the Laclede and Hercules batteries, and the Edison, or Sawyer-Man styles of main and branch cut-outs, together with a full line of rosettes, wall receptacles, key and keyless sockets for all systems. Special attention is given by the company to its porcelain department. Their factory is well equipped and their excellent goods are sold at reasonable prices.

Electrical and Street Railway Patents.

Issued June 26, 1894.

521,778. Railway-Car Truck. Norman C. Bassett, Lynn, Mass., assignor to the Thomson-Houston Electric Company, of Connecticut. Filed Apr. 20, 1891.

521,787. Process of Manufacturing Car-Wheels. Andrew J. Fisher, Buda, Ill. Filed June 4, 1892. Renewed May 17, 1894.

521,791. Machine for Making Storage-Battery Grids of Forced Lead William W. Griscom, Haverford, Pa. Filed July 24, 1893.

521,798. Electric Arc-Lamp. S. P. Johnson, Schenectady, N. Y. Filed Dec. 20, 1892.

521,799. Electric Motor. Joseph Lee, Brooklyn, N. Y. Filed Aug. 2, 1893.

521,809. Electric Lamp-Lighter. James F. McLaughlin, Philadelphia, Pa. Filed Mar. 22, 1893.

521,840. Electric Alarm-Clock. Nina F. Whitney, Columbus, Ohio. Filed Dec. 2, 1893.

521,877. Electric Arc-Lamp. William J. Davy, London, England. Filed Apr. 14, 1894.

521,891. Conduit Electric Railway. Charles J. Reed, Orange, N. J, assignor by direct and mesne assignments to the Reed Electric Company, Philadelphia, Pa. Filed Apr. 14, 1892.

521,892. Conduit Electric Railway. Charles J. Reed, Orange, N. J., assignor to the Reed Electric Company, Philadelphia, Pa. Filed Feb. 13, 1893.

521,897. Method of Forming Storage-Battery Plates. Charles Sorley and James K. Pumpelly, Chicago, Ill., assignors to the Pumpelly-Sorley Storage Battery Company, same place. Filed Mar. 24, 1893.

521,908. Automatic Safety-Joint for Electric Wires. James H. Curry, Wilkinsburg, Pa., assignor of eighty-three one-hundred and twenty-eighths to Frank B. Tomb, same place, Samuel J. Graham and A. H. Childs, Pittsburgh, Pa, and Robert A. Gillispie. Filed Nov. 22, 1893.

521,914. Electric Soldering-Tool. James F. McLaughlin, Philadelphia, Pa. Filed May 19, 1893.

521,924. Transformer Electric-Lighting System. Peter Wright, Philadelphia, Pa., assignor to the United Gas Improvement Company, same place. Filed Dec. 9, 1893.

521,925. Transformer System of Electrical Distribution. Peter Wright, Philadelphia, Pa., assignor to the United Gas Improvement Company, same place. Filed Jan. 3, 1894.

521,936. Electric-Arc Lamp. Louis B. Marks, New York, N. Y., assignor to the Royal Arc Electric Company, same place. Filed Mar. 30, 1894.

521,952. Adjustable Carrier for Electric Lamps. Robert Faries, Decatur, Ill. Filed Feb. 23, 1894.

521,966. Safety-Guard for Cars. August Soffel, Brooklyn, N. Y. Filed Feb. 23, 1894.

521,981. Safety Appliance for Street-Railway Cars. Frank W. Jenkins, Brooklyn, N. Y. Filed Aug. 4, 1893.

522,029. Electric Time-Signaling System and Apparatus. Walter A. Purcell, Newark, N. J. Filed Nov. 16, 1892.

522,051. Brush-Holder for Dynamo-Electric Machines. Rodolphus Fuller, Detroit, Mich. Filed Mar. 19, 1894.

522,057. Trolley-Stand. Eleazer F. A. Heastings, Avalon, Pa. Filed Apr. 12, 1894.

522,067. Means for Suspending Electric Motors from Cars. Robert Lundell, Brooklyn, assignor of two-thirds to Edward H. Johnson, New York, N. Y. Filed Sept. 4, 1893.

522,070. Car-Fender. Marguerite Maidhof and Victor F. Maidhof, New York, N. Y. Filed Jan. 25, 1894.

522,083. Dynamo or Magneto-Electric Machine. Leonard Paget, New York, N. Y., assignor of one-half to Chas. J. Kintner, same place. Filed June 20, 1889.

522,084. Apparatus for Manufacturing Car-Wheels. John Parkinson, Sr., Philadelphia, Pa., assignor of one-half to John Parkinson, Jr., and Gottlieb Schmidt, same place. Filed Oct. 21, 1893.

522,097. Electrically-Operated Adding-Machine. Robert Baumann, St. Louis, Mo. Filed Sept 4, 1893.

522,099. Life-Guard for Cars. Joseph J. Beals, Cambridge, assignor of one-half to Wallace L. Broadbent, Boston, Mass. Filed Dec. 26, 1893.

522,100. Safety-Guard for Cars. Joseph W. Betz, Brooklyn, N. Y. Filed Dec. 8, 1893.

522,113. Electrically-Operated Register. Sheldon J. Glass, Milwaukee, Wis. Filed Oct. 23, 1891.

522,115. Wheel-Fender and Safety Attachment for Street-Cars. Frank H. Homan, Patchogue, N. Y. Filed Jan. 24, 1894.

522,127. Voltaic Battery. Henry Timm, New York, N. Y. Filed Apr. 19, 1894.

522,147. Flexible-Belt Fender for Street-Railway Cars. Richard B. Chambers, Chester, Pa., assignor to Crosby M. Black, same place. Filed Mar. 6, 1894.

522,151. Method of Heating Metals Electrically. Chas. L. Coffin, Detroit, Mich. Filed Nov. 16, 1893

522,180 Trolley-Wire Hanger. Thomas J. McTighe, New York, N. Y., assignor, by mesne assignments, to Frederick K. Fitch, same place. Filed Jan 23, 1893. Renewed Jan. 22, 1894.

REISSUES.

11,423. Electric Burglar-Alarm. Alfred Stromberg, Chicago, Ill., assignor of one-half to Mark Simons, same place. Filed May 31, 1894. Original No. 483,-728, dated Oct. 4, 1892.

EXPIRED.

192,361. Electro-Magnetic Registering Apparatus for Turnstiles. B. F. Card, Brooklyn, N. Y. [Filed Mar. 30, 1877.]

ELECTRICAL AGE

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NEW YORK, JULY 14, 1894.

CONTENTS.

PROTECTION OF CIRCUITS AGAINST LIGHTNING.

In a paper read by Mr. G. L. Lang, at the convention of Railway Telegraph Superintendents in Detroit last June, that gentleman calls attention to the inadequacy of the ordinary wire lightning protectors. There is a manifest need for a protector that will preserve the continuity of the circuit after a stroke of lightning, as well as to protect the apparatus on the circuit. At a cable house, for instance, the fuses may blow, but in so doing they open the circuit, and it cannot be restored until a lineman is despatched to the seat of trouble. An automatic device is needed in such and similar situations.

IMPORTANT LAMP DECISION.

A decision of great importance has been rendered by Judge Dallas, of the United States Circuit Court, Philadelphia, in the case of General Electric Company against the Citizens' Electric Light Company, of Lancaster, Pa. The former company asked for an injunction to restrain the defendant from using lamps alleged to be infringement on the Edison patents. Judge Dallas refused to grant the request, holding that the Edison patent has expired. This decision is in line with that of Judge Ricks, of Cleveland, in the Buckeye case.

NEW TELEGRAPH CABLES.

The work of laying the third cable for the Commercial Cable Company is now being completed, and the Anglo-American Cable Company is now engaged in laying its sixth cable across the Atlantic. These additions, we believe, will make the total number of telegraph cables lying on the bed of the Atlantic no less than twelve. Most of these are duplexed, which in each case practically doubles the capacity for handling business.

DO HEAVY ELECTRIC SHOCKS ALWAYS KILL?

The eminent French scientist, Dr. D'Arsonval, has on more than one occasion expressed a protest against the electric method of executing criminals, as practiced in this state, on the ground that the electric shock does not kill, but only caused an appearance of death. Dr. D'Arsonval, in a communication which appears on another page, relates some facts which tend to establish the position he has hitherto taken on the subject, and these facts together with numerous experiments made by him have led to positive conclusions, and the enunciation of the formula that "A man struck by lightning should be treated like one drowned." Electricity occasions death in two, but very different manners, he says; namely, by lesion or destruction of the tissues, and by excitement of the nerve centres, producing the arrest of respiration and syncope, but without material injuries. In support of his assertion that persons that have been apparently killed by electric shock can be resuscitated, he mentions the case of a man who received for a considerable period of time a shock of a 4,500-volt alternating current, and who was afterwards brought back to life by the treatment usually practiced in case of drowning accidents—that is, by artificial respiration. These facts, coming from one so high in authority, should receive the immediate consideration of the proper authorities of this state. A commission of medical and electrical experts should be appointed to investigate the matter and settle the question, that all doubt may be removed. Human nature rebels at the mere suspicion of a possibility that many of the victims of the electrical chair met their death, not by shock, but by the knife of the doctor, or suffocation in the grave.

EXPERIMENTS ON TWO-PHASE MOTORS.*

BY DR. LOUIS DUNCAN, S. H. BROWN, W. P. ANDERSON AND S. Q. HAYES.

Within the last few years rotary field motors have been greatly improved, and the conditions for successful design are moderately well understood. The problem has been attacked mathematically, and results have been obtained which, while interesting, have not been submitted to the test of experiment. The mathematical treatment is difficult, unless many essential phenomena are omitted; indeed it is only lately that the solution of the case of a motor supplied from a constant potential circuit has been undertaken, and as this is the condition of actual practice the results even with their evident limitations are important and interesting. The phenomena that occur in the armatures of these motors are of special importance, but they have not yet been submitted to experimental investigation.

The experiments of which this article is a description were intended for the purpose of developing a method of obtaining the current and electro-motive force curves of multiphase motors, and of applying it to a two-phase, 2-h. p. Tesla motor kindly furnished by the Westinghouse Electric and Manufacturing Co. While the results are probably correct for the machine tested, yet as the motor was small with inward projecting pole-pieces, the results will differ considerably from those that would have been obtained on a larger machine, or one without projecting pole-pieces. It was impossible for us to get any other machine, and the development of a method is, we think, of as great importance as the results themselves.

In a rotary field motor, if the resultant field is not exactly uniform, but presents some irregularities, then if the difference between the speed of the field and the speed of the armature is not a multiple of both, the armature electro-motive force will not in general be a periodic curve, because if we consider an armature coil enclosing a maximum number of lines of induction, then when it again includes the maximum number, the field will be in a different position with respect to the poles, and its maximum value may be different. Or, to put it another way, if the difference of the speeds of the field and armature is not a multiple of both, then any particular armature coil will not have the same relative position with respect to both the field and the pole-pieces in its successive positions of maximum induction. It is necessary, then, in order to obtain periodic armature currents, that some form of gearing be employed.

If large machines are to be tested, where it would be inconvenient to transmit a large amount of power by gearing, the motor may be loaded until the desired speed of test is approximately attained, when a very light gearing between the dynamo and motor will serve to keep this speed constant, the gearing serving amply to check any small tendency toward a change of speed. In our own experiments, the power to be transmitted was small, and the construction of the motor was such that we had no room for a gearing and for a coupling to a load. We consequently geared the motor to the dynamo, the motor energy being given back to the dynamo.

The apparatus experimented on consisted of a 25-h. p. two-phase dynamo—an ordinary constant current machine supplied with four collecting rings—and one two-phase, 8-pole, 2-h. p. Tesla motor. The electromotive force of the dynamo, was practically a sine curve. In our work the motor was not run up to its full capacity, as we were limited by the amount of power the gearing would safely transmit. We cannot better describe the armature winding of the motor than by quoting part of a letter written me by Mr. Chas. F. Scott, of the Westinghouse Co.

"The one you have has, however, 41 slots. The odd slot was placed in this motor so that the relation of the armature teeth to the field-poles was different in different parts of the circumference, and the forty incipient dead points which might have occurred were avoided by the addition of the extra slot. The winding consists of four layers; the first and third are exactly similar and coincident in the slots occupied, and the second and fourth are similarly related. The four coils in each layer are connected in series and short circuited."

The idea was to make the mutual induction of an armature coil with respect to the poles in a sine curve. Of course, with a limited number of slots it is impossible to have the mutual induction of the field and armature exactly a sine curve. But it is possible to very nearly accomplish this, especially in large armatures, and the importance of it is beginning to be appreciated. Mr. Scott, of the Westinghouse Co., was one of the first to appreciate the importance of the armature winding and the proper method of doing it, and he deserves much credit for his quiet and persistent work which has resulted in the production of excellent motors instead of voluminous papers.

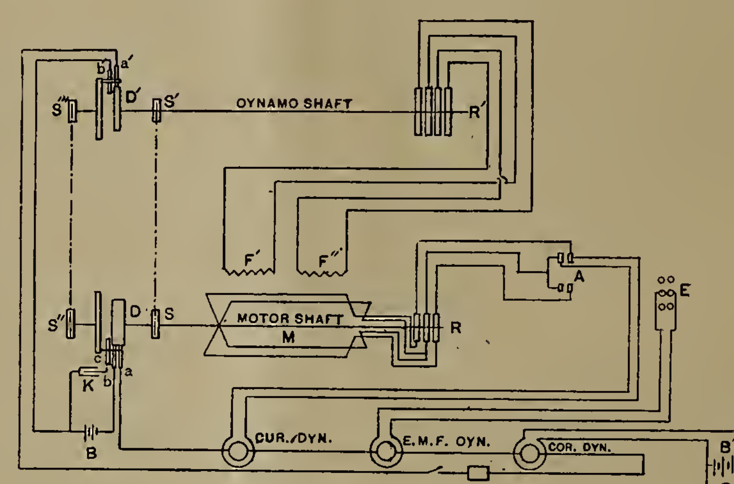


DIAGRAM OF CONNECTIONS

FIG. 1.

It is of course true that the period of the armature is the sum of the periods of the field and the armature. As we wished to obtain the curve of the armature current by the contact method, it became necessary to get contacts whose period was the sum of the field and armature periods. This was obtained by an arrangement of apparatus shown in Figs. 1 and 2. In Fig. 1, S and S′ are the two sprocket wheels which gear the two machines together and give them the desired relative speeds. S and S are two others which gear the graduated disks which carry the brushes. D and D are the two instantaneous contact disks, one mounted on each shaft, and A, B, C, A′, B′ are the wiping brushes. K is a condenser and B a charging battery. B and C make the circuit through the battery and condenser once every revolution, thus keeping the condenser charged. When A and A′ make simultaneous contact, the battery circuit is broken and the condenser is discharged through the movable coils of the dynamometer, which are all connected in series. F and F′ are the motor field coils. R and R′ the ring of the motor and dynamo respectively. E is a double pole, double throw switch to which are connected the terminals whose potential difference curves are desired. M is the motor armature, and A is a switch in the circuit of the current instrument. B′ is a battery which sends a steady current through the large coils of a dynamometer. This dynamometer is used as a correcting instrument, and the resistance in the condenser circuit is regulated

* Paper read at the General Meeting of the American Institute of Electrical Engineers, Philadelphia, May 16, 1894.

to keep its deflection constant. If the brushes are set together on the contacts, and then the two machines revolve with a given speed ratio, say, four to three, the brushes will again be simultaneously on the contacts, when the machines have made respectively four and three revolutions. If the ratio was seven to six, the machines would make seven and six revolutions before the contacts would again be coincident. In this way we obtained the needed instantaneous current.

After obtaining one point on the curve in this way, and wishing to obtain another point, we must shift our brushes through angular distances proportional to the speed ratio of the two machines; otherwise they would not make simultaneous contact again. Having shifted them in this ratio (say if the ratio is six to seven we would shift ten degrees on the dynamo disks, and six-sevenths of ten degrees on the motor disks) we obtain another point on the curve. To accomplish this easily, we gear the brushes together in the same ratio as the armatures are geared, as is shown in Fig. 1. Our gearing both for the brushes and armatures consisted of sprocket wheels and chains and was very satisfactory.

As the machine we tested was small, and was run much below its rated electromotive force, it was not, of course, particularly efficient, and as the armature efficiency is approximately the ratio of the armature speed

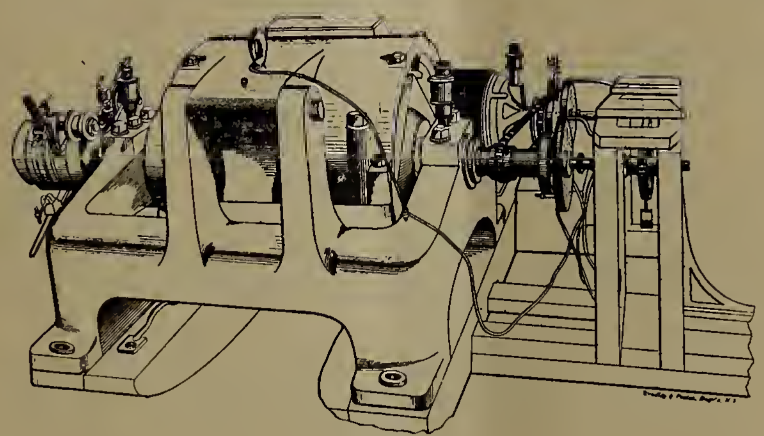


FIG. 2.

to the field speed, this ratio was comparatively small, and the period of the armature current was small, thus enabling us to use for measuring it a form of dynamometer which has been described before, and which was invented by one of us for obtaining such curves. It consists of a stationary coil carrying the current whose curve is to be obtained, and a movable coil through which passes an instantaneous direct current obtained by making the circuit on the armature disks before described. If this instantaneous current occurs when the alternating current is zero, we will get no deflection of the instrument. If it occurs when the alternating current is maximum we will get a maximum deflection, and in general, the deflection will be proportional to the instantaneous value of the alternating current. The dynamometer used had a long period and was well damped, and we had no difficulty in reading even when the period of the armature current was as much as one-quarter second.

If very efficient machines were to be tested, where the period of the armature current is very large indeed, then some electrometer method or a telephone method would be used, or the deflection of a galvanometer needle in the field of the current could be easily photographed.

The curves we have obtained are as follows: The electromotive force applied to the armature. Effective electromotive force of the armature. The counter electromotive force of the armature. The armature current. The value of field electromotive force and current for open and closed armature circuit. These for ratios of three to four and six to seven.

We also obtained the various currents and electromotive forces when the armature was held stationary, with and without resistance in the outside circuit. There are really three distinct sets of curves; those relating to the 3 to 4 gearing, those for the 6 to 7 gearing, and those in which the armature was stationary. The angular positions do not correspond for the first two sets. For the second and third they very nearly correspond. This is due to the fact that we did not at first clearly appreciate the importance of permanently fixing the relative positions of the armatures of the two machines. Afterwards we made marks on each armature, and if for any reason we took off the gearing, we replaced it so these marks came opposite points which we fixed on the frames of the two machines. It should also be remarked that the curves for the two sets of armature coils, marked A and B, should not in general present the same irregularities, as their relative positions with respect to the poles and the reluctant field are different. The dynamo being a four-pole machine, this must be taken account of in calculating the angles on the base line.

The length of an armature curve in terms of the positions of the dynamo brush should be $360 \times 4/2 = 7,200$ in the case of the 3 to 4 gearing, and $360 \times 7/2 = 1,260$. for the 6 to 7 gearing. We have not the same confidence in the results of the 3 to 4 gearing as for the 6 to 7 gearing; the latter being taken from several sets of observations which checked very well.

The curves of the applied electromotive force are obtained in the following manner: The armature was held stationary, while the field revolved at its normal rate. The reading of our electromotive force dynamometer then gave us a point on the electromotive force curve. The armature was then moved through a given angle while the brush on the dynamo disk was moved through an angle corresponding to the ratio of gearing of the two machines. In this way another point was obtained on the curve. What we obtained was the electromotive force applied to the armature when there was no current flowing through it, and when the gearing was 3 to 4 or 6 to 7, according to the relative movement we gave the motor armature and the dynamo brush. It should be remarked that all of the armature curves marked electromotive force curves are obtained when the armature circuit is open, and therefore do not correspond to the actual condition of affairs when the armature is closed, as they do not contain the effects of armature reaction and self-induction.

The effective electromotive force of the armature was simply measured by opening the armature circuit and getting the potential difference on the motor terminals when the motor was geared to the dynamo with ratios 6 to 7 and 3 to 4. The difference between these curves and the curves of impressed electromotive force is the counter electromotive force. We could have obtained the counter electromotive force by supplying the fields with continuous currents whose ratio to one another would be that of the two-phase currents and varying the relative values of these currents as we vary the point of contact of our instantaneous current. This would have been a laborious task and was not necessary. It was not possible to obtain these quantities by direct observation when the armature circuit was closed, and when the machine was running under normal conditions. The effective electromotive force is, of course, the difference between the applied and the counter electromotive forces, and, if these are irregular, their difference becomes the more irregular as they are the more equal in value, that is, as the efficiency of the motor is higher; so that while in this machine whose maximum armature efficiency was made about 87 per cent., the irregularity is considerable, it would be very much exaggerated in a large motor whose armature efficiency might be 97 per cent. or 98 per cent., and in this case great care should be taken to produce a perfectly regular field. The effect of the armature reaction and self-induction is to decrease these irregularities.

It seems to us that the most important curves we have obtained are those of applied and counter electromotive forces, effective electromotive force, and the armature current. They show at once the great importance of designing a machine whose applied and counter electromotive forces are both sine curves, and the method may be easily used to experiment on actual machines and to find out if this condition is fulfilled. Again the comparison of the effective electromotive forces with no armature current, with the fall of potential due to the armature current, show us that there is some beneficial effect from self-induction in the armature. The principal results show that the special machine does not give us regular currents and electromotive forces, but it is to a large extent due to the fact that in these small machines considerations of economy make it necessary to wind the field coils on spools instead of winding them through slots cut in the field iron.

In designing a motor to give absolute regular electromotive force curves, we must take two things into account: The field due to the dynamo current must be regular, and the armature winding must be such that it will give a regular electromotive force in a regular field. To satisfy this condition in the field winding, projecting pole-pieces should certainly be avoided. To satisfy the condition in the armature would require an infinite number of armature windings, but it can be practically satisfied in the larger machines with a reasonable number of windings. It must not be understood that it is specially easy to accomplish this.

We think that the curves we have given show that the design of rotary field motors requires careful experimental study, and we believe that such a study may be easily made, even for machines ot large capacity.

RESUSCITATION AFTER ELECTRIC SHOCKS.*

BY DR. A. D'ARSONVAL.

In my paper of April 4, 1887, I showed that electricity occasions death in two very different manners:

1. By lesion or destruction of the tissues (disruptive and electrolytic effects of the discharge).

2. By excitement of the nerve centres, producing the arrest of respiration and syncope, but without material injuries.

In the former case the death is final; in the latter, it is merely apparent. I have proved that it is then possible to resuscitate the victim by means of artificial respiration. I have been able to sum up my numerous experiments in the following practical formula: *A man struck by lightning should be treated like one drowned.*

Taking my stand on these facts, I have protested against the penalty of death inflicted in America under the (barbarous) name of *electrocution*, the industrial alternating current employed in this case producing nearly always the second kind of death.

An accident which happened in the last few days—the conditions of which could be ascertained with all the precision of a laboratory experiment—has just confirmed in man what I have seen in the lower animals.

This is an account of the case as communicated to me by MM. Picou and Maurice Leblanc, two well-known electricians, eye-witnesses of the accident and restorers of the person "electrocuted."

When the accident occurred at St. Denis, the electrometer of Epinay, fixed between two of our three wires, marked 4,500 volts, and the ammeter, inserted in one of them showed 750 milliampères.

At the place where the disaster occurred the three wires are supported by a small post fixed to a wall at about six metres above the ground. The man who was struck was astride on the lower connecting-bar holding in one hand one of the conductors. He had carried with him a telephone-wire which he was about to fix. This wire rested on the connecting-bar and touched another of the three conductors.

The current was closed through the man, entering by one hand and escaping in short circuit by one buttock.

He had, therefore, undergone directly the whole tension (4,500 volts, frequency about 55). It is difficult to say exactly how long, but certainly for some minutes. The short circuit which he occasioned led to the production of sparks at the collector of the Epinay apparatus. The agent superintending suspected an accident and telephoned to La Chapelle to stop. All this represents a rather long time.

At this instant we were setting out from Epinay, and were already in the train, when we were informed that an accident had just happened.

About a quarter of an hour after we arrived at St. Denis; this man was still astride on the connecting-bar, and no longer showed any sign of life. It was very difficult to take him down, and this operation took at least half an hour.

Following your advice we practised artificial respiration (working the arms) but at first without result. I then forced open his mouth and loosened the tongue, when his lungs began to act almost immediately. In two hours he was able to speak. He was burnt at the right hand and on the buttock. Today he is doing well.

Some days ago they informed me again: "The injured man is doing well. It must be noted that no particular trouble, due to the passage of the current through the body, has been manifested. It is merely needful to attend to the burns."

All comment seems to me superfluous, and I merely repeat in conclusion: A man struck by electricity should be treated as if drowned.

* *Comptes Rendus*, Vol. cxviii.

AN ELECTRICALLY COOKED DINNER.

A unique dinner was recently given by the City of London Electric Lighting Co., where everything served had been cooked by electricity. The guests, which included the Lord Mayor of London, Sir David Salomons, the directors of the company and a number of press representatives were privileged to inspect the process of cooking, which elicited their highest praise.

The dinner was prepared in electrical ovens, which were furnished with four switches so as to control the heating of either the top, of the bottom, of the sides independently, or the whole of the oven.

Other appliances included electrical hot-plates, electric frying-pans, electric saucepans, electric fish-pans, etc. The dinner proved most satisfactory and very entertaining. Prof. S. P. Thompson and Dr. Ernest Hart responded to toasts.

It is curious to notice that so long ago as 1749 the idea of such a dinner was anticipated by Benjamin Franklin, as will be seen from the following extract of his letter to Peter Collinson, dated April 29, 1749:

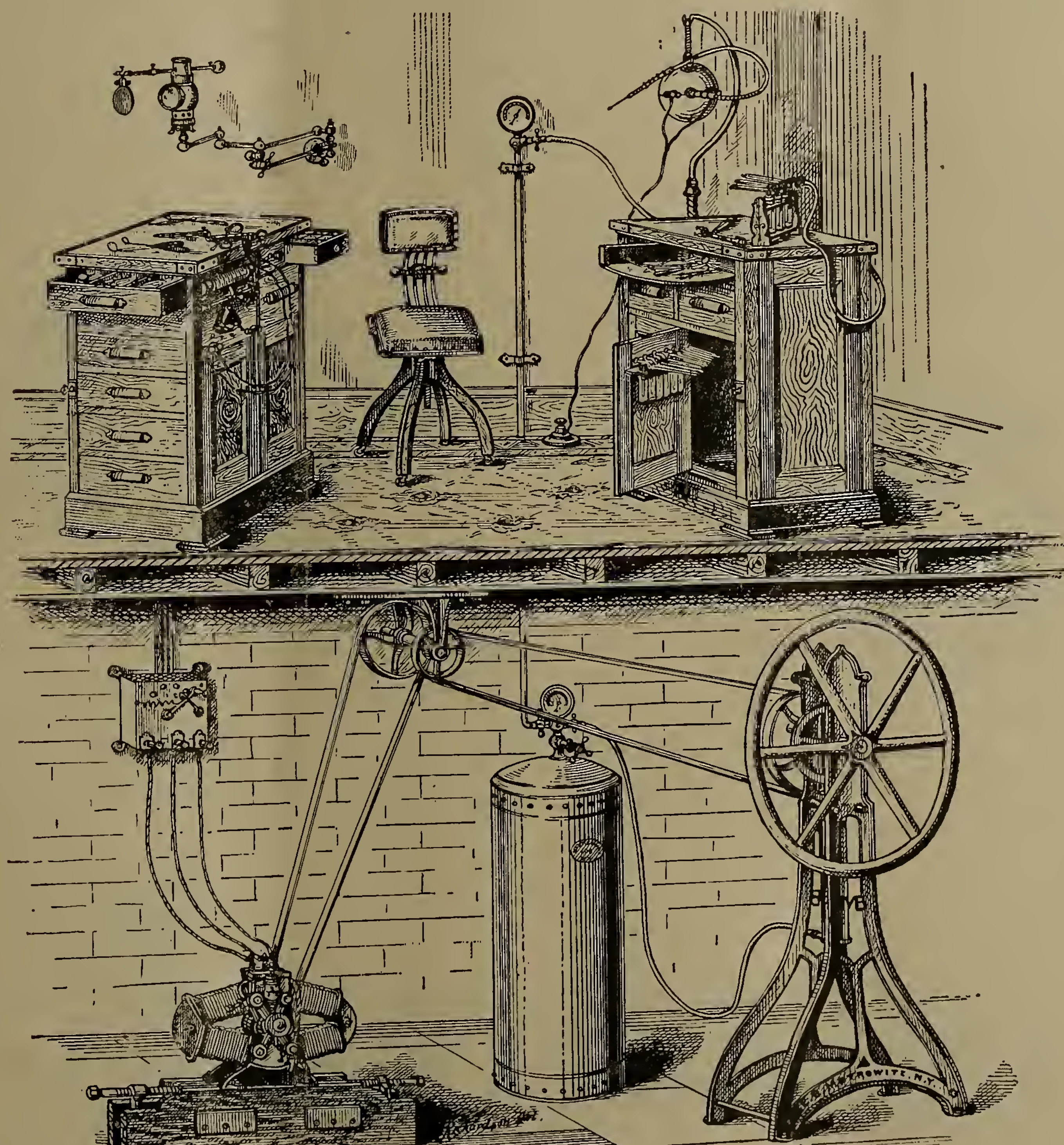
"Chagrined a little that we have hitherto been able to produce nothing in this way of use to mankind, and the hot weather coming on, when electrical experiments are not so agreeable, 'tis proposed to put an end to them for this season, somewhat humorously, in a party of pleasure on the banks of *Skuylkill.* Spirits, at the same time, are to be fired by a spark sent from side to side through the river, without any other conductor than the water, an experiment which we some time since performed, to the amazement of many. A turkey is to be killed for our dinner by the *electrical shock*, and roasted by the *electrical jack*, before a fire kindled by the *electrified bottle*, when the healths of all the famous electricians in *England*, *Holland*, *France* and *Germany* are to be drank in *electrical bumpers*, under the discharge of guns from the *electrical battery.*—"Experiments and Observations on Electricity" (Franklin). London, 1751, pages 34-35."

ELECTRIC SPRAY OUTFIT.

Electric current and electrical apparatus are almost daily finding new uses in the practice of medicine and surgery. This is due to the extreme ease of manipulation and application, for which devices of this character are renowned. The wide application of electricity in its various transmutations to such uses has indirectly accomplished a great deal of good for the benefit of suffering mankind—it has stimulated and effected vast improvements in medical and surgical practice, such improvements being necessary accompaniments to the stimulating influences of rapid advances made in the electrical features of the science.

The accompanying illustration shows an apparatus manufactured by E. B. Meyrowitz, 104 East 23rd street, New York city, that no doubt will attract the attention of the electro-medical surgical fraternity. It consists of a spray outfit, designed for the use of nose and throat specialists. On the gas burner is shown a light condenser and reflecting mirror for use in the examination of the throat.

The cabinets on either side are arranged to contain the various instruments, including a storage battery and the spray apparatus. Behind one of the cabinets, hanging from a neat stand, is an electric motor, which is used in connection with operations on the nasal septum. This motor is driven by the power of the storage battery.



MEYROWITZ'S ELECTRIC SPRAY OUTFIT.

The gauge against the wall is used in connection with the spray apparatus, and indicates the amount of pressure contained in the air tank, which is placed in the cellar. The air is compressed by means of the rotating pump, which is driven by an electric motor, as shown.

IRON ARMORED INSULATING CONDUIT.

Among the many improvements in the field of electric wiring, few have attained such popularity and received such commendations as the recent addition of iron armored insulating conduit to its long list of apparatus, by the Interior Conduit and Insulation Co., of New York city. The Interior Conduit system has always enjoyed a reputation for its flexibility and its value is now enhanced by the use of material indestructible and imperishable. The tendency towards larger proportions in architecture of late years has made substantial materials a necessity, and in keeping with the new steel internal structure the iron conduit is found of the utmost utility and value.

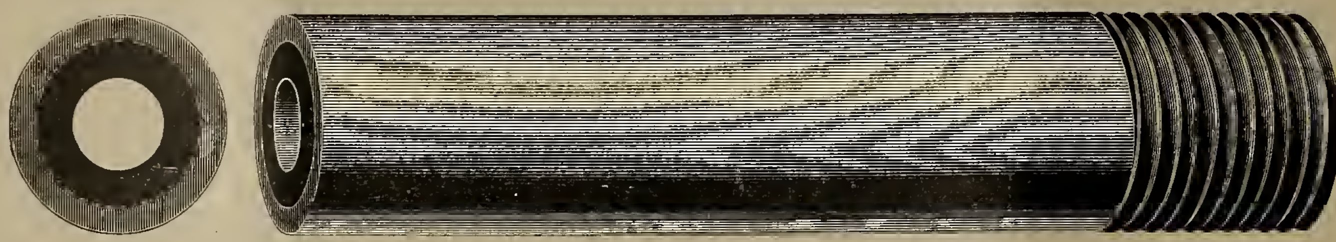


FIG. 1.

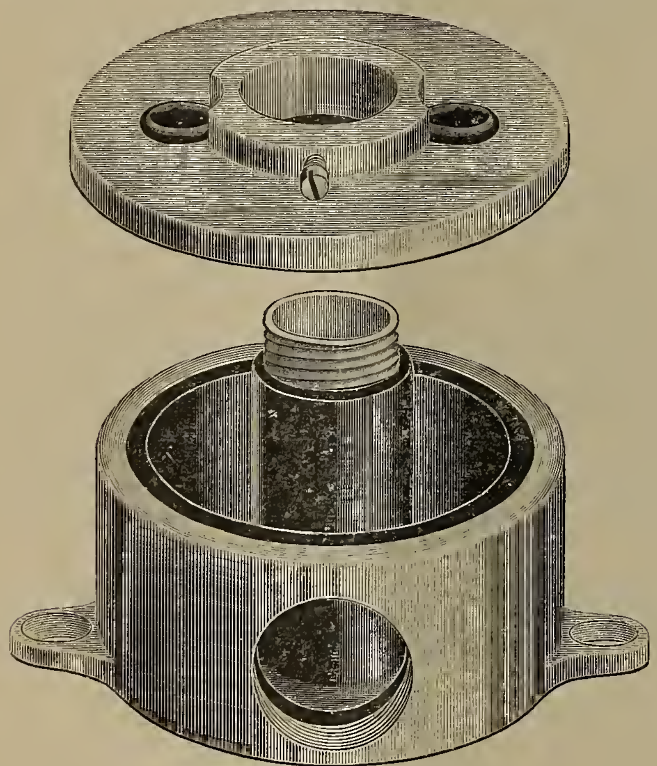


FIG. 4.

The insulated armored conduit consists of the company's plain insulating tubing placed within a heavy wall of lap-seamed, wrought iron pipe, which thus furnishes an excellent armor $\frac{1}{8}$ of an inch in thickness. The inner tube and its outer wall are remarkably well consolidated and welded together. The flexibility of the system is maintained by the use of iron armored insulating junction boxes, elbows, couplings, etc. This conduit possesses all the qualities of gas or water pipe, and by means of the tools, furnished by the company, for cutting, threading, etc., can be installed with equal ease. It is so simple and durable that it can be used under concrete, tiled or mosaic floors, etc., without the precautions necessary with plain or brass armored conduit; and, at the same time, a great saving in labor is due to the fact that it can be installed at an early age in the construction of a new building, without anxiety as to the rough usage it may have to sustain.

We herewith illustrate some of the features of iron armored insulating conduit.

Fig. 1 shows the actual size of $\frac{3}{8}$ inch (inside diameter) iron conduit.

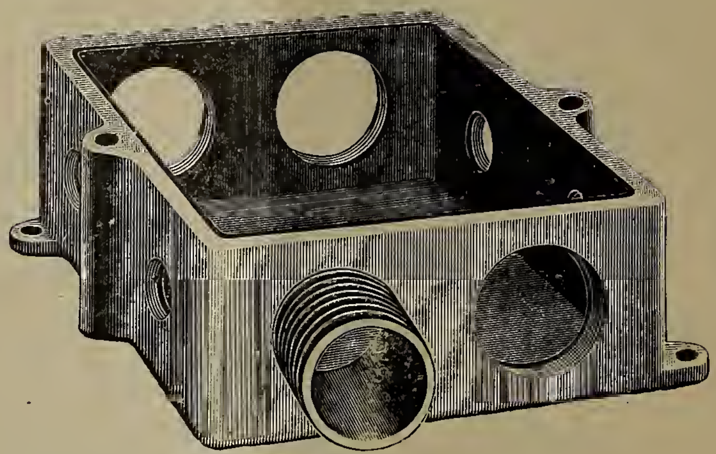


FIG. 3.

Fig. 2 shows a continuous insulating nipple, and its application to a junction box, and illustrates how the continuity of the system's insulation can be maintained if the tube should be too short by inaccuracy of measurement. The nipples can also be applied throughout the system to correct slight mismeasurements.

Fig. 3 shows a box, and Fig. 4, an outlet box.

Fig. 5 shows the application of the iron armored insulating conduit.

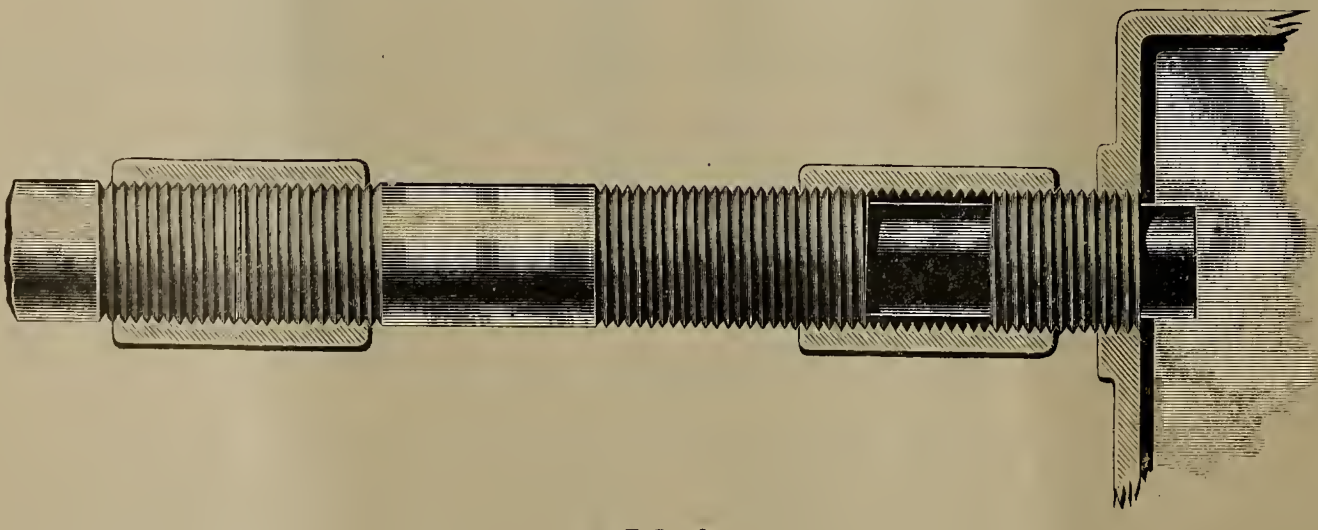


FIG. 2.

The system includes elbows, elbow outlets, S elbows, branch boxes, box nipples, corner elbows, and all the other necessary parts to make it complete, and adaptable to all situations.

ELECTRICAL "FAKES."

BY WM. MC CRACKEN.

In looking over my file of the Electrical Age I noticed an article in the issue of April 21, of this year, headed "Battery Fakes," which article I had overlooked. No doubt many others have had experiences of the nature of those recorded by "C. M. W.," and if all those who have met with frauds in this line would take a few minutes to write down the facts and have them published in the electrical journals, such reading would be of considerable interest as well as amusing.

I will set the example, and give a brief account of some of the things of this kind that have at different times in the past come under my observation.

Perhaps your readers have not forgotten a gentleman by the name of Chasse, who in 1880 appeared in Hartford, Conn., with a wonderful system of multiplex telegraphy. He claimed that by his system 18 messages could be transmitted in each direction, simultaneously, over one wire; and invited a number of electricians to witness the practical operation of the apparatus. The thing worked well, and the messages were being transmitted in fine style, as clear cut as could be desired. One gentleman among the visitors suspected that there

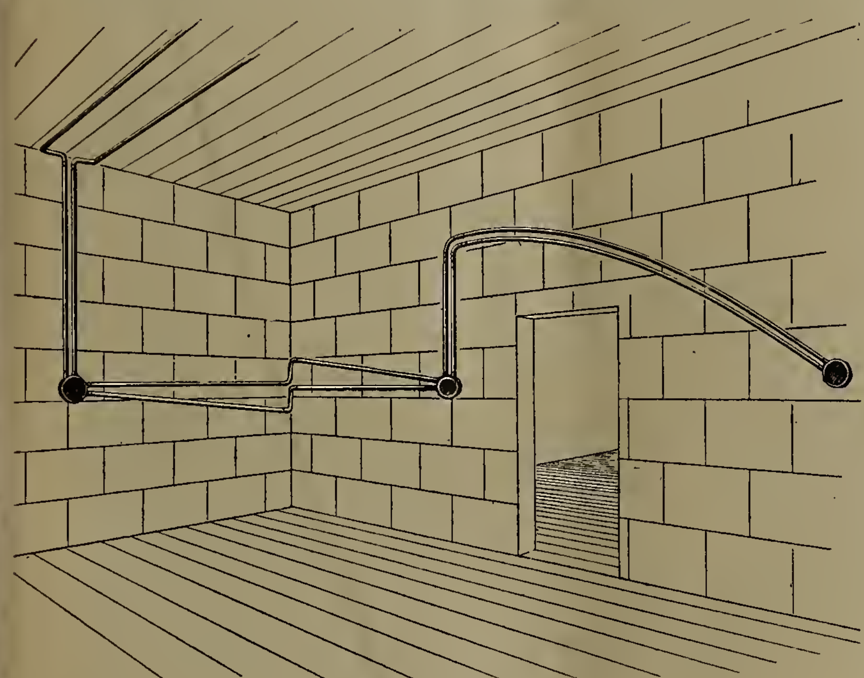


FIG. 5.

was a trick somewhere, and proceeded to investigate. He found that by means of fine wires attached to the ends of double-pointed tacks, which held in place the one wire, which was claimed to be doing all the work, as many circuits as there were sets of apparatus were provided, and practically, each message had a wire of its own to work on. Mr. Chasse disappeared from the scene of his exploits as quickly as he appeared.

I remember another case where an individual by the name of *Lamb* had a device for harnessing electricity from the earth and the clouds, and applying it to useful purposes. He had a lot of wires leading from a ground plate buried in the back yard to a lot of queer-looking instruments. He claimed to be able to extract electricity from the ground and air in great quantities without any special generator. The operation of the instruments was proof that he had captured some of the subtle fluid, and fortunes were waiting for those who invested capital in the invention. The more the capital the more the electricity! Of course, there were plenty of people who jumped at the opportunity to put their money into something that would generate unlimited quantities of electricity for nothing. The game, however, like others of its class, was exposed, and it was found that a concealed battery was working the instruments, and nature's supply of current had nothing whatever to do with the effort to bamboozle the people out of their cash.

The "Rheumatism Curing Chain" was one of the most palpable frauds ever perpetrated on the gullible public. It emphasized the fact, however, that humanity will go to any ends to alleviate suffering. The "chain" consisted of a flexible conductor with a piece of lead at each end, and the remedial process consisted in holding one of the lead pieces in one hand while the other lead was immersed in a bowl of water hard by the sufferer. This was a beautiful illustration of simplicity and faith, and yet one of the most surprising features was the fact that the fraud was carried on near Boston, the last place where any one would believe such rascality could be perpetrated.

The man who devised the method of killing induction by using helically grooved line wire may have been sincere in his own invention. However, it was soon shown to be no good. His theory of operation was that the legitimate current would run through the body of the wire, while the disturbing current would run along the groove. What he did with the current when it got to the end of the groove I do not know. He might have carried the idea further and utilized the induced current in the noble work of self-annihilation, by returning it in a grooved run in the opposite direction.

The lightning-rod has offered more opportunities for the perpetration of fraud than any other device involving the electric fluid. In some parts of the country we see whole farms fairly bristling with lightning-rods, showing that the lightning-rod man has been ravaging the land. Some lightning-rods are serviceable, but a great many are more ornamental than useful. One man, some years ago, announced that the lightning-rod practice was all wrong and his system was right. He invented a lightning-rod which did not enter or touch the ground at all; it ran along the ridge of the house, and had both ends turned upwards, and pointed like Neptune's trident. There was a beautiful theory attached to this invention. It was that the lightning would strike one projecting point, run along the rod and pass off into the cloud, whence it came, at the other point.

Most of these things happened in the past, but if we could only secure a record of what is going on at the present time, we would be astonished to see that people are still putting their faith and money into crazy notions, and the present generation will be succeeded by another that will do the same thing when an opportunity offers.

FOREIGN NOTES OF INTEREST.

Germany is not backward in electric lighting. There are now 8,000 electric light installations in Germany.

The directors of the tramway company in Hazen, Westphalia, intend to adopt accumulator traction on the section of their line between Markt, Körnerstrasse and Küchelhausen.

Official trials have been recently made of the electric tramway at Erfurt, which has been erected on the Thomson-Houston system by the Union Electricity Company of Berlin. A part of the system is now open for traffic.

The arrangements for the establishment of telephonic communication between Berlin and Munich are progressing. There will also be connected with this system the towns of Augsburg, Bamberg, Bayreuth, Erlangen, Fürth, Regensburg and Würtzburg.

THE STOREY ELECTRIC MOTOR.

The extreme flexibility of application of electric power is well exemplified in the accompanying illustration.

The Storey motor is specially designed for the direct driving of tools, and in the illustration the process of dressing rough castings is shown. The motor mechanism is entirely enclosed, and it is impossible for foreign substances to gain entrance thereto, and cause short circuits and other troubles that open mechanism would be liable to underlike circumstances. The use of most any other motor for such a purpose as that illustrated would be almost fatal, owing to the difficulty that would be experienced in preventing the particles of iron ground off by the emery wheel from entering the motor mechanism.

The motor is provided, in this case, with handles on the sides of the cast iron case to facilitate handling, and it is counterbalanced by a weight at the opposite end of the rope, for the purpose of relieving the operator of the weight of the machine in shifting it about.

As will be seen, the emery wheel is attached directly to the shaft of the motor.

The Storey motors and dynamos, which are manufactured and sold by the Storey Motor and Tool Co., 120 Liberty street, New York, are designed for direct currents. They are made in all sizes, slow and high speed, and in construction are simple, compact and symmetrical. They are cylindrical in shape, as far as outward appearances go. A pyramidal base is supplied with the smaller machines, but all bases are detachable, leaving the machine a perfect cylinder, adapted to fit into spaces and corners.

In constructive details, some novel features have been adopted, and it is surprising how compact these machines are. They are very much lighter in weight than any other make of machine of equal power, and they are dust proof. The company also makes a special air and water-tight motor. The bearings of these machines are self-oiling or graphite, as desired.

The Storey motor can be mounted in any position—with the shaft horizontal, vertical or at an oblique angle—and it has stood the test of time, which, after all, is the most reliable test that can be applied to any machine.

These machines are adaptable as emery grinders, buffing lathes, etc., and are applicable in any situation for any power purpose whatever.

The wide range of application of the Storey motors constitutes, besides their efficiency, their most important feature.

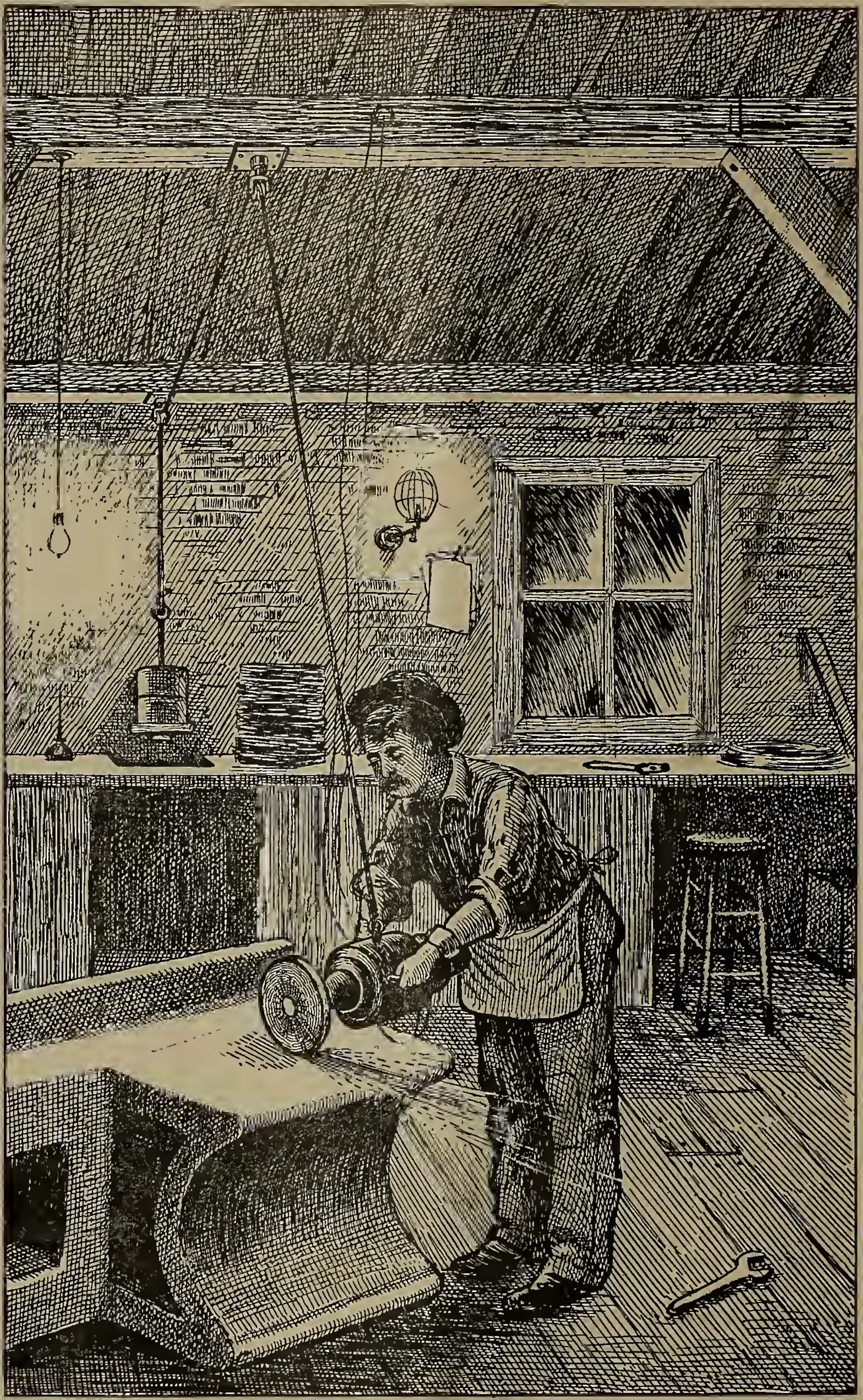
ANSWERS TO INQUIRIES.

L. I. B. G. Barenkopf asks:—Should the brushes of a dynamo be shifted when the poles of the armature are directly opposite the poles of the field magnet? *A.* This depends upon the winding of the armature. If the wires run from the coil straight out to the armature, the change should take place about half way between the poles.

FUSE WIRES AS PROTECTORS.*

BY G. L. LANG.

Many so-called "protectors" have been brought to the front in recent years, some of which had merit, and some entirely impracticable. When the Western Union Telegraph Company adopted a simple fuse wire to be introduced into each circuit at the larger offices, we hoped the problem of how to protect our apparatus from damage by lightning and other high tension cur-



DRESSING IRON CASTING WITH STOREY MOTOR.

rents was solved. These wires are placed just above the switchboards and are usually of No. 36, German silver wire, which is almost as fine as a spider's web, which has given them the name of "spider wires."

These wires are also used in cable houses for the protection of underground and submarine cables. From the first there has been this disadvantage in their use, especially on railroad circuits; the fuses usually go with the first flash, leaving the train dispatcher without

* Read at the Convention of Railway Telegraph Superintendents, Detroit, Mich., June 14, 1894.

a wire until they can be restored, which is not always practicable until the storm has passed, as the neighborhood of a large switchboard is not considered a particularly healthy locality during a thunder-storm.

While the fuse reliably protects the instruments and switchboards, recent events have gone a long way toward convincing me that their use is not desirable.

In one case a telegraph wire became crossed with an electric light wire, sending a current of sufficient quantity into the office to heat the fuse wire to such an extent as to ignite the wood with which it came in contact, but not enough to melt the wire. The result was a burned office.

Another case only a month ago, at Putnam, Conn. This is a junction point where wires come from six different directions. The wires enter the office in the usual way—rubber-covered wire passing through hard-rubber tubing—necessarily quite close together. During a heavy thunder-storm almost the first flash of lightning burned every fuse wire; the next and subsequent discharges burned the rubber from most of the wires at the window and set the woodwork on fire.

My theory is, that when the usual route of the current was interrupted by the fusing of the protectors, there was no path left, so as a matter of necessity these inconceivably high tension currents had to force a way through, which they did by jumping from one wire to another where they came nearest, developing heat enough to melt the rubber covering and ignite the wood. It is my opinion that had there been no fuse wires to give way and open the circuits the various discharges would have been safely carried off by the wires, the instruments being cut out. This was the third time this building had been fired by lightning since the introduction of fuse wires.

I have removed the fuses from that office, considering the risk less with the wires run direct to the switchboard.

Twice within a year the large cable house in Boston, at the end of the underground system, has caught fire. The origin of the fires is a mystery, but the most probable theory is that the fuse wires became heated enough to start a fire. Since the last fire, slabs of slate have been provided as a base for the fuse wires, instead of a board.

A recent case on our New York line where the fuse wires in a cable house were burned by lightning early in the night, thus depriving the company of the use of twenty-one New York and Boston circuits all night. The cases I have mentioned seem to show that what is gained in one direction by the use of fuses is more than lost in others.

This little story is not intended as a contribution to science, or a criticism of present methods, but is presented with the hope that by turning thought in this direction some practicable improvement may be made.

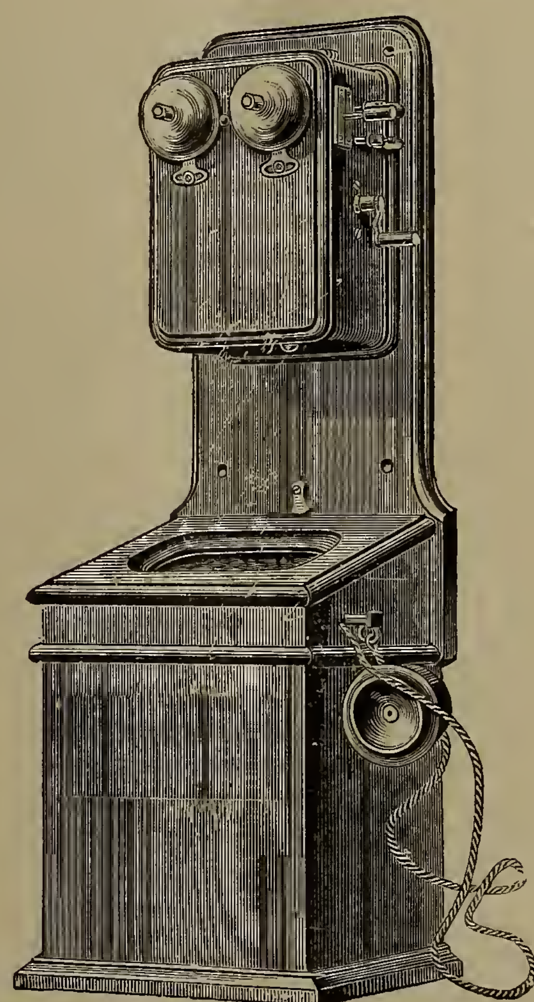
LARGE ELECTRO-DEPOSITED COPPER TUBE.

What is said to be the largest seamless copper tube in the world has been recently made for a firm of machine makers in Switzerland by the German Elmore Co., at Schladern, near Cologne, Germany. The tube which is 7 feet in diameter by 16 feet long and ¼ of an inch thick, was of perfect finish when taken from the bath or tank in which it was deposited, and required no turning or shaping whatever. The company, which is noted for its specialty of large tubes, proposes to make a still larger tube for the same firm, which will be 8 feet in diameter.

THE COLUMBIA TELEPHONE MANUFACTURING COMPANY.

The instrument illustrated herewith has been brought out to satisfy the demands for a first-class non-infringing telephone transmitter. The transmitter is of the multiple-carbon type, and consists essentially of a number of carbon pencils resting on bearings, the latter being of such shape as to afford several sharp contact points. The carbons are fixed to the under side of a thin diapraghm of wood, against which the sound waves of the speaker's voice impinge.

When not in use, the receiver is suspended on a hook which operates a switch. When the receiver is thus



COLUMBIA TELEPHONE.

suspended a bell rings and continues to ring until the switch is thrown, thus cutting out the battery and preventing its running down.

This instrument is made by the Columbia Telephone Manufacturing Company, 138 Front street, New York, which company controls the patents of Jas. W. McDonough, H. H. Eldred and other well-known inventors.

The company expects to shortly place on the market an automatic telephone exchange system which permits of any one subscriber placing himself in communication with any other subscriber without the assistance of the central office.

NEW YORK STREET RAILWAY ASSOCIATION.

We have received a copy of the printed report of the proceedings of the eleventh annual meeting of the Street Railway Association of the State of New York, which was held in Rochester, September 19, 1893. The next meeting of this association will be held at the Yates House, Syracuse, on Tuesday, September 18, 1894.

NEW ATLANTIC CABLE.

The cable steamer Faraday, which has been engaged for nearly a month in laying the third cable for the Commercial Cable Company, practically completed her work on July 4. Early in the morning of that day she anchored off Canso, N. S., having been engaged just 20 days in the work of laying the cable. The manufacturers of this cable, Messrs. Siemens Bros. & Co., of London, guaranteed it to be 33 per cent. speedier than either of the company's other two cables, but tests now being made show that it will likely exceed the guarantee limit.

NEW BOOKS.

American Street Railway Investments, a Supplement to the Street Railway Journal : Published annually for the use of Bankers, Brokers, Capitalists, Investors and Street Railway Companies. The Street Railway Publishing Co., New York. 216 pages, including twenty-four maps. Cloth. Price, $5 00.

The need of a careful and authoritative compilation of the capitalization and other statistics of the street railway companies of this country has long been felt. This need has become intensified during the last few years by the general employment of mechanical in place of animal power. This has called for a large amount of capital, with the result of greatly broadening the market for this class of securities.

"American Street Railway Investments" is the first publication giving, in a comprehensive and systematic manner, data regarding the operation and management of the different properties, which will enable dealers and investors to judge of the relative merits of the securities described.

Over 1,000 street railway companies are reported in this work, operating in about 600 cities and towns. The street railway information in all cities of 50,000 inhabitants, and in a few smaller places, is preceded by a condensed presentation of such municipal statistics as have a more or less direct bearing on the value of each city for street railway operation. Maps of many cities are given showing the routes of the street railways in each place so illustrated.

It is the purpose of the Street Railway Publishing Company to issue this work each year, and the appearance of the first fruits of their efforts shows that no pains have been spared to make the book as complete and accurate as possible. It will no doubt find a large field of usefulness.

LEGAL.

Montgomery Waddell, receiver for the Waddell-Entz Company, has petitioned the Superior Court in Bridgeport, Conn., for permission to lease the plant of the company to E. P. Bullard, of Bridgeport, Conn., until February 1, 1895. A hearing on the petition has been ordered for July 13, 1894, at 10 a. m., in the Superior Court room, Bridgeport, Conn.

Stop Thief.—An invention is reported to have been made designed to prevent thefts in cloak-rooms. The pegs are connected to batteries and bells. When the weight of the coat or hat is on the peg it cuts off the current and the bell remains silent, but on the removal of the apparel the bell immediately rings and the attention of the attendant is attracted. Something to stop the stealing of umbrellas is now in order.

GERMAN ELECTRICAL ENGINEERS.

On June 5–9 the two principal societies of German Electrical Engineers met in Leipsic, at which several interesting papers were read. The bodies are the Free Union of Representatives of German Electricity Works, and the Union of Electrical Engineers of Germany. At the meeting of the first named society, the proceedings referred more particularly to the working and management of electric stations. Before the Union of Electrical Engineers of Germany, papers were read, abstracts of which are given in the *Electrical Engineer* of London.

Dr. Ostwald, of Leipsic, presented the first paper, dealing with "The Scientific Electro-Chemistry of the Present and the Technical of the Future." The author laid stress on the fact that scientific electro-chemistry as developed in recent years would largely assist technical work in new directions. After dealing with the question of electrolytes, the speaker stated that an improvement in thermo-dynamic machines was only possible in one way—namely, by working with higher starting temperatures. How that was to be accomplished must be left to the technical men, but it might be remarked that a solution appeared to lie in the direction of gas motors. If it was possible to transform in some manner or other the chemical energy of fuel—in which the question of heat was left out of consideration—into mechanical work, they would not be bound to inconveniently high temperatures, and would be able to utilize the whole amount without being compelled to accept those inconveniences in the question of purchase. The solution of this great technical question—the provision of cheap energy—must be found in electro-chemistry, in the sense of some form of galvanic battery which at present could not be imagined.

Herr F. Ross, of Vienna, then described the "Nissl telephone exchange system." The object of the system is to reduce the installation cost and working expenses, and the author stated that the method allowed of several subscribers to communicate automatically over a single wire with the telephone exchange without interfering with each other. The principle of the method is stated to be as follows : At a certain point to which a single wire has been carried is arranged clock-work mechanism which causes a shaft to revolve. The speed of this shaft is governed by the number of subscribers' instruments to be served. For instance, in the case of four instruments the shaft would make a complete revolution in one minute. On the circumference of the shaft are arranged contact-pieces upon which feathers slide in such a manner that individual subscribers are brought successively into communication with the exchange for a short period; when the shaft is at rest the connection lasts. Each subscriber is enabled to arrest the rotation of the shaft at any moment when he is in communication with the exchange. Similarly, the exchange can stop the revolving of the shaft. The bringing to rest of the shaft is effected by means of a current passing through an electromagnet which actuates an armature, causing a catch to be inserted in the cogs of a spur wheel. Arrangements are provided for indicating both to the exchange and to the subscribers which contact is sliding under the feather.

Herr W. Lahmeyer, of Frankfort-on-the-Maine, presented a paper on "The Arrangement of Rotary Current Installations and Rectifiers." The author remarked that the arrangement allowed, on the one hand, of the maintenance of the pressure of the lighting current when a number of electromotors was used, and, on the other hand, an increase in the output of the primary machines. The principle of the method lies in the transmission from the secondary machines to the generators of a variable amount of magnetizing current, according to requirements. The system, which allows of motors being practically employed, has been introduced by the Lahmeyer works at Bockenheim, and in the case of the transmission of 300 h.p. from Bozingen to Biel, in Switzerland. At present, two rectifiers of 600 h.p. are in course of construction at the Frankfort works.

Mr. Gisbert Kapp then gave a historical account of the development of electrical engineering in England, and mentioned the reasons that had led to the adoption of the systems of electric lighting employed. In conclusion, he referred to the existing and projected electric railways.

Dr. G. Rössler, of Charlottenburg, in a paper dealing with "The Pressure and Current Curves of Various Types of Alternators and their Influence upon the Lighting Power of Alternating-Current Lamps," discussed some investigations which he had made, in conjunction with Dr. Wedding, in the electro-technical laboratory of the Technical High School, in Berlin. In conjunction with the investigations, the author entered into the question as to the illuminating power of alternating-current arc lamps. A comparison between the lighting efficiency of direct current arc lamps and alternating arc lamps showed the former to be more favorable.

Herr F. Teichmüller, of Mülheim-on-the Rhine, read a paper on "The Conductivity of Copper." He stated that the specific conductivity of copper was expressed in so many ways as to lead to confusion. It was desirable therefore that a standard method should be introduced. The basis of a system must be the absolute measuring method, and he concluded with the expressed wish that a commission should be nominated to discuss the question.

Herr von Dolivo-Dobrowolsky, of Berlin, then presented a paper on "Direct-Current Machines on the Three-Wire System." The author described a method of distribution on a three-wire system from a single dynamo. It is, of course, well-known that to establish a three-wire system, a neutral point must be created in the generating system, and to which the compensating wire is connected. It is in the formation of this neutral point that the originality of the system described lies.

Instead of joining two dynamos in series to obtain this result, there are connected to two points diametrically opposed of the armature the two extremities of a coil, having great self-induction and a feeble ohmic resistance. During the rotation of the armature there will be produced between the points an alternating E.M.F.; but as the coefficient of self-induction of the system has a great value, the alternating current created in the circuit will be weak. It is possible to reduce the intensity of this current as much as desired by increasing the coefficient of self-induction of the coil, which can easily be done by arranging it on a core closed in iron.

If the compensating wire, by which the groups of lamps are connected in series, is placed into communication with the neutral point, and if the "bridges" used contain in operation the same number of lamps or apparatus, the neutral wire will remain without current. But if No. 1 "bridge" is loaded more than No. 2, the excess of current of the first over the second will return to the dynamo by the compensating wire, and, reaching one point, this current will be divided. As it is continuous, it will have no difficulty in traversing the coil mentioned so as to penetrate the armature. By the aid of this device, exactly the same conditions as in the case of the use of two generators arranged in series are obtained. The independence of the two consuming groups is complete, and if one or other of these groups consumes more current than the other, the pressures remain the same, since the excess of the current returns to the armature without any loss by the neutral wire and by the coil.

As it is not always practicably possible to revolve the coil of the armature with the dynamo, two diametrically opposed segments of the commutator can be respectively connected to two rings on the shaft, and upon which press two brushes placed in communication with the two extremities of the coil. This coil, which in this case is fixed, is arranged in a box at the side of the dynamo, and always has, as in the preceding case, its neutral point connected to the compensating wire. This method can be employed for the purpose of regulating the pressure, especially in the case where the central station is distant, and supplies current at a pressure equal to the total tension of the two groups of lamps. In this case it is only necessary to insert near the places of utilization one or several of these dynamos provided with self-induction bobbins. The brushes are put into communication with the main conductors in such a manner that the armature commences to revolve and works as a motor; the neutral wire has not to be connected to the central station situated some distance away, and it then only serves for the compensation of the two circuits in use.

PROPAGATION OF MAGNETIZATION OF IRON AS AFFECTED BY THE ELECTRIC CURRENTS IN THE IRON.

BY J. HOPKINSON AND E. WILSON.

Consider a solid, cylindrical electro-magnet; it is well known that, in reversing the magnetizing current, the induction does not instantly reverse, but a certain time elapses before it again attains its full value, that it reverses at a later time at the centre of the core than near its surface, and that the delay in reversal near the centre is due to the electric currents induced in the iron. The object of the present paper is to investigate these effects.

The magnet experimented upon had a diameter of four inches, and formed a closed magnetic circuit. Through a part of its length the cylinder of four inches diameter was formed of an iron core, surrounded by two concentric, closely fitting tubes. Exploring coils of fine copper wire were bedded in the iron between the surfaces of the tubes. The currents induced in these exploring coils were observed when the current in the main coil of the magnet was reversed. These currents in some cases last for over half a minute.

Inferences can be drawn from these results as to the behavior of other diameters than four inches. Comparing two cylinders of different diameters, similar events occur, but at times proportional to the squares of the diameters of the cylinders. From this consideration and the experiments, a judgment is formed as to the effects of local currents in the cores of transformers, and of the armatures of dynamo machines.

PERSONAL.

We are informed that Mr. F. A. Mason, formerly secretary and treasurer of the Interior Conduit and Insulation Company, like all who stray from the flock, is now desirous of returning to his first love, "electricity." Mr. Mason's experience will make him valuable to any electrical concern with which he may become identified.

Mr. G. M. Haskell, formerly with the street railway department of the Thomson-Houston Co., Boston, is now connected with the J. G. Brill Co., of Philadelphia, the well-known builders of street cars, trucks, etc.

*Abstract of Paper read before the Royal Society, (England), May 17, 1894.

CANADIAN ELECTRICAL ASSOCIATION.

The next convention of this association, which will be held in Montreal the latter part of September, promises to be one of unusual interest, and the committee having the arrangements in charge are providing liberally for the entertainment of the members who will attend.

The date of the convention will if possible be arranged to suit the usual Fall excursions given by the railroad companies to Montreal and Quebec, so that extremely favorable rates may be expected.

The convention will be held in the Mechanics' Institute Building, and will extend over three days—one business session being held on the first day, two on the second day, and one on the forenoon of the third day.

The business part of the convention will comprise some important matters, such as the election of officers for the ensuing year, and amendments to the constitution and by-laws. The papers that will be brought before the convention, and the discussions thereon, will be of the utmost interest to all branches of the profession. They comprise:

"The Possibility of Securing Better Regulation at Central Light and Power Stations by means of Fly-Wheel Accumulators of Improved Construction," by Mr. John Galt, C. E. and M. E. Toronto; "A Method of Distribution with Equalization of Potential Difference," by D. H. Keeley, of the Government Telegraph Service, Ottawa; "The Application of Electricity for Medical and Kindred Purposes, from Light and Power Circuits," by Mr. W. B. Shaw, Montreal; "Electrolysis," by Mr. J. A. Baylis, Bell Telephone Co., Toronto; "Telephone Cables, their Construction and Maintenance," by Mr. F. J. F. Schwartz, Bell Telephone Co., Montreal; "Alternating Motors," by Mr. L. M. Pinolet, Montreal.

Papers by Mr. E. C. Breithaupt, Berlin, Ont.; Mr. T. R. Rosebrugh, Toronto, and Mr. John Langton, Toronto.

The social part of the programme will be looked after by the Montreal Committee, and will include visits to McGill University, the Power Station of the Montreal Street Railway and other electrical works; an excursion to Lachine and down the Rapids; drive to Mount Royal Park; trip over the Montreal Island Railway, an inspection of the docks and ocean steamers, etc., etc.

WHAT THE NEW YORK STREET CAR COMPANIES PAY THE CITY.

The following statement has been prepared by Comptroller Fitch, of New York city, showing the amounts paid by street railway companies to the city of New York since 1880. The comptroller states that there is no uniform rule regarding the amount the companies shall pay. Some companies are bound by stipulations entered into upon the granting to them of additional privileges; others are subject to the municipal ordinances providing for car license fees, and the very recently incorporated companies come under the provisions of the general railroad law of the state. The amounts paid are as follows:

Broadway and Seventh Avenue and Broadway Surface Railroad—From 1885 to 1890 this company paid the city three per cent. of its gross receipts and $50 per annum license fee for each car. From 1890 to 1893 it paid five per cent. of gross receipts, $50 per car, and $40,000 per annum, stipulated sum. From 1893 it paid five per cent. of gross receipts, not to be less than $150,000 per annum, and $50 per car.

Sixth Avenue Railroad Company—Fifty dollars per car per annum since 1889.

Chambers and Grand Street Ferry Railroad—Three per cent. from 1887 to 1891, and five per cent. with $50 car fee since 1891.

Central Cross-town Railway Company—Three per cent. of its gross receipts from 1887 to 1893.

Central Park, North and East River Railroad Company—Fifty dollars per car per annum since 1886.

Ninth Avenue Railroad Company—Fifty dollars per car since 1889.

Second Avenue Railroad—Five per cent. of gross receipts from 1890, and one-third of one per cent. on certain extensions.

Third Avenue Railroad—Twenty dollar car fee from 1886 to 1893.

Twenty-third Street Railroad—Five per cent. of gross receipts from 1890.

Twenty-third Street Railway—One per cent. of gross receipts from 1891, and $50 for large cars, $25 for small cars.

North and East River Railroad Company—Sold at auction for 38 per cent. of gross receipts; unable to make payments; now operated by contractor.

Hudson River Railroad Company—Dummies $50 per year each.

New York Elevated Railroad—Five per cent. of net proceeds; has paid nothing since 1890. The Court of Appeals has decided that the city can recover five per cent of the net income only on passenger traffic on the Ninth avenue line from Greenwich to Sixty-first street, and two and a half per cent. from Sixty-first to Eighty-third street.

Christopher and Tenth Street Railroad—Three per cent. of gross receipts since 1888.

Dry Dock, East Broadway and Battery Railroad—Five per cent. of net proceeds, $50 each for large cars, $25 for small cars since 1888.

Eighth Avenue Railroad—Fifty dollars per car per year since 1882.

Forty-second Street and Grand Street Ferry Railroad—Fifty dollars per car since 1888.

Forty-second Street and Manhattanville and St. Nicholas Avenue Railroad—Three per cent. of gross receipts from 1885 to 1891, and five cent. from 1891.

Houston, West Street and Pavonia Ferry Railroad—One thousand dollars per annum stipulated sum and $50 for each car.

New York and Harlem Railroad—Three per cent. on gross receipts of extensions from 1885 to 1893.

Twenty-eighth and Twenty-ninth Street Railroad Company—Not completed. To pay three per cent on gross receipts the first five years and five per cent. thereafter, to which add 29 2-10 per cent. bid at time of sale.

Metropolitan Cross-town Line—Six per cent. on gross receipts and $50 per car from 1891.

Union Railway Company—One per cent. of gross receipts when the average reaches $1,700 per day. Has paid nothing in two years.

ANOTHER ATLANTIC CABLE.

The Anglo-American Cable Co. is laying its sixth telegraph cable across the Atlantic. The cable steamer "Britannia," having on board about 190 miles of the western shore end, arrived at Heart's Content, N. F., on July 7, from London, and will at once proceed to lay down the cable which is on board. The steamer "Scotia" will lay the deep-sea section, and will splice that portion of the cable with the shore section laid by the "Britannia." Then the "Britannia" will proceed to London to receive the eastern shore section, which she will lay after meeting the "Scotia" and making the splice. This new cable is said to be the largest in the world.

NEW CORPORATIONS.

The Zucker, Levett & Loeb Co., New York, N. Y., by A. Levett, Chas. Loeb, W. R. W Mentz and Henry L. Haas, to manufacture electrical apparatus, platers' supplies, and polishing material; capital stock, $100,000.

The Golaid Water Power Co., Golaid, Texas, to furnish electric light and heat, water and ice; capital stock, $30,000.

The Gordon, Burnham Battery Co., Portland, Me., to supply electric light, heat and power; capital stock, $1,000,000.

The Fredericktown Electrical and Manufacturing Co., Fredericktown, Mo, to establish an electric light and power plant; capital stock, $6,000.

The Westerville and Worthington Street Railway Co., Columbus, Ohio; capital stock, $35,000.

The Rogers Park Lighting Co., Chicago, Ill., by Henry Niestand, G. N. Stone and L. G Kirkland; capital stock, $30,000.

The Momence Electric-Ball Storage Battery Co., by C. A. Lettigh, L Walker and F. E. Lane; capital stock, $15,000.

The Ambler Electric Railway Co., Reading, Pa., by W. B Krick and others; capital stock, $12,000.

The Fanner Electric Co., St. Louis, Mo.; capital stock, $60,000.

The Cebolla Railway Co., Denver, Col., to construct an electric railway system; capital stock, $100,000.

The Ellicott Electric Heating Co., Buffalo, N. Y., by C. W. Pardee as director, and others; capital stock, $25,000.

The Electric Boiler Co., Rochester, N. Y.; capital stock, $50,000.

WANT THE GOVERNMENT TO OWN EVERYTHING.

The state labor conference held in Springfield, Illinois, on July 4, adopted a platform, of which the following planks are a part:

"We demand the immediate nationalization of the telegraph and telephone to be followed by Governmenttal ownership of the railroad and mines.

"We demand the municipal ownership of street railways, gas and electric light plants, for the public distribution of light, heat and power."

NEW YORK NOTES.

Office of the Electrical Age,
World Building, New York,
July 9, 1894.

Mr. James E. McElroy, of the Harrison Telephone Company, 44 Wall street, died last week of appendicitis.

The Harrison Telephone Company, 44 Wall street, is making arrangements to move its offices to Chicago.

Mr. Henry G. Issertel, well-known in the electrical trades and an intense hustler, has been with the H. W. Johns Company for some months, and is doing an excellent business.

Fire on July 7 damaged the factories of the Brooklyn Electrical Manufacturing Co., and Huebel & Manger, 286-290 Graham street, Brooklyn, N. Y.

The National Conduit Manufacturing Co., Times Building, city, has just closed a contract with the New England Telephone Company to construct all of the underground conduits required this year. In all 200,000 feet of conduit will be laid down. The National Company is now building a comprehensive underground system for the Allegheny County Light Company, Pittsburgh, Pa. This will cover the City of Pittsburgh and will require an immense amount of the company's celebrated cement-lined conduit. The National Conduit Mfg. Co has laid over 1,000,000 feet of conduit in Philadelphia, Boston, Worcester, Portland, Lowell, Providence, St. Louis and Milwaukee, and in New York city for the Metropolitan Traction Company.

Mr. Sidney H. Wheelhouse, the Chicago representative of the Star Headlight Co., of Utica, N. Y., was a caller at the office a few days ago. He reports a great boom all over the country in the Star Company's headlights.

The National Street Railway Construction Co., Times Building, city, lately purchased the exclusive right to the Lawrence underground trolley system of electric railway for New York, Kings and Queens Counties. Mr. E. S. Perrot is president of this company, and J. P. McQuaide, secretary and treasurer. W. T. H.

TRADE NOTES.

The Eagle Valley Tanning Co., Ridgway, Pa., writes as follows to C. D. Bernsee, Vanderbilt Building, New York, manufacturer of the Eco-Magneto Watchman's Clock: "We have been using your system of watch clock for nearly a year, and must say that, so far, it has answered every requirement, and we find in its use an accurate record of the movements of our night watchman."

L. J. Wing & Co, 109 Liberty street, New York, are making a specialty of gasoline engines for yachts both for propelling the boat and driving the dynamo for lighting purposes. The same engine does both. This firm installs electric light plants, using gas or gasoline engines for the production of power, and with Wing's equalizing device such plants give a light equal to the best of those operated by steam.

The Fulton Foundry and Machine Works, 21 Furman street, Brooklyn, is one of the most progressive concerns of the kind in the country. They have superior facilities for general foundry work, in making castings, etc., and the plant includes fine tools and machinery, combined with skilful labor, for the making of models and light machinery for inventors and others. They make a specialty of dies, presses, fittings, etc., and make special tools to order.

PATENTS.

Up to the hour of going to press our usual weekly report of patents issued had not reached us. They will in all probability appear in our next issue.

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NEW YORK, JULY 21, 1894.

CONTENTS.

ILLNESS OF PROF. HELMHOLTZ.

The electrical fraternity in America were pained last week to learn of the serious illness in Berlin of Prof. von Helmholtz. The professor is now suffering from a stroke of paralysis. Prof. Helmholtz is one of the foremost scientists of the day and while in this country during the World's Fair last year he made a great many friends, who were impressed with a deep feeling of admiration for the great man. We hope he will entirely recover from his illness.

RAILROADS AND THE TELEPHONE.

To the careful observer of progress along electrical lines, it is manifestly evident that the telephone is surely coming to the front as an important department in railroading. Little has hitherto been said regarding the use of this instrument on railroads, and it was not until recently, at the convention in Detroit, of Railroad Telegraph Superintendents, that the extent of such use of the telephone became apparent. Several of the foremost railroads in the United States have introduced it for various purposes in connection with the handling of traffic. At the Detroit meeting it was pointed out by Mr. Charles Selden that it was practicable even to give train orders by telephone, suggesting a method by which this important service could thus be safely carried on. It would not be wise, however, to adopt the telephone in place of the telegraph too suddenly; the employés must be gradually educated to it. One railroad—the New York Central and Hudson River—we understand has a telephone in each of its stations between New York and Albany, and the service is very effective. It is not at all likely that the telephone will displace the telegraph entirely except, possibly, in rare cases; there is work enough on large railroads for both services, and what change does take place will mostly be in the nature of a redistribution of the electric correspondence between the telephone and the telegraph. In Europe the telephone is largely used on railroads, as indicated in an article on this subject which appears in another column There certainly is greater flexibility to the telephone system than the telegraph, and it possesses a greater range of action, and as its application to so many different uses and situations become more greatly appreciated, its importance as an arm of the railroad service will become correspondingly greater.

THE PACIFIC CABLE PROJECT.

It looks as if the English government, or its dependencies, would ultimately head off the United States in the matter of laying a submarine telegraph cable across the Pacific Ocean. Although we have no reliable data at hand as to the commercial value of the enterprise, it is questionable if it would pay to "sink" so much money. The foreign countries interested look at the matter as offering a strategic advantage in case of warlike operations, the commercial aspect being merely a secondary consideration. They believe in the theory that in times of peace preparations should be made for war; while in this country we are apt to neglect these considerations and weigh the enterprise in the measure of dollars and cents. No doubt the successful laying of a Pacific cable would be a brilliant achievement for the country or countries accomplishing the undertaking, and while glory and honor would attend the result, there is evidently "not enough in it" to induce American capital to take hold of the matter. If there were any probability of making the enterprise pay a reasonable return on the investment, it is likely that American money would "talk" more than it does respecting the project.

RESONANCE ANALYSIS OF ALTERNATING AND POLYPHASE CURRENTS.*

BY M. I. PUPIN, PH. D.

The presence of upper harmonics in an alternating current wave is a fact which deserves careful consideration, both on account of the purely scientific interest which is attached to it, and also on account of the technical bearing of electrical resonance upon the construction of conductors possessing appreciable distributed capacity.

That alternating current and electromotive force waves of a great variety of forms can be produced by properly designing the pole-pieces of the field magnet, and the iron core of the armature of an alternator is a fact nearly as old as the discovery of electro-magnetic induction. Fully as old is also the knowledge that a great variety of alternating current and electromotive force waves can be obtained by means of the induction of an intermittent current.

A careful investigation of these waves was first made more than forty years ago by Lenz[1] and Koosen,[2] who employed alternators with iron in the armature. They plotted these waves from the instantaneous values of current and electromotive force obtained by means of the now well-known revolving sliding contact. Employing the same method of investigation, Joubert[3] showed, in 1880, that the electromotive force wave obtained from an eight-pole Siemens alternator without iron in the armature is very nearly a pure sine wave. The method is now known as *Joubert's method of sliding contact.* In 1888 Dr. L. Duncan showed how successfully this method can be employed in the study of alternating current waves produced by commercial machines in actual operation. The same method was considerably elaborated by Professor H. J. Ryan[4] in an investigation of the action of transformers. The name, "*indicator diagram,*" has been applied to wave curves of current and electromotive force obtained by Joubert's method, and very properly, I think, because they do very clearly indicate the action of alternating current apparatus. The process of taking these indicator diagrams has been shortened very much by Dr. L. Duncan's four dynamometer method.

Our knowledge of the action of alternating current apparatus has been extended considerably by these indicator diagrams.

For instance, we are now much more certain of the limitations which must be imposed upon the simple harmonic wave theory of alternating currents than we were a few years ago, and it looks very much as if progress in this direction, even more than in any other, meant progress towards a complete theory of the working of alternating current apparatus. Hence the desirability of as large a number of workers in this particular region of electrical research as possible.

There is no doubt that a simpler method would increase this number: for though much must be said in favor of the sliding contact method of obtaining indicator diagrams, yet it must also be acknowledged that the method is a very laborious and uninteresting process of investigation. A great many attempts have been made to devise some optical or some automatic method, but with little success. There is another reason why a new method of studying alternating current waves seems desirable. It is this: The method of sliding contact is not sufficiently sensitive to detect small deviations from a true sine wave, and consequently it is not capable of following up the causes of these deviations, when the effects seem to be absent. For instance, the primary current of a transformer can differ very much from a true sine form when the secondary circuit is open, but when a large current is flowing through an approximately non-self-inductive secondary circuit, then the primary can be made to differ inappreciably from a true sine wave. *The question arises now, what has become of these causes when the secondary carries a heavy load?*

This question is of deep scientific interest; it is also of considerable technical importance. For, if these causes are present at all loads and only hidden by the principal wave, then, considering that these hidden small causes can produce large effects when conditions favoring resonance arise, it is evident that they must be carefully watched and guarded against in the construction of long lines possessing distributing capacity. I do not think that indicator diagrams obtained by the method of sliding contact are capable of giving a definite answer to this important question.

The method of analyzing alternating current waves by electrical resonance which I employed in the following investigation was suggested by me a year ago[1]. It is the object of this paper to describe this method at some length, and to illustrate, by some of the more definite results so far obtained, the simplicity, sensitiveness and reliability of the method. I shall also point out that this method of resonance analysis works quite satisfactorily even in those cases alluded to above, where the sliding contact method would in all probability fail.

Description of the Method.—Consider the following arrangement of circuits:—A non-self-inductive resistance *ab* Fig. 1 is inserted in the circuit of an alternator A and the primary B of a transformer. In shunt with *ab* is a circuit, *a, c, d, b,* consisting of an inertia coil, *c,* of a large number of turns of copper wire of low resistance, about 10 ohms, but containing no iron, and a condenser, *d,* divided into subdivisions ranging from .001 M. F. up. In shunt with the condenser, *d,* is an electrostatic voltmeter, *e.* The self-induction of the coil, *c,* can be varied by throwing a larger or smaller number of its sections into the circuit. The resistance can be varied by a rheostat, *f.* Suppose now that the self-induction of *c* is kept constant, and that the capacity of the condenser is gradually increased from zero up. Whenever a capacity has been reached, which, with the self-induction of the circuit, *a, c, d, f, b, a,* produces resonance with one of the harmonics in the main circuit, then the resonant rise of potential will produce a large deflection in the voltmeter. In this manner all the harmonics which are present in the current of the main circuit can be detected in the course of a few minutes. If the *resonator circuit, a, c, d, f, b,* is placed in shunt with the non-self-inductive circuit (this circuit is denoted in Fig. 1 by a line beaded with asterisks and running from one pole of the alternator to the other) consisting of a bank of incandescent lamps, then the harmonics of the impressed electromotive force can be detected in the same manner. The ratio of the amplitudes of these harmonics to that of the fundamental can also be determined by this method, if desirable, provided the conditions of the experiment are properly arranged.

Prof. Pupin then describes the various experiments, showing the rusults by tables and curves. These experiments included a study of the damping effect of the dielectric in the condenser; and a second test for resonator indications and sympathetic resonance. Then follow

* Abstract of a paper presented at the Eleventh General Meeting of the American Institute of Electrical Engineers, Philadelphia, May 18, 1894.

1. Pogg Ann. 76 p. 494, 1849;—92 p. 123, 1854.
2. Pogg Ann. 87 p. 386, 1852.
3. *Comptes Rendus*, Vol. xci, p. 161, 1880; Ann. de l'ecole super. 10 p. 131, 1881.
4. Transactions, vol. vii. p. 1, Jan., 1890.

1. M. I. Pupin, "Electrical Oscillations of Low Frequency and their Resonants," *American Journal of Science*, vol. xlv., p. 429, May, 1893.

the results of the investigations into the location of the origin of upper harmonics, by (*a*) experiments with alternator of smooth core armature, and (*b*) experiments with alternator of slotted core armature type. The effect of load upon harmonics is next considered at considerable length, and, regarding the distortion of the secondary current, he says :

It was pointed out that the superposition of harmonics upon the fundamental wave was confined to the primary circuit when the secondary is closed by a non-self inductive resistance, that is, if the transformer is of closed magnetic circuit type. With an open magnetic circuit transformer the deviation of the primary current wave from the simple harmonic form, due to action of the generator or the transformer, or both, is felt more or less in the secondary current also. If, however the secondary is closed by a ferric self-inductance, then odd harmonics will appear in this circuit also in both types of transformers. In fact, the secondary circuit should now, as far as the harmonics are concerned, be considered as a separate circuit, in which the secondary coil of the transformer and the ferric inductance in the secondary circuit play the same part as the armature of

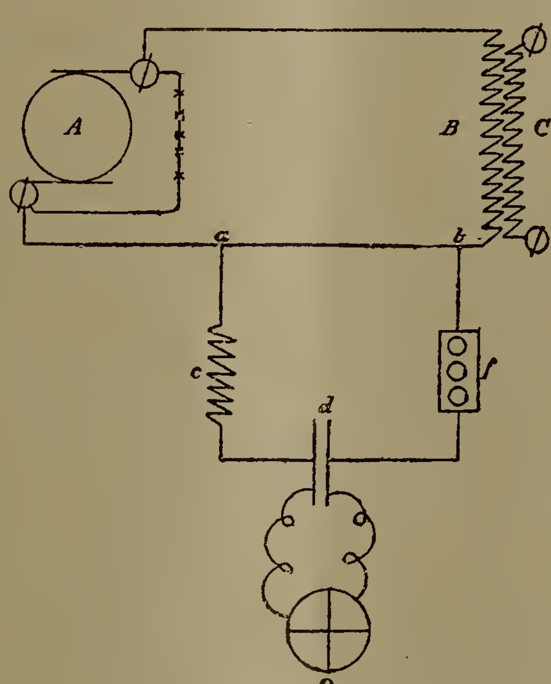


FIG. I.

the alternator and the transformer play in the primary circuit.

The series of experiments which related to the origin and growth of harmonics in the secondary circuit was exactly the same as the one described above, by means of which the so-called distortion of the primary current was studied. The results were the same. The presence of harmonics is due to the action of the ferric inductance; their strength increases proportionally to the intensity of magnetization of the iron in the ferric inductance. They seem to be entirely independent of hysteresis, that is, if by hysteresis the process be understood by means of which most of the heat is generated in a very finely laminated, well insulated and well annealed iron core, when such a core is subjected to rapid reversals of magnetism. I shall describe briefly an experiment bearing upon this point. The secondary circuit of the five K. W. transformer was closed by an electrolyte resistance, and a short cylindrical coil having about 120 turns coarse copper wire. A short cylindrical core made up of very fine (No. 26 B. and S.), and well annealed iron wire could be inserted into this coil. The core was 40 cm. high and 5 cm. in diameter. The wires were fairly well insulated from each other. A layer of fine copper wire surrounding this coil formed part of the resonator circuit. First, the secondary current was passed through the coil before the iron core was inserted. The resonator could detect no harmonic worth mentioning even when the current was increased almost to full load. But as soon as the iron core was introduced the odd harmonics appeared, especially the third harmonic; its strength increased proportionally to the current. Placing now another similar iron core on the top of the first, and adjusting it in such a way that it allowed a small rocking motion, the two cores could be set into violent vibration by the inductive action of the current, which gave a very loud note corresponding in pitch to the frequency of the alternator. The vibration could be stopped by pressing the top core against the lower core and against the table. The vibration produced no appreciable difference in the strength of the harmonic; if anything, it seems to make it stronger. This experiment seems to me to render the theory, which ascribes the origin of harmonics to the hysteretic action of iron, completely untenable.

I do not think that the proper time has arrived yet for the formulation of a physical theory which will give a complete account of the peculiar behavior of iron, by means of which it superposes odd harmonics upon the wave of a simple harmonic current. The view which irresistibly suggests itself to my mind is simply this : Upper harmonics will be generated whenever more or less abrupt changes of the magnetic state in any part of the magnetic field through which an alternating current flows occur. A slotted core armature, or an armature made up of coils with iron cores distributed over a drum common to all of them, will introduce such abrupt changes. An alternating current motor, especially when it is not of a smooth core armature type, will also cause abrupt changes of magnetism and hence cause strong deviations of the feeding current from the simple harmonic form. But if this view be correct, then every complete cycle of magnetization to which iron is subjected when under the inductive action of a simple harmonic current must be accompanied by some abrupt changes in magnetism, and that, too, whether the mean magnetic intensity of the cycle be large or small. A great many things may be suggested which could account for such cyclic abrupt changes. One thing is certain and that is, that hysteresis, as commonly understood, will not account for them; for these peculiar abrupt cyclic changes, if they really exist and are the cause of harmonics, are not affected by mechanical vibrations by which, as is well known, all hysteretic effects are influenced very much. *But whatever the real theory underlying these upper harmonics may be, the bare fact which the engineers have to face is : There is no cure against harmonics as long as the circuits contain iron. Hence construct your lines in such a way that conditions favoring resonance with the frequency of the fundamental or with one of its odd upper harmonics will seldom occur, and whenever they do occur the resonant rise of potential should not be capable of producing any damage. Avoid slotted armatures and armatures with projecting pole-pieces, and keep the magnetization down as much as possible.*

Fluctuations of the Rotary Field.—Before closing this paper I will describe briefly the application of the resonance method of analysis to the study of the intensity fluctuations of a rotary magnetic field. The investigation was carried out by two students of the Electrical Department of Columbia College, at my suggestion, and will be published in the near future. The method, briefly stated, is this : A suitable number of turns of wire are subjected to the induction of a rotary magnetic field. These turns form part of a resonator. Whatever fluctuations there be in intensity of the rotary field they will be periodic, their period bearing a perfectly definite ratio to the periodicity of the current which produces the rotary field. For instance in a three-phase combination of alternating currents, the intensity of the rotary field will, according to theory, show six maxima and six minima during each complete revolution, the maxima differing from the minima by about 14 per cent. A circuit, subjected to the inductive action of such a field should have a periodic electromotive force induced in it whose frequency will be either three or six times the frequency of the fundamental, according to the shape of the curve of fluctuations. Similarly in a rotary magnetic field produced by a two-phase combination of alternating currents. If such electromotive forces were induced the resonator would detect them, and from the resonant rise of potential the extent of the fluctuations producing these electromotive forces could be estimated.

No electromotive forces of this type were detected in either a tri-phase or a two-phase combination. Hence the inference: *Rotary magnetic fields produced by reasonably well constructed machines are not accompanied by fluctuations in their intensity.*

THE TELEPHONE ON RAILROADS.

In a paper read by G. Dumont before the French Society of Civil Engineers, that gentleman gives an account of the use to which the telephone is put as an adjunct to the operation of French railroads. It seems that the telephone in France is growing in favor in this direction. In our own country it is now being extensively used for general railroad purposes, and judging from the remarks made at the recent convention of Railway Telegraph Superintendents in Detroit, the telephone is even likely to supersede the telegraph to a great extent in the transaction of railroad business.

In France communication with subscribers of city telephone systems is limited, as the high tax on instruments compels the companies to restrict the number of installations. But for communication in the yards the telephone is used to connect the superintendent with the freight offices, switch towers, shops, etc. In certain yards even orders are given, except such as affect the safety of trains Important messages are written down in a special book and are compared by repeating.

Some companies think of replacing the telegraph by telephone even for the transmission of important orders. There are some railroads with light traffic where the telephone is already thus used, but the entire substitution of the telephone would be difficult. The single iron conductors used for the telegraph would not be suitable, and it would be necessary to establish special telephone lines with double wire. On the Vincennes railroad in the stations between Paris Bastille and La Varenne, which are at distances of about one mile, at a signal by telegraph the telegraph wires are connected with the telephone instruments and are thus made available for an extended telephonic intercourse. The arrangement gives excellent results. The Northern Railroad of France has established on trial telephone stations on the open road along some of its main lines, through which assistance can be summoned from the stations in case of accident. The stations are equipped with telephone receivers. Portable telephone instruments are in use on some small French roads. The large Austrian railroads use field telephone instruments of the Gattinger system, which in a few minutes can be connected with the telegraph wires at any point, their use not interrupting the telegraphic communication. Under favorable conditions conversation is possible at distances up to 31 miles.

In England telephone connection between block signal stations is common. On the seven large French railroads there were in use in January, 1893, about 1,210 telephones against 5,200 telegraph stations.

It is now conceded that on secondary railroads the telephone may completely replace the telegraph. For these roads, where traffic is light and where stations are often platforms only, an apparatus was needed simpler and more expeditious than the telegraph. The telephone has been used for the complete operations of secondary roads in Belgium. There are no buildings at the stopping-places, and the telephones are placed in a locked box in a room of a neighboring tavern. Each station has a microphone, two receivers, and a magneto-electric call apparatus. All stations of a road are on the same circuit. Conversation has been held between the end stations of a line 36 miles long and having eighteen stations. At first No. 9 wires were used, but now No. 15 phosphor bronze wires of 30 per cent. conductivity are preferred. The total number of telephone stations on the Belgian secondary roads is 197, on an average 2 1 miles apart.

The total length of roads is 675 miles, of which 170 miles have iron and the rest bronze wires. In the narrow gauge roads of the river Maas, which comprise 96 miles, the telephone is used almost exclusively.

AN ELECTRO-CHEMICAL METHOD OF OBSERVING ALTERNATING CURRENTS.

In a recent issue of the *Comptes Rendus*, Mr. R. Janet deals with this subject. He states that there are two factors in connection with alternating currents which are not always easy to measure—viz., frequency and difference of phase.

The author has devised a graphical method offering great facilities for making measurements. Over a recording metallic cylinder is placed a sheet of paper which has been soaked in a solution of ferro-cyanide of potassium and nitrate of ammonia. An iron or steel style is made to press against this paper. The cylinder and the style are then connected respectively to the two points across which it is necessary to study the periodic E.M.F. As the circuit has no self-induction, the current will be in phase with the E.M.F. If under these conditions the cylinder be rotated, periodic blue lines will be produced corresponding to the maximum values of the E.M F.'s. By this method frequency can be very readily measured. For measuring the difference of phase between two E.M.F.'s of the same frequency, it is only necessary to record the two impressions side by side, and to measure the distance between the two maximum values. By this method it would be easy to measure the difference of phase between the primary and secondary currents and E.M.F.'s of a transformer. The author has found this method capable of being applied to many cases.

Experiments were made on currents obtained from Zipernowsky alternators at 110 volts. (1) Three points —A, B, C,—on the circuit were taken, and separated by non-inductive resistances consisting of incandescent lamps. The point B was connected with the cylinder, and A and C with two styles. Under these conditions two discontinuous lines were obtained; the maxima of one separating into two equal parts the intervals formed by the maxima of the other. (2) An inductive resistance was inserted in place of one of the above non-inductive resistances. The difference of phase was immediately changed. The maxima of the discontinuous line corresponding to the inductive resistance separated into two parts, the intervals of the maxima corresponding to the lamp resistance.

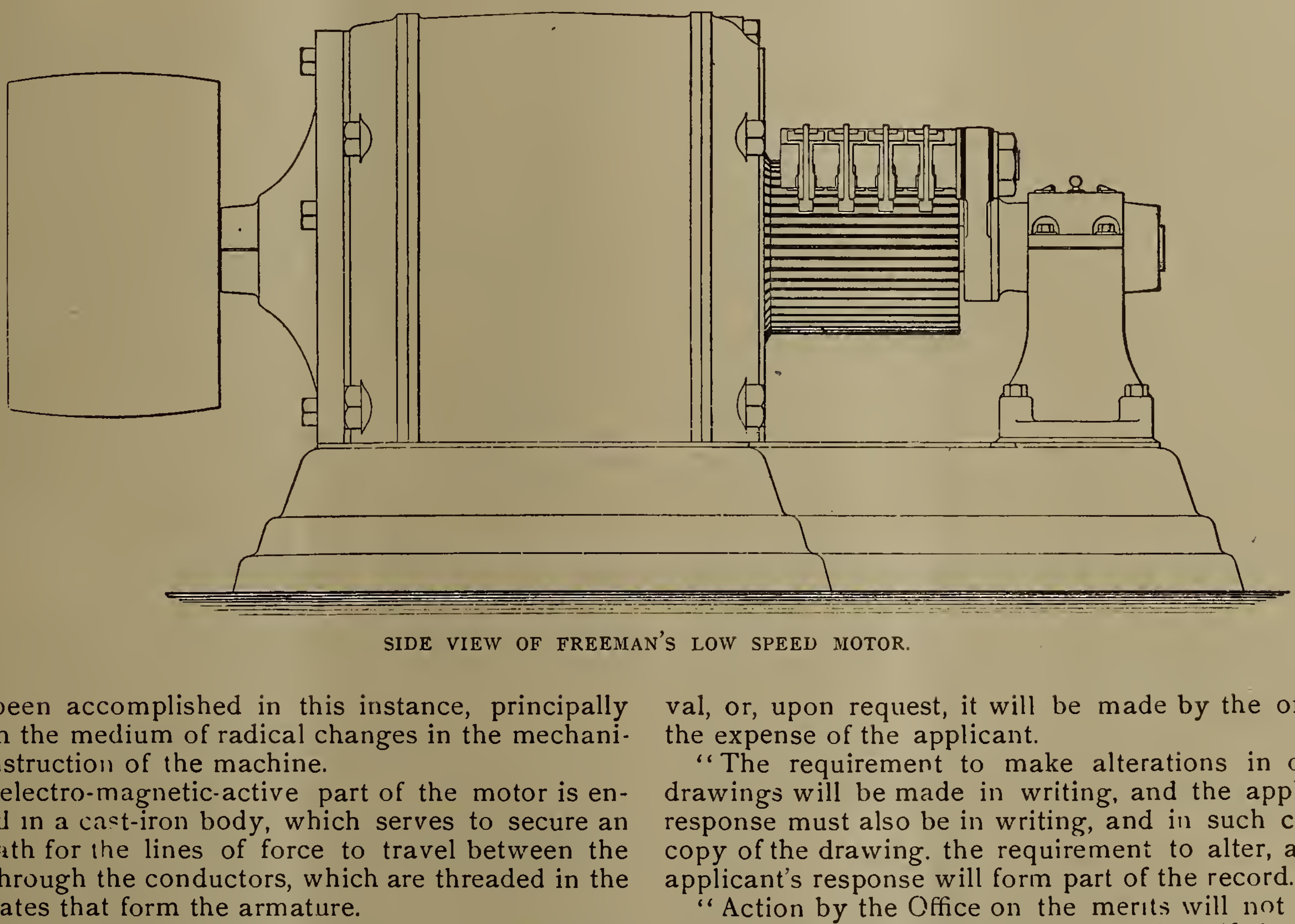
Glass, copper, zinc, lead, platinum, carbon, plaster, petroleum, silk, cotton and paper are used in the manufacture of incandescent lamps.

FREEMAN'S LOW-SPEED MOTOR.

The extensive use of electric motors has largely familiarized the public with their workings, and given practical proof of their superiority over other power generators. At the present time electric motors are accepted as the best medium through which to secure power in places where space is limited and the power is required periodically, and where necessity demands minimum expense in caring for the motive power.

There are a large number of electric motors in the market which give fair results, and probably the greatest objection that can be made to them is the high speed which they must run at, to secure a reasonably effective efficiency.

Mr. W. K. Freeman, of 136 Liberty street, New York, appreciating these objectionable features in motors, began a series of experiments hoping to reduce the speed and succeeded, without increasing weight or dimensions, and while it might appear to be impossible to decrease the speed of a motor and retain its effective horse-power, it has been accomplished in this instance, principally through the medium of radical changes in the mechanical construction of the machine.



SIDE VIEW OF FREEMAN'S LOW SPEED MOTOR.

The electro-magnetic-active part of the motor is enveloped in a cast-iron body, which serves to secure an easy path for the lines of force to travel between the poles through the conductors, which are threaded in the iron plates that form the armature.

It is claimed for this type of motor that it is less liable to ordinary accidents than other makes and that all the parts are accessible and easy to repair. With a uniform system of making all like parts interchangeable there seems little left to wish for in what might be justly called an ideal electric motor.

THE PACIFIC CABLE.

A dispatch from Montreal, on July 10, states that Mr. A. von Siemens, of the well-known firm of Siemens Bros., Cable Manufacturers, London, is in Ottawa and has made a proposition to lay the proposed cable from Victoria, B. C., to Sydney, N. S. W. He will guarantee to complete the work within three years. His offer, it is stated, is being considered by the Dominion government.

PATENT DRAWINGS.

Following is a copy of the only order now in force in the Patent Office, Washington, with reference to patent drawings. Its provisions are of sufficient importance to all inventors to warrant its publication in our columns

"Erasures or other alterations of drawings will not be made or permitted, except in compliance with this order.

"Applicants are requested to furnish, with their originals a blue print or other photographic copy of all drawings forming part of an application, and where this is done, the original drawings may be taken to the Attorneys' room, but not otherwise.

"Before making a requirement to alter an o iginal drawing the Examiner will formally make the blue print or other copy a part of the files, and in case no such copy has been furnished by the applicant, the office will make such copy without charge, and thereupon the required alteration may be made by the applicant, under the direction of the Examiner and subject to his approval, or, upon request, it will be made by the office at the expense of the applicant.

"The requirement to make alterations in original drawings will be made in writing, and the applicant's response must also be in writing, and in such case the copy of the drawing, the requirement to alter, and the applicant's response will form part of the record.

"Action by the Office on the merits will not be suspended pending the change of a drawing, if the invention claimed may be understood by the Examiner.

"For the purposes of this order the Office, upon the request of applicants, will make blue prints at the charge of five cents a sheet.

"In appeal cases and upon the declaration of an interference a blue print or other copy will be sent forward with the files, the Examiner retaining the original drawings in his room until the hearing

"Except as herein required such blue print or other copy will not be made a part of the file, and may not be preserved after an application passes into a patent.

LONG DISTANCE TELEPHONE.—The telephone line between Berlin and Vienna will be completed and in operation by November 1 next. The charge to be made will be 4 shil. for three minutes' conversation—an equivalent of $1.00 in American money.

FOREIGN NOTES OF INTEREST.

Glasgow Tramways.—The Glasgow corporation has just come into possession of the tramways in that city, and is now operating the same. An English contemporary says the corporation does not seem inclined to go in for electric traction, but will introduce progressive ideas in a small way. To begin with, oil will be used for illuminating purposes.

Electrical Exhibition at Budapest.—On the 10th of June there was opened at Budapest by the Hungarian Minister of Commerce an exhibition of electrically driven machines, the object being to demonstrate to the public the importance of electricity for power purposes. There are 22 Hungarian and 23 foreign exhibitors, who are represented by over 200 machines of various kinds Current is obtained from the street mains of the Hungarian Electricity Company, who furnish it free. Messrs. Ganz & Co. have also furnished the electric motors gratuitously, as have Messrs. Siemens & Halske, part of the fittings. Exhibitors have obtained their space without any charge whatever.

Electrolytic Decomposition of Water.—M. Le Blanc, in a paper published in a German periodical, upholds the view of the primary decomposition of water, and replies to the objections brought forward by Arrhenius. The increase in the electrolytic decomposition of water by the addition of an electrolyte is explained, not by an increase in the degree of dissociation of the water, but in the capability of ion formation. He also explains the fact that hydrogen is not immediately liberated during the electrolysis of an alkali salt with a mercury cathode, by stating that the potassium ions give up their electricity to the mercury more readily than the hydrogen ions That hydrogen ions are present in water is shown also by the fact that potassium reacts readily with water and not with paraffin. In the case of solution of various metallic cyanides in potassium cyanides, he points out that cadmium is easily separable, but platinum scarcely so, which is hard to explain on a secondary decomposition hypothesis, unless the electrodeposited platinum were soluble in potassium cyanide; this, however, he proves experimentally is not the case. He finally points out that the primary decomposition theory has the advantage of simplicity.—*Electrical Engineer*, London.

The Bolton (England) Corporation proposes to fit up houses for electric light and charge a rental for the fittings and wire.

The French Thomson-Houston Co.—The Compagnie Française pour l'Exploitation des Procédés Thomson-Houston have declared a dividend on the past year's working of 5 per cent. The company have decided to manufacture their electrical plant in France, and for this purpose the works of M. Postel-Vinay are to be acquired by a new company to be formed by the latter and by the Thomson-Houston Co. It has been resolved to increase the capital of the Thomson-Houston Co. from £40,000 to £200,000.

PERSONAL.

Mr. William H. Browne, who has lately resigned his position as general manager of the United Electric Light and Power Company, has just been appointed receiver for the Flushing, L. I., Railway Company. Mr. Browne's experience for the past six years makes him very fit for this position, as his duties have been very wide and varied. He has been extremely successful.

LEGAL.

Chief Justice Brown, of the Supreme Court, Brooklyn, on July 12 rendered a decision in favor of the defendants in the suit of John Adamson against the Nassau and Kings County Electric Railway Companies. Adamson, a tax-payer, brought suit for an injunction to temporarily restrain these roads from continuing the construction of their new trolley lines, for which they had received a franchise by the last Board of Aldermen. It was contended that the valuable grant had been obtained through fraud and that the interests of the city had not been properly protected. The municipal authorities were also charged with having unduly favored these companies over the Union Street Railway Company and with having failed to give the application of the latter proper consideration.

It is reported that the Norwalk and South Norwalk Electric Light Co., Norwalk, Conn., has gone into the hands of a receiver. Mr. L. C. Whitney, superintendent of the New Britain Electric Light Co., being appointed as such.

The Chattanooga Electric Railway, Chattanooga, N. C., is reported to have gone into the hands of a receiver.

The Novelty Electric Co., of Memphis, Tenn., it is reported, has assigned.

THE MORSE CLUB.

On July 11 several prominent telegraph men in this city met and organized the Morse Club. The object of the society is to meet on the 24th of May each year, to fittingly celebrate the transmission of the first message (which was on May 24, 1844), and events pertaining thereto; to take care of the statue of Prof. S. F. B. Morse, in Central Park, New York city, and to decorate the same on Memorial Day and other occasions.

The initiation fee has been fixed at $3.00 and annual dues $2.00. All expenses of the annual reunions are to be paid out of the funds in the treasury. The scope of the club is national, and it is expected that telegraphers all over the country will become members.

The officers elected for the first year are: M. R. Hults, president; T. E. Fleming, vice-president; Geo. F. Fagan, secretary; W. C. Burton, treasurer.

LARGE TAXPAYERS.

Among the large corporations in New York city that pay taxes on personal assessments are the following electrical and street railway companies:

General Electric Company, $9,776,930; Metropolitan Telegraph and Telephone Company, $1,360,000; Third Avenue Railroad Company, $1,280,341; Broadway and Seventh Avenue Railroad Company, $892,130; Edison General Electric Company, $600,000; Metropolitan Traction Company, $173,749; Edison Electric Light Company, $140,000.

THE CARE OF DYNAMOS AND MOTORS.

"I should think some one would get up a book giving directions for the care of dynamos and motors; also for determining the cause of faults in practical working and how to apply the remedy."

This was a remark made by one electrician to another. The other was up to the times and replied:

"Why; there is such a book and it is exactly what you are looking for. It is called 'Management of Dynamos and Motors,' and Crocker and Wheeler are the authors. Send $1.00 to the Electrical Age, New York, and they will send you a copy by return mail."

TACHOMETER AND THOMPSON INDICATOR.

We give below illustrations of two pieces of apparatus that are indispensable to every steam plant operator.

The tachometer shown in Fig. 1 is of the portable type, and by applying it by hand to the centre of a rotating shaft it will instantly and correctly indicate the number of revolutions of the shaft per minute.

This instrument is provided with three scales, indicating speeds ranging from 40 to 3,000 revolutions. The point is detachable and may be fastened on any of the three arbors, which correspond to the three scales.

Other types of tachometers are made by this firm, Messrs. Schaeffer and Budenberg, of New York city.

Fig. 2 shows an improved Thompson Indicator made by the same firm. This indicator is adapted for all speeds.

The distinguishing feature of this indicator is its

FIG. 1.

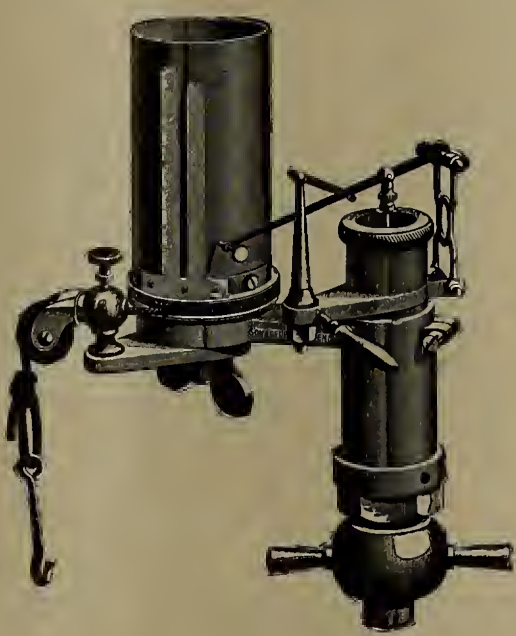


FIG. 2.

parallel motion. All parts are light and irregularities due to inertia are reduced to a minimum. The pencil point describes a straight line and the motion of the same is precisely proportional to the displacement of the indicator piston throughout the stroke.

Besides these apparatus, Messrs. Schaeffer and Budenberg manufacture pressure and vacuum gauges of every description, injectors and ejectors, and steam engine and boiler appliances in general. The works of the firm are in Brooklyn, N. Y., and their salesrooms are at 66 John stieet, New York and 22 West Lake street, Chicago.

OBITUARY.

EDMOND JULIEN.

Edmond Julien, the distinguished engineer and founder of what is known in this country and Europe as the Julien system, died at his home in Brussels on the 5th day of this month.

Mr. Julien was born at Andenne, on the 31st day of August, 1838. He was by profession a civil engineer, and in that capacity built a number of railroads in Russia and Spain. He had the reputation of being of the first rank as a railroad engineer. He amassed considerable wealth in railroad building, and embarked almost all of it in the storage battery business in connection with Faure and Phillipart. He built what was probably the first storage battery factory in Europe, at Brussels; and in 1885 his storage battery car took the first prize in mechanical traction at the Antwerp exposition.

Mr. Julien was very highly esteemed by his fellow citizens at Brussels; and King Leopold knighted him in 1889. He was a man of most imposing appearance, being nearly 6 ft. 4 in in height, and of splendid proportions. He leaves a charming family, and a beautiful home in Brussels where hospitality was expended with a lavish hand.

LEONARD'S NEW SYSTEM OF ELECTRIC HEATING.

It is well known that by sending current through a resistance the entire electrical energy can be converted into heat, and as regards the efficiency of the conversion of electric energy into heat, therefore, no improvement can be effected. The utilization of the heat developed by the passage of the current through the resistance, however, presents great possibilities of improvement. It is very important for the operation of such tools as electric soldering irons, flat irons, embossing irons, and many other similar devices, some of which are used in almost every industry, that the heat developed in the resistance shall be conducted to the working surface as rapidly as possible and with the least amount of waste.

Mr. H. Ward Leonard has just had issued to him patent No. 522,718, of July 10 1894, for an electric heater which is likely to mark a very distinct advance in this line. The invention is quite radical, and the patent obtained by him contains very broad claims. The first claim reads as follows: A device in which electrical energy is converted into heat, having a thinly insulated conductor embedded in and completely surrounded by, a closely applied mass of metal substantially as set forth."

Mr. Leonard has many modifications of the general principles of his invention, but the description of one modification will give a general idea of the same.

The resistance, which is a metal wire, is thinly coated with some form of fire-proof insulation, which hermetically seals the conductor from the air such as enamel or glass. The wall of insulation around the conductor is quite thin. The conductor so insulated is placed in a mould, and a suitable metal is cast about the insulated resistance so as to completely imbed it in the cast metal. This surrounding body of metal, as it cools, subjects the insulated conductor to strong pressure, insuring perfect mechanical contact throughout. The surrounding metal also hermetically seals the resistance from any possible contact with the air and from all chemical action. While the insulation surrounding the conductor is of comparatively poor quality as a conductor of heat, the wall of this insulation is so thin that it affords the least possible resistance to the flux of heat from the heated resistance of the surrounding metal body, consequently the temperature of the heated resistance and the temperature at the surface of use will be as nearly the same as possible, and the resistance is therefore not subjected to a temperature appreciably higher than that of the surface of use.

It is possible to operate tools heated by the Leonard system at a bright red heat without any destructive effect whatever, and this possibility opens up a very wide field for the application of electricity to various tools used in the arts and industries which have heretofore necessarily been heated by gas, charcoal stoves, etc.

The Carpenter Enamel Rheostat Company, of which Mr. Leonard is president, will manufacture apparatus under this patent

Among the various kinds of apparatus which will soon be on the market due to this invention are the following: all kinds of soldering irons and embossing irons, flat irons and tailors' gooses, cooking utensils, electric stoves, electric ovens, egg boilers, etc.; also, many applications to small appliances, such as curling irons, sealing-wax heaters, etc. Also, all kinds of atmospheric heaters, such as street car heaters, and heaters for dwellings where the cost of electric current is sufficiently low to make it possible for electric heating to compete with fuel directly. In this regard Mr. Leonard estimates that where power can be had which does not cost more per horse-power, per annum, than the cost of two tons of good coal, electric heating can compete on the score of economy alone with heat from fuel direct, and the many advantages of electric heaters are so pronounced that they will frequently be applied for atmospheric heating, even though the actual direct cost be much greater than that due to heating by fuel.

STREET RAILWAY NEWS.

THE DETROIT STREET RAILROADS.

It is reported that Thomas Nevins, of Orange, N. J., signed the papers last week giving him control of the entire system of street railways in Detroit, Mich., excepting a short line, two miles in length. The lines are 80 miles in length, and it is Mr. Nevin's intention to extend them 50 miles more, and introduce the trolley system on all. Workingmen will be charged a three cent fare between the hours of 5:30 and 7 o'clock A. M., and 5:15 and 6:15 P. M., in consideration for the franchise, and the company will be exempt from taxes and expenses for maintenance of streets, etc. The company, it is stated, has an absolute contract with the city for 30 years, with a clause providing that the city may purchase the roads if it chooses to do so.

THE NEW YORK AND PHILADELPHIA ELECTRIC ROAD.

A dispatch from Trenton, N. J., on July 13, reports that Frank A. Magowan, of Trenton, paid the State Treasurer $28,000, the amount required as a deposit under the railroad law of New Jersey, and at the same time filed surveys, routes and descriptions, and secured a charter for the New York and Philadelphia Traction Company.

Mr. Magowan is president of the company, which is to have a capital of $10,000,000. Others interested are the Central New Jersey Traction Company, of which Mr. Magowan is president, and which E. W. Hine, of Newark, is vice-president; J. H. Baldwin, of Newark, secretary; James H. Darrah, of Trenton, treasurer, and Col. D. K. Bayne of New York, William H. Skirm of Trenton, Joseph H. Real of Bloomfield, and J. C. McNaughton of Philadelphia, are directors.

There will be about 150 miles of electric railways. The road will begin at Paterson, where connection will be made with the trolley system of that town; leaving Paterson, the road will pass through Upper Montclair, Montclair, Bloomfield, Orange, East Orange, West Orange, South Orange, Springfield, Westfield, Fanwood, Netherwood, Plainfield, Dunellen, and Bound Brook; thence to Millstone, Princeton, Lawrenceville and Trenton. Below Trenton the new road will pass through the towns along the line of the Pennsylvania railroad and at Frankford connect with existing lines into Philadelphia.

From Bloomington a branch line will run to Caldwell and Irvington, connecting at the latter place with the existing lines of the Consolidated Traction Company, making a direct line to Newark. Branch lines will run to Chatham, Madison and Morristown, from Bloomfield; and to New Brunswick, Somerville, Raritan, Rahway, Elizabeth, Woodbridge and Perth Amboy.

The projectors of the new system of roads compute that they will acquire the patronage of 5,000,000 travellers, and transport much freight and merchandise.

Work is to begun at or near Trenton and will be carried on in both directions. Seventy miles of local lines in different cities are to be merged in the system.

NEW BOOKS.

Alternating Current Wiring and Distribution. By Wm. Le Roy Emmet, E. E., Member A. I. E. E. New York: 1894. The Electrical Engineer, N. Y., 76 pages, 4½x7. Price, $1.

It is the object of this valuable little work to point out, in a practical way, the laws governing the distribution of alternating currents, and it addresses itself particularly to practical men. In carrying out his programme the author first describes the various influences effecting alternating distribution, such as the surface or "skin" effect, the influence of neighboring alternating circuits, and the self-inductive effects, discussing each of these and showing the manner in which they must be taken into account in laying out lines in order to get the most economical size of conductors for the given amount of work. He next takes up the effects of transformers and motors in circuit, and shows by practical determination and an actual case how much the generator must be over-compounded in order to be self-regulating, and the voltage necessary on the line, the line losses, etc., in order to obtain the best working condition. This is followed by two chapters on the methods of determining step-up and step-down transformers for long distance transmission, including a discussion and application of the two-phase and three-phase transformer system.

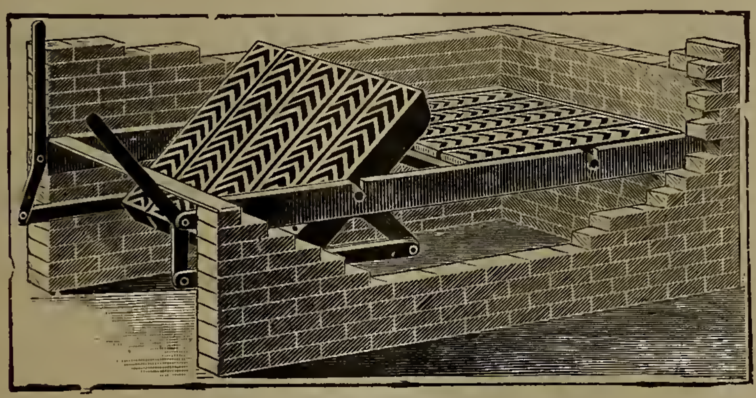
The intelligent application of the principles contained in this little work will save the electrical engineer and station manager, not only considerable money, but much annoyance. The questions here discussed are the most important now before the electrical community, and the author's wide practical experience in this field gives his work a special value at this time.

Telegraphy Extraordinary.—The Cape of Good Hope telegraph service has always been famous for the smartness of its operators, says the London *Electrical Review*. An excellent piece of work was done by three of the Cape Town staff on May 17. The Cape Parliament was opened on that day, and the Governor's speech, reaching to a total length of 1,700 words, was telegraphed all over South Africa. To Kimberley it was sent in 35 minutes, or at the rate of 48½ words per minute, to King Williamstown in 40 minutes (42½ words per minute), and to Port Elizabeth in 41½ minutes (41 words per minute). All three circuits are key-worked Morse, with printers at the receiving ends. The tape upon which the received message was printed at Kimberley was carefully examined, and the signals were found to be well formed and good. Only judicious abbreviations were used, and therefore the message could be read without difficulty from start to finish, notwithstanding the fast manipulation. King Williamstown also read the message without a single stoppage, and but one trifling repetition was called for by Port Elizabeth. The Kimberley performance establishes a record for speed in key working. The sending operator on this line was a Mr. Harrison, who recently left the Imperial Post-Office Service to enter that of the Cape.

TUPPER GRATES.

The importance of having a serviceable and efficient grate under a boiler cannot be overestimated. That the power to generate steam in a boiler depends to a great extent upon clean fires is a well-established fact, and it therefore becomes a matter of prime importance to provide means of readily getting rid of the accumulation of ashes under a fire.

The accompanying illustration gives a view of the No. 6 dumping grate manufactured by W. W. Tupper & Co., 39 and 41 Cortlandt street, New York. This grate is adapted for all kinds of fuel. The air openings in these grates vary from one quarter inch to one inch, according to the size of the fuel used. They are uniform and proportionately large, effecting perfect combustion in all parts of the furnace alike. It is said that these grates prevent the formation of clinker and no raking or slicing is necessary Owing to the angular shape of the grates the expansion and contraction does not warp or fracture them, and owing to their construction, also, they are not so easily burned out as grates of many other makes.



TUPPER'S NO. 6 DUMPING GRATE.

Another style of grate made by this firm is the No. 5 rocking grate, which is also adaptable to all kinds of fuel. In it each bar rocks on its longitudinal axis and all bars work together. In this way the ashes covering the entire grate area are dumped at one operation.

POSSIBLE CONTRACTS.

The Key West Gas & Electric Light Co. has increased its capital stock from $75,000 to $250,000 for the purpose of enlarging its plant.

The Bell Telephone Co., Americus, Ga., will construct a telephone line to Albany, Ga. J. D. Peacock is the manager of the Americus Exchange.

R. P. Dagget & Co., 28 Marion Building, Indianapolis, Ind., can give information concerning an electric light plant to be purchased.

A new telephone exchange is to be established in Newberne, N. C. For further information address P. H Pelletier.

Horace S. Cummings, Washington, D. C., is reported to have purchased a tract of land on which an electric light plant will be erected. He represents a syndicate.

The Viaduct Manufacturing Co., Baltimore, Md., will build a new plant to take the place of the one recently burned at Relay, Md.

The Howard Harrison Iron Co., Bessemer, Ala., proposes to introduce electric cranes in its factory.

An electric light plant is to be installed by the Traders' Company, Clarksburg, W. Va. Mr. D. P. Morgan is president.

The city clerk, Parkersburg, W. Va., can give information concerning franchise just granted for an electric railway.

An electric power plant is to be established at Elberton, Ga., for further information address D. A. Mathews.

Eperandieu and Cramer, representing the Niagara Power & Development Co., are reported to be endeavoring to form a company in Knoxville, Tenn., to build an electric road from that city to Spring Place.

J. Allen Brown and E. B. Neave have secured a franchise for the construction of a telephone system in Salisbury, N. C., and require necessary equipment.

An electric light plant is to be installed in Front Royal, Va. The Mayor of that place can give all the necessary information.

Johnson, Caruthers & Rand, Memphis, Tenn., are in the market for a 20-h. p. electric motor.

The North Highlands Railway Co., Columbus, Ga., has been granted a franchise for the operation of an electric railway.

W. E. Sudlow & Co., Florence, S. C., desire prices on transformers and other supplies.

Jonah White, Rutherford, N. C., can give information regarding the construction of an electric railway between Rutherfordton and Chimney Rock, a distance of 17 miles.

Thos. S. Hodgson, 6 East Lexington street, Baltimore, Md , can give information regarding 2½ miles of electric railway to be constructed by the Somerset Electric Light and Railway Company, recently chartered.

An electric railway is to be built in Williamsburg, Va. The Mayor of that place can give all the necessary information regarding the same.

The Key West, Fla., street railroads are to be equipped with electricity. Address John J. Philbrick for further information

An electric railway between Saundersville and Tennile, Ga , is proposed. Address J. N. Gilmore for further particulars.

Address the city clerk, Alexandria, Va., for information regarding an electric motor which is to be purchased. H. C. Saffell may also be addressed on the same subject.

The Goliad Water Power Co , Gonzales, Tex., is going to put in a 500-light dynamo. For further information address F. R. Starr, jr.

Chas. Sperry, superintendent, St. Augustine Railroad and Steamboat Co., 12 W. 31st street, N. Y. City, can give information regarding a proposed electric railroad in St Augustine, Fla.

Ontario, Can., proposes to establish a municipal electric light system, requiring a plant for 1,300 arc lights. City Engineer, E. A. Keating, can give further information.

It is reported that the Maryland Central Railroad Co., Baltimore, Md , is seriously considering the advisability of introducing electricity on its lines for the propulsion of trains.

C. W. Walker, Augusta, Ga., can give information regarding the disposition of 4,000 electric h. p. for light and power purposes, on a basis of $5.50 per h. p. annually.

The plant of the Osage Electric Light Co., Osage, Ia., was recently burned. It will probably be rebuilt.

The Rome City Street Railway Co., Rome, N. Y., contemplates changing its motive power to electricity.

An electric light plant is to be constructed in St. Bernard, O. Address H. J. Witt.

Gabriel B. Reed, Kearney, N. J., can give information regarding contract for street lighting.

J. Koller, Napoleon, O., can give information regarding the contemplated purchase of dynamos for 60 arc lights and 1,500 incandescent lights.

M. C. H. Fowler, Rome, N. Y., can give information regarding an electric light contract for 150 arc lights for one, three or six years.

The city clerk of Kalamazoo, Mich., Chauncey Strong, can give information regarding the construction of an electric light plant for the city.

An electric light plant is to be established in Estherville, Ia. Address N. B. Egbert, city clerk.

An electric light contract is to be given out August 1 in Norwood, Pa. For further information address G. C. Skelton.

The Shelbyville Water and Light Co., Shelbyville, Ky., will erect an electric light plant, and is now in the market for the necessary electric and steam plant, complete.

Chas. Fitzgerald, Guthrie, Oklahoma, has been granted a franchise for the construction of an electric railway, the equipment for which is yet to be purchased.

Information regarding street railway franchises in San Francisco, Cal., can be obtained by addressing J. A. Russell, city clerk.

Address Judge T. F. Nash, Dallas, Tex., concerning electric wiring contract.

NEW CORPORATIONS.

Bluff City Electric Street Railway Co., Waukegan, Ill., by De Witt L. Jones, S. D. Talcott and Chas. Whitney. Capital stock, $200,000.

Freeport Electric Co., Freeport, Ill. Capital stock, $150,000; incorporators, Robert S. Brown, John B. Taylor and Geo. H. Currie.

Leavenworth Electric Railway Co., Leavenworth, Kans. Capital stock, $300,000.

Mutual Telephone Co., Wichita, Kans. Capital stock, $100,000.

Osborne Switch Co., Newark, N. J., manufacturing electrical machinery, etc. Capital stock, $100,000.

The Cleveland and Elyria Railway Co., Cleveland, Ohio. Capital stock, $100,000.

The Mason Telephone Co., Richmond, Va., with Maurice Hunter, President, W. A. Mason, of Sumter, S. C., vice-president, and Maurice Thomas, secretary and treasurer. Capital stock, $10,000, with privilege of increasing same to $50,000.

Joseph Telephone Co., Joseph, Ore. Capital stock, $500.

Economic Light, Heat and Power Co., Snohomish, Wash. Capital stock, $25,000.

The Traction Construction Co., Denver, Col., by Geo. E. B. Hart and others, to construct and operate electrical and cable railways and tramways. Capital stock, $50,000.

Little Cyclone Fan Co., Kansas City, Mo., by W. P. Waite and others. Capital stock, $10,000; to manufacture electric fans.

The Spencer Motor Co., Glastonbury, Conn., by S. P. Turner and others. Capital stock, $2,000.

The Murphy Power Co., Chicago, Ill., by S. M. Murphy and others. Capital stock, $3.000.

Council Bluffs and Lake Manawa Electric Railway Co., Council Bluffs, Iowa, by J. W. Bedford and others. Capital stock, $50,000.

Brodie Electric Co., Manchester, N. H., manufacturing electrical apparatus, etc. Capital stock, $25,000.

The Infinity Manufacturing Co., New York, N. Y., electric dry batteries. Capital stock, $4,000.

The Fire & Police Telegraph Co., Louisville, Ky., dealing in electrical apparatus. Capital stock, $50,000.

Musical Telephone Co., Saco, Me., manufacturing and dealing in telephones, etc. Capital stock, $100,000.

United Electric Corporation, Minneapolis, Minn., manufacturing electrical apparatus, operating electric lighting, street railway and power plants. Capital stock, $10,000.

Grand Rapids Machine Electric Co., Grand Rapids, Mo. Capital stock, $10,000.

The Peoples' Gas and Electric Light Co., Saratoga Springs, N. Y. Capital stock, $75,000.

The Eldred Electrical Manufacturing Co., Eldred, Onondaga County, N. Y., by Wm. C. Ranney, Lewis B. Doman and Albert E. Doman, to manufacture electrical appliances and apparatus, and engines, boilers and machinery. Capital stock, $10,000.

The Oswegatchie Light & Power Co., Gouverneur, N. Y., by H. Walter Webb, Augustus G. Payne, Wm. J. Arkell, Augustus L. McCrea, Jr., and Angustus J. McDonald, to furnish gas and electricity in towns of Gouverneur, Edwards, Fowler and other towns in St. Lawrence County. Capital stock, $60,000.

Yearsley-Harris Electric Company, Philadelphia, Pa. Thomas Yearsley retires—Harris Electric Co. succeeds.

The Co-operative Heat, Light & Power Co , Sioux Falls, S. D., manufacturing electricity, gas, oil, etc. Capital stock, $50,000.

The Delaware Valley Electric Railway Co., Philadelphia, Pa. Capital stock, $1,000,000.

NEW YORK NOTES.

Office of the Electrical Age,
First Floor, World Building,
New York, July 16, 1894.

The Western Union has purchased the American Rapid Telegraph Company's property which it had worked under lease, and which was sold by the bondholders. Western Union has increased its capital stock $550,000, to pay for its acquisition.

New York city's latest directory indicates a total population within the present city limits of nearly 2,000,000. Within a radius of twenty miles from Central Park as the centre of the city the population is over 4,000, 00, of which more than 1,000,000 are in Brooklyn. This is a large field for electric enterprise.

The Magnetic Club held its midsummer dinner at College Point, L. I., on the 18th inst. The Western

Union Telegraph Company placed its steamer "Western Union" at the disposal of the club, and a large number of members took the boat at 3 : 15 and proceeded to scene of the feast. Before the dinner some athletic sports were indulged in, and a thoroughly enjoyable time was had all around.

The Oakman Electric Company, of 136 Liberty street, is having an excellent demand for its latest novelties in Freeman Transformers, the Monarch Cut-out, New England Switches, and greatest of all, the Defiance Lightning arrester. They call particular attention to the fact that if you want anything in your station in the way of little things, or special devices, they are the concern you are looking for.

The Okonite Company, Ltd., that all wire users know is still at the old stand, 13 Park Row, under the capable management of Willard L. Candee and H. Durant Cheever. Our friend Captain Candee has made this wire famous throughout the country. He has devoted his energies in the past ten years or more to the wire question, and it is a well-knwn fact that Okonite Company's goods cannot be surpassed for quality, finish and efficiency, as well as long life. They never deteriorate through age.

McLeod, Ward & Co., 91 Liberty street, New York city, are noted for their fans. In their cosy office and salesrooms can be found everything the heart can wish for in ventilating goods and fan motor outfits. Their noted Kinsman desk lamp is having a continuous sale, and will be found in the leading counting-rooms of the country.

Day's Kerite wires and cables are noted for their high grade insulation. Their aerial and submarine cables can be found in extensive use in the city and about the waters of the North and East rivers and New York Bay, and are giving perfect satisfaction. Some of them have been in use over a quarter of a century. The house is still keeping pace with the stream of orders which it is receiving for their popular goods. Mr. Ham, the manager of the home office, 203 Broadway, New York city, will always be found at his post of duty, ready to give all information regarding Kerite goods.

Eco-Magneto Watchman's Clocks are made and installed by C. D. Bernsee, Vanderbilt Building, New York city, and are of the very best that can be had for watchmen's service. They do away with the use of electric batteries. Mr. Bernsee uses small magnetos at each station.

Mr. Walter K. Freeman, of 136 Liberty street, New York city, consulting electrical engineer, is having unusual success. His services have been secured for the supervision and installation of a number of electric light and railway and power plants.

Columbia Telephones as manufactured by the Columbia Telephone Co., 138 Front street, New York city, are the very best for long distance service and short lines The receivers and transmitters are of the very best design and are sold outright. The inventors and managers of this telephone have been interested in telephones for the past ten or fifteen years.

Mr. J. P. Hall, electrical contractor, of 143 Liberty street, New York city, has installed some of the largest isolated plants in this section. He makes a specialty of isolated work. Among some of the buildings in which he has installed electric light plants are the Charities Building, the World Building, the Central Building and many others equally as large. His work stands as a monument to his skill and labor.

If you are in need of gas and electric combination fixtures, you should write to W. C. Vosburgh Manufacturing Co., 269–281 State street, Brooklyn, N. Y., as they have the largest line of goods and the handsomest patterns and designs of any house in this country, and you can always be suited here. The prices are moderate.

Those in need of a good patent attorney, to take out an invention or draw up plans or specifications, or expert services, should call upon Wm. A. Rosenbaum, 177 Times Building, New York city. We can recommend him thoroughly and he can give the very best service for the least money, and always gives satisfaction.

If you want a press or a piece of special machinery, or dies for stamping out any particular shape, Mr. W. E. Jones, 14 and 16 Water street, Brooklyn, N. Y., is the man to see. He personally supervises all work of this nature and guarantees it before it leaves his shop.

The Vetter Incandescent Current Tap, made by J. C. Vetter & Co., 104 East 23rd street, New York city, is meeting with an excellent demand. There are many applications for this ingenious little article, which are explained in J. C. Vetter & Co.'s advertisement on page 9 of this paper.

Do you know how to secure a non-magnetic watch free? If you do not, write to the office of the Electrical Age for particulars.

Geo. L. Colgate Company, selling agents for the Whitney electrical instruments, are receiving large orders and constant inquiries for these noted instruments for central and isolated electric light plants, as well as for railway stations. Those desiring a first-class article of this nature should correspond with the Geo. L. Colgate Company, 136 Liberty street, New York city.

The Electric Bell & Resistance Co., Newark, N. J., is making bells for electric light and electric railway service, of any voltage. They are also making a very fine high resistance carbon wire, covered like other insulated wires, which can be used for all purposes of resistance coils, etc.

J. L. Somoff, 11 Park Row, New York city, is celebrated for the many varieties of small incandescent lamps which he manufactures. He can give you a lamp of any candle-power, voltage and amperage from the size of a pin head to the size of a human head, and to meet any requirement; also in glass of any color.

L J. Wing & Co., 109 Liberty street, New York city, are making a specialty of electric light and power plants and install gas engines, electric motors, as well as their well-known Wing disk fans. They also install combination plants of gas or gasoline engines with dynamos, for all purposes, and fit out yachts with special engines for power and light.

Julius T. Dudley & Co., 136 Liberty street, New York city, make a specialty of rolling stock equipment and supplies, new and second-hand. They buy and sell new and second-hand equipment, and exchange the same on cash instalments or bonds.

Wm. M. Marshall, 709 Lexington avenue, New York city, has the reputation of making the best condensers manufactured in the World. Mr. Marshall's goods are justly celebrated, and when you have his condensers you have something that is reliable. W. T. H.

TRADE NOTES.

In a letter regarding the Eco Magneto Watchman's Clock system, the Strong Mfg. Co., of Winsted, Conn., say : "About fifteen months ago we had the Eco Magneto Watchman's Clock system put in our works, and it is but fair to say that during all that time it has given us perfect satisfaction. It has, so far, proved to be all that was claimed for it, and is making as perfect records today as when first put in." Mr. C. D. Bernsee, Vanderbilt Building, New York city, is the manufacturer of these valuable devices.

The C. McIntire Co., 13 & 15 Franklin st., Newark, N. J., manufacturers of the universally known McIntire connectors, terminals and specialties, report an active business, especially in electric railway and telephone terminals. These terminals and connectors are made of the best lake copper.

The Sebastian Lathe Co., Cincinnati, O., manufacturers of engine and speed lathes, and dealers in planers, shapers, drill presses, and machinists' tools and supplies, have just issued an illustrated catalogue and price-list of their products. A copy can be had free on application.

Wagner direct and alternating current fan motors are having a continuous sale through their popularity made by the Geo. L. Colgate Company, of 136 Liberty street, New York city.

Star mouldings for electrical purposes, as sold by the Geo. L. Colgate Company, of 136 Liberty street, New York city, are of the very best workmanship and finish. Thousands of feet are being shipped daily.

J. Jones & Son, 67 Cortlandt street, New York, report closing a contract for a year's supply of their Anti-Thunderbolt Oil Paper with a large motor company. They installed eight fan motors last Saturday, and these machines are being quickly disposed of at the low prices they are being sold by this firm. Keeping the large and well-assorted stock they do, goods are shipped out of their own store and not from other places, making prompt shipments a desirable feature.

Seymour & Whitlock, 43 Lawrence street, Newark, N. J., are having a successful run this season with their celebrated rotary ventilating fans. These devices are met with everywhere, in restaurants and other public places, and wherever they are found crowds are wont to congregate on account of the comfort they afford. This firm makes fans of all kinds and for all purposes. They are largely used in hospitals, and they are simple in construction and easily taken care of.

Electrical and Street Railway Patents.

Issued July 3 and July 10, 1894.

522,189. Electric-Railway-Car Truck. Francis O. Blackwell, Lynn, Mass., assignor to the Thomson-Houston Electric Company, of Connecticut. Filed May 1, 1891.

522,194. Car-Fender. Alfred L. Clark, Springfield, Ohio. Filed June 5, 1893.

522,216. Wire-Support for Overhead Electric Railways. Arthur W. Jones, Boston, Mass., assignor to the Thomson-Houston Electric Company, of Connecticut. Filed May 21, 1892.

522,224. Trolley-Car. Herbert J. Lycett, Bryn Mawr, assignor to John A. Brill, Philadelphia, Pa. Filed Nov. 9, 1893.

522,231. Auxiliary Fire-Alarm-Signal System. Joseph Sachs, New York, N. Y. Filed Nov. 8, 1892.

522,232. Electric Safety-Fuse. Joseph Sachs, New York, N. Y. Filed Apr. 10, 1893.

522,233. Electric-Arc Lamp. Albert Schweitzer, Allegheny, Pa., assignor of two-thirds to Frederick Goellner, same place, and Conrad Weber, Shaler, Pa. Filed Dec. 28, 1893.

522,241. Alternating-Current Dynamo-Electric Machine. Elihu Thomson, Swampscott, assignor to the General Electric Company, Boston, Mass. Filed Oct. 21, 1893.

522,242. Process of Manufacturing Insulating Material. August F. Tinnerholm and Charles F. Peterson, Schenectady, N. Y., assignors to the General Electric Company, Boston, Mass. Filed July 31, 1893.

522,274. Dynamo-Electric Machine. Charles E. Scribner, Chicago, Ill., assignor to the Western Electric Company, same place. Filed June 1, 1889. Renewed Dec. 7, 1893.

522,275. Regulator for Dynamo-Electric Machines. Charles E. Scribner, Chicago, Ill., assignor to the Western Electric Company, same place. Filed Oct. 14, 1889. Renewed Dec. 7, 1893.

522,276. Electric-Arc Lamp. Albert W. Smith, San Francisco, Cal. Filed Apr. 2, 1894.

522,286. Dynamo-Electric Machine or Motor. Charles S. Bradley, Avon, N. Y. Filed Oct. 26, 1893.

522,294. Electric-Arc Lamp. Edward Heymann and Frank W. Heymann, Boston, Mass. Filed Apr. 14, 1893.

522,302. Self-Locking Cleat for Electric Wires. Elias Nashold, Chicago, Ill., assignor of two-fifths to Henry W. Baskett, same place. Filed Feb. 23, 1894.

522,327. Electric-Arc Lamp. Jesse F. Kester, Buffalo, N. Y., assignor to the F. P. Little Electrical Construction and Supply Company, same place. Filed Nov. 23, 1893.

522,332. Electric Switch. John Van Vleck, New York, N. Y. Filed May 28, 1894.

522,344. Alternating-Current Motor. John F. Kelly, Pittsfield, Mass., assignor to the Stanley Laboratory Company, same place. Filed Feb. 26, 1894.

522,345. Method of Producing Continuous Motion by Alternating Currents. John F. Kelly, Pittsfield, Mass., assignor to the Stanley Laboratory Company, same place. Filed Feb. 26, 1894.

522,346. Automatic Fire-Alarm. Charles A. Mann, Buffalo, N. Y., assignor of one-half to Charles J. Slada, same place. Filed Mar. 16, 1894.

522,349. Rail-Joint and Bond for Electric Railways. Julius Meyer, New York, N. Y. Filed Oct. 21, 1893.

522,352. Electrical Fishing Apparatus. Edward Poppowitsch, Brooklyn, N. Y. Filed Mar. 22, 1894.

522,356. Alternating-Current Motor. William Stanley, Jr., Pittsfield, Mass., assignor to the Stanley Laboratory Company, same place. Filed Apr. 2, 1894.

522,362. Suspension-Clip for Trolley-Wires. William F. D. Crane, East Orange, N. J., assignor to the Johns-Pratt Company, Hartford, Conn. Filed Mar. 10, 1894.

522,365. Safety Attachment for Car-Trucks. Louis F. Fisher, Willow Springs, Mo. Filed Nov. 28, 1893.

522,370. Distributing-Board for Electric Circuits. Reinhold Herman, Crafton, Pa. Filed Dec. 14, 1893.

522,374. Electric-Railway Supply-Circuit. Rudolph M. Hunter, Philadelphia, Pa., assignor to the Thomson-Houston Electric Company, of Connecticut. Filed May 8, 1894.

522,388. Electric-Railway Switch and Trolley. Frederick S. Perrin, Lynn, Mass., assignor of three-fourths to Wm. B. Baldwin, New York, N. Y., George Fink, Jersey City, N. J., and Anthony F. Buchenberger, Brooklyn, N. Y. Filed Mar. 12, 1892.

522,404. Telephone-Transmitter. Wm. R. Cole, Detroit, Mich. Filed Apr. 30, 1894.

522,412. Safety Car-Fender. Daniel Harding, Towson, and Wm. L. Fitzhugh, Baltimore, assignors, by direct and mesne assignments, to said Harding, and John I. Yellott, Towson, Md. Filed Apr. 9, 1894.

522,431. Electric-Alarm Signal for Railway-Crossings. James J Ross, Detroit, Mich., assignor of one-half to Geo. R. Holden, same place. Filed Apr. 17, 1894.

522,440. Conduit Electric Railway. John H. Tyrrell, New York, N. Y. Filed Jan. 23, 1894.

522,449. Car Fender. Wm. V. Cleary, New York, N. Y. Filed Nov. 25, 1893.

522,460. Electric-Railway Conduit. Albert T. Fay, Minneapolis, Minn. Filed Apr. 15, 1892. Renewed Nov. 16, 1893.

522,461. Conduit for Trolley-Arms. Albert T. Fay, Minneapolis, Minn. Filed July 26, 1892. Renewed Nov. 16, 1893.

522,479. Electrode for Secondary Batteries. Wm. Morrison, Des Moines, Iowa, assignor to the American Battery Co., Chicago, Ill. Filed Apr. 25, 1892.

522,500. Telegraph-Repeater. Alfred D. P. Weaver, Jackson, Miss. Filed Dec. 26, 1893.

522,506. Electric Converter. Geo. D. Burton, Boston, and Edwin E. Angell, Somerville, Mass , assignors to the Electrical Forging Co., of Maine. Filed Nov. 14, 1892.

522,507. Electric Converter. Geo. D. Burton, Boston, and Edwin E. Angell, Somerville, Mass., assignors to the Electrical Forging Co , of Maine. Filed Nov. 29, 1892.

522,527. Electric Automatic Circuit-Breaker. Carl W. Larson, Lynn, assignor of one-half to August Langell, Boston, Mass Filed Oct. 17, 1893.

522,528. Electric Topedo Apparatus and System for Railway Signaling. Jacob W. Lattig, Easton, Pa. Filed Feb. 27, 1894.

522,530. Car Fender and Brake. Henry Maass, Jersey City, N. J. Filed Mar. 22, 1894.

522,550. Trolley-Wheel Chas. E. Bostwick, Du Bois, Pa., assignor of one-half to G. E. Grier, James W. Grier, and John C. Grier, same place. Filed Mar. 15, 1894.

522,559. Galvanic Battery. Franz Fullner, Chicago, Ill. Filed Aug. 28, 1893.

522,564. Multiple Telephony. Maurice Hutin and Maurice Leblanc, Paris, France. Filed June 1, 1894. Patented in France Dec. 13, 1893, No. 234,785; in England Apr. 6 1894, No. 6,888 and in Belgium Apr. 10, 1894 No. 109,416.

ISSUED JULY 10.

522,579. Gear-Casing for Railway Motors. Norman C. Bassett, Lynn, Mass., assignor to the Thomson-Houston Electric Co., of Connecticut. Filed Mar. 20, 1891.

522,580. Dynamo-Electric Machine. Louis Bell, Lynn, assignor to the General Electric Co., Boston, Mass. Filed Sept. 19, 1892.

522,597. Electric Switch. Joseph Hutchinson, New York, N. Y. Filed June 14, 1893.

522,614. Electrolytic Diaphragm. Isaiah L. Roberts, Brooklyn, N. Y. Filed Feb. 10, 1893.

522,615 Electrolytic Apparatus. Isaiah L. Roberts, Brooklyn, N. Y. Filed Aug. 19, 1893.

522,616. Method of Electrolytic Decomposition of Salts. Isaiah L. Roberts, Brooklyn, N. Y. Original application filed Sept. 27. 1892. Divided and this application filed Sept. 4, 1893.

522,618. Apparatus for Electrolysis of Salts. Isaiah L. Roberts, Brooklyn, N. Y. Filed Oct. 4, 1892. Renewed Feb. 1, 1894.

522,619. Electrolytic-Decomposition Tank. Isaiah L. Roberts, Brooklyn, N. Y. Filed Nov. 25, 1891. Renewed Jan. 29, 1894.

522,633. Method of Making Composite Car-Wheels Nathan Washburn, Boston, Mass. Original application filed Jan. 28, 1893. Divided and this application filed Oct. 14, 1893.

522,655. Conduit Railway-Trolley. John L. Creveling, Auburn, N. Y. Filed Apr. 5, 1894.

522,664. Electric Distribution-Box. Oscar D. Kleinsteuber and Monroe A. Kleinsteuber, Milwaukee, Wis., assignors of one-third to John T. Janssen, same place. Filed Apr. 5, 1894.

522,665. Car-brake. Geo. W. Kramer, Peoria, Ill Filed Nov. 6, 1893.

522,674. Electric Meter. Gustave A. Scheeffer, Peoria, Ill. Filed Apr. 2, 1894.

522,680. Electric-Arc Lamp. Moses S. Okun, New York, assignor to Theodore F. Bourne, Clifton, N. Y. Filed Sept. 21, 1892.

522,690. Electric-Lamp Holder. Martin P. Meyer, Rochester, N. Y. Filed Feb. 27, 1894.

522,694. Electrically-Controlled Whistle and Valve for Operating same. Chas. E. Ongley, New York, N. Y., assignor to Geo. J. Schoeffel, same place. Filed Oct. 30, 1893.

522,707. Telephony. Frank R. Colvin, New York, N. Y. Filed May 22, 1894.

522,709. Contact-Shoe for Electric Locomotives. John J. Green, Boonton, N. J., assignor to the Universal Electric Co., New York, N. Y. Filed July 5, 1893.

522,710. Contact-Bar for Electric Locomotives. John J. Green, Boonton, N. J., assignor to the Universal Electric Co., of the city of New York, New York, N. Y. Filed Oct. 9, 1893.

522,711. Supply System for Electric Railways. John J. Green, Boonton, N. J., assignor to the Conduit Construction Co., New York, N. Y. Filed Oct. 9, 1893.

522,718. Electric Heater. Harry W. Leonard, New York, N. Y. Filed Mar. 22, 1893.

522,724. Electric Synchronizer for Clocks. Ludwig von Orth, Berlin, Germany. Filed May 6, 1892.

522,727. Electric Lamplighter. Josephus C. Chambers, Detroit, Mich. Filed Feb. 10, 1894.

522,733. Electric Door-Opener. Henry F. Keil, New York, N. Y. Filed Jan. 30, 1894.

522,735. Electric-Arc Lamp. Peter Kirkegaard, Brooklyn, N. Y. Filed Sept. 28, 1893.

522,790. Electric-Arc Lamp. Edward F. Gwynn, Delaware, Ohio. Filed Apr. 28, 1893.

522,820. Means for Regulating Alternating-Current Motors. Edward M. Bentley, Boston, Mass., assignor to the General Electric Company, same place. Filed Apr. 17, 1893.

522,834. Electric Locomotive. Edward Hopkinson, Manchester, England. Filed July 21, 1891. Patented in England, Mar. 14, 1888. No. 3,981.

522,835. Electric Crane. Edward Hopkinson, Manchester, England. Original application filed July 21, 1888. Divided and this application filed Mar. 15, 1894. Patented in England, Mar. 14, 1888. No. 3,981.

522,836. Galvanic Battery. Louis F. Johnson, Poughkeepsie, N. Y. Filed Apr. 7, 1894.

522,837. Current-Separator. Louis F. Johnson, Poughkeepsie, N. Y. Filed Apr. 7, 1894.

522,839. Electrolytical Apparatus. Oskar Knöfler, Charlottenburg, Germany. Filed Dec. 7, 1892.

522,844. Trolley-Ear. Charles A. Lieb, New York, N. Y., assignor to the General Electric Company, Boston, Mass. Filed Apr. 12, 1894.

522,845. Trolley-Wheel. Charles A. Lieb, New York, N. Y., assignor to the General Electric Company, Boston, Mass. Filed Apr. 12, 1894.

522,851. Motor Safety Device. Arthur W. K. Peirce, Plymouth, Mass., assignor to the General Electric Company, of New York. Filed Oct. 29, 1892.

522,892. Telautograph. Elisha Gray, Highland Park, Ill. Filed Mar. 8, 1893.

522,893. Telautograph. Elisha Gray, Highland Park, Ill. Filed Jan. 27, 1894.

522,894. Closed Conduit for Electric Railways. Charles I. Greer, Washington, D. C., assignor of one-half to Charles B. Peirce, same place. Filed Apr. 16, 1894.

522,896. Hanger for Electric Lamps. Henry C. Henley, St. Louis, Mo. Filed July 27, 1893.

522,898. Track-Cleaner and Switch-Thrower. Isaac W. Hewitt, Akron, Ohio. Filed Mar. 3, 1894.

522,905. Car-Fender. Lucius Q. C. Lamar, Oxford, Miss. Filed Mar. 31, 1894.

522,914. Street-Railway Switch. William E. Murray, Daniel W. Hatfield and George W. Hatfield, Harrisburg, Pa. Filed Mar. 30, 1894.

522,915. Trolley-Pole. Alexander S. McBean, Montreal, Canada. Filed Apr. 10, 1894.

522,920. Electric Governor. Marcus P. Schenck, Springfield, Mass. Filed Nov. 21, 1893.

522,925. Operator's Telephone-Circuit. Thomas C. Wales, Jr, Boston, Mass., assignor to the American Bell Telephone Company, same place. Filed Dec. 2, 1893.

522,934. Electric Cigar-Lighter. John J. Eberhard and Carl G. Schimkatt, Fremont, Ohio, assignors to the United States Electric Lamp Lighter Company, Detroit, Mich. Filed Sept. 25, 1893.

522,948. Electrical Measuring-Instrument. Edward Weston, Newark, N. J. Filed Oct. 3, 1892.

522,950. Electrical Measuring-Instrument. Edward Weston, Newark, N. J. Filed Feb. 21, 1894.

REISSUES.

11,428. Electric Signaling Apparatus. John P. Coleman, Swissvale, Pa., assignor to the Union Switch and Signal Company, same place. Filed Dec. 5, 1893. Original No. 395,315, dated Jan. 1, 1889.

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ELECTRIC LIGHTING OF RAILWAY TRAINS.

The problem of lighting railway trains by electricity has always possessed a fascination for inventors, and while success up to the present time has been only partial there is no doubt that a complete solution of the problem is only a question time, if it has not already been achieved. We print elsewhere in this issue a paper read at the Detroit Convention of the Railway Telegraph Superintendents last June, which deals with this important subject. It is a valuable paper on account of the figures given, representing the cost of the various systems of electric lighting for train service. As far as we know this is the first time that figures of this kind have been given. Mr. Leonard, the author of this paper, refers in detail to a system of recent invention that seems to have solved the problem of car lighting, and tests have thus far borne out the accuracy of the figures given.

WATER POWER AT WASHINGTON.

The War Department has made its report to the United States Senate concerning the feasibility of using the water power of the Great Falls of the Potomac for the purpose of lighting by electricity public buildings and grounds of the District of Columbia. The conclusion of the report is that electrical power can readily be transmitted from Great Falls to Washington, and that the falls are available at lowest stages of the river, for 6,395 horse-power without storage of water, and 8,648 horse-power with storage, while only 4,408 horse-power are required for present lighting purposes. The total expense for 6,589 lights is given at $203,300; for one light, $52.33.

EVILS OF COMPETITION.

The article entitled "A 'Living Price' in Electrical Engineering," which we reproduce in this issue from an English contemporary, while of English origin, contains a statement of facts that obtain in this country as well as in England. No sane man can see any good to any one in the fierce competition that depresses prices for material and workmanship to a level below that which renders a fair return for first-class work. An individual or a combination of individuals go into business primarily to make money and not for the love of the thing; therefore if a contract is undertaken at a cost below that which should be charged for good and reliable work, either the contractor will lose money, or he avoids the loss of it by substituting inferior goods and workmanship than those called for. In some businesses the infraction of the contract as regards material and workmanship is not likely to be attended with evil results; but it is not so in the electrical trade. Poor workmanship and material in an electric installation means positive danger, and it seems rather strange that those engaged in these dishonest practices do not realize that they are not only injuring themselves, but the trade in general, as well; many honest ones suffer by the dishonesty of a few. The electrical business is, in one sense, a new one, and the people are not yet sufficiently familiar with it to place in it the confidence that it deserves. Under these circumstances a fire or an accident through defective work is not likely to stimulate a feeling of confidence in the public mind; it is rather a positive injury to such growth. The few unprincipled ones who go into business to get rich quickly without regard to consequences should be branded in some way. The cupidity of the average human being unquestionably has a good deal to do with this condition of things, but there is no doubt that a healthier state of affairs would soon be brought about if contractors would maintain fair prices for first-class work. The future of the business should be taken care of as well as the present. Insurance companies would not then shake their heads in doubt, so to speak, when considering an electrical risk, and the business in general would enjoy the reputation which it fully deserves, but which is frequently abused.

THE ELECTRIC LIGHTING OF RAILWAY TRAINS.*

BY M. B. LEONARD.

The question of lighting passenger trains by electricity, though not less than twelve years old and frequently discussed, is still an interesting subject. The superiority of the electric light over the oil lamp or gas burner is so manifest that it is scarcely necessary to point out its freedom from appreciable heat, the absence of all odor, its steadiness and flexibility of distribution, as well as the greater amount of illumination that can be obtained from it, to explain why the leading railroads of this country have adopted the electric light as one of the drawing cards for their finest trains, the expense thereof being a secondary consideration as compared with the advantages of securing the best system of illumination.

Much interest has been taken in the system so successfully developed by Mr. Geo. Gibbs, mechanical engineer of the Chicago, Milwaukee and St. Paul Railway, in which the lamps in the coaches are supplied with current direct, without the intervention of storage batteries, from a 15-K. W. Edison dynamo directly connected to an 18-H. P. Westinghouse automatic engine carried in summer on one end of the baggage cars on two of their through trains, and in the baggage compartment of their combined buffet cars on two others, taking steam from the locomotive and attended to by the baggage master. In winter the equipment is transferred to the special light and heat tenders, which are also fitted up for the purpose of supplying steam heat to the train. Nearly 100 cars have been already equipped with 16-c. p. 110-volt lamps and wired on the equipotential system. The number of lamps per train supplied by the dynamo vary from 130 to 225, and the cars have made nearly 196,000 miles each without a single accident. This system has been giving entire satisfaction, and will doubtless be further extended, though there seems to be one drawback, in that the lighting by the electric current ceases whenever the cars are shifted to or from the train It has been proposed to remedy this by using small storage batteries supplying a few low voltage lamps in each car, with an automatic switch that throws them in circuit when the locomotive, or the light and heat tender is cut off from the train. A novel feature of this system is the fixed berth lamps designed by Mr. Gibbs. They are ornamental in appearance, economical in operation, and much more satisfactory than the flexible cord arrangement heretofore used.

The cost of the equipment and the present expense of operating the system are said to be, figured on a 7 car train:

For baggage car, including engine, dynamo, switchboard and wiring	$1,250.00	
2 coaches at 127.00	254.00	
2 parlor cars at 311.00	622.00	
2 sleeping cars at 245.00	490.00	$2,616.

per train, or per car $374.

For a seven car train, comprising baggage or combined car, 4 coaches, 1 parlor car and 1 sleeper, the average cost of equipment would be about $338 per car.

And the expense of operation per trip of 430 miles is estimated as follows:

Attendance on train (½ wages of 2 men)	$2.62
Supervision	.62
Lamp renewals (2 at 40c)	.80
Oil and waste	.22
Miscellaneous supplies and labor	.20
Interest and depreciation at 10 per cent. on cost of train equipment	.87
Total	$5.33

or, per car per day 88c, per car per hour, 6.3c.

If a ten car train be run, the cost per car hour would be correspondingly less; in fact it is stated that the cost of labor and repairs of four such trains in 1892 were, per month:

For labor $650.00
For material .... 175.86, or $825.86 per month, cost per car per day of 9 hours' lighting 78.6c.

Being for labor	61.9c
" " material	16.7

and per lamp per hour approximately ½ a cent.

The combined dynamo and storage battery system first introduced by the Pullman Palace Car Co , in 1887, does not seem to be meeting with the degree of success anticipated. Many of the roads upon which it has been used are gradually abandoning it, although during January, February, March and April last, the Pullman Co. operated 42 cars in this way, 24 on the Florida special between Jersey City and St. Augustine, and 18 between New York and Chicago on the Penn. R. R., the cost of which is set forth by Mr. A. H. Bauer, chief electrician of the Pullman Co., to have been 6/10c per lamp hour.*

The experience of the Chesapeake and Ohio Railway Company in connection with the storage battery system will doubtless prove interesting to those considering the subject. Discarding the combined dynamo and storage battery system on account of the expense and trouble involved, the management of the company, after a series of tests decided to adopt the type of storage batteries brought out by the Dayton Manufacturing Co., and made in the manner described in the patents issued to W. L. Silvey.

Thirty-three cars are now being lighted on the C. & O. Railway from 76 sets of the Silvey battery, 12 cells to the set, which are charged at the Covington, Ky., plant, built specially for this purpose by the railway company. The batteries are handled between the car and plant on a special form of truck by two men, and sufficiently charged to last for the round trip between Cincinnati and New York The cars are brilliantly lighted and receive no attention whatever during the run. They are fitted with 24-volt lamps as follows: Coaches, 10 lamps; combined cars, 10; express, 8; diners, 18; postal cars, 10; sleepers, 20; baggage cars, 3; in all, 59 cars have been so equipped, but in 26 of them oil is still used, though these cars can be lighted by electricity without any further outlay whatever than the cost of the storage batteries required for this purpose.

A statement recently prepared for General Manager Stevens, shows the cost of lighting the 33 cars by this system during 1893, to have been as follows:

Cost of building in which charging plant is located	$1,800.00
2 dynamos and fixtures	3,401.00
1 70-H. P. engine	806.00
1 boiler and setting	550.00
Wiring station, etc.	58.00
Extra armature	399.50
1 transfer truck	63.00
Total	$7,077.50

Depreciation on plant at 6%	$424.70
Interest " " "	424.70

Cost of equipment of

5 diners	at	$71.30	$ 356 50
4 postal cars	at	69.50	278.00
8 coaches	at	57.60	460.80
8 combined cars	at	37.60	303.20
8 express cars	at	30 40	243.20
33 cars			$1,641.70

* Abstract of a paper read at the annual meeeting of the Association of Railway Telegraph Superintendents, Detroit, Mich., June 14, 1894.

* See ELECTRICAL AGE, June 11, 1892.

Depreciation thereon at 6%	$98.50
Interest	98.50
Cost of 76 sets of Silvey batteries, 12 cells each at $180.00 per set.....$13,680.00	
Interest thereon at 6%	$ 820.80
Total charge per year on capital acct.	$1,867.20
Cost of maintenance per year for labor	$4,677.77
" " " " materials for renewals, etc	4,285.29
Cost of fuel used at plant, averaging 5 lbs. per H. P. hour, 10 hours per day, 365 days, 639 tons at 85 cents, delivered at Covington, Ky.	543.15
Total expense for the year	$11,373.41
Cost per car per year	$344.65
" " month	28.72
" " day avg. 14 hrs. lighting.	94 4/10c.
" " hour of light	06 7/10c.
Averaging the number of lamps per car at 9 3/10 of 16 c.p. each, or a total of 148 8/10 c.p. per car, the cost per lamp per hour appears to be	82/100c.

The motive power department of the Chesapeake and Ohio Railway has gone somewhat further into the matter of the expense of lighting its passenger equipment during 1893, and shows that the cars lighted by the Pintsch gas system on the C. & O. Ry. cost for that period as follows.

Mr. Leonard then gives the figures showing the cost of the gas and oil systems in detail, and makes a comparison **with** the electric system as follows:

Comparing the expense per car per day of 14 hours lighting of the three systems, and basing the illumination per car at 148.8/10 c.p. for this purpose (the exact amount of the electric light equipment) the cost is stated to have been for last year as follows :

Pintsch gas	$1.08 5/10	per car day
Electric light	94 4/10	" "
Oil	55 1/10	" "

The electric light being about 13% less than the gas, but about 70% greater than the oil. The C. & O. Railway Co. has been using the Silvey battery system over two years and the figures given therefore are the results of actual experience, much care having been used to secure their accuracy, though the rate of depreciation is rather small.

The method of taking power from the car axles has been realized to the fullest extent and is, I believe, demonstrated in the system recently brought out by Lieutenant I. N. Lewis, of the U. S. Army, and covered very fully by the patents recently issued to him. In this system are combined a dynamo fixed on the car truck itself and belted to the car axle, with flexible connection charging a storage battery of twelve cells carried under the car, and at the same time, if necessary, supplying current for the lamps in the car. The results of the trials that have been in progress for the past four months on the business car of General Manager Stevens, of the C. & O. Ry., indicate that the problem of cheap electric lighting for passenger trains has been fully and satisfactorily solved by this method of operation.

In the Lewis system, a bipolar dynamo wound for a maximum output of 25 volts and 50 amperes, with one set of carbon brushes in rectangular holders fixed at right angles to the commutator, and always in contact with it, using graphite bearings for the armature shaft, to do away with the need of oil, and iron clad or fitted with a close iron cover protecting commutator, fields and brushes ; is bolted on to the bolster or truck beam, and connected by a raw hide belt 3 inches wide to a 20 inch pulley on the axle, the armature shaft carrying a 7¾ inch pulley. To keep the belt tight on the armature pulley, because of the short distance between centres, a pair of spring idlers is used, consisting of two flanged pulleys 4½ inches in diameter, over which the belt runs, revolving on graphite bearings and held together by a spiral spring on each side with adjustable nuts.

The distinguishing feature of this system is the way in which the dynamo is wound, by which the machine is made self-regulating for all speeds and a constant potential at the battery terminals obtained without employing any of the auxiliary regulating devices heretofore necessary in plants of the English type, in order to obtain constant E. M. F. regardless of the varying speed of the train. This Lieutenant Lewis has accomplished by utilizing the compound principle in the winding of the field coils, the coils being energized with current from the storage battery, and the circuit being open until closed by a ball governor switch on one end of the armature shaft rotating vertically and operating to close the circuit at a predetermined speed, thus preventing waste of the current when the car is standing still. The compound or series coil of the fields, instead of being wound in the usual way to maintain the strength of the field magnetism, is reversed or wound differentially, so that instead of augmenting the field magnetism as the speed of the car rises, thus raising the voltage, it acts precisely in the opposite manner, and demagnetizes or weakens the field as the car speed increases, keeping the voltage down notwithstanding the increased speed, so that the potential does not exceed the maximum of 25 volts, while the current output may rise from 1 to 50 amperes depending on the speed of the car. On the dynamo is a slate block to which all of the dynamo wire terminals are run, and to which is also fitted a movable slate cap with contact points terminating in a flexible cable of wires for the purpose of carrying the current generated by the dynamo, etc., to the storage batteries, lamps, automatic pole changer, and cut-out switch on the car, so that in the event of the car truck having to be moved from the car for any purpose, it is only necessary to turn a single screw to disconnect the movable cap and dynamo terminal block, in order to take out the truck without interfering with the electrical apparatus.

Next to the dynamo the most important features of this system are the pole changer, that automatically insures a current of constant polarity passing into the storage battery or lamps regardless of the direction in which the car is moving, and the cut-out switch that opens automatically the charging circuit between the dynamo and storage battery when the speed of the car falls below a certain limit, and thereby prevents the battery from discharging itself through the dynamo. Another function of this apparatus is to automatically close the charging circuit as soon as the speed of the car is high enough to generate the proper E. M. F. for charging. These two devices are placed side by side in a slate backed box 2½ inches deep, 12 inches long by 10 inches wide, with a glass front permanently fastened, and after being once adjusted no further attention is necessary. This box, to which is connected the flexible cable from the dynamo above referred to, is the only portion of the apparatus placed inside the car, and can be put up, in the toilet room, linen closet or other convenient location. To the bottom of it is attached a porcelain fuse block, and a snap switch by which all the lamps in the car can be turned on or off simultaneously if desired. The battery will furnish about eight hours' lighting when the car is stationary.

(*Continued on page* 50.)

"A LIVING PRICE" IN ELECTRICAL ENGINEERING.*

BY SIDNEY F. WALKER.

While the whole world is resounding with the clamor raised by the working miner and his friends, in their efforts to secure what he considers to be "a living wage," it may not be amiss for electrical engineers to consider the, to them, equally important matter of securing a living price for their work.

Electrical engineering is considered, and with some reason, to be *the* profession of the future. It is the one profession not yet overcrowded, and it will probably be many years before there ceases to be room for those who know their work and like it.

But on the commercial side of the question the outlook is not always so rosy, even in what are termed good times. In fact, it is almost an open question whether so-called bad times are not better for *bonâ fide* electrical engineering businesses, so far as profits are concerned, than good times.

So few firms have yet learnt the important lesson that all electrical engineering businesses are very expensive to conduct successfully; and so the majority of firms compete against each other in the endeavor to secure business that can only involve them in loss.

It ought surely to be an axiom by now, that in any business the only fund from which all expenses, all wages, all interest and all profits are to be paid, is that formed by the profits on business done. In the case of electrical engineering, on installations completed, on sales made. And, if any business is to be successful, the rate of profit must be such, no matter how high it may seem, as will provide for all these items out of the annual turnover. Rents, taxes, gas, electric current, if used, stationery, stamps, telegrams, clerks, all have to be paid for. And you must advertise in some form or other if you are to secure business. It will be of no use dubbing yourself a manufacturer or contractor, and waiting for people to find it out. Not only must you let those you wish to be your clients know of your being established, but you must acquire their confidence. They must have a resonable assurance that you are able to carry out your work before they will place work with you. And when you have arrived at the stage when you may obtain work if your price is favorable, more expense awaits you, in the shape of tenders to be prepared, possibly drawings to be made, etc.

Even when you have secured the work and carried it out your expenses do not cease. In many cases the users are new to the apparatus, and little accidents occur, sometimes little mischiefs, which you will do wisely to make good at your own cost; the expense is less than the loss of business that would be involved if you did not. Even now your expenses are not at an end. Perhaps a friendly rival approaches your customer and makes disparaging remarks on your work. Perhaps he does not make any remark, he only shakes his head or shrugs his shoulders In either case the operation will lead to further expense on your part to remove the impression your friend has created. And even after that your expenses are not at an end. You have to collect the amounts of your several sales or contracts—sometimes an expensive matter—and you have to keep an accurate record of all your transactions; of your sales, of your wages, of your purchases, what your contracts cost you and so on. It will be said, no doubt, and with perfect truth, that all this is common to every engineering business. What the writer wishes to point out is, that while they are supposed to fall more lightly on an electrical engineering business, in practice they fall far more heavily. The very nearness of everything, the elements of uncertainty and of risk, all tend to increase the working expenses.

And the danger of this is so much greater because unseen. Engineers young to business, and those outside of the business entirely, are often unable to see why certain expenses should be incurred; and it is only sharp experience that teaches them, they meanwhile living in a fool's paradise, thinking how very well they are doing, while the older firms they are trying to displace are merely waiting till the inevitable awakening comes.

And so it may well turn out that in order to show an actual profit on the year's trading, your apparent profit may look very large indeed. Your young rival, for instance, who was, perhaps, lately on the staff of some other firm, calls it positively iniquitous; yet it represents to the electrical engineer in business, or to the shareholder in an electrical engineering company, a *living price* as truly, far more truly, than does the sum the working miner is claiming as a living wage. And if this is so, is not the cutting of prices that is so constantly going on, not only foolish but wrong?

Do not directors and managers of electrical engineering companies who sell below this living price, except under dire necessity, betray the trust reposed in them as truly as if they gave their companies' money away? And is not every private firm who do the same similarly guilty to those who are dependent on them, inasmuch as it can only lead to financial disaster?

And yet look at what has been done in the past. To take an instance, when the Edison-Swan Company allowed a discount on their lamps proportional to the sales, and so arranged that both large and small traders could secure a fair profit, what happened? *The consumer was actually offered these lamps at a lower price than the largest buyer could purchase them for.* And today there is the same foolish rush for the honor of supplying goods at less than cost, and yet out of this minus quantity must come all the expenses detailed above.

There are, of course, cases where firms tender for one thing and supply another, but the consideration of business of that kind hardly falls within the scope of this article. It meets its own reward, and usually at no distant date.

But if we look on the other side of the picture and ask who have been the successful firms, it will be found that the firms who have stood as electrical engineering has advanced have been few; but they have all been marked by the same characteristics.

Their work has been the best that the knowledge and experience at the time could produce, and they have usually followed their work, to ensure its success. This is often a source of very considerable expense.

They have kept steadily before them the fact that unless thay secured, in the main, a living price, they could not go on advancing, they could not go on at all, and they have insisted on having their price.

They have been free from all the tricks so common to firms who wish to secure business at any price.

Their motto appears to have been "We cannot afford to lose, and we cannot afford to do bad work."

The writer does not wish to be misunderstood. There are times when it is perfectly legitimate to lower prices; there are times even when prices *must* be lowered, even to a very low margin over cost.

There may be times even when it is not only legitimate, but absolutely necessary to sell under cost. But these times should be rare, they should be the exception, and they should only be allowed under dire necessity.

In conclusion, the writer trusts that none of the readers of this article will imagine that he wishes in any way to put the dial of progress back. It would be impossible

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* *Electrical Review.*—London.

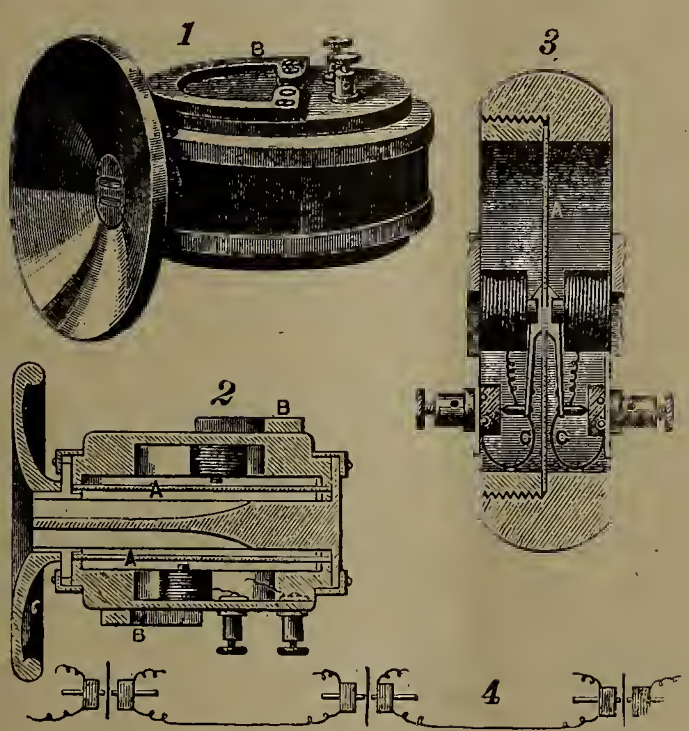
for him to do so. But he trusts also that none of them will imagine that mere cheapness will accelerate the progress of the advance of electricity, or that its advance will be retarded by the insistence upon the receipt of a living price for their work.

Whatever may be the commercial course in the future, whether marked by the unhealthy signs that have been so manifest in the past, or by the stronger, safer, and more manly status involved in a living price, the advance of electricity must, and will go on, like the advance of civilization itself, crushing out of existence all that opposes its progress, and crushing first the weaklings who are afraid to stand by and guide it.

NOREIGA'S NEW TELEPHONE.

The recent expiration of important telephone patents has greatly stimulated invention in telephony. The accompanying illustrations show some improvements in telephones recently patented in Mexico, by Eloy Noreiga, a well-known electrical inventor. He claims that these improvements produce marked results.

The following description of the apparatus is given in



NOREIGA'S TELEPHONF.

the *Scientific American*, from which paper our illustrations are also taken.

The double receiver, shown in perspective in Fig. 1 and in section in Fig. 2, is sensitive to weak impulses and gives excellent results with the normal volume of sound and current at the transmitting end of the line

This instrument has a cell or casing provided with two separate chambers containing diaphragms. The two chambers terminate in an ear piece. Each diaphragm is in the field of a polarized magnet attached to the side of the casing, and the bobbins of the two magnets are connected with the telephone line.

In Fig. 3 is shown in section a double telephone, in which two polarized electro-magnets are supported on opposite sides of the iron diaphragm. The diaphragm carries two arms of insulating material, one on either side, each provided with a metallic electrode at its free end, which rests on a contact block attached to the binding post. The metallic electrodes are connected with the bobbins, and the arms which support them are connected with delicate curved springs extending to the blocks attached to the binding posts

This instrument may be used for receiving from separate lines, also for transmitting to two circuits. It may also be arranged for use as a repeater, for repeating from one line to another, as indicated in Fig. 5.

The magnets used in these instruments are made from a new alloy of iron and tungsten, which is more efficient than iron or steel. The inventor claims the efficiency of these magnets ten times greater than that of the ordinary steel magnet.

ELECTRICITY IN THE ATMOSPHERE.

BY MEYER BLOOMFIELD.

Among the many relations of electricity to the phenomena of nature, none are so beautiful or as interesting as the various electrical phenomena of the atmosphere. Indeed, it would be difficult to name any atmospheric change which is not in some manner due to the agency of electricity, for the atmosphere is always more or less pervaded by electricity, which produces some wonderful results, among the most familiar being lightning, the aurora, and St. Elmo's fire.

The first noteworthy observation on this subject was made by Franklin, who in 1752 established the identity of lightning by means familiar to everyone. This discovery was very important, inasmuch as it led to the invention of the lightning rod, which now protects tall buildings and ships against the destructive effects of lightning. The investigations following Franklin's discovery brought out the following interesting facts: Atmospheric electricity is generally positive, but sometimes changes to negative on the approach of clouds; it exists in greater quantities in the higher regions of the atmosphere than near the earth's surface; it is greater in still air than in air in motion; it undergoes marked variations in its intensity at certain periods and localities. These facts have greatly aided in explaining the causes of the many atmospheric changes.

Lightning being the first important discovery in this direction, we shall begin with it. The lightning flash is caused by a disruptive discharge occurring between a charged cloud and the earth, or between neighboring clouds whenever the difference of potential is sufficiently great. The resulting thunder is caused by the discharge through the air producing a vacuum, which is suddenly and loudly filled by air again.

There are five varieties of lightning; forked lightning in form is really a series of short curves, as instantaneous photographs of the flash show; sheet lightning, probably caused by simultaneous discharges magnified in appearance by reflection, appears as an expanded flash which illumines the surrounding sky; heat lightning or lightning without thunder, is often seen near the horizon during clear, hot weather, and is probably a reflection of the light from a lightning discharge too far below the horizon to permit the thunder to be heard; volcanic lightning is observed around the craters of volcanoes during their eruption; the rare globular lightning either remains stationary in the air during its duration or moves slowly through it.

St. Elmo's fire, a very beautiful sight, is the tongues of faintly luminous fire sometimes seen on dark nights at the pointed ends of earth connected bodies, such, for example, as the tops of church steeples or the masts of ships. It is caused by convective discharge from the points.

The Aurora Borealis, or northern lights, is the most beautiful electrical phenomena in nature, and therefore deserves a detailed description.

During the winter of the northern hemisphere the inhabitants are without the light of the sun for months, but their long, dreary night is relieved by the presence of this beautiful light, which occurs with great frequency in these regions. Its appearance has been described by many observers, and is briefly as follows: A dingy aspect of the sky in the direction of the North is generally the precursor of the aurora; and this gradually becomes darker in color and assumes the form of a segment surrounded by a faintly luminous arch, which rests on each end of the horizon. This "dark segment" has the appearance of a thick cloud, and is frequently seen as such in the fading twilight before the development of the auroral light. Its density, however, is not very great, for stars are sometimes seen through it. At one end of the segment a ray of light appears which rapidly mounts its way up the segment to the zenith with alternative brightness and dimness. Other rays begin to dart forth at various points until the aurora attains its full brilliancy and activity, rays projecting from every part of the arch, thus appearing like a huge wheel with numerous projecting, illuminated, teeth-like spokes. The rays assume various colors, sometimes a green, a purple, a red, or a rose color, giving the whole a brilliant effect. The heaven from North to East and West now appears like a vast cupola of fire, supported by many columns of colored lights, which contrasting with the surrounding semi-darkness is one of the most magnificent sights in the world.

Though the exact cause of the aurora is unknown, the following observations tend to confirm the assertion that the aurora is of an electrical nature. During the prevalence of the aurora the air contains such an unusual amount of free electricity that long lines of telegraph have been operated by the electricity taken from the air; earth currents due to the potential difference in various parts of the earth are produced, which cause considerable trouble to telegraphers; and magnetic storms frequently arise at such times and cause the magnetism of the earth to undergo considerable variations. Whatever its cause may be, an appearance similar to the aurora can be reproduced by the passage of an electrical discharge through a "Geissler tube," which consists of a vacuous tube of glass provided with platinum electrodes passed through and fused into the glass, then passing the discharge of a frictional machine or an induction coil; through it the luminous effect is obtained.

Auroras frequently accompany those strange outbursts on the sun called sun-spots. Auroras have also been observed in the Southern hemisphere.

So it is evident that besides its invaluable function upon earth, electricity plays an important part in the manifestations of nature. The writer still believes the assertions he made a year ago, that "It will yet be found that electricity is the cause, directly or indirectly, of all the manifestations of nature."

THE ELECTRICAL CONDUCTIVITY OF GASES.—In some recent researches by F. Braun on the electrical conductivity of gases, which are described in the *Zeitschrift für Physikalische Chemie*, several interesting cases were investigated. These may be divided into three heads, and the results of the observations were substantially as follows:—(1) *Compound gases at the moment of formation.* The gases studied were mixtures of nitric oxide and air, and of chlorine and hydrogen; these were caused to unite under the influence of heat or diffused daylight. A Leyden jar battery of about 4,000 volts E. M. F. was employed, but no conduction was observed. (2) *Gases during the time of explosion* A mixture of carbon monoxide and oxygen was employed, and the current used was obtained from 7 to 20 small Grove cells. In this case there appeared to be undoubted conduction through the exploding gases. (3) *Gases at high temperatures.* The gases were heated to 1,000°—1,200° C., and the current used was obtained from a Leclanché cell. It was found that ammonium chloride and cadmium iodide conducted well; that ammonia, iodine and hydrogen chloride conducted; that hydrogen iodide, hydrogen bromide and mercuric oxide conducted slightly; but that carbon dioxide, steam and nitric peroxide, did not appear to conduct at all.

STREET RAILWAY NEWS.

EXPERIENCE WITH THE T RAIL IN SEVERAL CITIES.*

A special committee, appointed by the common council of Saginaw, Mich., to investigate in other cities the use of the T rail for street railroad tracks in paved streets, after investigating and examining the matter in Port Huron, Detroit, Toledo, Columbus, Springfield and Chicago, has submitted the following report:

PORT HURON.—In this city all street-car tracks are laid with a forty-five pound T rail, ordinary railroad section, laid on a 5 x 5 inch longitudinal pine stringer; this laid on ties spaced three feet from centre to centre. The space on the outside of the rail, between the rail head and flange, is filled with a 2 x 2 inch pine strip, and the pavement laid against it, and the top flush with the top of the rail. On the inner side of the rail the space is filled with a 2 x 2 inch oak strip, laid about one inch below the top of the rail, and the pavement laid against it, and crowning to the centre between rails to the top of rails.

When the track was laid in the new pavements, and in conjunction with the laying of the pavements, the pavement is in good condition, and the T rails offer no obstruction to the free use of vehicles of that part of the street occupied by railroad tracks. Where the tracks were laid in the old pavements the pavement between the tracks is rough and rutted along the rail, so that in many places it is dangerous to turn out of the track when driving upon it, though it offers no more obstruction on crossing the track than in crossing many other parts of the same part of the street. The tracks are in good condition for a rapid transit street railway system.

DETROIT.—Prior to 1892 all street car tracks were laid with the flat top rail, either of girder or strap section (the top of rail about the same as in use in this city). May 27, 1892, the following ordinance was passed and adopted:

Section 1. It is hereby ordained by the people of the city of Detroit, that whenever any street railway track shall hereafter be constructed or reconstructed on any paved street, or on any street then being paved or repaved, the same shall be laid with girder-grooved rails. Said rails shall not be of less that 77½ pounds weight to the lineal yard, and of improved pattern and style, with groove on inner side of the rail, the upper surface of the inner head of the rail to be not more than one-quarter of an inch below the upper surface of the outer head of the rail.

All work shall be done under the supervision of the board of public works.

Under this ordinance the 77½ pound grooved rail has been laid in parts of Woodward avenue, Gratiot avenue, Michigan avenue and Champlain street, in conjunction with the paving of those streets and avenues with asphalt, brick, granite and cedar block pavements, with

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* *Paving and Municipal Engineering*, July, 1894.

no special care to fit the pavement close against the web of the rail.

The pavement is laid close against the head or tread of the rail, and the space against the web filled with cement grouting.

The rail is six and one-fourth inches high and four-inch base laid on a tie plate spiked to white oak ties, laid about three feet from centre to centre, and the rail is connected every eight feet with cross rods 1 x 1½ inches in size, to preserve the gauge of the track, which is very important with this section of rail.

This section seemed to offer but very little obstruction to the use of the street for vehicles.

TOLEDO.—All the rails used in this city for street car lines are the common flat top rail with a tram of one and a half inches in width, and the pavement is generally laid level with the top of the rail, which forms a groove on the tram of the rail one and a half inches wide and one inch deep, which makes it very objectionable for public travel.

COLUMBUS.—All the street car tracks in this city are laid with the flat top rail with narrow tram, except a short piece of groove girder rail, just laid in repairing the track on one of the principal streets. This section is about the same shaped groove and top as the Detroit section, and is nine inches high and weighs ninety pounds per yard. The flat top rail generally in use is a girder section weighing forty-six pounds to the yard, laid on chairs to elevate the rail above the pavement foundation, but this section is found to be too light to stand up under electric motor cars, and is being replaced by a seventy-pound rail of the same section except it is six and one-fourth inches deep. An ordinance has recently been passed by the council of the city granting a suburban electric line the right of way through the paved streets of the city, and the board of public works and city engineer have given permission to use a T rail, the space on the outside of the rails to be paved closely with paving brick.

SPRINGFIELD, O.—All the street car lines in this city are laid with the T rail section, except a few blocks of the old flat rail originally constructed for horse-car lines. Most of the rails used are the ordinary railroad T rail section, weighing fifty pounds to the yard. One street, which is now being paved, and a street car track being laid in it, is being laid with the electric welded T rail known as the Johnson street railway T rail, weighing sixty-two pounds to the yard.

The T rail tracks laid in this city are laid in paved and dirt streets. When laid in brick pavements the bricks are laid close to the head of the rail on the outside of the track level with the top of the rail and between the rail one-half inch below the top of the rail and crown to the centre of the track, level with the top of the rail. On dirt and gravel streets the space between the rails and along the outside of rails is filled with dirt and gravel same as rest of the street. There is no planking or paving between the rails on unimproved streets.

All the T rail tracks in this city are in good condition both for the street car company and the public using the streets, and the T rail where laid in brick pavement offer as little obstruction to the use of the public to drive upon or across as any section of rail in use.

CHICAGO.—All the street car tracks in this city are laid with the girder rail five to six inches high, with a three-inch wheel tram. This width of wheel tram is specified by the commissioner of board of public works for all street car tracks.

This width of tram is adopted to prevent the wheels of heavy loaded wagons from cutting a rut along the inside of the rail. The street car tracks are used for driving upon the same as any other part of the street, as the streets are generally crowded from curb to curb with buggies, wagons, carts and street cars, so the paved portion of the street is all occupied, so it is necessary that the street car tracks be constructed like tram roads as well as for street cars.

"One thing which was forcibly brought to the attention of your committee is that, if the public have rapid transit which they so much demand and should have, that teamsters driving with loaded wagons and other vehicles cannot have the free use of the street car tracks for a roadway, only to the detriment and impediment of the street car service; and when the streets are paved as wide as they are in this city, the sooner the public driving carriages and wagons and vehicles of all kinds are educated to understand that they have no business driving in the street car tracks, except to cross them, the sooner we will have rapid transit, better and more reliable street car service, better and smoother street car tracks to ride over.

"In the judgment of your committee there are only two sections of rails that should be permitted to be laid in our wide paved streets, and these are the street railway T rail, and the full groove or English groove-girder rail. Either of these sections can be used, we believe, with perfect safety to the public using the street, and if properly laid will make a good street car track.

"If the street railway T rail is used it should be not less than sixty pounds to seventy pounds per yard and 5¾ inches high with the paving brick or blocks shaped to fit close to the web of the rail and half an inch below the top of the rail on the inside, and level with the top of the rail on the outside.

"If the grooved rail is used it should weigh not less than seventy to eighty pounds per yard, and the paving fitted close around the head and web of the rail.

"While a lighter section of rail than these mentioned may be amply strong for the motor cars now in use, it is only a question of a short time when the lighter sections will be found inadequate in strength to carry the heavy motor cars and loads placed upon them. As the tendency is to use larger, heavier and stronger cars, which will carry heavier loads, and this increased rolling load will at the same time demand a heavier rail and more permanent track to sustain the weight placed upon it, it is necessary at this time to provide a rail section that will be ample in strength and rigidity, not only for the present but for the future, to prevent the destruction and waste to both the street pavements and the tracks of the street car company, in renewing its tracks."

OBJECTS TO BEING TAXED.

The Board of Assessors in Brooklyn has placed a personal assessment of $4,000,000 on the Brooklyn City Railroad Company, but the company objects to any personal tax whatever. In a statement read before the Board the aggregate value of the company's property is placed at $12,169,343, and the company claims that it is entitled to certain reductions which would wipe out the personal tax altogether. President Lewis states that the company's property has depreciated in value during the past year to the amount of $4,000,000. The gross earnings during the same period were $4,200,000.

Last year the Brooklyn Traction Company objected to the payment of taxes on the $1,015,500 assessed valuation of its property and brought suit in the Supreme Court to sustain the claim that it had no real or personal property subject to taxation. Gen. Tracy, counsel for the company, contended that the capital stock of the company was invested in the shares of the Atlantic Avenue Company, which had been already taxed. Justice Gaynor has decided in favor of the company. He says:

"All lands and personal property, whether owned by corporations or individuals, are alike liable to taxation. The property of a corporation is called its capital. It is not the paper certificate of shares of capital in a corporation that are taxed. The actual property, not the paper certificates representing it, is what is taxed. To tax the property, and then the paper certificates representing it, would be taxing the same property twice.

"The relator, the Brooklyn Traction Company, is the owner of shares of stock in the Atlantic Avenue Railroad Company. It may no more be taxed upon said shares than may any other owner of shares in the said company be taxed upon his shares. This is obvious; but nevertheless the Legislature in a spirit which, except for the occurrence of this case, would have to be deemed needless caution, has commanded assessors in the marshalling of the assets of corporations for taxation to exclude or deduct all shares of stock owned by them in corporations whose capital is taxable."

CAPO-FARAD BATTERY CELL.

The Nassau Electrical Company, 106 Liberty street, New York city, is to the front with a new arrangement of its chloride of silver cell, named by Mr. Jas. J. Pearson (who got it up) the "Capo-Farad." As most of our readers are aware the mechanical and chemical difficulties in making a reliable miniature cell, combining high E. M. F. with lasting qualities and immunity from damage under rough usage, are by no means easy to overcome. In the Capo-Farad, however, Mr. Pearson claims to have fully met them, resulting in a

SMALLEST BATTERY MADE.

cell with an E. M. F. of 1.10 volts with a current of 2 amperes, contained in a shell 11/16 inches in diameter by 2¾ inches long, and of less than one ounce in weight. These diminutive cells will work in any position, and it is stated they can be driven, as a gunshot, through a 1-inch pineboard without injuring the cell in any way. Such a cell seems to have reached the minimum of size and weight consistent with reliability and general use.

The elements are chloride of silver and zinc, the latter being the containing case or shell itself, which permits one contact to be taken from any part of its surface The thickness of the shell is sufficiently in excess of the battery's requirements to preclude the possibility of "holing" or leakage. It has all the advantages of a wet cell without being wet, for it is securely plug sealed, an arrangement which gives the freedom from trouble and attention hitherto supposed to be confined to the dry cell only, while the fluid excitant lowers the internal resistance and gives the battery the certainty and rapidity in action of the best class of wet cell. To such of our readers who want a reliable battery of light weight and small dimensions, the Capo-Farad is commended.

The Theoretical Value of the Ohm —In a note of M. A. Leduc, presented to the Académie des Sciences, the writer states that the theoretical value of the ohm to be that of a column of mercury 106.32 cm. long and 1 mm. square section at 0° C. He arrives at this result from an examination of a determination by M. Wuilleumier, which gives the length as 106.267. This latter dimension M. Leduc points out is due to an error which, when corrected, gives the higher value, which is one closely in accord with that of Rayleigh, Kohlrausch, Rowland, Mascart and others.

(*Continued from page* 45.)

A brief description of the method by which current of the same polarity is always delivered to the battery, regardless of the reversals of direction in which the car is moving, will doubtless be of interest.

Imagine two V-shaped strips of brass placed opposite but not in contact with each other, their points extending outwards, with another strip of brass above and one below the opening so formed; to these latter strips the charging wires from the armature are respectively connected; to the former or V-shaped strips are respectively attached the positive and negative wires of the battery. Pivoted in the centre of the diamond shape thus formed, is a vertical lever fitted with contact brushes, that will engage the top strip and right hand side strip, and at the same time the lower strip and the opposite side strip; actuating the vertical lever is an electro-magnet firmly secured thereto, and connected by flexible wires to the armature leads; this electro-magnet is so arranged as to play between two other electro-magnets, the polarities of which are so adjusted that their poles, presented to the poles of the vertical lever electro-magnet, will be of the same sign, thereby causing repulsion on one side and attraction on the other side of the lever magnet, thus connecting the right hand strip and the left hand strip with the bottom strip, or vice versa.

Assuming that the positive current is flowing from the armature to the top strip, a contact of this strip with the right hand strip will send the positive current into the battery, from which it returns through the left hand strip, and the bottom strip to the negative lead of the armature. Reversing the motion of the car, what happens? The top strip, previously the positive lead, now becomes the negative, and the bottom strip is now the positive lead; as the armature revolves in the opposite direction the lever is thrown over engaging the top strip with the left hand strip, and the bottom strip with the right hand strip; the positive current flows through the right hand strip just as before, to the battery and back to the left hand strip, thence to the negative lead of the armature; thus whether the car moves backward or forward the right hand strip always conveys the positive current to the batteries and the left hand strip is the medium by which the circuit is established with the armature. Thus the battery is always charged with the same polarity by this beautiful and simple device, which is unfailing in its operation.

The cut-out switch may be illustrated by a short vertical lever pivoted in the centre, carrying spring contact points at one end that, on operating the lever, close the charging circuit of the batteries, which is normally open. On the other end of the lever is fixed a small electro-magnet, its terminals in circuit between the armature leads. Opposite this end of the lever a large electro-magnet is permanently fixed and connected in series with the charging circuit. As the dynamo builds up or increases its output, the core of the lever magnet will be strongly polarized, and as the core of the fixed magnet is of the opposite polarity, the attraction between the two cores becomes so strong as eventually to pull over the lever, and close, by means of the spring contact points upon it, the charging circuit of the batteries, the lever being held firmly in this position. The point at which this is done is determined by a suitable retractile spring with lock nuts. Should the current be reversed in the large magnet, through the fall of voltage in the dynamo by the car slowing down and the consequent discharge of the battery back through the switch, then there will be an actual repulsion between the cores of the two magnets, and the switch will be forcibly thrown back, opening the charging circuit and thus automatically preventing the discharge of the storage battery through the dynamo.

(*To be continued.*)

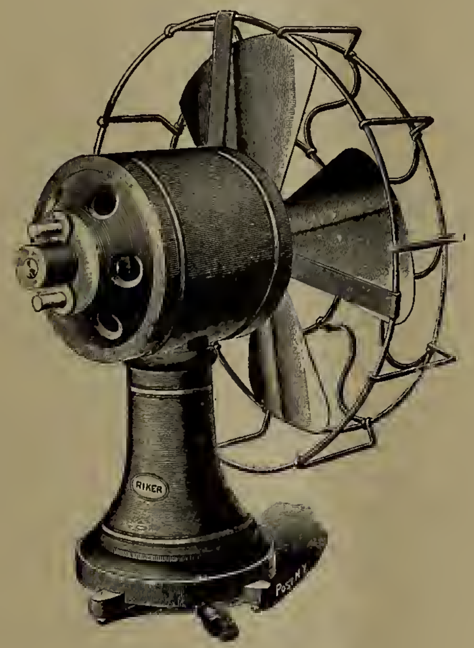
RIKER NEW FAN MOTOR.

The Riker Electric Motor Co., of 45–47 York street, Brooklyn, N. Y., has just put upon the market a fan motor which has some noteworthy features.

This outfit is extremely compact and well built. The fan has four blades and is 12 inches in diameter, revolving at four speeds. The various speeds are obtained by means of a controlling switch placed at the bottom of the motor base, and the range of the same is from 1,100 to 1,800 revolutions per minute.

The entire mechanism of the motor is enclosed in a cylindrical malleable iron casting, which also serves as a protection against mechanical injury, the commutator, as well as the armature and field coils, being thus protected. The brushes are self-adjusting, and self-oiling bearings are provided.

This outfit is well-made and efficient, which are characteristic features of all the electric machinery produced by the Riker Company. From the fact that a large number of advance orders have been received for these outfits, it is evident that the machine is destined to meet with a large market.



RIKER NEW FAN MOTOR

The price for the outfit is very reasonable, and there can be little excuse for not keeping cool indoors when a fan can be obtained at so low a cost.

CORRESPONDENT'S COLUMN.

Correspondence from practical men upon topics or interest relating to electricity or kindred subjects, will find a place in this department; our readers are invited to avail themselves of this department when desirous of seeking of imparting information.

Names and addresses must accompany all letters. This is for our own information and not for publication.

The editor, while not holding himself responsible for the opinions expressed, will gladly put the letters in proper shape if necessary.

Address all communications for this column to the Correspondence Editor," Electrical Age, *World Building, N. Y.*

(11) "Moscowitz" writes:—I made a pair of receivers of the Bell telephone pattern, and when I tried them I found that the sounds were low and indistinct. Will you kindly tell me the cause of this? *A.* You may have placed the diaphragm at too great a distance from the pole of the magnet, or you may have used a weak magnet, or your wire may be short-circuited, or perhaps you have not sufficient length of wire on your spools.

(12) L. D. asks:—What is the E. M. F. of a nickel-plating dynamo of 40 gallons' capacity. *A.* Seven or eight volts.

(13) B. Casey asks:—What is the rule to know the charging time of a given accumulator? I have an accumulator for medical use composed of four separate accumulators to be charged, connected in parallel with two Bunsen 20 cells for eight hours. I would like to know how many hours it will take to charge them with four telegraph cells? *A.* Charge your batteries until the positive plates look like wet slate, nearly black; when partly discharged they become dark red, chocolate or plum color. Four gravity cells to each cell of storage battery will charge storage cells in about the same time, seven or eight hours.

(14) O. I. F. asks:—What is the cause of reversed currents in plating dynamos. *A.* The secondary current from the plating vat.

RECEIVER FOR THE WARING CO.

At a meeting of the stockholders of the Waring Electric Co., of Manchester, Conn., it was voted to wind up the business affairs of the company. The statement presented at the meeting showed that the liabilities of the concern exceeded the assets. Application was made for a receiver by some of the shareholders in the minority, and Mr. C. T. Welles, of Manchester, Conn., was appointed. Among the claims against the company is one of Claflin & Kimball for $8,000 for alleged defective lamps, and the Mather Electric Company placed an attachment on the Waring Co.'s plant for rent.

In January last the Edison Company obtained an injunction against the Waring Company, since which time no business has been done by the latter concern. The majority of the stock is said to be controlled by Claflin & Kimball, of Boston.

PERSONAL.

M. Horatio A. Foster, the well-known electrical engineer, has assumed the editorship of *Electric Power* of this city. Mr. Foster, in addition to his editorial duties, still represents in this country Prof. George Forbes, of England, who is engaged in the development of the Niagara Falls power project.

A New Telephone System.—Señor R. Roderiguez Marino has devised a system of telephony in which the subscribers do not have batteries, and this has been laid by him before the Madrid Telegraph Department. He points out that the old system presents inconveniences, and that it would be better to have all the batteries at the exchange, where they could be easily controlled. Instead of sending the current from the battery through the microphone and the primary wire of an induction coil, while the telephone is connected with the secondary wire of this coil and the line, he connects the line conductors with the microphones and the primary wires of the induction coils, while the telephone is only connected with the secondary wire of the coil. The return takes place under the same conditions as before. The battery from which the microphone is worked can be placed at any part of the line, and it can therefore be placed in the exchange.—*London Electrician.*

Lord Kelvin Honored.—Lord Kelvin has been awarded the Grand Médaille of the Société d'Encouragement pour l'Industrie Nationale of Paris, for his scientific work.

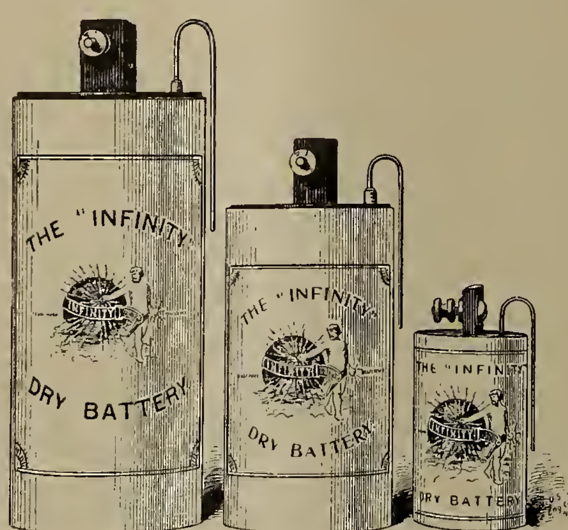
A NEW DRY BATTERY.

The "Infinity" Dry Battery, which has recently been put upon the market, is said to be the acme of perfection in dry batteries.

A reliable and durable dry battery is something that has been looked forward to for a long time, and if the "Infinity" is all that is claimed for it, it certainly is just what is wanted.

It is said to be the best dry battery yet produced, and the only one capable of doing the severe work required in telephony, railroad signaling, electrically ignited gas engines, dental and surgical incandescent lamps, dental and phonographic motors, etc., etc.

For ordinary electric bell and gas lighting work it is said that this battery will last for years. It has the advantage of being absolutely dry, and can be frozen or heated without detriment to its life or operation. Neither does it deteriorate by standing, that is, there is no consumption of materials when on open circuit.



INFINITY DRY BATTERY.

The cells are hermetically sealed in glass jars, which greatly enhance the insulation, and they are guaranteed to give entire satisfaction. They are enclosed in a cell of heavy cardboard.

They are made in three sizes, the E. M. F. of each being 1.45 volts; the internal resistance varying from .32 to .53 ohms.

The "Infinity" Dry Battery is made by the Infinity Manufacturing Co., 128 West 33d street, New York city.

THE INCANDESCENT LAMP.

How delicate is the work in making an incandescent lamp. A description of the process is intensely interesting, and J. E. Randall's little book, entitled "Practical Treatise on the Incandescent Lamp," tells all about it from Alpha to Omega. Price 50 cents. Address Electrical Age, New York.

A NEW COMMUTATOR LUBRICATING COMPOUND.

The Knott Manufacturing Co., of 796 Seventh avenue, New York city, has placed upon the market a commutator lubricating compound that is meeting with much success. It is compounded upon entirely new principles and overcomes the objections to the majority of similar articles now sold, as it is made up only of vegetable substances, and is guaranteed to contain no vaseline, paraffine, beeswax or glycerine. It can be applied to all descriptions of electric motors and has proven a great economizer of brushes and commutators. It has been highly endorsed by the Thomson-Houston Electric Co., Mt. Morris Electric Light Co., Edison Co., 53d street station and the principal electric plants in New York. It should commend itself to all central stations, trolley roads and dynamo engineers.

NEW YORK NOTES.

Office of the Electrical Age,
World Building, New York,
July 23, 1894.

The Harrison International Telephone Co., 44 and 46 Wall street, New York city, in a circular announces the removal to Chicago of its construction department, organized as the Harrison International Telephone Construction Co. The Chicago headquarters of this branch of the concern are in the Chamber of Commerce Building. The company announces in the same circular that on August 1 next it will commence to book orders for the Ford automatic switchboard.

The George L. Colgate Company, 136 Liberty street, city, recently secured the agency for the Linton and Southwick switches for electric light, electric railway and electric power work. They are made in capacities from 25 amperes up—"to a million amperes, if necessary," as Mr. Colgate remarked—for switchboard use. This concern carries a stock of Infinity dry batteries and is doing an excellent business in the same. It is said that two cells of this battery ran a small electric fan outfit for nearly a week, and after they were allowed to recuperate they were apparently as good as ever.

Messrs. Tanner and Harris last week formed a copartnership and have opened offices at Room 528, No. 136 Liberty street, city. They will undertake electrical and mechanical engineering work in all its branches, including the installation of generators, motors and all kinds of electrical apparatus. They will also engage in general electrical work. Mr. Harris has had several years' experience in this business and has the highest testimonials for his engineering skill. The firm has recently closed contracts for the installation of a number of ceiling fans with motors; also for the installation of an isolated electric light plant.

In the early days of the electrical business, Centre street was the focal point, and while in late years it has not figured especially in electrical activity, it seems to be again assuming its old-time prominence. The original electrical supply house and manufacturing company was located on this street 30 years ago. Our old friend V. Prentiss, the electrical instrument maker is back, at No. 206; Charles Bogue is at the same number, manufacturing electric light and railway apparatus; Mr. Denison, of Telautograph fame, is at No. 143 making special electrical machines; Wirshong still holds the fort at Duane and Centre streets, and is making all kinds of electrical apparatus, and the Colwell Lead Co., No. 63 Centre street, continues to produce large quantities of sheet lead for storage batteries. The Mutual Electrical Construction Co., 143 Centre street, electrical engineers and general machinists, deal in dynamos and motors; C. R. Nething has his place on Centre street, where he makes electrical instruments and does experimental work, and the Everlasting Dry Battery Co. is located at the corner of Centre and White streets. The latter concern makes a dry battery which is claimed to be everlasting. Besides the houses mentioned there are many others on Centre street, which bears out the assumption that this thoroughfare still has some attractions for electrical enterprise. W. T. H.

POSSIBLE CONTRACTS.

Wm. Moore, the City Clerk of Spokane, Washington, will give facts concerning the furnishing of the city with electric street lights.

A. Zucker, 33 Union Square, New York city, is in the market for an electric light and bell plant.

Wm. S. Kaufman, Richmond, Ind., is going to purchase an electric light outfit, bells, etc.

The Keyser Electric Light Co., Keyser, W. Va., is in the market for the equipment necessary for an electric light plant in that place.

The Great Kanawha Water Power, Electrical Manufacturing and Land Co., Charleston, W. Va., invites estimates on an electrical plant for the utilization of the power of the Great Kanawha Falls. The company has just been organized with that object in view.

The City Clerk of Danville, Ky., can give information regarding a new telephone system to be organized there.

An electric light plant is to be established at Scotland Neck, N. C. Address S. F. Dunn for further particulars.

The Bel Air Telephone Company, Bel Air, Md., is in the market for material and apparatus for a new exchange to be established. Mr. Henry Hines is manager of the company.

The Salisbury Telephone Co., Salisbury, N. C., has been organized by J. A. Brown and E. B. Neave, and a telephone line will be constructed.

The City Clerk of Richmond, Va., can give information regarding the appropriation of $100,000 for an electric light plant.

Bracey Bros. and the McNeir Co., of Chicago, have been awarded a contract for the erection of an electric light plant in Winchester, Tenn.

NEW CORPORATIONS.

The Nascent Extraction Metal Co., Denver, Col., extracting metals from earth by electricity, etc. Capital stock, $100,000.

Murphy Power Co., Chicago, Ill., manufacturing electricity, light, heat and power. Capital stock, $3,000.

The Pneumatic Fire Alarm Telegraph Co., of New York, Jersey City, N. J. Capital stock, $250,000.

Citizens' Telephone Exchange Co., Jersey City, N. J. Capital stock, $150,000.

The North and South Electric Railway, Yonkers, N. Y. Capital stock, $50,000. Incorporators: Delavan Baldwin, S. T. Hubbard, John C. Shotts and T. H. Silkman, of Yonkers, and others.

Brooklyn Gas and Electric Co., Brooklyn, N. Y., manufacturing gas and electricity. Capital stock, 10,000.

The Mansfield Telephone & Message Co., Mansfield, Ohio. Capital stock, $30,000.

The Defiance Light and Railway Co., Defiance, O., supplying gas and electricity, operating electric street railroads. Capital stock, $100,000.

The Stanstead Electric Light Co., Montreal, Can., by Henry M. D., Chas. A., and F. E. Lovell and others, for the purpose of furnishing electric light and power for streets and private residences. Capital stock, $25,000.

The Traction Construction Co., Denver, Col., constructing railways, etc. Capital stock, $50,000.

United Electric Corporation, Minneapolis, Minn., manufacturing electrical apparatus, operating electric lighting, street railway and power plants. Capital stock, $10,000.

Duluth-Superior Traction Co., Elizabeth, N. J., operating street railways, etc. Capital stock, $2,000,000.

The People's Gas & Electric Light Co., Saratoga Springs, N. Y. Capital stock, $75,000.

The Delaware Valley Electric Railway Co., Philadelphia, Pa. Capital stock, $1,000,000.

The Elizabethtown Electric Light Co., Elizabethtown, Pa., by Jacob G. Stauffer, D. Z. Whitmer, J. C. Redsecker, Simon S. Nissley and Martin G. Kelly. Capital stock, $10,000.

The Toledo Consolidated Electric Co., Toledo, O., supplying electric light and power. Capital stock, $100,000.

New Athens Electric Light & Power Co., New Athens, Ill., by Paul Lehman and others. Capital stock, $4,500.

Montgomery Electric Light & Power Co., Montgomery, Ill., by Lysander Hord, Jr., John G. Habermeyer and Wm. C. Weise. Capital stock, $10,000.

The Keyser Electric Light Co., Keyser, W. Va., by J. H. Vernon, F. P. Whitmer, P. V. Davis and others. Capital stock, $50,000. An electric light plant will be erected.

The Great Kanawha Water Power, Electrical Manufacturing & Land Co., Charleston, W. Va., by Oliver A. Patten, W. W. Tompkins, W. D. Scott, M. Levi, and T. F. Schneider of Charleston, Charles M. Reed of Baltimore, and Alex. McClentick of Lexington, Ky. Authorized capital stock, $2,000,000.

DOT YOUR I'S AND CROSS YOUR T'S.

The Patent-Office authorities have given notice that in the printing of claims of applications for patents, the punctuation of the claims as made by applicants be strictly followed, and that the punctuation of the specification made by applicants be not departed from except to cure a manifest absurdity.

HOW INDUCTION COILS ARE MADE.

There is no more important piece of apparatus needed for experimental work in electricity than an induction coil, and it is well to know how to make one. Send 50 cents to the ELECTRICAL AGE, New York, for a copy of "How to Make and Use Induction Coils," by Dyer.

CATALOGUE OF ELECTRICAL BOOKS.

The following is a catalogue of books on every electrical subject, complete to date. It is classified according to subjects, which arrangement will facilitate the finding of a book on any particular subject, without having to go through a long list, and then, as is often the case, give it up in disgust.

Preserve this list!

ACCUMULATORS AND PRIMARY BATTERIES.

Gladstone & Tribe's Chemistry of Planté & Faure's Secondary Batteries $1 00
Niblett's, J. T., Portative Electricity, 234 pages, 90 illustrations 1 00
Planté's Storage of Electrical Energy 4 00
Reynier's The Electric Accumulator 3 00
Salomon's Complete Handbook on the Management of Accumulators 1 25
Benjamin's The Voltaic Cell, its Construction and its Capacity 5 00
Niaudet's Elementary Treatise on Electric Batteries 2 50
Trevert's How to make Electrical Batteries at Home 25

DYNAMOS.

Badt's, F. B, Dynamo Tenders' Handbook, 226 Pages, 138 Engravings 1 00
Bottone's How to Manage the Dynamo 0 60
Bottone's How to Make and Use a Dynamo 1 00
Crocker & Wheeler's Practical Management of Dynamos and Motors, 100 Pages, fully illustrated 1 00
Gatehouse's Strange History of the Dynamo 40
Halliday's Notes on Designs on Small Dynamos 1 00
Hering's Principles of Dynamo-Electric Machinery 2 50
Hering's Practical Directions for Winding Magnets for Dynamos 1 25
Hopkinson's Dynamic Electricity; its Modern Use and Measurement 50
Hopkinson's Original Papers on Dynamos, Machinery and Allied Subjects 1 00
Jackson's Text-Book on Electro-Magnets and the Construction of Dynamos, Vol. 1 .... 2 25
Kimball's Dynamo; How it is Made and How to Use It 30
Prescott's Dynamo Electricity; Its Generation, Application, Transmission, Storage and Measurement 5 00
Schellen's Magneto-Electric and Dynamo-Electrical Machines. Vol. I 5 00
Thompson's Dynamo-Electric Machines 50
Thompson's Dynamo-Electric Machinery. Text Book for Students of Electro-Technics. Fourth Edition 9 00
Trevert's Dynamos and Electric Motors and All About Them 50
Trevert's How to Make a Dynamo 10
Urquhart's Dynamo Construction 3 00
Walker's Practical Dynamo Building for Amateurs. 75
Watson's How to Make a 1 H. P. Dynamo 25

ELECTRIC LIGHTING.

Cunynghame's Treatise on the Law of Electric Lighting 5 00
Day's Electric Light Arithmetic 50
Dredge's Electric Illumination. Two Vols 22 50
Du Moncel's Electric Lighting 1 25
Gordon's Practical Treatise on Electric Lighting. 4 50
Hedge's Continental Electric Light Central Stations 6 00
Latimer's Incandescent Electric Lighting. A Practical Description of the Edison System 50
May's Electric Lighting Plant. The Management of and Instruction Regarding Same 1 00
Maycock's Electric Lighting and Power Distribution 75
Merrill's Electric Light Specifications for the Use of Engineers and Architects. 176 pages 1 50
Morton & Anderson's Electric Lighting and Underwriters' Standard Requirements 1 50
Pope's Evolution of the Incandescent Lamp 1 00
Pritchard's Manufacture of Electric Light Carbons. 75
Randall's Practical Treatise on Incandescent Lamps 50
Russell's Electric Light Cables and the Distribution of Electricity 2 25
Salomon's Electric Light Installations and the Management of Accumulators 2 00
Stephen's Wrinkles in Electric Lighting 1 00
Swinton's Elementary Principles of Electric Lighting 60
Thomson's, Prof. Elihu, A Popular Lecture on Light 20
Tyndall's Light and Electricity 1 25
Urquhart's Electric Light; Its Production and its Use 3 00
Urquhart's Electric Light Fitting 2 00

(*To be continued.*)

NEW BOOKS.

A Laboratory Manual of Physics and Applied Electricity. Arranged and edited by Edward L. Nichols, Professor of Physics, Cornell University. In two volumes. Macmillan & Co., New York and London. Pp. 294; illustrations and tables. Price $3.00.

Volume 1 of this work has just been issued and is devoted to the junior course in general physics, Ernest Merritt and Frederick J. Rogers being the authors. The work has been written, as the preface indicates, to supply in some measure the needs of a modern laboratory, in which the existing manuals of physics have been found inadequate. It is not, however, intended to supplant all other sources of information; on the contrary, continual reference to other works is encouraged.

The first volume is intended for beginners and affords explicit directions, together with demonstrations and occasional elementary statements of principles. It is the outgrowth of 25 years' experience of a system of junior instruction, and only such experiments as have been in actual use are incorporated in the text. Seven chapters of the twelve are devoted to electricity under the general heads: Static Electricity; Magnetism; Electric Current; Difference of Potential and Electromotive Force; Resistance; Electrical Quantity; Induction. The subjects are well illustrated and the type is large and clear. In the back of the book are the usual tables of logarithms, sines, tangents, etc.

NEW PUBLICATION.

The New Science Review is the title of a new monthly magazine which made its appearance for the first time this month. It is published by the Transatlantic Publishing Company, of New York and London. The first number contains an article by Lieut. F. Jarvis Patten, entitled "Nikola Tesla and his Works."

Light.—All scientific men are practically a unit in their views regarding the theory of light. It is believed that light is a wave motion of the ether, which fills all space and probably permeates all bodies.

TRADE NOTES.

C. D. Bernsee, New York: "We are pleased to testify to the merits of the Eco-Magneto Watch Clock. We consider this system second to none, and take pleasure in recommending it to others." So write Orlo Atwood & Sons, New London, Conn.

The Buckeye Electric Co. has appointed the Manhattan General Construction Co., 50 Broadway, New York city, its present agent for New York and vicinity, exclusive agent for Massachusetts, Rhode Island and Connecticut, in addition to the territory already covered.

The Swinging Ball Lightning Arrester, in its four years of continuous sale, has never been more popular than it is now, through the influence of Geo. L. Colgate Company. It seems that a new demand has been created for them, as they are having a bigger sale than ever. No one using dynamos should be without them.

The celebrated McNutt Incandescent lamps have stood the test of several years' use and are still in extensive use. The Geo. L. Colgate Company is making it more popular than ever. This lamp is said to have given greater satisfaction than any other lamp in the market.

TWO TO FIFTEEN DAYS' PLEASURE TOURS,

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Forty-eight pages, six maps, describing fifty tours, costing from three to thirty dollars A copy will be sent free, post-paid, to any address in the world, on receipt of two 2-cent stamps, by George H. Daniels, General Passenger Agent, Grand Central Station, New York.

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Electrical and Street Railway Patents.

Issued July 17, 1894.

522,964. Manufacture of Incandescent Electric Lamps. Henry D. Burnett, Lynn, and Samuel E. Doane, Swampscott, Mass., assignors to the General Electric Company, of New York. Filed Dec. 3, 1892.

522,983. Galvanic Battery. Gardner Hewett, New York, N. Y., assignor of four-fifths to Wm. Heaton Longsdorf, same place. Filed Sept. 19, 1893.

522,986. System of Electric Distribution and Generation. Edwin J. Houston, Philadelphia, Pa. Filed Nov. 17, 1887.

522,988. Method of and Apparatus for Transforming Alternating into Continuous Currents. John F. Kelly, Pittsfield, Mass., assignor to the Stanley Laboratory Company, same place. Filed Jan. 6, 1894.

522,999. Electrical-Connection Cord. Alfred H. McCulloch, Boston, Mass., assignor to the American Bell Telephone Company, of Massachusetts. Filed Feb. 6, 1894.

523,007. Electric-Lamp Support. James J. Renehan, New Britain, Conn. Filed Nov. 21, 1893.

523,019. Commutator for Dynamo-Electric Machines. Elihu Thomson, Swampscott, Mass., assignor to the General Electric Company, of New York. Filed Feb. 10, 1894.

523,026. Diaphragm for Electrolytic Cells. Charles N. Waite, Rumford, Me. Filed Aug. 12, 1893.

523,039. Car-Brake. Carl Keiner, Vienna, Austria-Hungary. Filed Oct. 23, 1893. Patented in Austria-Hungary, Nov. 2, 1892, No. 19,212 and 42,103, and in France, Feb. 28, 1893, No. 228,271.

523,055. Process of Making Battery-Plates. William L. Silvey, Dayton, Ohio. Filed Sept. 9, 1892.

523,074. Electric Switch. Jesse F. Kester, Buffalo, N. Y., assignor to F. P. Little Electrical Construction and Supply Company, same place. Filed Nov. 28, 1893.

523,104. Electric-Railway Supply System. William A. Butler, New York, N. Y., assignor to John Gilmore Boyd, same place. Filed Mar. 16, 1894.

523,119. Quadruplex Neutral Relay. Charles D. Haskins, Brooklyn, N. Y., assignor to the Western Electric Company, Chicago, Ill. Filed April 3, 1893.

523,120. Electric Signaling Apparatus. William W. Hibbard, Rochester, N. Y., assignor to the Standard Electric Signal Company, same place. Filed Aug. 12, 1893.

523,121. Electric Signaling Apparatus. William W. Hibbard, Rochester, N. Y., assignor to the Standard Electric Signal Company, same place. Filed Aug. 12, 1893.

523,122. Differentiating Apparatus for Electric Signal

Systems. William W. Hibbard, Rochester, N. Y., assignor to the Standard Electric Signal Company, same place. Filed Aug. 12, 1893.

523,123. Electric Signal-Box. William W. Hibbard, Rochester, N. Y., assignor to the Standard Electric Signal Company, same place. Filed Aug. 12, 1893.

523,124. Electric Signal-Box. William W. Hibbard, Rochester, N. Y., assignor to the Standard Electric Signal Company, same place. Filed Aug. 12, 1893.

523,140. Electric Motor. Julian F. Denison, New Haven, Conn., assignor to the Backus Manufacturing Company, of New Jersey. Filed Apr. 6, 1894.

523,144. Electric-Arc Lamp. Walter E. Frost, Lewiston, Me., assignor to Daniel A. Field, same place, and George P. Smith, Auburn, Me. Filed July 31, 1893.

523,146. Conduit Electric Railway. Charles D. Jenney, Indianapolis, Ind. Filed Mar. 5, 1894.

523,154. Switch-Point for Street-Railways. Herbert S. Smith, Brooklyn, N. Y., assignor to himself, and Frank E. Knight, New York, N. Y. Filed Jan. 15, 1894.

523,160. Electrical Conductor. Gilbert H. Blakesley, Bristol, Conn. Filed Apr. 7, 1893.

523,163. Trolley. Joseph Guzowski, Chicago, Ill. Filed Jan. 13, 1893.

523,164. Supply System for Electric Railways. Edward H. Johnson, New York, and Robert Lundell, Brooklyn, N. Y., assignors to the Johnson Subtrolley Company, New York, N. Y. Filed Dec. 19, 1893.

523,165. Supply System for Electric Railways. Edward H. Johnson, New York, and Robert Lundell, Brooklyn, N. Y., assignors to the Johnson Subtrolley Company, New York, N. Y. Filed Jan. 16, 1894.

523,166. Supply System for Electric Railways. Edward H. Johnson, New York, and Robert Lundell, Brooklyn, N. Y., assignors to the Johnson Subtrolley Company, New York, N. Y. Filed Feb. 10, 1894.

523,172. Electric-Railway Crossing-Insulator. Henry B. Nichols and Frederick H. Lincoln, Philadelphia, Pa. Filed May 9, 1894.

523,182. Guard-Rail for Street-Railways. Gleason F. Starkweather, Chicago, Ill., assignor to the Paige Iron Works, same place. Filed July 21, 1892.

523,204. Incandescent Electric Lamp. Wm. E. Forest, New York, N. Y., assignor to the Livgro Incandescent Lamp Company, of New Jersey. Filed Aug. 1, 1893.

523,208. Snow-Plow for Railways. John Kallauner, Topeka, Kan. Filed Apr. 17, 1893.

523,219. Car-Brake. Patrick Leen, Cincinnati, assignor to the Dayton Manufacturing Company, Dayton, Ohio. Filed Feb. 14, 1894.

523,247. Magneto-Electric Machine. Ernest Tillman, New York, N. Y., assignor of one-half to Charles K. Lexow, same place. Filed Nov. 22, 1893.

523,264. Material for Making Electric-Light Filaments. Gustave A. Cannot, London, England. Filed Dec. 12, 1893. Patented in England, Sept. 1, 1891, No. 14,854; in France Sept 15, 1891, No. 216,144; in Belgium Sept. 15, 1891, No. 96,398, and in Austria-Hungary Apr. 21, 1892, No. 60,599.

523,271. Conduit Electric Railway. John W. Eisenhuth, San Francisco, Cal. Filed Mar. 12, 1894.

523,276. Telephone-Transmitter. Theodore Grissinger, Mechanicsburg, Pa. Filed May 24, 1894.

523,278. Electric Rail-Bond. James G. Hallas, Waterbury, Conn., assignor to the Benedict & Burnham Manufacturing Company, same place. Filed May 1, 1894.

523,284. Bonding-Joint for Electric Railways. Andrew L. Johnston, Richmond, Va. Filed May 5, 1894.

523,288. Machine for Upsetting or Shrinking Tires. James R. Little, Quincy, Ill., assignor to The J. R. Little Metal Wheel Company, same place. Filed June 11, 1892.

523,305. Incandescent Electric Lamp. John E. Criggal, Springfield, Mass., assignor to the Davis Electrical Works, same place. Filed June 11, 1894.

523,306. Electric Railway. Henry A. Doty, Janesville, Wis., assignor to Mary E. Doty, same place. Filed Mar 27, 1894.

523,313. Electric-Railway System. Rudolph M. Hunter, Philadelphia, Pa., assignor to the Thomson-Houston Electric Company, of Boston, Mass. Original application filed Apr. 28, 1886. Divided and this application filed Mar. 14, 1889.

523,319. Electrical Conductor for Trolleys. John W. Eisenhuth, San Francisco, Cal. Filed June 21, 1893.

ELECTRICAL AGE

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NEW YORK, AUGUST 4, 1894.

CONTENTS.

WESTINGHOUSE INTERESTS ON TOP IN NEW YORK CITY.

We are informed that, June last, Mr. George Westinghouse and some prominent politicians of New York city formed a company under the name of the United States Electric Light and Power Company, with Mr. Westinghouse as president. The new company got control of the Brush Electric Company, of New York, and on July 11 there was a general exodus of old Brush employés, from the highest to the lowest, President Pomeroy and General Manager Spear being among them. Mr. Ed. W. Stevenson, the Brush Company's electrician, was also one of the unfortunate ones. The interests representing these two companies have entire control of the electric light subways of this city, which gives them a great power over all other companies using the subways. The new officers of the Brush Company are C. J. Canda, president, and C. J. Marsh, secretary and treasurer.

POLYPHASE MOTORS.

Dr. Louis Bell, in his paper read at the Philadelphia meeting of the American Institute of Electrical Engineers, last May, gives some extremely interesting facts about polyphase motors. He was, in the earlier days of his experience with these machines, rather skeptical regarding their efficiency, but greater familiarity with them, in principle and practice, leads him to opine that the polyphase motor will become a formidable rival of the direct current machine. This paper, which we publish in full elsewhere in this issue, is replete with valuable information on this interesting subject, and should be carefully read.

CORRESPONDENCE SCHOOLS.

"Correspondence Schools" have recently sprung up in different parts of the country and are claiming the attention of educators and others, besides those who are availing themselves of the advantages thus offered. The opponents of the system have said a good deal to its detriment, but as a rule we think they carry on their warfare on uncertain premises. The correspondence system of teaching, as we understand it, is not intended, nor never was intended, to take the place of common schools or higher educational institutions, and for this reason it has a field of its own, and entirely its own, to work in. It affords to those who did not have earlier opportunities a chance to acquire knowledge. Those who, as a rule, avail of the advantages thus afforded are young men engaged in business and mechanics, who, not having the opportunity to acquire book knowledge of the trades or professions they are inclined to pursue, see in this new system a way of learning, during their leisure hours, what they especially wish to know. The method requires study, of course, but those who undertake the task understand that the studying may be done at home, or when their time is not occupied with work. It, moreover, requires close application, as any study does, but there is no question that any one going at the task with a determination to succeed will succeed.

There is no royal road to knowledge; it requires hard work to get it; but when it is obtained it constitutes part of the capital stock of the one possessing it, and some time or other will become valuable to its possessor. The correspondence system is not claimed to be the best of all educational systems; it is intended rather to supply a deficiency which none of the usual methods of learning can meet, and standing alone, on that basis, it is, we think, a success. Its object is simply to help along those who in late years have an ambition to better their station in life, but who, in their earlier years, were not able for one reason or another to properly fit themselves for the battle.

If the correspondence method of teaching is conducted honestly and by persons qualified to instruct, we see no reason why it should not become a great success in its own field. There are scores of worthy young men who need the aid that such an institution affords.

SOME FACTS ABOUT POLYPHASE MOTORS.*

BY LOUIS BELL, PH. D.

In connection with the long distance transmission of power most engineers will, I think, agree with me in the position that alternating current motors of some kind, and of alternating currents preferably the polyphase variety, are almost a necessity. We have been forced to their use by the exigencies of long distance service, which compel either the total abandonment of continuous current, or its use under very embarrassing conditions.

There has, however, been a tendency to look upon the polyphase motor as a somewhat undesirable resort to which we have been driven by long distance work. Such, indeed, was my own belief from *a priori* reasoning, and before I had obtained that practical knowledge of the subject which can only come from personal experience both with the design and application of any class of apparatus. By such experience and by the commercial demands which have been coming in with steadily increasing frequency, I have been forced into taking the position that the polyphase motor is intrinsically preferable to the continuous current motor for a vast majority of all the uses to which such machinery may be applied.

At present, appearances indicate that not only will the polyphase motor displace direct current apparatus for most long distance transmission plants, but will prove a formidable competitor in all applications of motors to industrial purposes, and this, although the polyphase apparatus is the growth of only a few years, while the direct current motor is the outcome of more than a decade of experience.

We may then, in instituting a comparison between polyphase and direct-current motors, consider the various properties which a good motor of any kind must necessarily have. Mechanically speaking, we would all agree that it should be simple in construction, strong, not liable to frequent or considerable repairs, convenient in form and not excessive in weight. As regards its properties, it should in general run cool, stand overloading without serious danger, run at a nearly constant speed, or be capable of considerable variation in speed if necessary. It should be capable for certain uses of sudden and violent exertion, and of easily changing its direction of rotation. In a purely electrical way, it should be simple, efficient both at high and low loads, and should not take excessive amounts of current either in starting or in running.

This represents a difficult list of conditions to fulfil with any one motor, but I believe they can be met better by polyphase than by direct current machines. A direct current motor, for instance, of a given construction and reasonable weight, cannot both run at a constant speed independent of a load in a particular case and at the same time be capable of running at a wide variety of other speeds. It usually will not stand considerable overloads without sparking, and at the same time give a fair efficiency at low loads; and so one might go on piling up difficulties. The polyphase motor, too, cannot meet all these conditions with equal success, but examining them one by one, you will find that on the whole we can obtain very excellent results.

Taken up *seriatim* the desirable properties which I have enumerated, and applying them to polyphase motors, we find as regards the first count that their construction is singularly free from complexity. They consist in general of two concentric masses of laminations, forming respectively the field magnet and armature. The armature is assembled on its shaft much as in direct current machinery, while the field laminations are held together by a clamping spider of very simple construction. The bearings are supported either on end spiders fitted to the field spiders by lathe work only, or on pillow blocks of the ordinary kind. Commutator and commutator connections there are none, nor should there be collecting rings except in rare instances. The armature need be exposed only to low voltage, and should preferably be wound with a comparatively small number of rather massive conductors, united at the ends either by a single plate or by very simple connectors, the latter form being preferable. The field winding is usually in a greater number of coils than is a direct current field winding, but each coil has a comparatively small number of convolutions, making the total winding by no means complicated.

In lieu of the starting rheostat of the direct current motor, we have a starting resistance which should preferably be placed within the armature, and consists of a few zig-zags of metal united at one end and connected at the other to three or more contact pieces. A solid collar short-circuiting these contacts and a forked lever to move the collar completes the equipment, as I am accustomed to employ it. Its most noticeable feature is that the revolving armature, the most troublesome and delicate part of a direct current machine, is free from complication, and that it is almost as solid as if it were a solid mass of metal and scarcely more liable to injury.

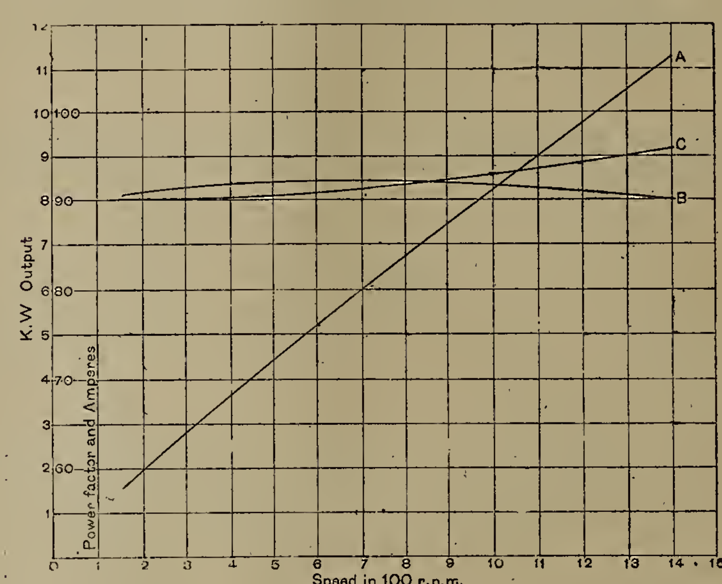


FIG. I.

This very obvious simplicity of construction and mechanical strength is strong evidence of unusual freedom from repairs, and as a result of experience I have found that the induction motor is singularly free from liability to accidents of every kind. I have never succeeded even by the severest kind of experimental work in burning out a field coil or doing any serious injury whatever to a motor, although I have kept some of them on static torque tests in rapid succession for hours at a time and have held them at rest and poured current through them until the leads burned off, the motor still remaining undamaged. If there is a test of extraordinary severity that I have not applied to induction motors, I have yet to learn of it. These properties are invaluable in commercial work, inasmuch as they practically remove the danger of crippling the motor even under exceptionally unfavorable conditions.

As regards the convenience of the form of polyphase induction motors, I think an inspection of any of the types which have been brought out will render argument unnecessary.

The magnetic necessities of the case have led all makers of such apparatus in this country and elsewhere to adopt a species of barrel shape as the general out-

* A paper presented at the Eleventh General Meeting of the American Institute of Electrical Engineers. Philadelphia, May 18, 1894.

line of the motor, modified only in the proportions of diameter to length, and in the adoption of one form or another of bearing. The tendency of this construction is to bring the centre of gravity of the machine very low, thus insuring unusual stability and freedom from general vibration. This form, too, enables one to place the motor in almost any position, which is convenient in applying it, upside down, as a side bracket, and the like.

The largest installation of induction motors in the world just put in operation in Columbia, S. C., aggregating over 1,200 h.p., is composed of inverted motors with their bases bolted to the ceiling timbers of the room.

As regards weight, the abolition of any sparking limit to the output and the excellent magnetic materials used might naturally be supposed to lead to motors of unusual light weight, and such is, in fact, the case. Sixty to seventy pounds per horse-power in motors of moderate size is a figure easily reached without any sacrifice of efficiency, and if occasion requires, these limits can be passed with great facility, 25 to 30 pounds of material per horse-power being quite attainable in large units while still retaining satisfactory properties. I must say, however, that for most uses I do not consider extreme lightness either necessary or desirable, although

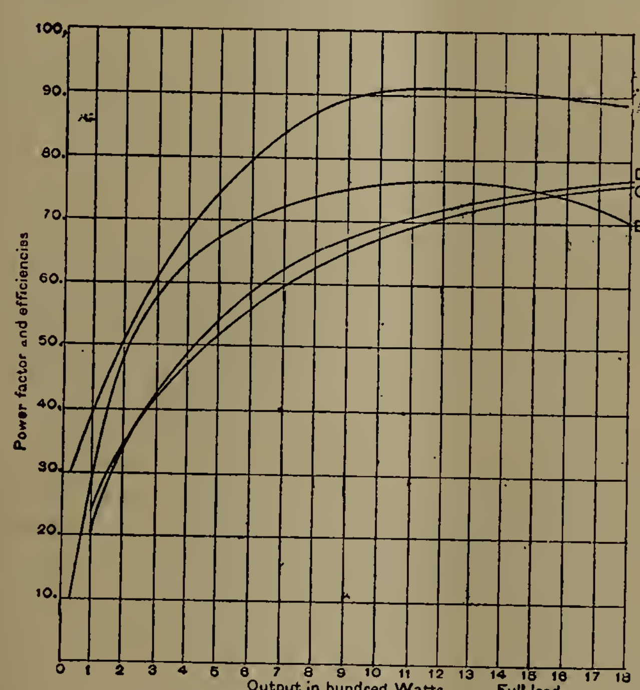


FIG. 2.

it is important to be able to secure it if necessary. So much for the mechanical character of induction motors.

Electrically speaking, the case is just as favorable. Unless forced to a very large output per pound of weight, an induction motor will run quite cool, at a heating limit, in fact, below that of most direct current machines of similar weight and output. This advantage is mainly due to the very substantial character of winding which can be conveniently employed, and to the fact that the winding is distributed so that the losses in the copper are not localized while the laminated character of the structure facilitates thorough ventilation. This freedom from excessive heating indicates that the polyphase motor can stand considerable overloading without any serious results, and experience has shown this to be the case. The worst that can really happen is that the motor may fall out of synchronism when the load is sufficiently great, thereby blowing the fuse in the primary line.

As sparking is obviated in this type of machine, it can readily be rated at such output as will give a proper limit of heating, and this output will in most cases allow from 30 to 60 per cent. of overloading before the machine will drop out of step. A wider range than this can be obtained if desirable, which it is generally not.

The limit of possible overloading fixes in a general way the possible static torque that can be obtained from a given machine, and this is apparently purely a matter of convenience in design, anything that can reasonably be required being quite attainable. There is no special difficulty in arranging polyphase motors for a starting torque four or five times the running torque, although this would be unnecessary except for severe hoisting and tramway work. At running torque the starting current taken may really be no greater than the running current. From this it will readily be seen that a properly planned polyphase motor is easily capable of very great and violent exertions in a case of necessity. It will endure complete reversal under full load within 10 or 15 seconds on motors of ordinary sizes, this time being sufficient for the machine to pass from full load in one direction to full load and speed in the other direction. This reversal is, as is well known, accomplished simply by reversing any two of the primary wires, the effect being to rotate the field in the opposite direction from the armature, thus causing an enormous rate of cutting lines of force, and consequently immense effort, causing the motor to stop and reverse.

SPEED VARIATION IN POLYPHASE MOTORS.

This subject has been for the most part in a rather hazy condition up to the present time. The induction motor has been generally known as non-synchronous, and such indeed it is. The name, however, has frequently been used in ignorance of the fact that an induction motor always tends towards synchronous running.

Under ordinary conditions the polyphase induction motor can be made to run at nearly constant speed independent of load, resembling in this respect a well designed shunt motor. A variation from no load to full load of 5 to 6% in speed would represent ordinary good practice, either in a shunt motor or a polyphase one, this limit being exceeded only in small motors or types which may be regarded as special. It is by no means difficult, however, so to design a polyphase motor that the speed shall possess very remarkable uniformity. This condition has been valuable in the Columbia plant previously alluded to. In this case tests of 17 motors showed a maximum variation in speed, from an output of 75 h.p. to friction load of the motor, of only 2 2%, individual motors showing slight variations down to 1½%.

The task of these particular motors is driving a cotton mill, hence the necessity for uniform speed. And this uniformity in speed is not greatly affected by variations in voltage, which would be quite sufficient to cause considerable speed variation in a shunt wound motor; in fact the induction motor is remarkably insensitive to moderate variations in voltage, unless it is heavily loaded.

This uniformity in speed has frequently been urged as an objection to the induction motor, barring its employment in cases where speed variation is necessary. This point is not well taken

The induction motor cannot be made to successfully run at reduced speed by varying the primary voltage. Under these circumstances the output of the machine falls off somewhat more rapidly than the square of the voltage, so that only trifling speed variations are possible. It is a fact, not generally known, however, that the speed of a polyphase motor can be varied with the same facility and within the same wide range as is possible in the case of a series wound continuous current machine, such as a railway motor. This is accomplished in the induction motor by a rheostat in the secondary circuit, just as it is accomplished in the series motor, by a rheostat in the main circuit. Thus equipped the two machines behave almost exactly alike. The speed at constant torque can be made to vary from full speed down to almost no speed, thus simulating the action of the series motor in the closest possible fashion. At any given speed an increase or decrease of the torque will decrease or increase the speed substantially alike in both classes of motors. In both, too, the efficiency is initially similar and falls off in practically the same ratio. A non-inductive resistance is necessary in case of the polyphase motor, an inductive one throwing the armature current so far out of phase as to interfere with the proper action of the motor.

Fig. 1 gives an excellent idea of the behavior of a polyphase motor with resistance in the secondary circuit.

Curve A shows the speed and output of a certain motor under these circumstances. It was a four-pole machine operated at 50 cycles per second, and the initial speed was reduced to 1400 by the resistance of the leads reaching across the room to the rheostat, composed of loops of manganin strip, which would be systematically varied. It will be seen that the word curve is almost a misnomer, the ratio between the speed and output at constant torque being almost a linear function, even when the speed fell to as low as 150 revolutions per minute. It was not carried lower than this only because of lack of adaptability in the rheostat. No series motor could show a more satisfactory result.

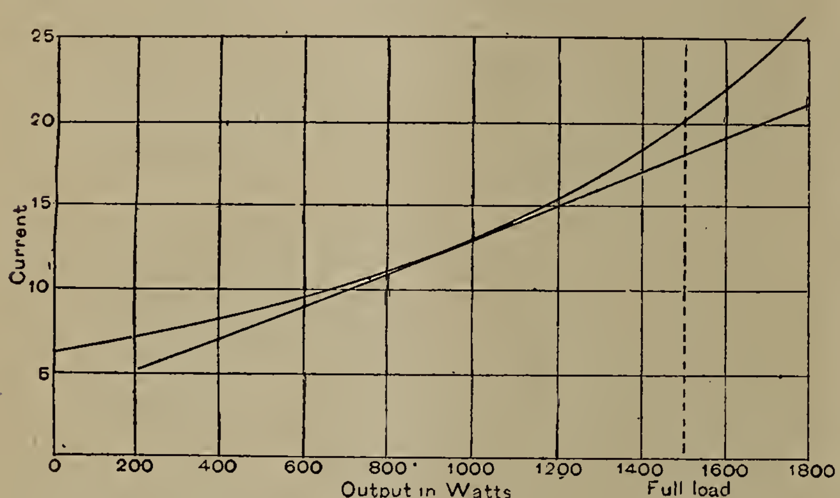


FIG. 3.

Curve B shows the power factor under these varying conditions. It is high at all loads and speeds, varying slightly with a maximum at about half speed.

Curve C shows the variation in current. This, as can be seen, is almost constant, falling off slightly at the lower speeds, the voltage being uniform throughout the test.

Speed variation by this method is not as efficient as might be wished, but still compares favorably with that obtained in a series motor with rheostatic control. Some modified methods of control promising a somewhat better efficiency have been suggested, but it seems probable that in the net result we shall find that continuous current and polyphase motors are about on a par in this respect. It should be noted that in continuous current motors speed variation by weakening the field is only practicable within a very limited range and requires an abnormally heavy motor. I think that with a similar change in design the polyphase motor could be made to operate nearly as well by change in its field strength. An efficient speed variation through a very wide range is attainable in either class of machine only by extraordinary means, as an elaborate combination of direct current machines, or frequently changing devices in the polyphase machines. From what has been said it will be apparent that the polyphase motor is perfectly capable of a complete control of speed on the same terms generally obtained with continuous current motors.

COMPARISON OF A POLYPHASE AND CONTINUOUS MOTOR.

Fig. 2 gives a striking comparison between the properties of the two classes of machines under consideration.

The polyphase motor selected for comparison is of 2-h. p. output, representing the average small motor to be found in central station practice. This particular size weighs 218 pounds complete and runs at a speed of 1,400 revolutions per minute on 50 cycles loaded. It is relatively neither better nor worse than polyphase motors of other sizes, as may be seen by reference to the curves in my previous paper on this general topic. The power factor in this case rises quite sharply, reaching 86 per cent. at half load and through most of the working range of the motor remains at or near 90 per cent., nearly 91 per cent. as a maximum. The efficiency has its maximum a little under full load of the motor and reaches nearly seventy-seven per cent., being 75 per cent. at full load. Both power factor and efficiency hold high values from half load up and do not fall off seriously until some distance below half load.

Contrast with curves A and B, belonging to the polyphase motor, curves C and D; the former is the efficiency curve of a 2-h. p. 500 volt motor of one of the well-known American makes, and curve D is a similar curve for 2-h. p. 110 volt motor of European manufacture. These are not selected curves but were the two completest available. Both these curves, C and D, show remarkable similarity. Neither of the motors sparked seriously at full load, the load limit being set rather by the heating. Both curves rise slowly and attain their maximum values at some point beyond the available load of the machine. At full load the efficiency is substantially the same as that of the triphase motor. At low loads it is noticeably worse. I think C and D are fair average machines. In tests of a wide variety of motors, some higher and lower efficiencies would be found. Such, too, would be the case in testing a variety of polyphase motors. In fact the mate of the triphase motor shown, sent through the factory at the same time, showed about 1½ per cent. higher efficiency, but a complete test was not attainable as the machine had to be immediately shipped. A comparison of these curves will render it evident that it is quite practicable to produce a polyphase motor having an efficiency fully equal to that of direct current motors of similar size, and I think the tendency will be towards better efficiency at moderate loads. It should be mentioned here that the 2-h. p. triphase motor was made of ordinary good armature iron, not selected, or specially treated in any way.

Finally, let me call sharp attention to curve 3, which shows the effect of the power factor, which I regret to say has been talked about not wisely but too well in most of the discussions pertaining to polyphase apparatus. Two curves in Fig. 3 show the total current in the line in the 2-h. p. triphase motor and the 110 volt continuous current motor above mentioned. The current curve of the continuous current machine is nearly a straight line, that of the polyphase machine is almost tangent to it and slightly concave upwards. A noticeable fact displayed is, that throughout the ordinary range of these two motors the currents were substantially equal, the existence of the power factor in the polyphase motor being only noticeable at very low loads and at overloads. This comparison should be a sufficient answer to the charges of excessive current that have so often been made against the polyphase machines. In a bad polyphase motor they would have foundation in fact. In a rather good one the net effect of the lagging current is trifling. It should further be noted that the current in this triphase motor at friction load is only about 30 per cent. of the current at full load, and of this only 30 per cent. represents loss of energy. This is in marked contrast with the results obtained from a foreign triphase motor of similar size exhibited at the World's Fair, in which the no-load current was nearly equal to that at full load, and the power factor at full load was barely 50 per cent.

In this brief discussion of some of the properties of modern polyphase motors, I have endeavored to show how nearly they fulfil the conditions which may be regarded as desirable in electric motors in general. That they do so as well, if not better, than the continuous current machines of similar capacity, I believe that I have satisfactorily shown.

The demand which certainly is arising for polyphase motors for general power purposes based on their intrinsic merits, indicates that the older type of machinery has found a dangerous rival, all questions of long distance transmission aside.

THE BOLOMETER.

A description of this exceedingly sensitive and simple instrument for measuring heat has been recently given by Dr. M. Th. Edelmann, of Munich, one of the original inventors of the instrument. In 1873, the late Dr. C. Lang and Edelmann, while engaged in the investigation of the dark lines in the heat spectrum, says the *Electrical Review* of London, hit upon the idea of allowing the radiation to fall upon thin stretched iron wires,

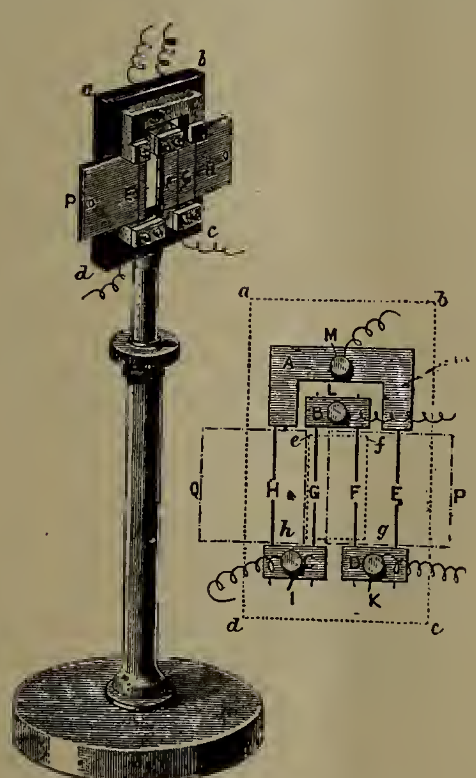


FIG. I. FIG. 2.

and then measuring the change of resistance produced by the heating, by means of a Wheatstone bridge. They used the apparatus about to be described, and could, even at that time, using a Wiedemann's galvanometer, detect the D line on the bridge wire. They refrained, however, from publication because they discovered nothing new, and because this method of measurement appeared to have no essential advantage over a linear thermopile. By chance, a similar method of measurement was tried by others, and later the name bolometer was given to the instrument. In the course of last year, by means of the exceedingly sensitive Rosenthal microgalvanometer, they were able to give to the bolometer an extraordinary degree of sensitiveness.

Upon a rectangular vulcanite board, *a*, *b*, *c*, *d* (in the middle of which a rectangular opening, E, F, G, H, is cut), the brass blocks, A, B, C, D (fig. 2), are screwed. Between these four thin blackened iron wires are stretched. These four wires form the four branches of a Wheatstone bridge, the terminal screws, I and K, serve to connect up the battery to the bridge, and the screws L, M, for the introduction of the Rosenthal microgalvanometer, or any other highly sensitive galvanoscope. The wire, E, is of somewhat higher resistance than the other three, and a rheostat is inserted between the screws, K and M, as a shunt to E, to enable the balance to be adjusted to bring the needle of the galvanometer to zero.

The side of the instrument, shown in fig. 1, is fitted with a wooden cover, having ventilation holes above and below. It is fixed to the vulcanite board, *a*, *b*, *c*, *d*, by a hinge, so that it can be easily opened. The two slides, P, Q, serve to reduce the opening, E, F, G, H, to a small slit in front of one of the wires, F, G. All four wires are coated with thin black pigment, and have each a resistance of 0.1 ohm, as also the microgalvanometer. With this arrangement, a temperature difference of one ten-thousandth of a degree Centigrade, between the wires F and G, will give a deflection of 20 mm. at a metre distance, with a current of 0.25 ampères in the main circuit. The rheostat is used to bring the galvanometer to zero before the experiment.

ELECTRIC STEERING COMPASS.

A new electric steering compass has been devised by Lieutenant Bersier, of the French navy. In this appliance the needle of the compass actuates the rudder by means of an electric current, and thus precludes the possibility of any error on the part of a living steersman from fatigue or confusion. The difficulty of constructing such a compass hitherto, says the London *Electrical Review*, has been owing partly to the heaving of the ship, and partly to the difficulty of causing the delicate needle or card to act on the steering gear without impeding its motion. In Lord Kelvin's compass, for example, the card is merely a skeleton disk of paper, silk thread and aluminium, with eight paralleled wires of magnetized steel underneath, and it rests freely on a point or pivot of iridium or other hard metal by means of a cup of ruby or sapphire. The slightest contact with another body would disturb its motions in the magnetic field of the earth. M. Bersier gets rid of all contact by making the current form a Ruhmkorff coil spark from a metal point on the edge of the card to semi-circular plates of metal insulated from each other and from the sides of the compass bowl in which they are fixed. The coil is excited by a battery if there is no electric lighting installation on the vessel; and a current of two to three amperes is sufficient. A wire from the coil leads to the pivot of the card and the cup over it, from which a light wire along the radius of the card corresponding to "north," conveys the current; and according as the ship is to right or left of the course a spark three centimetres long passes to the right or left plate in the bowl and excites one or other of two electro-magnets forming the circuit of a small electromotor. This motor works the steering motor like the hands of a man. The mechanism can be applied to any existing steering gear. The new compass has been tried in the French squadron for several months past, and is said to have succeeded perfectly well. The compass card seems quite indifferent to the spark, probably because the current of the coil is alternating and of low strength. Moreover, certain precautions are taken in producing the spark, and the coil and electro-magnets are at some distance, about five metres from the compass. The new compass also registers all variations, of course, if desired, the spark piercing a band of paper which is moved by clock-work up the bowl. Moreover, by a simple arrangement of Geissler tubes, steering orders can be automatically transmitted and the course changed from any part of the ship. In practice the compass enables a course to be steered to a fraction of a degree—that is to say, with much greater precision than by hand, and it is claimed that it is specially suitable for passenger steamers such as the Atlantic liners, as it would enable them to travel in a straighter line, thus saving both time and money. It also permits the vessel to be steered from the masthead compass.

THE ELECTRIC LIGHTING OF RAILWAY TRAINS.

BY M. B. LEONARD.

(*Concluded from Page 50.*)

The storage batteries used in this system may be of any preferred type, though the results obtained thus far with the chloride accumulator appear to be the most satisfactory. The batteries are carried in a box under the car and out of the way. In the event that four or more cars equipped with this system be carried in a train, they are fitted with a special form of switch to open the charging circuit automatically whenever the battery is fully charged and thus prevent the unnecessary taxing of the locomotive for power. As the apparatus does not operate until the train has attained a speed of about 20 miles per hour, no extra effort is imposed on the locomotive in starting the train.

The cost of the entire outfit, including dynamo, batteries, switches, running gear, lamps and wiring, does not exceed $500 per car, and each car is entirely self-contained, though if necessary, batteries on neighboring cars could be charged when desired. The apparatus being entirely automatic in its operation requires no skilled attention save a periodical inspection at terminal points, and while the tests on the C. & O. Railway developed some mechanical defects that were remedied as fast as they appeared, it is gratifying to state that not once has the electrical portion of the apparatus failed to work properly. Arrangements have been made to equip some of the Pullman cars on the C. & O. Railway that do not run into Covington, Ky., and, therefore, cannot be supplied by our regular charging plant. For some time past a car equipped with this system has been running regularly on the Brooklyn Bridge at New York with perfect success, and another car is about to be installed there.

A very conservative estimate has been made by eminent electrical engineers of the cost of lighting a car by this system on the basis of 10 hours per day of lighting, and is stated to be as follows:

For equipment of one ordinary passenger coach fitted with 12 lamps of 16 c.p., 24 volts, 1 kilo watt dynamo, 13 cells storage battery, 150 ampere hours' capacity each:

Original cost of apparatus		$500.00
Cost of operation per annum:		
Interest on original cost at 6%		30.00
Depreciation of battery at 25% on 13 cells at $12.50 each		40 62
Depreciation on balance of plant at 10%		33.75
Lamp renewals (500 hour basis)		40.00
Attendance		10.00
Pulleys and belts		6.60
Other renewals:		
Brushes	$1.50	
Jars	3.00	
Acid	2.50	
Connections	1.70	
Switch	3.00	
Shade and sockets	2.50	14.20
Total per car per year		$175.17

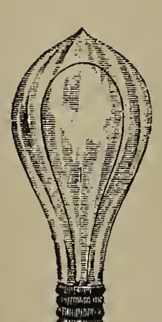
With the graphite bearings no oil is used. The batteries being stationary, no crates are required and the depreciation is very much reduced.

Total estimated cost per car per month	$14.59 75/100
" " " " day	.47 99/100
" " " " hour	.04 79/100
" " " lamp hour	39/100

The significance of these figures, which are believed to be above rather than below the actual cost of operation, and the economy of lighting by this system, will be more fully appreciated when it is borne in mind that the cost of generating the current alone in the largest and most modern of our central electric light and power stations, equipped with the best compound condensing engines, etc., is estimated by the best authorities to be about ¼ cent per lamp hour, which does not, of course, include the cost of lamp and other renewals or depreciation of the plant outside of the central station.

It is evident from the above data set forth that the lighting of our passenger cars by electricity has passed far beyond the experimental stage, and can now be accomplished at an expense no greater than that of oil; in fact, even less. It is therefore greatly to be hoped that the superior advantages of electricity will ere long cause it to be utilized so largely that not only will our trains be illuminated by this, perhaps the most useful of all Nature's forces, but that the weary traveller may in winter be warmed by heaters and in summer be cooled by fans operated from electricity, generated by the least expensive of all methods, the movement of the car itself.

THE LIVGRO INCANDESCENT LAMP COMPANY.



The incandescent lamp situation was made interesting quite recently by the announcement that a new lamp was about to make its appearance, and contend for business and honors.

The new lamp, which is now ready for the market, is known as the "Livgro" and is manufactured by the Livgro Incandescent Lamp Company, which was incorporated in New Jersey last May. The company's plant is in Harrison, N. J., near that of the General Electric Company. Last March the promoters of the company secured the valuable property and have ever since been engaged in equipping the establishment with the most complete and approved apparatus obtainable for the manufacture of incandescent lamps. As is to be expected, everything is of the most modern design, which will enable the company to produce its goods in the best manner and at the lowest price.

The inventor and patentee of the Livgro lamp is Dr. William E. Forest, a prominent physician of New York city. The patents on this lamp have been allowed, and it is stated that the claims covering the invention are broad and give great strength and value to the patent.

The patent has been examined by experts and they assert that it infringes in no manner the existing patents on incandescent lamps. The Livgro lamp is not an all-glass lamp, the neck is composed of a metallic alloy seal, and the leading-in wires are of iron. These lamps have been thoroughly tested and their efficiency is said to be superior to that of any other lamp on the market. The bulb is made of pure but tough glass, and its shape is a slight departure from the form that is so well-known, although in general outline it is designed on similar lines. The facilities of the factory are laid out on a large scale, and there will be easy capacity for the production of lamps in large quantities.

The superintendent of the works is Mr. C. F. Whittemore, who was formerly with the Davis Electrical Works, Springfield, Mass. Mr. Whittemore is one of the most skilful lamp makers in the country, and under his supervision nothing but first-class work will be turned out of the new establishment.

Mr. J. Livingston is president of the new company and Albert H. Gross, secretary and treasurer. Both gentlemen are well-known capitalists.

The New York agent of the company, Mr. Paul Dreher, has fitted out handsome offices in Room 525, the Cable Building, Broadway and Houston street.

"COLUMBIA" PRESSURE RECORDING GAUGE.

The competition in manufacturing industries has rendered it absolutely necessary to cut down the waste and losses to the lowest attainable limit. This applies equally to both time, material and labor, and nowhere is it of greater importance to watch these factors than in a steam plant. In the generation and utilization of steam losses are apt to exist without making themselves apparent, unless special apparatus be used for their detection. By carelessness or ignorance coal may be uselessly consumed under a boiler, and much of its heat wasted and lost, and there is no better check on such waste than a reliable pressure gauge.

The "Columbia" Pressure Recording Gauge, which is illustrated herewith, is one of the most reliable instruments of its kind in the market. It is designed for recording the pressure of steam, water, gas or air, and is therefore quite universal in its application.

As a steam gauge it may be placed near the boiler or at any distance from it—in the office, for instance. When placed in the office a true record of the steam pressure is constantly under the eye of the manager, and if any negligence in the work of maintaining steam or other irregularity occurs, the fact becomes at once apparent in the record.

As will be seen from fig. 1 the pressures are recorded on a circular card, with the time divisions arranged radially, while the pressures are recorded on the concentric circles.

In fig. 2 is given a view of the mechanism of the gauge. It consists of a Bourdon Tube Spring in suitable form in connection with a novel adjustable lever mechanism and a pointer, which carries the marking pen. It is provided with a clock movement to which is attached a metal disk with the chart, making one revolution in every 24 hours.

This gauge is simple in its construction and is based on approved principles. For sensitiveness, accuracy and durability it is said to be unexcelled.

The most prominent engineers admit the importance of recording gauges, and these devices have proved of great value to their owners.

These gauges are made by Schaeffer & Budenburg, 66 John street, New York.

FIG. 1.

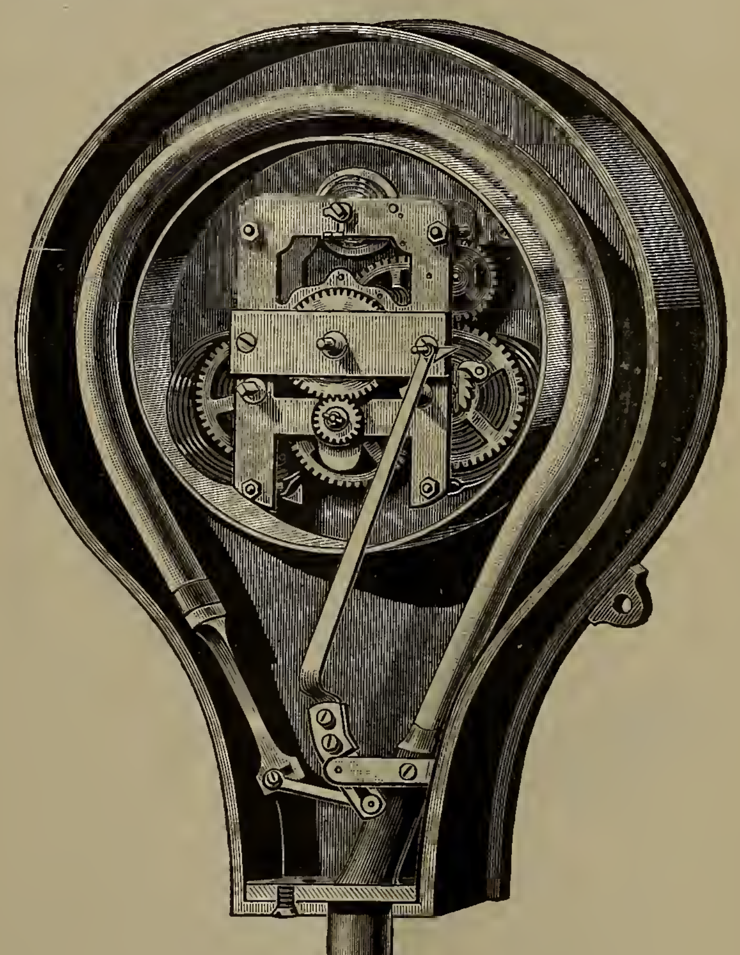


FIG. 2.

NEW ATLANTIC CABLE.

A despatch from Heart's Content, N. F., on July 27, announces the completion of the work of laying of the Anglo-American Telegraph Company's new Atlantic cable. The last splice was made at 11 A. M., Greenwich time, on that date.

The time taken in laying the new cable, it is said, is the shortest on record. The expedition left Heart's Content on July 15, in the afternoon, and the final splice was made on the morning of the 27th, or in less than twelve days. As the Irish shore end was laid in less than two days, the total time taken was inside of two weeks.

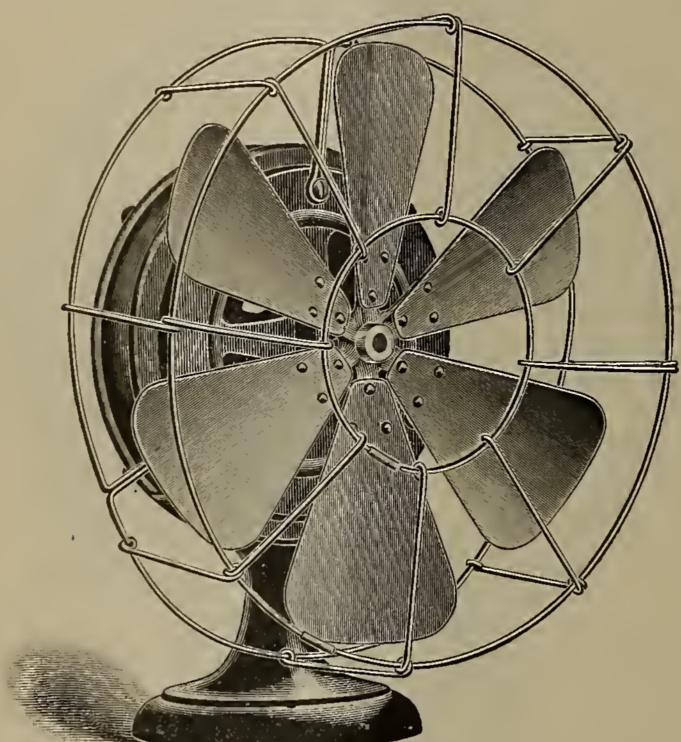
This cable is said to be the heaviest ever laid. A curious coincidence in connection with its completion is the fact that the final splice was made on the anniversary of the day on which the first successful cable was landed at Heart's Content, in 1866, twenty-eight years ago; and not only the same date, but on the same day of the week.

The new cable is laid between Heart's Centent and Valentia, Ireland. The copper conductor weighs 600 pounds per nautical mile.

GENERAL ELECTRIC CO'S ALTERNATING FAN MOTOR.

The extreme summer heat which is upon the country has turned the mind of every man fortunate to live or have his office in a building where electricity has been installed to the pleasant artificial breezes created by the fan motor. In those buildings furnished with direct current the installation of a fan motor is not difficult, but in those lighted from alternating current the unhappy occupants have had to swelter, as no efficient alternating fan motors have been procurable in quantities to supply the demand.

The General Electric Company has just perfected one, which should come to these unfortunate wights as a blessed boon. It is small and compact, and is con-



GENERAL ELECTRIC CO'S ALTERNATING FAN MOTOR.

structed for any alternating current circuit of 52 or 104 volts. The armature or moving parts is nothing more than a solid metal wheel hung on one bearing. It has no wires at all, no brushes, no commutators, no collecting rings—in fact, no contact part at all to cause trouble. The current from the transformer enters only a number of stationary field spools which cannot burn out, and which are entirely enclosed and protected.

The fan is ten inches in diameter, has six blades and is protected by a polished brass guard. It starts as soon as the current is thrown on and runs at 1,800 revolutions, giving quite a powerful and cooling breeze.

The principal feature of this fan motor, contradistinguishing it from all other fan motors, is that it cannot get out of order. It is finished in black japan on a broad, stable base.

ENGLISH TELEGRAPH SERVICE.

In the English telegraph service a candidate for a position or promotion is required to undergo an examination as to his fitness for the position he desires to attain. The following is a list of the subjects a candidate for promotion must be examined in :

1. Crossing and looping wires with facility and certainty.
2. Tracing and localizing faults in instruments.
3. Tracing and localizing permanent and intermittent earth, contact and disconnections on wires.
4. Methods of testing the E.M.F. and resistances of batteries, and a general knowledge of the essential features of the various descriptions of batteries.
5. System of morning testing, both as regards sending and receiving currents, with the necessary calculations in connection with the same.
6. Making up special circuits in cases of emergency.
7. Joining up and adjusting single needle, single current, and double current Morse, both simplex and duplex, and Wheatstone apparatus.
8. Fitting a Wheatstone transmitter to an ordinary key-worked circuit.
9. A general knowledge of the principles of quadruplex and multiplex working.
10. Measuring resistances by the Wheatstone Bridge.

THE PHENOMENA OF ALTERNATING MAGNETIC FIELDS.*

BY ELIHU THOMSON.

The great advances made during the past seven or eight years in the employment of alternating currents of electricity to supplement or even to supplant the continuous current in the transmission of power and in lighting, are well known. We are learning from day to day more and more of the wonderful capabilities of such currents as well as of their great flexibility. The facility with which we may transform electric pressures and currents in alternating-current work, so as to exchange a few amperes at thousands of volts' pressure for thousands of amperes at few volts' pressure, or the reverse, is one of the great advantages possessed. The transformation, made as it is by a simple induction coil of wire and iron without moving parts, is also accomplished with such high efficiencies as 97 or 98 per cent. We may have alternating-current waves of any pitch or frequency, of any quality or shape of wave, of any amplitude or power. We may have two or more waves of the same pitch, but not in the same phase, working together in the same system or produced therein by suitable devices from a single wave. Thus arise multiphase or polyphase currents, the best-known relations of phases being two-phase and three-phase currents. The capability of such currents to produce rotary magnetic fields, and, as a result thereof, rotary movement without commutators, is of great and increasing importance in technical work.

In addition to these developments of alternating-current work we may in the future be able to note special applications of waves of different pitch superposed, and with various phasal relations. We have already telephone systems which depend on the superposition of waves of every pitch on the same system, and we may possibly look forward to other applications on a large scale of similar superposed waves. The possibilities for future research in the alternating-current field are still great, notwithstanding the very important advances made within the past few years, many of which are still but little known, some remaining still buried in the patent-office, while others are yet confined to the laboratory.

The purpose of this paper is to present in simple form the general characteristics of an alternating-current magnetic field as distinguished from the field of a permanent magnet, or one produced by a steady electric

* *Engineering Magazine*, July 1894.

current, and to point out the uses which can be made of the properties of the alternating field.

To intensify the effects of a magnetic field produced either by a steady, continuous current of electricity or by an alternating current, it is of course usual to employ an iron body or core, which, on account of its superior permeability to magnetic forces or susceptibility to magnetic excitation, gives much more intense actions than air. Just what constitutes the difference between substances which, like iron, are highly magnetic and others but little different from air or vacuum in this respect, is as yet quite unknown. There are, however, very decided differences between the magnetic fields produced by steady, continuous currents, and alternating magnetic fields. The former may be called passive, or static in character, while the latter may in truth be referred to as active, or dynamic. The passive or steady field has no action on closed metal bands placed in it except during the act of placing, while the alternating field has a very decided action of one kind or another.

Let us assume, then, that we have side by side good examples of apparatus, one of which furnishes us with a steady magnetic field and the other with an alternating field. It will suffice for this to provide for the first an upright iron bar of say two inches in diameter and ten inches long as our magnetic mass, and surround it by a coil of insulated wire having a continuous current sent through it. We cannot properly select such an iron bar for our magnetic mass in the second or alternating field apparatus, because we should find not only that the effects obtainable from it would be comparatively weak, but the core itself would rapidly get hot, owing to currents induced in its mass. Instead, therefore, we build up a wire bundle to the desired diameter, say two inches, by taking a great number of well-annealed soft-iron wires of ten inches length and about one-twentieth inch diameter. These wires are either varnished before being collected together or well scaled in the annealing. They are thus insulated from each other, at least sufficiently for our purpose. We surround this bundle or iron-wire core by a coil which is traversed by powerful alternating currents, changing their direction say 100 or more times per second.

We have now the means for comparing the effects of a steady magnetic field at the end of the iron bar with those of an alternating field at the upper end of the wire bundle. Let us bring a piece of steel or iron of some size successively into each field. In the steady field it is simply attracted, and if of hard steel is found permanently magnetized on taking it away. It is not otherwise affected to any appreciable degree. But in the alternating field it is less strongly attracted and intermittently, as is evident from the tremor or vibration, and it soon becomes hot. If of hard steel, such for example, as a file, it may become so hot in a minute or two as to be incapable of being held in the fingers. Energy or work is evidently being expended on the piece, and this is abstracted from the source which keeps up the alternating current in the coil around the wire bundle. Substitute for the steel a bundle of very fine iron wires or sheets of very soft iron, and if these be presented on edge or in line with the field scarcely any heat is developed, but if the magnetic lines traverse the wires or sheets laterally the bundle at once heats.

We come now to consider a more decided difference between the two fields of magnetism—namely the action on closed bands or conductors, such as rings of copper, coils of wire with the ends joined, and disks, etc., of metals which are good conductors for electric currents. We may take, for example, a ring of copper or a round disk of the same metal, say four or five inches in diameter, and place it flatwise against the pole of the steady field magnet and it is not perceptibly acted on in any way, while if the same be done with the alternating magnet there will be noted a powerful repelling force exerted on the ring or disk such that even though it be of considerable weight it will be lifted and thrust off the pole. The writer discovered this action in 1886 and experimented at length upon it in many modified ways. If the ring be held down to the alternating pole or near thereto it rapidly gets warm. Indeed, with sufficient energy of alternating field a ring five inches in diameter made of copper wire one-quarter inch thick may be made red hot and kept so in mid-air indefinitely. With care, a ring may be made to float in mid-air over the alternating magnet pole for a second or two, but the condition is one of very unstable equilibrium. It is made stable by tying strings to the ring so carried downward that the ring strains them upward in being lifted off the pole.

The cause of the actions of heating and repulsion in the experiments just noted may be readily understood. Even when the ring was put over the steady pole, there was in fact a resistance to its motion, but only during the act of placing or while it was in motion. If the ring be brought very suddenly over the steady magnet, it will be vigorously held off. Owing to this fact, it is found to be quite difficult to strike the pole of a powerful magnet by a thin flat sheet of copper brought down by the hand, even when the magnetism is steady.

The reason is, that during the movement in the field a powerful current is induced or set up in the moving sheet which reacts on the field and distorts it, with the effect of a repulsive effort exerted in the sheet to keep the sheet away.

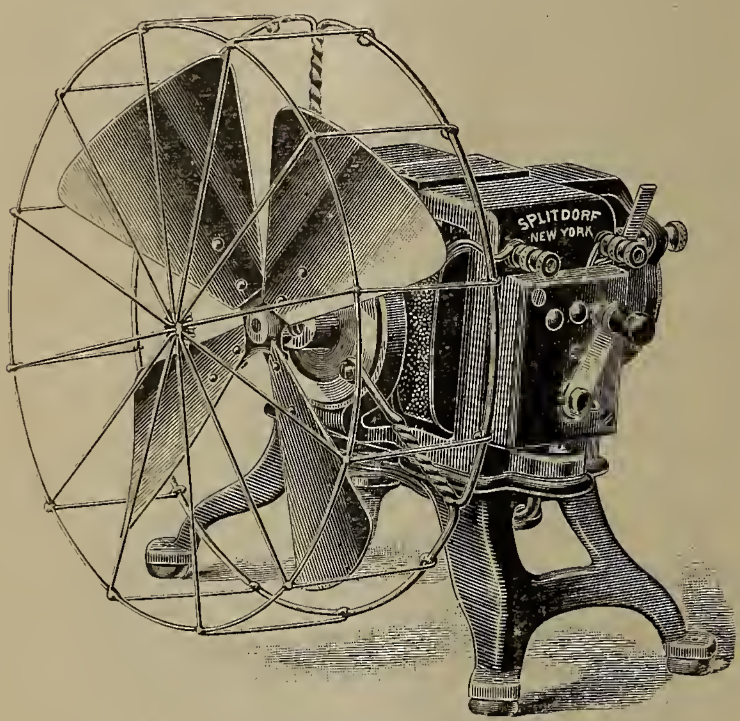
Similarly, if the sheet has been laid on the magnet pole and attempt be made to suddenly remove it flatwise, there will be found a strong opposing force exerted to retain the sheet or disk. In this case the currents induced by the movement are in a direction to cause attraction to the magnet. When the alternating field is used the currents which are induced in the ring or disk are opposite in direction to those which would produce the magnetic field itself and a repulsive effort is therefore exerted. To put it differently, the lines of force of the magetic field in this case are opposed or distorted by the induced currents in the ring or disk. The reaction of these currents on the field producing them forces the ring or disk from the field. Hence the alternating field is capable itself of heating conductors placed therein and of exerting mechanical force.

It would be out of place here to discuss fully the theory of the actions induced. It may be stated, however, that the fact that the current waves induced in the ring or disk by the alternating field are retained or lagged in virtue of their self-induction, from their true relation to the inducing field, is the cause of the repulsion. The alternating magnetism of itself would produce no repulsion were it not that the currents lag in the ring or disk so as to become virtually opposing or repelling currents, instead of equally repelling and attracting to the field. Rings of brass or German silver are much less powerfully acted on than those of the best conductors, such as copper and silver. Hence, for example, a real silver dollar is repelled energetically in the alternating field while one of a base alloy is hardly affected at all. This is owing to the relatively smaller currents induced in the poorer conductor, as well as to the fact that the currents are not retarded or lagged sufficiently for the maximum effect. Let us substitute a coil of wire of many turns, insulated from each other, for the ring in the repulsion experiment. In the steady magnetic field there is no effect, but in the alternating field there are waves of current induced such that an incandescent lamp connected to the terminals of the coil may be lighted when the coil is brought into the alternating field. Its brightness will vary with the position of the coil with relation to the lines of force and their density. The maximum effect will be when the whole of the alternating field is enclosed by the coil. As the coil is lifted away the brilliancy of the lamp serves as a rough measure of the reduction of the intensity of the field, or rather of its inductive action at a distance.

(*To be Continued.*)

SPLITDORF FAN MOTOR.

The fan motor herewith illustrated is a standard machine and has met with large sales during the past two or three seasons, this season especially. It is a direct-current machine, wound for 110 volt circuits, and has three speeds. The switch at the side regulates the speeds, which vary from light to strong.



SPLITDORF FAN MOTOR.

It is said to be the most economical ⅛ h. p. motor on the market, and, considering the extraordinary finish and workmanship, the price is remarkably low. The castings are of the highest grade and best finish, and the general make-up of the machine shows that extra care is used in its construction. The reputation these motors have is abundant evidence that a good motor is always a standard article. They are of artistic design.

Mr. C. F. Splitdorf, 27 Vandewater street, New York city, the manufacturer of these excellent fan motors, is already at work on his 1895 machine, which will have a 16 inch fan, and, it is said, will be the cheapest motor on the market for its size, and the most efficient.

Mr. Splitdorf is an extensive manufacturer of general electrical supplies for electric lighting, electric railways, telephone, telegraph, etc., etc. He makes a specialty of small induction coils for telephones, and is strictly first-class in his work. He has a well-arranged and equipped factory, and his facilities enable him to undertake any size order for electrical goods.

NEW PUBLICATION.

The Universal Index to the World's Technical and Scientific Literature, is the title of a new publication in Leipzig, Germany. The Index is printed in three languages, namely, German, English and French, and gives a list of the principal articles appearing in technical and scientific publications throughout the world. American publications occupy a good portion of the space.

ELECTRIC POSTAL CARS IN BROOKLYN.

The Post-office authorities in Brooklyn have arranged to run two electric postal cars over the Atlantic avenue road from the main post-office to Coney Island. Two sub-stations and ten local offices will be served *enroute*, and the postal clerks will sort the mail during transit. A spur of the line has been run into the general post-office to facilitate handling of the mail and save time. The experiment went into practical operation on August 1, and if it is successful the system will be extended in other directions for the benefit of the suburban service.

TAXING BROOKLYN CORPORATIONS.

Among the Brooklyn corporations upon whose personalty assessed valuations have been placed by the Board of Assessors of that city, for the purpose of taxation, are the following:

Brooklyn City Railroad Company, $2,250,000; Atlantic Avenue Railroad Company, $490,000; Coney Island and Brooklyn Railroad Company, $370,000; Citizens' Electric Light Company, $206,000; Brooklyn Heights Railroad Company, $100,000; Prospect Park and Coney Island Railroad Company, $20,000; Brooklyn District Telegraph Company, $1,500.

NEW YORK NOTES.

Office of the Electrical Age,
World Building, New York,
July 30, 1894.

Mr. E. G. Webster, the popular and experienced salesman of the Solar Arc Lamp Co., 280 Broadway, N. Y., is doing a fine business with these new lamps. He is taking lots of orders.

F. A. Williams, representing the Safety Insulated Wire and Cable Co., 234 W. 29th street, city, returned to New York this week after an extended trip. As usual, he came back well loaded with orders.

The Wenstrom Electric Co., of Baltimore, Md., has quite a history, and to attempt to relate it in these columns would necessitate the use of an entire edition of the Electrical Age, so I will only deal with the latest phase of the company's career. The Wenstrom Co., of Baltimore, Md., manufacturers of the Wenstrom dynamos and electrical apparatus, has bought up the U. S. Wenstrom Electric Co., of 457 Broadway, N. Y., J. B. DeLery, president and Benjamin Blum, secretary and treasurer. These gentlemen were the owners of all the Wenstrom patents in the country, for the manufacture and sale of Wenstrom electrical apparatus in the United States. The U. S. Wenstrom Company had brought suit against the Baltimore Company and others to enjoin them from manufacturing, using and selling Wenstrom apparatus. The Baltimore Company came forward and bought up the U. S. Wenstrom Company and all its rights, title, etc., in Wenstrom patents, and has agreed to pay royalties to DeLery and Blum. This information is obtained from a reliable source.

Foster M. Voorhees, Receiver for the Royal Arc Electric Company, has given notice to the company's creditors that all claims against the company must be proved before the Receiver within two months from July 26, or be excluded from the benefit of such dividends as may hereafter be declared upon the proceeds of the effects of the said company. W. T. H.

POSSIBLE CONTRACTS.

Electric light and water works are to be established in Elberton, Ga. The Mayor of that place can give further information.

The plant and property of the Potomac Electric Company, Alexandria, Va., is advertised for sale on August 25, by the Commissioners of Sales, appointed by the Circuit Court in the Chancery case of J. B. O'Gorman, against the Potomac Electric Company. The Commissioners of Sales are Geo. A. Mushbach, Saml. G. Brent, John Critcher and James K. Caton.

Fire damaged the station of the Bloomington, Ill., Electric Light Company to the extent of $2,000.

The United States Senate has passed a bill authorizing the Metropolitan Street Railway Company, of Washington, D. C., to adopt the underground electric system.

The survey of the Baltimore, Middle River and Sparrow Point electric railway has been completed. Mr. Thos B. Gatch, of Baltimore, is president of the company.

It is reported that A. M. Billings, of Chicago, and others have purchased the Raleigh Springs Railroad Company, Memphis, Tenn. The line is 12 miles long and will be completed by the Citizens' Street Railway Company.

There is a project to build an electric railroad from Annapolis to Bay Ridge, Md. Philadelphia and Annapolis people are interested.

A company is being organized in Corsicana, Texas, to construct a telephone line. Jas. L. Autry can give further information regarding the material and equipment which are to be purchased.

. A company is being organized in Rome, Ga., by Z. B. Hargrove, J. W. Rounsaville and T. F. Howell to develop the water power of the Etowah River, and build an electric plant for the utilization of the power.

The City and Suburban Railway Company, Baltimore, Md., is trying to secure the right of way for the extension of its electric road to Loudon Park and Catonsville

A. W. Robinson & Co , Sharptown, Md., desire an estimate for the construction of a nine-mile telephone line.

The Bradford Electric Light and Power Co., Bradford, Pa., has given a contract for the erection of a new electric light and power station which, it is said, will be one of the most complete in Western Pennsylvania.

The State Railroad Commission has granted the application of the Coney Island and Brooklyn Railroad Company, Brooklyn, N. Y., to introduce the electric trolley system on certain of its lines.

NEW CORPORATIONS.

Los Angeles Edison Electric Co., San Francisco, Cal., operating electrical machinery, supplying light, heat and power; capital stock, $500,000.

Universal Electric Messenger Call Co., Portland, Me., manufacturing electrical and mechanical appliances, etc.; capital stock, $100,000.

Inter-State Telephone Co., St. Johnsville, N. Y.; capital stock, $3,500.

The Cincinnati Electric Service Company, Cincinnati, O.; capital stock, $10,000.

The Cleveland Storage Battery Co., Cleveland, O., manufacturing electrical devices, storage batteries, etc.; capital stock, $150,000.

The Sandusky Telephone Co., Sandusky, O.; capital stock, $30,000.

The Steubenville Traction Co., Steubenville, O., capital stock, $100,000.

Clamond Telephone Co., Philadelphia, Pa.; capital stock, $300,000.

Oelwein Telephone Co., Oelwein, Ia.; capital stock, $5,000.

Seattle Home Telephone Co., Seattle, Wash.; capital stock, $100,000.

Keyser Electric Co., Keyser, W. Va., manufacturing electricity, etc.

The United States Electric Forging Co., New York, N. Y.; capital stock, $1,000,000.

The Norwood Construction and Electric Co., Chicago, Ill., by E. D. Smith, M. Sampson and Jas. A. Lowe; capital stock, $20,000.

St. George Electric Co , Ltd., St. Johns, N. B., by T. H. Estabrooks, A. P. Barnhill and Dr. M. Baird, of St. John, and A. T. Dunn and F. B. Dunn, of Mushouash. Capital stock, $100,000.

St. George Electric Light and Power Co., St. Johns, N. B., by J. Sutton Clark, Timothy O'Brien, Andrew S. Baldwin, Jno. Frawley, Dr. H. J. Taylor, Jas. Vogue and John O'Brien. Capital stock, $5,000.

Red Line Traction Co., Chicago, Ill., by R. V. McNelhis, Frank Keogh and T. J. Hodkins. Capital stock, $500,000.

F. D. Potter Co., Albany, N. Y., by David W. Potter, of Waldoborough, Me., Wm. J. Newton and Jos. Hutchinson, of New York City, to deal in electrical apparatus and machinery, and to carry on the business of consulting engineers. Capital stock, $1,000.

The Harrison Inter-State Telephone and Telegraph Co., Frederick. Md., by Peter D. Fahrney, Jno. Baumgardner, Jas. L. Walker, Francis B. Sappington and Edgar L. Miller. Capital stock, $25,000.

United Gas and Electric Light Co., Saratoga Springs, N. Y., by Chas. E. Arnold, of Albany and Edward L. Slattery and Elias H. Peters, of Saratoga Springs, to manufacture and supply gas and electricity for public and private purposes. Capital stock, $50,000.

The Yonkers Electric Railway Co., Yonkers, N. Y., by J. Irving Burns, W. Delevan Baldwin, Gelston Affleck, of Yonkers, B. L Rice, Chas. J. Downing, of New York city, Geo. S. Forbush, of Brookline, Mass., Geo. W. Williams, of Bandon, Ore., W. R. Hurd, of Hartford, Conn., and O. Noble Rowan, of Irvington. Capital stock, $1,000,000.

Fenders.—The Newark (N. J) Board of Works has ordered that all trolley cars in Newark shall be equipped with life-saving fenders before October 1, and has passed a resolution imposing a penalty of $50 a day thereafter for each car unprovided with a fender. The company has made many tests of patent fenders and has decided to accept an automatic one invented by S. A. Darrach, of Newark.

How Simple! "In the ground generator, they simply insert zincs and carbon directly in the ground without any containing vessel or cell, and saturated with a very weak solution of acids. Then, when the power of the generator begins to run down, all that is required to restore full electro-force is to add another supply of the fluid. By this means the carbons are depolarized without removing them from the ground, consequently the generator can be run day and night until the zincs are worn out."—*San Francisco Paper.*

TUPPER ROCKING GRATE.

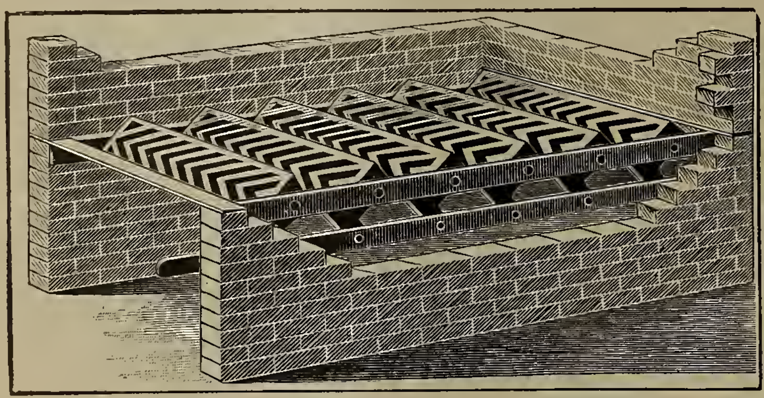
Next to the boiler itself the most important thing is the grate. A poorly designed grate renders it impossible to keep up a good fire, and consequently there is liable to be a deficiency of steam and certainly a waste of fuel. A good grate, therefore, is an important part of a boiler plant.

We illustrate herewith a grate made by W. W. Tupper & Co., 39 and 41 Cortlandt street, New York, that is in extensive use. It is known as No. 5 Rocking grate, and is adaptable for all kinds of fuel. Economy of fuel and durability are the main points claimed for these grates.

In the past eleven years W. W. Tupper & Co. have furnished over 8,000 factories and steamers with their grates, and they have, it is said, proved to be the best and most economical in use.

Improvements in their form give them the requisite strength with the largest percentage of air openings for burning the various kinds and sizes of coal.

They do not warp or break, and expansion and contraction takes place without any strain on the parts. In many furnaces where these grates are in use blowers have been dispensed with entirely.



TUPPER'S NO. 5 ROCKING GRATE.

The No. 6 dumping grate made by this firm, and which we described and illustrated in our issue of July 21, is also adapted for all kinds of fuel. The grates are of the same construction in both styles, the difference being that in the No. 5 all of the bars rock, while in No. 6 the half sections of the grate are dumped.

The many testimonials in the possession of W. W. Tupper & Co. show how highly esteemed these grates are.

Caustic Soda.—It is possible that the various applications of electrolysis will eventually find their true place rather as adjuncts to other manufacturing processes than as substitutes for them. A method recently devised by T. Craney appears to be a move in this direction; he proposes to prepare caustic soda—which, as everyone knows, is one of the most useful chemicals, and of almost cosmopolitan application—from brine by the *aid* of electrolysis. The decomposition of the salt solution in the cells is not carried to its full limit, but only to the extent of producing a 1 per cent. or 2 per cent. solution of caustic soda. This solution is then drawn off and its place supplied by water of condensation from the evaporators which are used in obtaining the soda in the more concentrated form. The salt brine is maintained on the anode side at its initial degree of strength, so that there is a constant supplying of raw material on the one hand, and a continuous removal of soda on the other. The plant in this process consists of a series of electrolytic cells, a receiver for the dilute caustic soda solution removed from the cathodes, electric generators, steam engines, boilers which are fed with the weak soda solution, to be run off when about doubled in strength into evaporators or vacuum pans from which the concentrated solution is discharged into kettles, where it is solidified. The idea underlying these arrangements is greater economy, which is stated to be effected to a high degree if the plant is kept in continuous action. It is not clear, however, what becomes of the chlorine inevitably produced during the electrolytic decomposition of the brine.—*Electrical Review*, London.

CATALOGUE OF ELECTRICAL BOOKS.

(*Continued from Page* 54.)

The following is a catalogue of books on every electrical subject, complete to date. It is classified according to subjects, which arrangement will facilitate the finding of a book on any particular subject, without having to go through a long list, and then, as is often the case, give it up in disgust.

Preserve this list!

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Gore's Art of Electro-Metallurgy.................$2 25
Gore's Electrolytic Separation of Metals......... 3 50
Gore's Theory and Practice of Electro-Depositions 80
Gore's Electro-Chemistry. Second Edition...... 80
Langbein's Treatise on Electro-Deposition of Metals 4 00
McMillan's Treatise on Electro-Metallurgy....... 3 50
Trevert's Practical Treatise on Electro-Plating. (Cloth).. 50
Urquhart's Electrotyping. A Practical Manual... 2 00
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ELECTRIC POWER.

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MOTORS.

Watson's How to Make a 1-H. P. Motor or Dynamo... 25
Crocker & Wheeler's Practical Management of Dynamos and Motors. 100 pages. Fully illustrated.. 1 00

Martin & Wetzler's Electric Motor and its Applications 3 00
Parkhurst's Electric Motor Construction for Amateurs 1 00
Trevert's Dynamos and Electric Motors and All About Them 50
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TELEGRAPHY.

Fahie's History of Telegraphy. Illustrated 3 00
Field's History of the Atlantic Telegraph 1 25
Hoskiaer's Guide for the Electrical Testing of Telegraph Cables 1 50
Loring's Hand-book of the Electro-Magnetic Telegraph. Cloth 75
Maver & Davis' The Quadruplex. Illustrated 1 50
Maver's American Telegraphy. Illustrated 3 50
Mullaly's The Laying of the Cable; or, the Ocean Telegraph 4 00
Plum's Military Telegraph During our Civil War. 2 vols 5 00
Pope's Modern Practice of the Electric Telegraph. 234 pages New edition. Illustrated 1 50
Preece & Sivewright's Telegraphy 2 00
Prescott's Electricity and the Electric Telegraph. 2 vols 7 00
Reid's Telegraph in America. 894 royal octavo pages .... Cloth, $5.00; Russia, 7 00
Sabine's History and Progress of the Electric Telegraph 1 25
Smith's Manual of Telegraphy. Designed for Beginners 30
Smith's Philosophy and Practice of Morse Telegraphy 25
Terry & Finn's Illustrations and Descriptions of Telegraphic Apparatus 1 50
William's Manual of Telegraphy 4 20

A DECISION IN FAVOR OF P. & B. PAPER.

We are advised by the Standard Paint Company, No. 2 Liberty street, New York city, of the close of the litigation to establish the validity of the U. S patent, under which that company has, since its organization, manufactured its paper, known under the trade name of "P. & B." paper. The U. S. Circuit Court for the District of New Jersey, on July 5. 1894, rendered a decree in the case of The Standard Paint Co. vs. Henry J. Bird and James L. Reynolds, in which it is adjudged that the assignors of this company were the first persons to produce a paper coated with the solid residuum of petroleum, and combining the characteristics of an odorless, water, acid, alkali and air-proof paper, and that the patent under which the company has hitherto manufactured was valid and had been infringed. The court, by Hon. George M. Dallas, Circuit Judge, holds that any paper possessing the same essential characteristics and produced by the coating with any material similar to that employed by this company, by whatever name it may be called, is an infringement of the patent, and that patent is good and valid in law.

In his opinion, Judge Dallas says: "As has been said, the product, *i. e.*, the coating materials, however, and from whatever produced, are the same, and by the use of either the same manufactured article is created, and this in the sense of the patent law constitutes identity. The material itself, not the substance from which it may be obtained, is the gist of the matter," and, "a patented manufacture is infringed by the making, use or sale of any manufacture which possesses the same essential characteristics. It is because it had never been used before, as, and for the purpose for which the patentees employed it, that the patent which they obtained is *impregnable to assault on the ground of anticipation.*" The court made a decree, giving the Standard Paint Company a permanent injunction against the defendants in the action referred to, and directing that an accounting be had to ascertain and determine the damages to the complainant by reason of the infringement.

This ligitation has covered a period of over four years, and has been attended by large expenditure and losses incident to this and other infringements. Having now obtained an injunction in the courts, the company will of course, seek to fully protect its rights.

TRADE NOTES.

Arthur Falkenau, Edwin R. Keller, Clayton W. Pike and Elmer G. Willyoung, of Philadelphia, have formed a copartnership under the title of the Falkenau Engineering Co., Ltd. The new company will conduct a general business as mechanical and electrical engineers, with headquarters in the Betz Building, Philadelphia.

The United Electric Corporation, which has just been incorporated in Minneapolis, Minn., will manufacture and deal in electric telephones and telephone appliances for telephone exchanges, private lines, factory plants, warehouses, mills, hotels, etc. The company will also install complete plants, and all of its goods are of high grade. Mr. Sam. Grant, the president, is a prominent capitalist in the Northwest, and Mr. Paul Bossart is a favorably and widely known electrician and a pioneer in the telephone business.

The Parkhill Mfg. Co., Fitchburg. Mass., write thus about the Eco-Magneto Watchman's clock: "We are glad to say that your system of watch-clock has given us entire satisfaction, and we take pleasure in recommending it."

Electrical and Street Railway Patents.

Issued July 24, 1894.

523,340. Construction of Railway-Tracks. Thomas H. Gibbon, New York, N. Y. Filed Mar. 28, 1893.

523,354. Electrically-Propelled Perambulator. Emil E. Keller, Chicago, Ill. Filed Apr. 20, 1892.

523,369. Electrical Igniting Device for Gas Engines. Alonzo J. Painter, Pasadena, Cal.; Nanie Painter, administratrix of Alonzo J. Painter, deceased. Filed July 28, 1893.

523,371. Secondary Battery. Antoine E. Peyrusson, Limoges, France. Filed Nov. 1, 1893. Patented in France Apr. 1, 1893, No. 229,096.

523,378. Transom for Cars. Theodore C. Salveter, St. Charles, Mo. Filed Feb. 9, 1894.

523,395. Multiple-Filament Lamp. Albert L. Clough, Manchester, N. H., assignor of one-half to Walter G. Chase, Boston, Mass. Filed Aug. 2, 1893.

523,396. Electric-Railway System. Albert C. Crehore, Ithaca, N. Y. Filed July 20, 1893.

523,401. Method of Working Arc Lamps. William S. Horry, New York, N. Y., assignor of one-half to Walter F. Smith, Philadelphia, Pa. Filed Oct. 17, 1893.

523,427. Car-Fender. Charles R. Hall, Philadelphia, Pa., assignor of one-third to Charles E. Jones, same place. Filed May 24, 1894.

523,436. Car-Brake System. Nathaniel Lombard, Boston, Mass. Filed Dec. 11, 1893.

523,444. Controlling Mechanism for Electric Motors. Charles H. Richardson, Philadelphia, Pa., assignor to the S. S. White Dental Manufacturing Company, same place. Filed Apr. 26, 1894.

523,446. Fare Register and Recorder. Charles S. Sergeant, Winchester, and Louis J. Hirt, Boston, Mass. Filed Nov. 20, 1893.

523,453. Mode of Mounting Dynamos on Car-Trucks William Biddle, Brooklyn, assignor to the American Railway Electric Light Company, New York, N. Y. Filed Oct. 6, 1893.

523,460. Incandescent Electric Lamp. Francis M. F. Cazin, Hoboken, N. J. Filed Dec. 7, 1892.

523,461. Electric Incandescent Lamp. Francis M. F. Cazin, Hoboken, N. J. Filed July 24, 1893.

523,471. Electric Snow-Plow. Louis J. Hirt, Somerville, Mass, Filed Nov. 20, 1893.

523,482. Adjustable Incandescent-Lamp Holder. Samuel E. Nutting, Chicago, Ill. Filed Aug. 17, 1893.

523,507. Street-Car Guard. Charles A. Barrett, Malden, Mass. Filed Apr. 27, 1894.

523,526. Car-Fender. Franklyn S. Hogg, New York, N. Y., assignor to himself and Barton B. Higgins, same place. Filed Jan. 19, 1894.

523,551. Car-Fender. Eldridge J. Smith, Washington, D. C., assignor to the Automatic Car-Fender Company, same place. Filed Apr. 27, 1894.

523,563. Car-Replacer. Robert E. Alexander, Forest City, Pa. Filed Apr. 3, 1894.

523,566. Electricity-Counter. François A. Broco, Paris, France. Filed Sept. 21, 1893. Patented in France, June 20, 1891, No. 214,327.

523,572. Electrical Converter. Robert H. Hassler, Dayton, Ohio. Filed Aug. 4, 1893.

523,595. Track-Clearer. Oscar Rothrock, New York, N. Y. Filed Dec. 6, 1893.

523,613. Telephone-Switch. Jacob O. Ziegler, Boston, Mass., assignor of one-half to Alfred A. Ziegler, same place. Filed May 10, 1894.

523,617. Signal-Telegraph. Claudius V. Boughton, Buffalo, N. Y., assignor to the Boughton Telephotos Company, same place. Filed Nov. 13, 1893.

523,625. Trolley-Catcher. Edwin M. Drummond, Louisville, Ky., assignor of one-half to Joseph O. Haddox, same place. Filed Mar. 3, 1894.

523,630. Telephone. Stephen D. Field, Stockbridge, assignor to the American Bell Telephone Company, Boston, Mass. Filed Apr. 7, 1894.

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CONTENTS.

THE BUSINESS OUTLOOK.

Notwithstanding the dulness of business throughout the country, electrical enterprise evidently holds out as strong attractions as ever to the capitalist, judging from the large number of new electrical concerns incorporated from week to week. It is a healthy sign, and the fact that so much confidence in electrical industry exists all over the country bespeaks a period of great activity when the normal conditions of business are reestablished. This is a great country, and with a rapidly increasing population and the revival of trade in general the demand for electrical apparatus of all kinds must inevitably increase. The outlook is extremely bright; indeed, there is already unmistakable evidences of a revival of activity. Patience will bring its reward always.

ELECTRICITY ON THE ERIE CANAL.

In a despatch from Albany, N. Y., Mr. Frank W. Hawley, vice-president of the Cataract General Electric Company, is reported to have stated that early in October next, 20,000 electrical horse-power, generated at the Niagara Falls plant, would be available in Buffalo. After that date the construction of lines east of Buffalo will be commenced, and it is expected that Rochester will be reached by April 15 next. The line will be erected along the banks of the Erie Canal for the purpose, mainly, of supplying electric motive power to canal boats.

LONG DISTANCE ELECTRIC ROADS.

"Trolley cars for Albany," or "Trolley cars for Philadelphia, Baltimore, Washington and the West," may be the cry heard at New York before long. The latest move in the long distance direction is the reported development of a line between New York and Albany, by connecting the different towns along the route by interurban lines. The observer of events sees in this development of the electric railroad idea a formidable competitor of the steam roads, and what the result will be would be hazardous to predict. Electricity will certainly push steam very hard in the matter of railroading, as well as along other industrial lines, and the steam roads should keep their eyes wide open. A strike of Pullman trolley car employés is one of the possibilities of the future, and who knows but that our friend Debs will then be Grand Chief Electrical Engineer of Strikes.

CONVENTION OF EDISON COMPANIES.

The Association of Edison Electric Illuminating Companies will hold its annual meeting in Boston on the 14th instant, and, according to the programme, it will undoubtedly be a profitable one in many ways. Ample enjoyment will be provided for the members and friends, and the papers to be read, judging from their titles, will be important and interesting. This is an excellent association in every particular save one. It ought to be more liberal in the matter of publicity of the papers read at its meetings. Once in a great while the electrical press is favored with a copy of a paper; but as a rule the precept of the proverbial clam is practiced to the full by the ruling powers of this association. It is hopeful that Mr. Barstow, the new secretary, will exercise his influence towards breaking down this Chinese custom. Let the world know what is being done by the Edison Companies; there is nothing to lose by making public the results of experience, but much to gain. Exclusiveness is pharisaical, and as applied to the Edison Companies' Association, one might get the impression that the Edison people were in possession of some omnipotent secret, or that their practice was so imperfect that they were ashamed to let their contemporaries know what they were really doing. False impressions can be avoided only by making the proceedings public.

THE WALKER MFG. CO.'S. STREET RAILWAY MOTOR.

A few months ago the Walker Manufacturing Co., of Cleveland, Ohio, added to its large manufacturing plant an electrical department for the production of electric generators and motors for street railways, ordinary power transmission, and mining and extra large alternating current machines for the transmission of power over long distances. The reputation that this concern had previously enjoyed rendered its entrance into the electrical field an easy matter, and the statement that its apparatus would be of the highest character, both as regards efficiency and workmanship, was accepted without any question, all of which exemplifies the value of a good reputation.

It is not our purpose at this time to describe all of the apparatus manufactured by this company, but to confine ourselves strictly to the railway motor, which possesses some interesting and valuable features.

The Walker street car motors represent the best results of practical experience, and combine all the features of most value in such apparatus.

Fig. 1 shows a rear view of a four-pole, single reduction steel motor, which is entirely enclosed in a malleable iron case. This motor has an easy capacity of 25-h. p., and will drive a car at any speed up to 25 miles an hour. The only attachment to the axle is through yielding supports, which method prevents the hammer blow as well as the inertia blow, both of which are destructive to track, rail-joints and the motor itself.

The Walker Company's method of suspension is ingenious and entirely novel, and is said to entirely obviate the injurious actions referred to. The motor is suspended at the rear by spiral springs between the lugs of the frame, and at the front it is suspended by a swinging arm from the ordinary spring truck bar, which arrangement allows the motor to ride freely, and readily adjust itself to varying conditions without strain or check on any part.

The motor is controlled by a series-parallel controller of superior type and of simple construction, and it is entirely water and dust tight. An opening is provided on the lid over the commutator, which enables the brushes to be easily reached. The frame is constructed in two parts and made of steel, of which metal the gears and pinions are also made.

The method of suspension can be seen in Fig. 1, which shows the spiral springs. Fig. 2 shows a sectional view through the bearings and housing and illustrates the construction of the bearings, which are designed to entirely prevent the admission of grease into the motor casing. The bearings are entirely outside of the motor casing or frame. The grease which comes out of the bearing falls to the ground through the opening C, thus preventing its getting inside of the motor case.

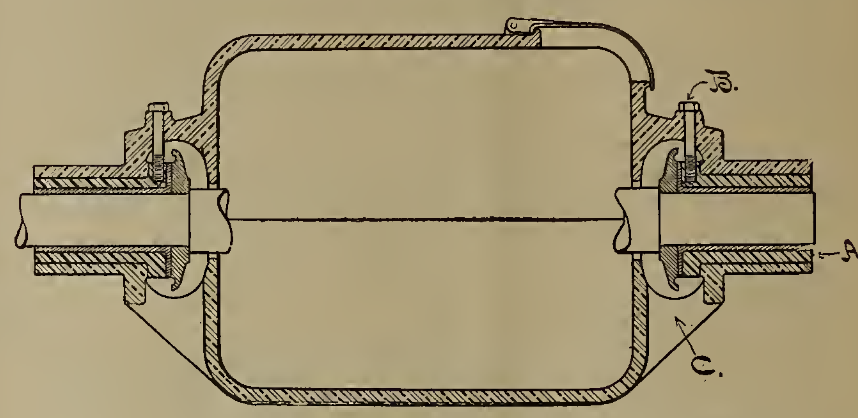


FIG 2.—SECTIONAL VIEW OF MOTOR CASING AND BEARINGS.

These motors, by their design, give the greatest mechanical strength for the least weight, the two factors being balanced to a nicety. Every pound of material has been placed where it can be utilized to the best advantage and there is no superfluity of metal anywhere.

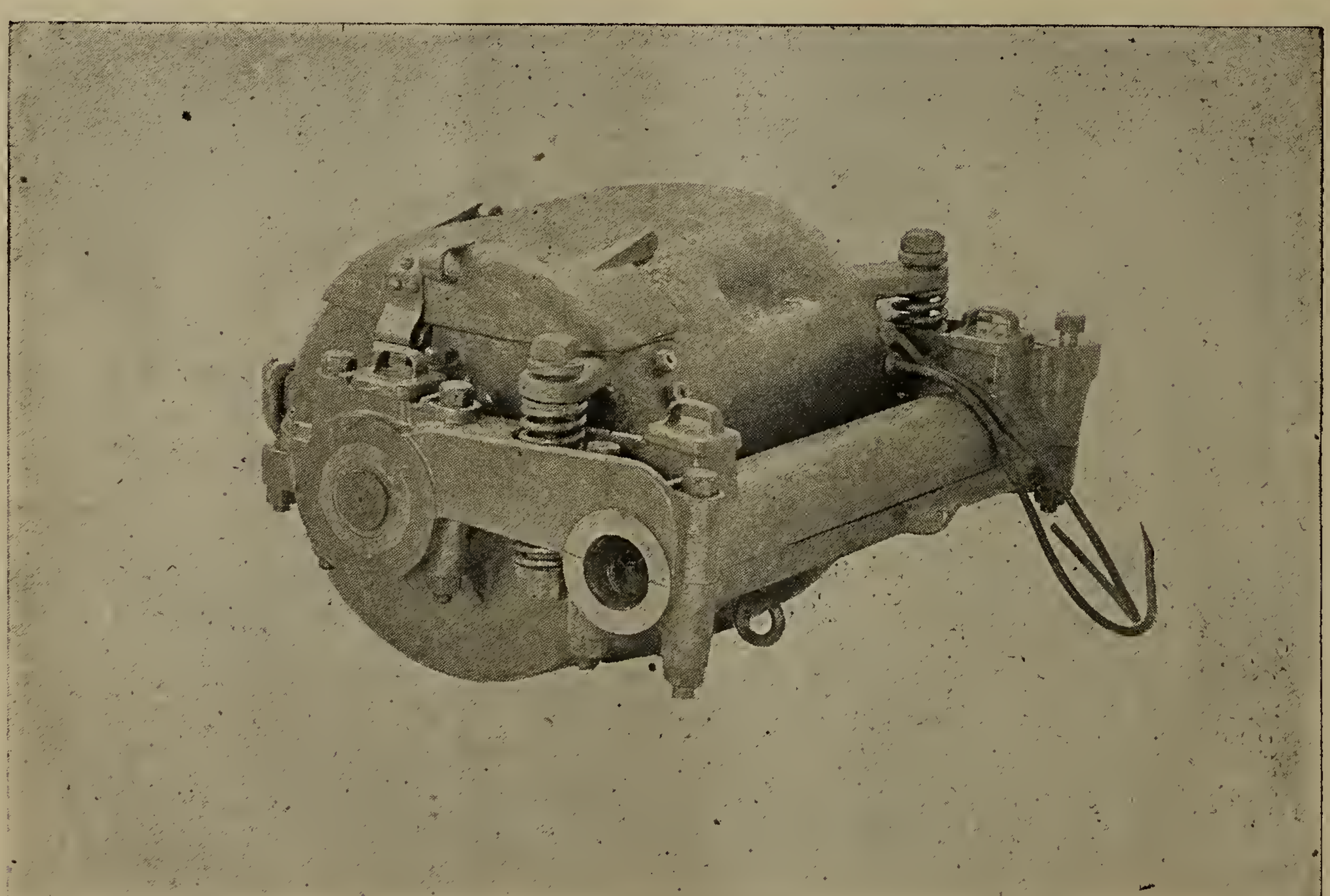


FIG. 1.—WALKER MFG. CO'S FOUR-POLE SINGLE REDUCTION STREET MOTOR.

Accessibility is another feature of these motors. They can be examined from above or below with equal facility, and the removal of parts is as easily accomplished. All parts are thoroughly protected, the armature, commutator, brushes and field coils being enclosed in a dust proof case.

The armature is of the toothed drum type, the coils being machine wound and interchangeable. The laminated core is built up on a strong cast-iron sleeve, which is accurately bored to standard gauge. The coils are insulated with mica, and, as in the case of all other insulated portions, they are subjected to a test of 5,000 volts.

The field magnets, of the four-pole type, are made entirely of cast steel, and the field coils are insulated with mica and are machine wound. The wire has ample capacity so that there is no undue heating, even from extreme and prolonged loads. The coils can be removed with ease and despatch.

The commutator is made up of the highest grade drop forged copper, insulated with the best of mica. Each segment has to stand the 5,000 volt test before it passes for assembling.

These motors are pr ctically noiseless in operation.

The plant of the Walker Manufacturing Company is one of the largest and most complete in the country, and is most modern in its equipment. The buildings cover an area of about 250,000 square feet of ground, and are constructed of brick, iron and glass.

DYNAMOS FOR CHARGING ACCUMULATORS.

Dynamos used for charging accumulators, writes M. W. Rechniewski in *L'Electricien*, have to fulfil certain conditions which are not always very convenient, especially in the case where the same machine has to charge the accumulators in the day and serve at night for the supply of current direct to the lighting mains. It is necessary under these conditions that the machines should work at 110 volts in the evening for lighting, and that the voltage may be increased to 155 or 160 for charging the accumulators in the day. The difference of voltage is still greater when there is an appreciable loss in the line. Supposing the loss is 10 volts at full charge, it will be necessary that the dynamo should furnish 110 volts at a low charge for lighting, 120 volts at full charge for lighting, and 170 volts for charging accumulators. It is necessary that the machine should work under these different conditions without sparking, and that the running should be steady. That is the difficulty.

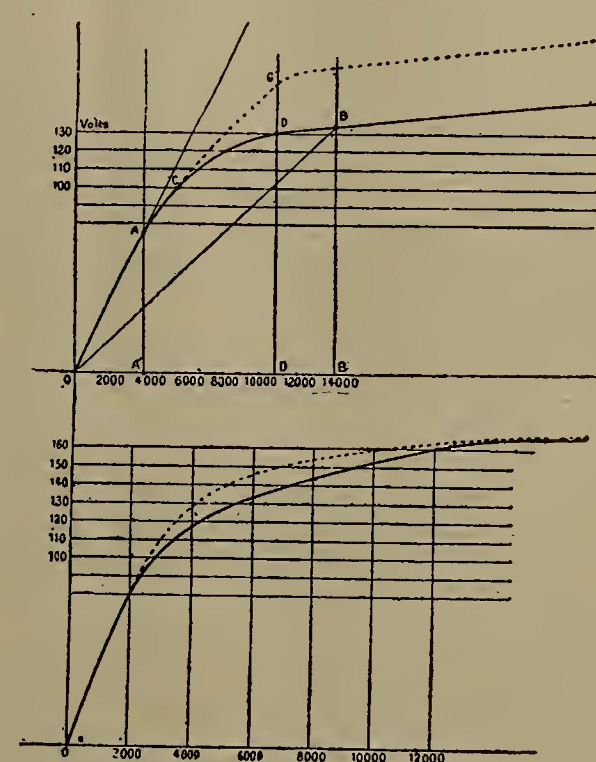
It is evidently easy to construct a machine working at 170 volts, but when we have to run it at 110 volts it has no steadiness, or the voltage increases beyond 110 volts, resulting in considerable variations in the lamps. Besides this, as the excitation for 110 volts is much reduced it is almost impossible to run properly without sparking with such low charges. This inconvenience can evidently be remedied by varying the speed of the dynamo proportionately to the voltage required. This method would be admirable from the point of view of working the dynamo, which would thus run at a constant saturation, but it is impossible to employ it. In most cases in practice it is necessary to run at a constant speed. The steadiness of the voltage can also be assured by exciting the dynamo by the accumulators; by this means all the voltages can be obtained in a steady manner, but good running is not assured as regards sparking.

Further, it will not be possible to run satisfactorily without accumulators, which is very inconvenient, as a stoppage will be necessitated while the accumulators are disconnected when being cleaned or repaired.

Considering this problem, first, from the point of view of steadiness, we will take, for example, the characteristic presented in Fig. 1, which is that of a normal 20,000-watt dynamo. It is known that the tangent *a* of the angle B O B^1 is proportional to the resistance of the exciting circuit of the dynamo. By varying this resistance by moving the exciting rheostat, the voltage of the machine can be varied and a given resistance corresponds with a given voltage, provided that this angle *a* shall be less than that made with one of the abscissæ by the tangent O T of the characteristic at the beginning.

If the resistance become greater, the dynamo would become unsteady immediately. But it can be seen that the characteristic confounds itself with the tangent during a tolerably long course, in this case from O to A—that is to say, for the value of the exciting resistance corresponding to the angle A O B^1, the voltage may take any value between O and A A^1. There is consequently unsteadiness.

The dynamo cannot, therefore, work practically below A A^1 volts, and, morever, it is prudent to keep above this extreme value. In the case of our figure, it would be inadvisable to descend below the point C—



FIGS. 1 AND 2.

that is to say, of 100 volts. On the other hand, the heating of the field magnets does not allow of exceeding an excitation of 11,000 ampere-turns, corresponding to about 130 volts. The margin for this machine is thus only 30 volts. This margin, further, is reduced when we remember that the characteristic only represents the working of the dynamo running unloaded, and when loaded the reaction of the armature, as well as the inevitable slackening of the speed, considerably lowers the margin which has been found.

If on leaving the point C, where the running is even, one could prevent the characteristic from inflecting more, and make it take, for example, the direction of the dotted tangent in Fig. 1, we would arrive, for the maximum excitation allowed, O D^1, at a final voltage much higher, and at a sufficient margin for even running at 110 volts, as well as at 170 volts.

This is the manner in which the firm of Messrs. Postel-Vinay have solved the problem. In order to obtain a characteristic of the form in question, they employ armatures with very fine teeth, which are already saturated for 100 volts, whereas the field magnet and the armature are still far from the point of saturation. This saturation of the teeth of the armature produces the first bend of the characteristic at about 100 volts. From this moment everything happens as though the intervening iron of all the height of the teeth had been increased—

that is to say, the characteristic again becomes rectilinear, but with a more feeble inclination than before, and this up to the moment of saturation of the field magnets and the armature where the characteristic inflects definitely and tends to become horizontal. The plain line of Fig. 2 represents the characteristic of a machine constructed on this principle, and it will be seen that the running, which is even at 100 volts, can still reach 150 for an excitation of about 9,000. The margin of 50 volts, which is found here, is more than sufficient, the loss of charge on the line being insignificant in this case. The same principle serves for regularly over-compounded dynamos. The dotted line in Fig. 2 shows what would be the characteristic of a machine made on the ordinary principle for 150 volts. It will thus be seen that the limits of even running are very nearly approached.

NEEDED MODIFICATIONS OF OUR PATENT LAWS.*

BY WALTER S. LOGAN.

Observations made in the course of a somewhat extended and laborious patent practice lead me to the conclusion that certain crucial changes in the Patent Laws of the United States are necessary, to give the country and the people, inventors and consumers alike, the fullest possible benefit of our patent system; and I submit the following propositions to this Association for discussion and for its judgment:

(1) We should not insist upon absolute novelty in the invention, as a condition of a patent.

(2) Where several inventors, working independently on the same problem at the same time, reach substantially the same result, or where all contribute to the result, the reward, that is, the profit of the total invention, should be judicially divided among the inventors, according to their respective merits.

(3) Simple invention should not be enough to give a man an absolute monopoly. The inventor should be required in addition to reduce his invention to practice and introduce its benefits to the pub'ic, or if he fails to do so, another under proper restrictions should have the right to do it and to share in the profits of the invention.

(4) Where the inventor himself fails either directly or through a licensee, to supply the full public demand for the patented invention, at prices which are at the same time reasonable to the public and give him a fair and liberal royalty for his invention, then the Court should have the power to compel him to grant licenses to others on reasonable terms, and to fix those terms.

In order to discuss these four propositions intelligently, it is necessary for us to consider for a moment the philosophical basis of property in inventions.

We are living in an unreverential age. Institutions can no longer stand on the basis of immemorial existence. Custom, however long continued, is not a sufficient justification for anything. Even the mantle of religion and the teachings of the Holy Writ will not suffice. Everything must justify itself by showing that it fits into the conditions of modern life, and is, on the whole, beneficial to the human race, or it must perish.

This test is applied even to such institutions as the Christian Church and the marriage relation—deemed, until recent times, too holy and too sacred for discussion or question.

Among the things most severely and persistently attacked in recent years has been the institution of property. Shall private property of any kind continue or shall the state, or the public in some form, be the only capitalist? Shall individuals or sets of individuals be allowed to maintain monopolies in some of the good things of the earth—in lands, in personal property or in rights and franchises, or shall all be allowed to enjoy everything equally?

The anarchist and the nihilist would pull down to the foundations and begin all anew; the communist would start with a re-division of things; the socialist would hold all things in common; the nationalist would make the state the only property owner; and Mr. Henry George would abolish private ownership in simple land and franchises and open the earth's surface on free and and equal terms to all its people.

There is more or less fascination in discussing and speculating upon all these questions; but my charter here, tonight, limits me, and I can consider none of them except as the consideration bears upon the question of patents, or property in inventions.

We have to watch tendencies now as we never did did before. The successful business man or lawyer, as well as the legislator, must be something of a seer. Things move so rapidly and change so quickly in this age of railroads, steamships, telegraphs and telephones, of the printing press, the newspaper and the magazine, under the stimulus of free thought and universal discussion, that unless one looks far ahead and steers his bark with the current, he will find himself stranded and left behind.

In what direction is property in inventions drifting? Is the inventor to be better or worse protected as years roll by? Is it safe for a man to make it his life's work to discover some new or better way of doing something, and what reward can he reap for his labor? Shall he provide cheap food for the world and then die of hunger himself? Shall he invent some new way of ministering to the general happiness and then live a life of individual poverty and wretchedness; or will the new civilization provide rewards adequate to the service and pay for what it gets?

There is no question which can be discussed, here or anywhere, of more transcendent importance.

There has been a great deal of speculation upon the philosophical basis of property in general. Why is one man allowed to put a fence around acres of the earth's surface, the common heritage of humanity, and keep all other men off? Why can anyone monopolize a rich jewel, dug out of the common earth, or a beautiful panel carved from a tree out of nature's forests? Why can he appropriate to himself the fruit and increase of flocks and herds which roam over the common sward and feed upon the herbage which comes from God's laboratory? Or why can the few men who compose the New York Central Railroad Company have the exclusive privilege of running a railroad through the Mohawk Valley?

Some incipient philosopher in the time of the New Testament was asking such a question as this of One at whose feet the world has since learned to worship and the reply came back, "Render unto Cæsar the things that are Cæsar's." The answer was one worthy of its divine origin, and so far as it goes no fault can possibly be found with it as an ethical maxim; but considered as an absolute rule of conduct, the difficulty with it is that we don't know what is properly Cæsar's and what isn't, and no attempt is made to enlighten us upon this subject. Is it Cæsar's or some one else's because it bears a certain image or superscription? Does it exist for the private benefit of some particular individual, because he happens to have been able to enclose it in his brawny hand and defend it with his strong arm? Is it his, simply because he has taken it from the bowels of the earth or re-fashioned some work of nature? Is it his because a man-constituted court has sat in judgment on the question and the sheriff or marshal has delivered it into his custody? Is it his be-

* Read before the American Association of Inventors and Manufacturers, Washington, D. C.

cause he has some privilege or immunity, general or special, which is denied to the rest of humanity? Is it his simply because he claims it and nobody else objects? What rule shall we adopt, what test shall we apply, to determine the question of ethical ownership to anything of which property is predicated?

Philosophers, metaphysicians and economists may discuss the question to any extent they will, and settle it to their own satisfaction as they may; but as for us, plain, practical men, who have to take the world as we find it, and are not even fully satisfied that we could have made a better one if we had had the contract, there is only one adequate basis for the right of property—the general good of all humanity. Private ownership of lands and goods has been acquiesced in, and our civilization has been built up around it, simply because the world has discovered by experience that it is better for all concerned, for the man who has not as well as for the man who has, that it should be so; because it has been found that each man gets more of the good things that the earth has to give him, with an exclusive and personal title to a little, rather than with an undivided, general interest in much. The basis of our titles is not in religion, in force, in sentiment or in wrong; it is in the fact that long centuries of experience have shown that the institution of private property is for the general welfare. The man who has profits by his own, and the man who has not profits by the possessions of his neighbors. It is, for the ordinary citizen, easier to buy a dinner, ready cooked, than to cook it, and besides, he probably gets a better dinner. The man just entering life is better off, if he have a chance to earn a living by working for others, than if he simply had an univided interest in uncultivated acres and full liberty to work and labor thereon to his utmost on his own account. The real test to which all human institutions must at last submit is: Would the world in the aggregate be better off, with, or without, them? Private property will continue so long as it is useful to humanity, and if the time ever comes when it ceases to be useful, the institution of private property will cease.

How is property useful? What good does it perform? What sphere in the world's economy does it occupy? As we answer these questions we shall be able to judge what kinds of property are likely to continue longest, to be held in the highest esteem, and to produce the greatest profit to the owner

I see nothing in property but a universal, highly evolved, automatic and generally just, system of rewards. Ownership of property enables its possessor to enjoy more of the blessings the world has to bestow and to get more out of life than he could without it. So everybody wants property. The world needs the work of its inhabitants. To get property, the citizen must be industrious, and so the world benefits by his industry. The world needs the results of accumulation and acquisition To accumulate and acquire, one has to be frugal and saving, and so the world profits by the individual's frugality. The world needs great works of improvement, railroads, steamships, factories, machinery, buildings, permanent structures and works of a hundred kinds. The ownership of these is profitable and produces a revenue. Therefore people invest the proceeds of their labor and their accumulations in these works, and the world profits thereby.

But what does the world need most? What is it that has, within the last century revolutionized the face of the earth and changed the whole manner of men's lives? What is it that makes the world a so much better place to live in now than it was a century ago? Mainly the work of its inventors and discoverers—of such men as Guttenburg, Arkwright, Watt, Stephenson, Fulton, McCormick, Pullman, Morse, Bell, Edison and hundreds and thousands of others whose united work has made it possible to cross the continent now easier than you could go one hundred miles in olden times; enables us to step into a palace, and after a few days of luxurious living, arrive on the other side of the earth; has made food so cheap that none need go hungry, and clothing so easy to obtain that shop-girls are dressed in finer raiment than queens used to wear; gives us the brilliancy of noonday through the long winter evenings, at an insignificant cost, the morning newspaper for two cents, and books so cheap that libraries are getting out of date; and enables us to enjoy life in all its phases to an extent that our grandfathers never could have dreamed of.

And so, we pay rewards to our inventors. We didn't appreciate at first what they were doing for us, and we got their work too cheap—so cheap that many a man who has done more for humanity with his brain than all the Rothschilds ever did with their money has died in poverty, and even his memory has had to wait for a more appreciative generation to do it justice. But these things right themselves, and mistakes and wrongs rarely survive the generations which commit them. We are honoring our inventors now in a more substantial way; we are beginning to allow them to get rich. I expect to live to see the time when Thomas A. Edison will be wealthier than any of the Vanderbilts, and he ought to be.

The world will need the services of the inventor quite as much in the future as it ever has in the past. We have only captured the outposts of knowledge, picked up a few grains here and there on the border. The whole vast country beyond is unexplored and waits for the great benefactors of humanity to recover it. In electrical science, for instance, we have only scratched the surface. The depths that have yet to be revealed no man has ever sounded. We have only learned the primer of the art of transportation. We still cling clumsily to the earth and dare not yet tread the free and waiting air. We dig deep in the ground for dirty coal, while the clean sunlight goes to waste all around us; and we still laboriously use the plough and the hoe to raise food, while we are waiting for the great chemist to come who will produce it direct from earth and air, without the intervention of vegetable or animal life. The planet we live on is good enough and there is enough of it to support ten times the population it now has, in comparative ease, luxury and leisure, instead of laborious and grinding toil, if we only knew how to do it. It is the inventors and discoverers who are to lead the way. For the great services which they have to render in the future, the world must pay them great rewards. It needs what they are doing now much more than it needs the result of patient, plodding industry, the savings of the prudent or the investments of the wise, and as it needs it more, it must and will pay better for it.

(*To be continued.*)

NEW YORK TO ALBANY BY ELECTRIC ROAD.

A despatch from Poughkeepsie, N. Y., states that the trolley road between that city and Wappinger's Falls, which is approaching completion, is only one link in a chain of trolley systems connecting all the inland towns between New York and Albany. A road connecting Wappinger's Falls with Fishkill will next be constructed. Mr. Hinckley, the president of the road, it is definitely stated, is one of the representatives of certain influential capitalists who are putting this formidable enterprise through.

THE PHENOMENA OF ALTERNATING MAGNETIC FIELDS.*

BY ELIHU THOMSON.

(*Continued from Page 66.*)

Indeed, we may take advantage of the arrangement just referred to for securing a constant illumination of the lamp or a constant current in its circuit by hanging the coil in the field to a scale-beam and so loading the same that the coil will have a definite tendency or weight tending to move it into a stronger portion of the field. This is counterbalanced by the repulsive action exerted on the coil so that the latter floats, as it were, in such a strength of field as will induce a definite current. Variations of the field, or the alternating current which produces such field, are compensated at once by an automatic adjustment of the coil in relation to the field.

This apparatus will undoubtedly be found useful in photometry for maintaining a standard current through a lamp. A very pretty modification of the experiment is that of the "floating lamp." A small coil of wire has attached to it a suitable incandescent lamp, and is water-proofed so as to allow immersion in water in a glass vessel placed over the alternating magnetic pole. The lamp and coil are so loaded that they freely sink when no alternating field is present. The putting on of alternating current so as to produce a powerful field causes the lamp to rise or float upward with its attached coil to a height such as will maintain a certain brilliancy and at the same time cause a balance to exist between the uplifting repulsion of the coil in the field, and its tendency to sink. Here, then, we have a lamp lighted under water without apparent connection with anything and maintaining a constant degree of illumination while floating, not at the surface, but in the body of the liquid. The insertion of a copper sheet between the glass vessel and the alternating pole screens or cuts off the effect to a large extent.

This brings us to another phase of the subject, for if, in applying the screen in the last experiment, we place it so that it only covers a part of the alternating magnet-pole, it will be seen that the lamp-coil is moved laterally so as to tend to place itself directly over the screening piece. If we now substitute for the lamp coil a plain ring placed over the copper screen so as to be free to move, it will slip over the screened portion of the pole as if attracted thereto. Indeed we may take two rings of copper and place them together in the alternating field. They will attract each other and, if of equal diameter, will lie parallel as one ring. The double ring will now be repelled from the pole as if it were a single ring. The explanation of the attraction of the two rings is simple. Both are under the same induction and currents are set up in both which are in the same direction at all times Currents in the same direction produce attraction of the conductors conveying them into parallelism and as near together as possible.

By utilizing this principle we are enabled to secure continuous movements as of rotation around an axis—for we have only so to dispose conducting metal that it shall continuously be attracted towards our metal screen. Placing then a screen or shading-plate over the alternating magnet pole so as to cover it only in part, we approach the edge of a disk of copper pivoted centrally and free to rotate, so that one side of the disk shall cover the "shaded" pole. It at once begins to revolve and soon rotates rapidly, the movement being such as to bring new portions of the rotating disk constantly over the screen. The phenomenon in reality depends on shifting magnetic fields The shading-piece or screen retards the development of the alternating polarities in the space near it, while there is no retardation over the unshaded or unscreened portion of the end of the wire core. The effect is the same as if the magnetism continually travelled or shifted from the clear part of the pole to the shaded or screened part. But lines of force in movement will push conductors with them, and so the disk subjected to such influence is driven continuously. If an iron or steel disk be mounted on pivots, it will also be driven over the shaded pole, but its plane of rotation should be at right angles to that of the copper disk. Both disks may be driven together in planes at right angles. The iron disk is driven by the shifting lines of force as if it were pulled around by a magnet. One copper disk may act as a screen for another and both be set in rotation if they are suitably placed. Similarly, copper and iron disks may react on each other and both be set in rotation. Indeed, it is possible to keep a number of copper and iron disks in rapid rotation by placing them suitably in a single alternating magnetic field. Pieces of steel, tubes of copper, lumps of brass, iron masses, placed in an alternating magnetic field so modify it as to cause shifting magnetism, such that rotations are produced in pivoted iron and copper disks placed near them. An almost endless variety of dispositions may be selected and the results correspondingly varied. Thus the simple placing of a steel file across the alternating pole gives rise to shifting lines of force starting at the pole and passing to the ends of the file. Pivoted iron and copper disks placed near the file are rotated accordingly. Magnetic fields may be caused to travel around iron rings, along copper tubes, over sheets, etc., in each case being detected in their movement by the tell-tale rotating disks. The best detector is a delicately-mounted iron disk made up of several round punchings of sheet iron, and provided with an overhanging rim of copper, thus resembling an iron pulley with a wider rim of copper.

We thus see that an alternating magnetic field is truly dynamic in that it not only actively repels close circuits or deflects them into positions parallel to the lines of force in such field, but also that the introduction into the field of such a simple thing as a piece of conducting metal, or a piece of magnetic substance, brings about laterally travelling or shifting lines of force which may confer rotation or movement even continuously to pivoted pieces of conducting or magnetic metal.

That these principles should fail to find practical applications would be extraordinary. Indeed, the fact is that they are applied in practice in many ways, the details of which would be out of place in the present paper. They have been utilized in constructing regulators for alternating current motors, as well as in the construction of meters for registering the consumption of energy on alternating circuits.

One of the most curious facts brought out in the course of experimentation, an outline of which has been given above, was that a structure of copper and iron, such as the iron disk or pulley with a copper rim, when once set in rotation in an alternating magnetic field would not only continue in rotation, but increase its speed up to a certain point, even though there existed no shading-piece nor other device in the field to set up shifting lines or travelling field. The copper rimmed wheel was sufficient unto itself after it was first started in rotation. Similarly, an armature of laminated iron, bearing closed coils or circuits on its exterior and placed in an alternating field will, after starting, continue its rotation. Not only that, but with a scientifically-constructed machine the tendency to rotate will not be easily checked by taking power from such armature. This machine is in brief the single-phase induction worked up to a fair degree of perfection in late years. By the employment of commutators which only act during starting or by embodying the principle of the shaded pole, these machines become self-starting in character under even load.

It may be said in conclusion that the study of alternating currents and, incidentally thereto, of the magnetic effects of such currents, has widened the field of electric possibility almost without limit, and that there are at present no signs of abatement of progress in the directions given to electrical research thereby.

Furthermore, the study of the interactions occurring between what may be termed energy storage in an alternating magnetic field and energy storage in electrostatic fields, is leading the way to the solution of many great problems. The combination together of the effects of inductance, or magnetism in a circuit with capacity, or electro-static induction, is indeed the field of work which has promise of great results in the future.

ELECTRIC WELDING AND METAL WORKING.*

BY HERMANN LEMP.

Thomson's welding process consists in passing an electric current of great volume by means of two clamps of good conducting metal (generally copper) through two pieces firmly abutted against each other between the clamps, which, when heated by the current, are forced togther by mechanical pressure. The metal between the clamps alone possesses the requisites for the conversion of electrical energy into heat. The only loss of energy to be counted on will be that caused by conduction of heat to the clamps of the apparatus, by radiation and the resistance loss in the electric generator and welding machine. By increasing the speed of operation the first two items, which are alone of importance, will be reduced.

The apparatus generally used to carry out the Thomson process is :

1. A genenerator of alternating currents.

2. A welding transformer provided with clamps and mechanical appliances to work the heated metal.

3. Electrical regulating apparatus to control the flow of current.

The generator is best when of a low periodicity. For the past five years fifty cycles per second have been used, and even lower ; twenty to thirty could be used to advantage on large work, owing to the great self-induction which the work proper creates. When one considers the immense volumes of currents required for welding copper approximating 60,000 amperes per square inch of metal, he can imagine the density of the alternating field surrounding the conductor. Other things equal, the self-induction will be proportional to the periodicity, and so will be the corresponding increase of current above what would be needed to convey the necessary energy to the metal, if there were no self-induction. The generators are not different from those found in electric lighting, except in voltage and periodicity. They can be used for lighting if required.

In some apparatus, known as direct-welders, and used only for small work, the alternating currents for welding are generated in the dynamo and carried to the clamps directly, without transformation, and the clamps and mechanical pressure devices are all incorporated in the dynamo. The transformer, however, is usually employed in practical work. Through its agency small currents set in motion by high electromotive forces can be converted into currents of great volume with small electromotive forces, just as light belts running at high speed are made to transmit, by means of proper pulleys, the same mechanical energy as slow-running, heavy belts. The product of the feet per second and pull in pounds exerted by the belt measures the energy conveyed. So, roughly, the product of the length of wire and density of current flowing through it may measure electric energy. A belt transmission and electric transmission are analogous, and the latter is explained by the former. The electric transformer is just as simple an apparatus as any set of pulleys—in fact, more so, on account of the fact that none of its parts are revolving. Friction in a belt transmission is equivalent to resistance in the magnetic and electric circuits.

Slippage is equivalent to what is known as magnetic leakage. An electric transformer in which the two windings are not closely related to each other, which allows a leakage of magnetic lines to take place between them, is comparable to a friction-pulley power transmission. If the load to be transmitted exceeds the friction, a slip will occur. A properly constructed transformer is like a positive coupling : it will transmit all the energy put upon it, or break down itself, or cause the generator to break down. This property is obtained by having the secondary conductor of a transformer completely surround the primary.

The most common form of transformer is a copper casting with either one or two grooves cut at one side ready to receive the primary winding, and its two terminals or poles respectively connected to the pieces to be welded by means of sliding contact surfaces. These forms are generally used in connection with a horizontal table for supporting the work.

For large apparatus, especially when the transformer itself is to be moved bodily to and from the work, the secondary is composed of two halves, which are bolted together with these grooved surfaces meeting. In the hollow rectangular frame thus formed, the primary coil lies both mechanically and electrically protected by the secondary. It is often customary to fill the intervening spaces with oil, which completes the insulating properties and permits a free communication of any heat generated in the primary to the outer walls of the secondary, from which it will be dissipated. These transformers have practically no leakage between primary and secondary. The only limiting item to transmission of energy through them is the ohmic resistance of the two windings.

The electric current is generally regulated by means of a reactive coil in series with the primary of welders or by rheostat in the field circuit of generator.

Certain materials have to be heated very slowly to prevent over-heating. Materials that are changed in nature at high temperature and that are easily fusible, such as copper, brass, tool steel, etc , are best welded rapidly. There is no opportunity given in rapid welding for deterioration of the metal, and whatever has been hurt is pushed out from the joint under longitudinal pressure. This method of rapid welding has come into great favor of late, and, inasmuch as an increased product is obtained by it, most users disregard the increased first cost of larger machinery on account of the benefit of increased production and uniformity. Under ordinary circumstances, we may say that seven horse-power minutes is a safe figure for bringing one cubic inch of metal to welding heat. This is practically the same for copper, brass and iron, with the distinction, however that for metals which conduct heat easily, a shorter time and correspondingly greater power must be used to prevent loss from both radiation and conduction. If the pieces to be welded are short and wide, making the conduction by the clamps great, from 10 to 15 horse-power minutes per cubic inch are required.

For heating iron or steel bars, as in upsetting or in ordinary forging operations, when of lengths not shorter

* *The Engineering Magazine*, August, 1894.

than a foot, from three to five horse-power minutes per cubic inch will be required to bring them to a bright red heat, and from four to ten horse-power minutes to bring them to a white heat, such as is used in blooms for rolling.

It is interesting to note that calorimetric methods have proved that, of all the electrical energy put into the metal to be heated, fully 75 per cent. is useful. The 25 per cent missing is mostly lost by radiation and conduction, showing a high efficiency of the electric conversion into heat, and that the actual cost of fuel for welds in an open forge and by the electric process is about equal under continuous working conditions, while with discontinuous working, the electric method is far ahead in economy. This has been rather a surprise to many, the question of fuel expense having always been regarded as settled to be greater for the electric process.

(*To be continued.*)

ELECTRIC LIGHTING OF RAILWAY TRAINS.

The General Electricity Company, of Berlin, has for several years been making extensive experiments on Prussian state railways, in the electric lighting of railway carriages. In a pamphlet recently issued by the company, some facts are given which, in connection with Mr. M. B. Leonard's paper on the same subject,* will be of interest to our readers.

The company's system differs from that introduced in England in the sense that it recommends the use of storage batteries which, when exhausted, are removed from the train to be recharged, a fresh set of accumulators being in the meantime substituted. Unless otherwise desired, one or more batteries are placed under or in each coach. It is pointed out that in determining the battery pressure, and therefore the number of cells to be used, the loss in pressure through internal resistance of the conductors is comparatively less when high tensions are employed. A battery to supply five 5-c.p. lamps for 40 hours weighs 466lb., with a discharge current at 15 volts, 515lb. at 22.5 volts, and 590lb. at 30 volts. Generally, a pressure of 22.5 volts (12 cells) is recommended, and 30 volts at the highest, although 15 volts is sufficient. If two lamps are to be installed for the lighting of a compartment it is better to provide two batteries, one for energizing each lamp. The batteries are placed in a wooden box, either arranged under the floor of the compartment or under the seats of the latter. Connection is made from the battery to the service conductors by means of flexible insulated wires and spring contacts, the wires outside the carriages being protected by gas-piping. A suitable switch is provided for each battery, and this is under the control of the guard or other attendant. The batteries are removed from the train when necessary for recharging at any railway station where a charging-room is available, and fresh ones substituted. It is mentioned that in the case of the Dortmund-Gronau-Enschede Railway the working results of the electric lighting of the trains have proved that this method is not more expensive than gas illumination, although the service is not very extensive.

RECEIVERS' SALE.

On Wednesday, August 8, Foster M. Voohees, receiver for the Royal Arc Electric Co., sold at Taylor's Hotel, Jersey City, N. J., United States patents for improvements in electric lighting as follows: No. 257,678, issued to Edwards or W. J Baxter, May 9, 1882; No. 257,679, issued to Edwards or W. J. Baxter, May 9, 1882; No. 275.168, issued to Edwards or W. J. Baxter, April 3, 1883; No. 275.169, issued to Edwards or W. J. Baxter, April 3, 1893; No. 275,170, issued to Edwards or W. J. Baxter, April 3, 1883; No. 275,171, issued to Edwards or W. J. Baxter, April 3, 1883; No. 275,172, issued to Edwards or W. J. Baxter, April 3, 1883; No. 275,173, issued to Edwards or W. J. Baxter, April 3, 1893; No. 275,174, issued to Edwards or W. J. Baxter, April 3, 1883, No. 281,985. issued to Beardslee, July 24, 1883; No. 265,737, issued to Beardslee, October 10, 1882; No. 288,157, issued to W. Baxter Jr., November 6, 1883; No. 306,998, issued to W. Baxter, Jr., October 21, 1884; No. 503,538, issued to Howard, August 15, 1893; No. 503,539, issued to Howard, August 15, 1893; No. 483,518, issued to Howard, June 5, 1894; No. 505,665, issued to Marks, June 26, 1894; No. 521,936, issued to Marks, June 25, 1894; No. 492,598, issued to Ransom and Wood, December 2, 1892; No. 496,244, issued to Marks and Ransom, June 5, 1894; also the following application for patent now pending in the Patent Office of the United States: No. 513,732, made by Marks, case still pending in the Patent Office.

*See Electrical Age, July 28 and Aug. 4, 1894.

CATALOGUE OF ELECTRICAL BOOKS.

(*Continued from Page* 69.)

The following is a catalogue of books on every electrical subject, complete to date. It is classified according to subjects, which arrangement will facilitate the finding of a book on any particular subject, without having to go through a long list, and then, as is often the case, give it up in disgust.

Preserve this list!

TELEPHONY.

Dolbear's Telephone	$0 50
Du Moncel's Telephone, Microphone and Phonograph	1 25
Hopkin's Telephone Lines and their Properties	1 50
Lockwood's Practical Information for Telephonists	1 00
Preece & Maier's Telephone	4 00
Prescott's Electric Telephone. Second Edition. 795 pages	6 00
Allsop's Telephones. Their Construction and Fitting. 256 pages. Illustrated	2 00
Preece & Stubb's Manual of Telephony	4 50
Bennett's, The Telephoning of Great Cities. (Paper)	35
Poole's Practical Telephone Hand-Book	1 00
Webb's Telephone Hand-Book	1 00
Hughes' The Magneto Hand Telephone	1 00
Cary's How to Make and Use the Telephone. 117 pages, 26 illustrations	1 00
Haskin's Telephone Troubles and How to Find Them	25
Houston's Electrical Transmission of Intelligence, including the Telephone. 330 pages, 88 illustrations	1 00
Thompson's Phillip Reis, Inventor of the Telephone. 182 pages. Illustrated	3 00

WIRE.

Badt's Incandescent Wiring Hand-Book. 72 pages, 42 illustrations	1 00
Davis' Standard Tables for Electric Wiremen	1 00
Keasby's Law of Electric Wires in Streets and Highways	3 50
Noll's How to Wire Buildings. A Manual of the Art of Interior Wiring	1 50

TEST OF LUNDELL FAN MOTORS.

An interesting test was made of Lundell fan motors, on July 16, at the factory of the Interior Conduit and Insulation Company, in this city. Twelve machines of three sizes were taken at random from the stock, and the results of the test are shown in the following tables:

No. 560.				No. 562.			
No.	Speed.	Volts.	Amp.	No.	Speed.	Volts.	Amp.
1	1700	115	.44	1	1450	114.7	.86
2	1670	115	.44	2	1410	114.5	.83
3	1780	114	.43	3	1418	114	.87
4	1750	114	.44	4	1466	114.5	.87
5	1800	115	.47	5	1403	117	.81
6	1650	115	.44	6	1440	115	.83
7	1730	115	.44	7	1455	114	.87
8	1760	114.5	.47	8	1410	113	.83
9	1710	114.5	.46	9	1405	114.5	.85
10	1760	116	.46	10	1405	115	.81
11	1760	116	.45	11	1395	115	.86
12	1710	115.5	.44	12	1408	115	.82
Mean	1732	114.96	.44 5/6		1422	114.7	.84¼

No. 568.

No.	Speed.	Volts.	Amp.
1	112	115.5	.98
2	120	116	.99
3	116	115	1.00
4	112	113	.98
5	112	114.5	1.00
6	116	114	.97
7	116	115	1.03
8	112	114 5	1.00
9	124	116	.98
10	116	115	1.02
11	122	115	1.05
12	116	115	1.00
Mean	116.16	114.89	1.00

The tests were made by D. C. Durland and S. Townsend, and Superintendent Chas. S. Pease certifies to the correctness of the same.

NEW YORK NOTES.

Office of the Electrical Age,
First Floor, World Building,
New York, August 6, 1894.

A few days ago the Okonite Company obtained judgment against ex-Mayor Patrick J. Gleason, of Long Island City, and of pugilistic fame, on property at Rockaway Beach, to satisfy a mortgage. The amount due was $6,376.

The Okonite Company is receiving the congratulations of its host of friends on its receipt of the World's Fair award for rubber insulated wires for electric lighting. It also received the award for lead-covered cable for underground electric light service. To those who know the Okonite wires and cables this news will not be surprising. The excellence of Okonite goods is constantly maintained and its merits are well known and established in the trade. W. T. H.

CLAUS ELECTRIC GENERATORS.

The machines manufactured by Mr. P. Claus, for the generation of current for electric light and power purposes, are well known for the many admirable features they possess. They are of the bi-polar and multi-polar types, and efficient in the highest degree.

The bi-polar machine is shown in perspective in Fig. 1, and the multi-polar in Fig. 2.

In the bi-polar pattern the drum armature is placed between two short, powerful magnets, the heavy iron yokes completely surrounding the magnet coils. The lower yoke forms a bracket for the bed-plate of the machine, the whole magnetic frame being one casting.

This form of frame gives the best electrical and mechanical results; the lines of force being concentrated upon the armature with practically no loss, and the broad base giving great stability to the machine. The design of the machine is neat and compact; the armature shaft is low down, and the pole-pieces, being one casting with the bed-plate, can not be disturbed from their position. These features insure safety and freedom from getting out of order.

By the removal of one bearing the whole machine can be taken apart; the armature can be pulled out and the magnet coils slipped off without trouble; the machine therefore offers the greatest facilities for repairs.

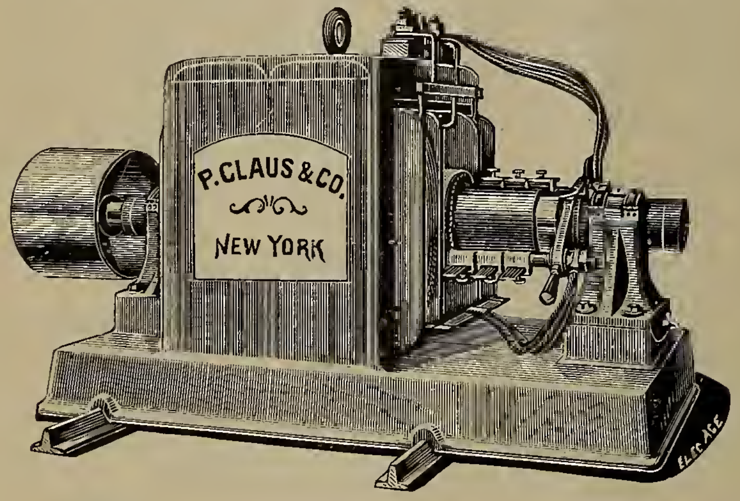


FIG. 1.

The bearings are self-oiling and self-centering, and taken altogether this machine stands preëminent for mechanical and electrical efficiency.

What we have said regarding the bi-polar machine applies equally as well to the multi-polar machine, except, of course, as regards the constructive features. The multi-polar machine has four poles, and is of slow speed. A machine of this type, which is in operation in the new Manhattan Opera House in New York city, runs at only 300 revolutions a minute.

The multi-polar machine represents years of experimenting and testing, and Mr. Claus takes great pride in its mechanical and electrical perfection. These machines are made in capacities from 800 to 2,000 16 c.p. lights, and it has been found both practical and profitable to put arc lamps on the circuit of an incandescent machine, the light given by them being as steady as if the lamps were fed by an arc machine.

Eureka tempered copper is used in the construction of the commutators of all the Claus generators.

The advantages claimed for these machines are: 1. High efficiency; 2. No sparking; 3. Solidity of construction and good workmanship; 4. Covered structure; 5. Accessibility of parts; 6. No scattering of lines of force; 7. Simplicity of construction.

Mr. Claus's works are at 333 and 335 East 107th street, New York city, occupying three floors, 50x80 feet, he having the use of 150 H. P. for power and other purposes. They are well equipped with modern machinery.

SIEMENS & HALSKE'S PLANT BURNED.

On the night of August 1 the manufacturing plant, in Chicago, of the Siemens & Halske Electric Co. was destroyed by fire, together with other manufactories. A

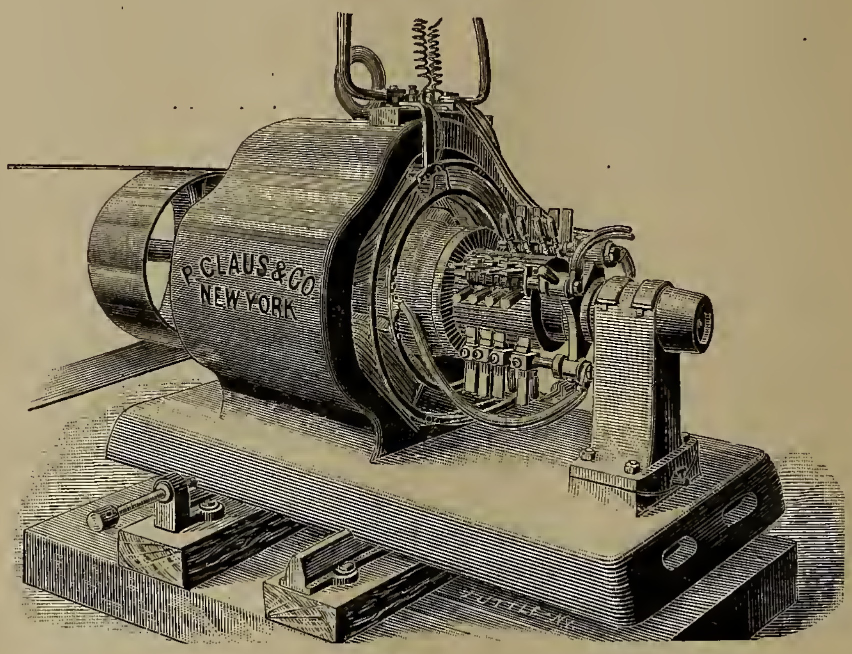


FIG. 2.

despatch from headquarters to Mr. Chas. D. Shain, the general eastern agent of the company, states the manufacturing will be resumed immediately and that deliveries will be made within ninety days. The patterns and plans were saved. The Siemens & Halske Electric Works were on Wood street and were damaged to the extent of from $150,000 to $200,000.

RECEIVER APPOINTED FOR THE REIS SPECIALTY CO.

The Reis Electric Specialty Co., of Baltimore, Md., has been placed in the hands of a receiver, who has taken charge of and will close up the business. Mr. Elias E. Reis, the president of the company, stated that the corporation is unable to successfully prosecute its business, owing, chiefly, to dissensions among some of its stockholders, and that the assets of the company are in danger of being wasted to the prejudice of the creditors. Hence the petition for a receiver—who has been appointed with the consent of all parties, for the purpose of dissolving the corporation and making an equitable distribution of the assets among the creditors and shareholders. The company was incorporated June 16, 1890, and has been engaged in the manufacture and sale of several well-known specialties, including the Reis regulating sockets for incandescent lamps. The company owns a number of valuable patents and a well-equipped manufacturing plant, occupying the entire building at No. 7 South Gay street. It is the intention of Mr. Reis to reorganize the company under more favorable conditions, and to take up in addition to the inventions now controlled by it, the manufacture of some additional specialties for which there is a large demand.

BUSINESS NOTES.

The firm of Ketchum & Speed, electricians, Boston, Mass., has been dissolved, and the business is continued by Mr. E. C. Ketchum.

The Standard Gas and Electric Light Co., Huntington, N. Y., has, it is reported, gone into the hands of a receiver.

T. W. Ness & Co., of Montreal, dealers in electrical supplies, etc., recently assigned.

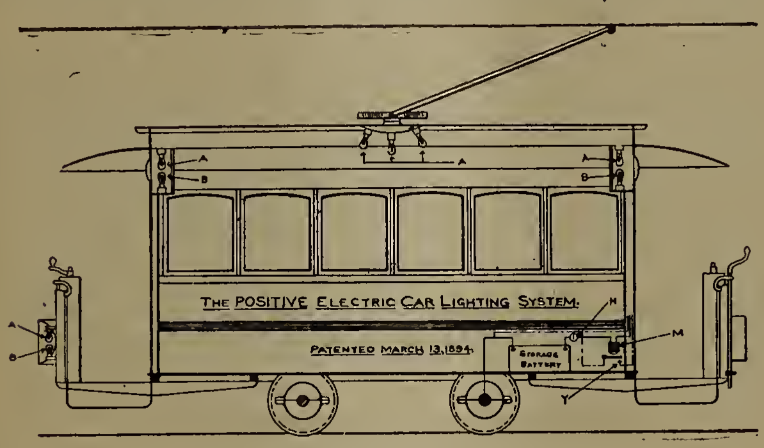
THE POSITIVE ELECTRIC CAR LIGHTING SYSTEM.

The use of oil lamps in the lighting of electric street cars is obviously objectionable. It calls for indifferent attendance and is of more or less trouble to the conductor or motorman.

The system herewith described insures light under all circumstances without special attention from the motorman, conductor or car cleaner.

The extinguishing of lights in a public conveyance is exceedingly annoying to ladies or timid persons, while every one feels like putting his hand on his watch pocket, or pocket-book, during these periods of total eclipse.

By the present system of operating electric street cars, a shunt current is passed through five incandescent lamps to the rail or return circuit. In this new system the current also passes through and lights these same lamps. It also passes through electro-magnet M,



NEW SYSTEM OF CAR LIGHTING.

switch H, storage battery to axle of car wheel and rail to ground, energizing electro-magnet M, whose armature is drawn forward, at the same time charging the storage battery.

If the trolley comes off, the current gives out, or is interrupted in any way, the armature of magnet M is drawn back against its back stop Y, closing the supplemental circuit from the storage battery through switch H to armature of magnet M, back stop Y, lamps B, B, returning to storage battery, thereby insuring light in the car whenever lights are required independent of the action of the trolley.

When the main circuit is restored by replacing the trolley, or otherwise, the current takes its original course through main circuit lamp, energizing magnet M (drawing its armature away from the back stop Y) storage battery and ground, recharging storage battery and lighting the car as before, thus automatically and positively insuring a constant light in the car under all circumstances.

Last Wednesday evening, on invitation of the officials of the American Manufacturing and Engineering Co., of 143 Liberty street, New York, the owners of the system, a party of representatives of electrical journals took a ride in a car on the North Hudson County Railway Co., Hoboken, N. J, which is equipped with this system, for the purpose of witnessing the practical operation of same. The trolley was several times disconnected from the wire for the purpose of showing how quickly the apparatus worked. There was hardly a flicker during the interval the current changed from the trolley to the storage battery, and when the trolley current was off, the storage battery supplied the lamps with a current that gave a beautiful white light, and of greater intensity than that given by the ordinary oil lamps. The apparatus worked infallibly each time, and the system proved to be successful in every way.

Besides lighting the car when the trolley current is off, the system possesses another feature which will be appreciated by street railroad men. In case of a breakdown or any other derangement of the motor, gearing, etc., it is customary to take one of the head lights or a torch to provide light for an examination. In this new system a socket can be provided underneath the car, and in case it becomes necessary to make an examination a plug attached at one end of a flexible cord and a lamp at the other, can be inserted into the socket in an instant, giving an abundance of light convenient to handle. With such a light parts of the motor and gearing that would be inaccessible with the ordinary light can easily be reached, thereby rendering the examination more thorough and effective, without any danger whatever.

A car equipment on this system includes 6 cells of Donaldson-McCrae storage battery, of 15 ampere-hours each, giving a discharge of 3 amperes at 12 volts. Ordinarily two 8 c. p lamps are used in the signal light boxes and a 10-c. p. power lamp in each of the two headlights. The battery outfit for each car weighs about 40 lbs, and this particular make of battery is said to be very durable, it being impossible to buckle the plates.

Mr. W. M. Miner, a well-known electrical engineer of New York, is the inventor and patentee of the system and is general manager of the company; Mr. F. E. Kinsman is president, and C. W. Leveridge, secretary and treasurer. All of these gentlemen were present and explained the system in detail.

The great convenience of this system and its low cost of maintenance are its chief merits, and when the cost of the apparatus is considered no first-class road can afford to be without it.

ASSOCIATION OF EDISON ILLUMINATING COMPANIES.

The next convention of the Association of Edison Illuminating Companies will be held at Boston, Mass., commencing on Tuesday, August 14, 1894, and will continue during Wednesday, and probably Thursday of that week.

Reports of committees chosen at the meetings of last year will be made, and the following papers of practical importance submitted:

Incandescent Lamps—(Mr. A. D. Page.)

The Relative Advantages of Direct and Alternating Currents for Distribution of Light and Power—(Mr. W. S. R. Emmet)

A Board of Control—(Prof. Wm. D. Marks.)

An Edison Station in a Small City. Its Past, Present and Future—(Mr M. A. Beal.)

Switchboard of the Edison Company of New York—(Mr. J. Van Vleck.)

Storage Batteries—(Mr. R. R. Bowker.)

Boiler Tests in Atlantic Avenue Station of the Edison Electric Illuminating Company of Boston—(R. S. Hale.)

Interesting Features of the Third District Station of the Edison Electric Illuminating Company of Boston—(A. G. Pierce.)

Low Tension Arc Street Lighting System—(Mr. W. S. Barstow.)

The headquarters of the association at Boston, will be at the "Vendome," one of the largest hotels in this country.

The meetings of the association will be held in the hotel, where ample accommodations have been provided.

The Edison Electric Illuminating Company of Boston (Mr. C. L. Edgar, vice-president and general manager) has arranged a very attractive programme for the entertainment of the delegates in the form of drives through the beautiful suburbs of Boston, probably the finest in the world Visits will also be made to the West End station of the Boston street railway system, and to the various Edison stations in Boston, where can be seen the latest type of central station equipments, including the recently installed central station storage battery now in successful every-day operation.

The General Electric Company will have present one or more of their officers and engineers, with a view of having them become personally acquainted with the different members of the association and of discussing matters of general interest.

The General Electric Company have extended an invitation to the members of the association to visit the Lynn works and join them in a dinner at Marblehead Neck.

During the convention sessions a special entertainment will be provided for ladies accompanying members.

The Edison Electric Illuminating Company of Boston have provided entertainment for all members who may find it possible to reach Boston on Monday evening.

It is thought advisable, after considering the experience of previous conventions, to devote the first two days strictly to the business of the association, with as short recesses as possible, leaving the third day entirely free for pleasure trips.

The programme for the convention will be as follows :

Tuesday, August 14—First Session, 10 a. m. sharp.

Reports of Committees. Addresses.

Second Session, 2 p. m.

Papers and Discussions. Addresses.

Wednesday, August 15—Early Morning, 8 a m.

Drives through the Suburbs of Boston.

Third Session, 11 a. m.

Papers and Discussions. Election of Officers.

Thursday, August 16.

Visit to the West End Power Station and the Stations of the Edison Electric Illuminating Company of Boston. Trip to Lynn and Entertainment at Marblehead.

NEW CORPORATIONS.

The Hinson Manufacturing Co., Chicago, Ill., manufacturing cast metal, railway rolling stock, electric motors, etc. . Capital stock, $500,000.

Chelsea Electric Light Co., Chelsea, Mich. Capital stock, $25,000.

Portable Electric Light and Power Co., Orange, N. J. Capital stock, $100,000.

The Standard Telegraph and Telephone Co., Cleveland, O. Capital stock, $50,000. Incorporators : Frank Rockefeller, T. B. Squire, and others.

National Union Telephone Co., San Antonio, Tex. Capital Stock, $50,000.

The Biddle Railway Car Electric Lighting Co., New York, N. Y. Capital stock, $500,000.

Arnold Telephone Co., Chicago, Ill., by Sam'l G. Arnold, Mangamin F. Marsh and William Howard. Capital stock, $100,000.

The United States Electrical Forging Co., New York, N. Y., by Edwin Garsia, G. S. Allison and others. Capital stock, $1,000,000.

Brooklyn Gas and Electric Co., Brooklyn, N. Y. Capital stock, $10,000.

The Vanderwerken, Rickerson & Brainerd Co., New York, N. Y., by Alfred Vanderwerken, Chas L Rickerson and Henry J. Brainerd, to manufacture electrical apparatus and to do a general manufacturing and mercantile business. Capital stock, $20,000.

The O'Fallon Electric Light, Power, Heat and Water Co., O'Fallon, Ill., by S. P. Smiley, E. Tiegman, Philip Heyde and Jos. Porter. Capital stock, $20,000.

Belding Electric Mail Box Co., Chicago, Ill., by Edwin C. T. Belding, Thomas W. Saunders and C. Stuart Beattie. Capital stock, $100,000.

Chicago Harrison Telephone Co., Chicago, Ill., by Thomas Whitney, M. A. Rose and C. R. H. Hughes. Capital stock, $4,000,000.

Robertson Insulated Conduit Electric Co., Chicago, Ill., by J. L. Murphy, Smith H. Gracy, Hamilton B. McMillan, B. W. Sherman, Willis Osgood and Charles A Dye. Capital stock, $1,000,000.

The New York Standard Construction Co., New York, N. Y., by Eugene Berry, Rutherford, N. J., Richard Krouse, Santiego, and Mark Sugarman, of Brooklyn, and Wm. T. Zandt, of New York, to construct electric light plants and railways and carry on various kinds of construction work. Capital stock, $50,000.

The National Union Telephone Co., San Antonio, Texas, by R. F. Alexander, O. B. Lowe, W. W. McClure, A. N. Calloway and others Capital stock, $50,000.

POSSIBLE CONTRACTS.

The Central Rapid Transit Co., of Chicago, contemplates extending its lines to Dunning and Norwood Park.

C. A. Fowler, Rome, N. Y., can give information regarding proposals being invited for furnishing the city with arc lights.

Efforts are being made in Union Mills, Md., to organize a company to construct an electric road through Leicester Town.

An electric light plant is to be installed in Iowa Falls, Iowa. For further information address the Mayor of that place.

The E. J. Wilson Electric Light Works, Vallejo, Cal., have been burned.

The Montgomery County Telephone Co., Gaithersburg, Md., will extend its telephone line to Rockville, a distance of five miles.

PERSONAL.

Henry W. Darling, who was elected to the treasurership of the General Electric Company, in Boston recently, was formerly a prominent dry goods merchant of Toronto, Ont , and was president of the Canadian Bank of Commerce ; also five years president of the Toronto Board of Trade, which body under his administration became the leading commercial organization of the Dominion. Mr. Darling's business capacity has had a thorough test in the experiences of the General Electric Company for the past two years, and his selection for the position of treasurer confirms the impression he has made as a man of extraordinary business ability.

Mr. A. H. Patterson, vice-president and general manager of the Phœnix Glass Co., 42 Murray street, New York, is in Europe spending his vacation, in company with Mrs. Patterson.

WORLD'S FAIR AWARDS FOR KERITE WIRES AND CABLES.

Those interested in electricity, who visited the World's Fair last year, will remember the fine display made in Electricity Building of the old, reliable Kerite Insulated Wires and Cables. It was not a mere display; there was something besides the exhibition—the reputation of the house was back of it all.

The Kerite Insulated Wires were for 100 days tested most exhaustively under every condition and they sustained their reputation in every particular. So well did they bear up under the examination of the judges appointed that the World's Fair Commission granted W. R. Brixey the only award on aerial, submarine and underground cables, and the highest award on electric light wires insulated with kerite, which proves conclusively the merits of this insulation for electrical purposes. For superior quality of material, highest insulation and long life, it is claimed that Kerite is unsurpassed.

The tests were made by a committee appointed by the World's Fair Commission and awards were granted W. R. Brixey as follows: Highest and only award on aerial, underground and submarine cables for excellence of material and construction; high insulation; reliability and durability demonstrated by records of prolonged service under exacting conditions; highest award on insulated wires for electric light service, for

1. Highest excellence in insulating qualities.
2. Durability of insulation under conditions found in commercial service.
3. Uniform high excellence in mechanical qualities of insulation.

The first test was for resistance to breaking down of the insulation, and consisted of applying a 2,000-volt Westinghouse alternating current, with Westinghouse step-up transformer; in the second test a continuous high pressure of 6,000 volts was applied, with the wires submerged in ordinary water, and the third was the "soak" test. The wires were soaked in a ten per cent. solution of sulphuric acid, a ten per cent. solution of lime, subway refuse dissolved in Chicago hydrant water, and in Chicago hydrant water, the entire test covering a period of 100 days.

The wires were tested weekly by a galvanometer, the figures being recorded for computing results. Ten different makes of wires were submitted to the test and we are informed that the Kerite was the only one that received the awards above enumerated.

Mr. W. R. Brixey, the sole manufacturer of the celebrated goods, has his headquarters at 203 Broadway, New York. Mr. J. E. Ham is general agent at the same address.

TRADE NOTES.

P. Claus, manufacturer of Claus dynamos, of 333 and 335 East 107th street, New York city, is now completing an order for three 1 000-light dynamos of the multipolar type for Philadelphia, and is installing two bi-polar 400-light machines in the Lyceum Theatre, New York city. The Astoria Packing Company's plant has just been installed by Mr. Claus with one 300-light bi-polar dynamo, 16 arc lamps being used on the same circuit with the incandescents, and he has secured an order from Cuba for a 75-h. p. engine, and a 750-light bi-polar Claus dynamo, which will run 400 incandescent and 20 arc lamps. Mr. Claus will supervise the installation of this plant. The West Shore Hotel, New York, recently completed is installed with an 800-light Claus multi-polar dynamo, running 650 incandescent lights, 6 arcs and 36 fans. The new Amsterdam Hotel has a 700-light Claus direct coupled multi-polar machine, running at 265 revolutions per minute. These hotel people take great pride in their electrical plants.

The Westinghouse Electric and Manufacturing Co., Pittsburgh, Pa., reports that during the month of July, the orders exceeded in number those of any month in the history of the concern. The July business was largely in excess of that of June, the June shipments exceeding $560,000.

The Belknap Motor Co., Portland, Me., manufacturers of dynamos and motors, have just completed an addition to their factory, which gives an increase of floor space of 7,000 feet. A well equipped tool and pattern shop are also provided.

The Cleveland General Electric Co., Cleveland, Ohio, has amended its charter, and changed its name to the Cleveland Illuminating Company.

Electrical and Street Railway Patents.

Issued July 31, 1894.

523 660. Fare-Register for Street-Cars. Edmund H. Duchemin, Newburyport, Mass. Filed May 8, 1893.

523,662. Electric Meter. Eugen Hartmann, Frankfort-on-the-Main, assignor to Hartmann & Braun, Bockenheim, near Frankfort-on-the-Main, Germany. Filed Mar. 23, 1893.

523,663. Commutator for Dynamo-Electric Machines. Joseph Hoffman, Schenectady, N. Y., assignor to the General Electric Company, Boston, Mass. Filed Dec. 21, 1893.

523,668. Dynamo-Electric Machine or Motor. Walter H. Knight, Lynn, assignor to the General Electric Company, Boston, Mass. Filed Jan. 9, 1894.

523,683. Life-Guard for Street-Cars. George A. Parmenter, Cambridge, and Charles S Gooding, Brookline, Mass., assignors to the Parmenter Car Fender Company, of Maine. Filed Feb. 23, 1894.

523,685. Armature for Dynamo-Electric Machines. Henry G. Reist, Lynn, assignor to the General Electric Company, Boston, Mass. Filed Sept. 15, 1893.

523,689. Process of Making Secondary-Battery Plates. William L. Silvey, Dayton, Ohio. Filed Sept. 22, 1892.

523 693. Car-Fender. Edgar Thomas, Pittsburgh, assignor of one-half to Philip M. Amberg, Allegheny, Pa. Filed Feb. 24, 1894.

523,695. Electro-Expansion Device. Elihu Thomson, Lynn, Mass., assignor to the Thomson-Houston Electric Company, of Connecticut. Filed Nov. 25, 1887.

523,696. Dynamo-Electric Machine. Elihu Thomson, Swampscott, assignor to the General Electric Company, Boston, Mass. Filed Mar. 19, 1894.

523,697. Arc-Rupturing Device. Gardner T. Voorhees, Boston, Mass. Filed May 8, 1893.

523,701. Automatic Circuit-Closer. Joel W. White, Providence, R. I., assignor of one-half to Ashbel T. Wall and George A. Wall. Filed Mar. 11, 1893.

523,704. Electric Meter. Thomas Duncan, Fort Wayne, Ind. Filed Mar. 14, 1894.

523,724. Electric Switch. George E. Linton, Worcester, Mass. Filed Mar. 22, 1894.

523,763. Car-Brake. John T. Duff, Pittsburgh, Pa. Filed Feb. 20, 1894.

523,767. Electric Signal for Railways. Charles A. Hammond, Boston, Mass. Filed Apr. 12, 1894.

523,775. Car-Brake. Michael McNulty, Norton, Va Filed Oct. 26, 1893.

523 776. Armature for Dynamo-Electric Machines. Horace F. Parshall, Lynn, assignor to the Thomson-Houston Electric Company, Boston, Mass. Filed Jan. 31, 1894.

523,798. Means for Testing Electric Signal-Boxes. Jacob F. Mehren, Chicago, Ill. Filed Nov. 24, 1893.

523,805. Electric Converters. John A. Cabot, Cincinnati, Ohio, assignor of two-thirds to Frank H. Kirchner and Henry M. Ziegler, same place. Filed Sept. 22, 1893.

523,822. Electro-magnetic Reciprocating Pump. Chas. J. Van Depoele, Lynn, Mass.; C. A. Coffin and Albert Wahl, administrators of said Van Depoele, deceased, assignors to the Thomson-Houston Electric Company, Boston, Mass. Filed Dec. 12, 1891.

523,847. Electric Signaling Apparatus for Railway Trains. Wm. H Baker, Pawtucket, R. I. Filed May 31, 1894.

523,865. Testing Device for Electric Circuits. George A. O'Neill, Boston, Mass. Filed Oct. 20, 1893.

523,889. Automatic Line Discharger. Jacinto F. Ganduxer, Gracia, Spain. Filed Nov 4, 1892. Patented in Spain Aug. 12, 1890, No. 10,923, and in France Dec. 24, 1891, No. 210,420.

523,892. Galvanic Element. Albrecht Heil, Crumbach, Germany. Filed Sept. 27, 1893.

523,893 Bushing for Electric Arc Lamps Thomas J. Houck, Baltimore, Md., assignor of one-half to James Frank Morrison, same placc. Filed Apr. 23, 1894.

523,921. Guard for Street-Railways. William T. Vose, Newton, Mass. Filed Aug. 19, 1893.

523,927. Magnetic Telephone. Frederick H. Brown, Chicago, Ill. Filed Nov. 25, 1893.

523,930. Fare-Register. Leo Ehrlich, St. Louis, Mo. Filed Sept. 20, 1893.

523,957. Electric Welding or Brazing Mechanism George D Burton, Boston, Mass. Filed June 3, 1893.

REISSUES.

11,433. Electric-Arc Lamp Joseph B. McKeown, Cleveland, Ohio. Filed May 22, 1894. Original No. 519,045, dated May 1, 1894.

ELECTRICAL AGE

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NEW YORK, AUGUST 18, 1894.

CONTENTS.

ELECTRICITY AND CLAMS.

To the uninitiated it may seem a difficult matter to perceive any relationship between electricity and clams, but there is. We shall not, however, attempt at this time to enter into a scientific discussion of the subject. Suffice it to say that our friend Eugene F. Phillips, of Providence, 14 years ago established the relationship, and every year since he has invited the relations to meet on the shores of Narragansett Bay where a grand, sociable time is had. This day has become to be regarded in the electrical trade as the day of days, and the spirit of the occasion is becoming so infectious that we would not be surprised to hear next of a movement to make the day a legal holiday in "Little Rhody," and call it "Electrical Day," or "Phillips Day." This year the 25th day of August is the time appointed for this grand concentration of electrical talent. We think Mr. Phillips has a secret process of fattening clams by electricity, for nowhere in the world can such be found as at the Phillips annual clam bakes.

REDUCING THE RESISTANCE TO TRADE.

Now that a tariff bill has been passed by Congress there seems to be a much easier feeling in trade. It is hoped that the effect will be to stimulate activity in every direction, and that it will be permanent. The dulness in the electrical business is a result of Ohm's law. There has been an abnormal resistance to trade, and this has necessarily reduced the current, although the electromotive force has remained constant. Just as soon as the cause of the extraordinary resistance is removed, then the current will increase accordingly, and things will boom. You can have your vacation next year, sure.

ELECTRIC WELDING.

We give elsewhere in this issue the concluding portion of Mr. Hermann Lemp's article on "Electric Welding and Metal Working." This article, which was begun in our last issue, is the latest authoritative contribution on this important and interesting subject, and by those who keep close watch on progress in the various departments of electrical application, it will be carefully studied. After describing the welding apparatus itself, Mr. Lemp gives an interesting account of the various industrial applications of the system. He points out the fact that in electric welding 75 per cent. of the electrical energy put in.o the metal to be heated is useful, the other 25 per cent. being unavoidably lost in radiation and conduction. He makes a statement in this connection that will be rather surprising to many, as the reverse fact has always been held as the true one. He compares the cost for fuel in the open forge and electric processes of welding, and asserts that under continuous working conditions it is about the same in each; under conditions, however, where the work is not continuousbut irregular, the electric method shows greater economy. It has always been supposed that under such conditions the figures were considerably against electricity. Among the industrial applications of electric welding may be mentioned the following: in wire mills where lengths of wire are welded, forming very great lengths; in carriage construction, for the purpose of welding tires, hub-bands, dasher frames, carriage steps, axles, etc.; in the manufacture of reamers, twist drills, taps, etc; welding of iron and other metal pipes; projectiles for guns, and finally the welding of street car rails, and other parts of railroad tracks that are usually bolted. This latter application is the latest, and is described at considerable length by Mr. Lemp, after which he sums up the advantages of the electric process, which are, indeed, very prominent. The electric welding process means saving of cost in time, labor and fuel.

ELECTRIC WELDING AND METAL WORKING.

BY HERMANN LEMP.

(*Concluded from Page* 78.)

The practical applications of the Thomson process to various industries will now be described briefly. Wire mills were early to recognize the advantages of the electric process for disposing of their shorts, incidental to the manufacture of wire, on one hand, and satisfying the demands of the trade for longer coils. Automatic machines are mostly used for this purpose ; that is, machines in which all conditions for good work are automatically maintained without requiring a special experience on the part of the operator.

Nearly every wire manufacturer of repute in the United States has either one or more of these machines. The firm of John A. Roebling's Sons & Co., in Trenton, are making, on the average, 600 welds per day of 10 hours, on telegraph wire. Most of the time is used in the handling of the heavy wire coils, as is seen by comparing the above output with the welding of brass wire loops and steel harness-rings done at the works of the Thomson Electric Welding Co., in Lynn, for outside customers, in which case the daily product of ten hours is 3,000 and 1,000 welds respectively. The increase in speed is simply due to quick handling of light objects as compared with heavy coils.

Mr. Roebling stated in 1892 that, of more than 1,000,000 welds made by his firm, not a single case of a bad weld had come to his knowledge. Carriage builders are largely users of the electric process. Tires, hub-bands, dasher-frames, carriage steps, and axles are welded in large quantities. Baby-carriage tires are welded at the rate of 1,500 to 2,000 in ten hours.

The hand hydraulic pressure, as used on some of the large machines, may be replaced by a special pump and accumulator controlled by valve. Both the clamping of the stock and the end pressure are hydraulic, relieving the operator of nearly all manual work.

The manufacturers of metal wheels have also found it advisable to use the electric process. A machine is designed to fasten the spokes of a metal wheel in the hub by welding two halves of a hub together, including the spokes between the welded surfaces, and of riveting the spokes in the tire by heating them electrically at their contact with each other.

The much-dreaded welding of high carbon steel, in the experience of the ordinary blacksmith methods, has, in the Thomson process, been rendered comparatively easy. This has been fully demonstrated by the Standard Tool Co., of Cleveland, who are manufacturing reamers, twist-drills, taps, etc., in enormous quantities, the characteristics of which are that only the cutting part of the tool is composed of tool steel, while the shank is of a good grade of machinery steel. Not only is there a saving in the manufacture, but also a better product is obtained; the shank is tougher and less brittle.

Recognizing the utility of the electric process, not only for welding commercial pipe length into endless coils, but also applying the same process to locally heating sections of pipe for bending, a special company was organized, the Electric Pipe Bending Company, for making continuous coils of every description.

In making continuous circular pipe the welder is mounted on a railway truck, and, while the pipe heated in a coke stove between welder and coiling apparatus is gradually wound up in the latter, a new piece of pipe is welded to the travelling end.

The average daily product with one set of apparatus for heating twenty-five inches of 2-inch pipe for bending (one welder and one heater) is 5,000 feet of 1-inch pipe; 3,500 feet of 2-inch pipe bent; 3,500 feet of 1-inch pipe; 2,000 feet of 2-inch pipe welded and bent.

An industry owing its existence entirely to the electric welding process is the manufacture of high grade projectiles, carried out by the American Projectile Co. By combining the welding process with forging and hydraulic pressing, a projectile can be produced which, in price, is nearly equal to the old and unreliable cast-iron shell, and which in quality far surpasses the latter. Official tests have proved the shells inferior to none, while in the method of manufacture there are possibilities to still further increase their efficiency without increasing the cost. The principle involved is, briefly, to unite two forgings representing respectively the base and point of shell by electric welding. The point can be made of very high carbon steel, while the body and base may be ordinary machinery steel.

An example of what a progressive mind will accomplish is given by the Johnson Company, of Johnstown, Pa., who, under the able leadership of Mr. A. J. Moxham, have applied the electric welding process in a manner that has almost startled its own projectors. I am not able to produce any photograph of the ponderous welding machinery used in this work, but will only give a few figures to show the magnitude of their undertaking. There are, approximately, ten welders in use, of an aggregate of 1,200 horse-power. From 12 to 16 square inches are currently welded. A single weld of 48 square inches even has been produced. The product is railway switches, crossings, frogs, special rails, splice-bars, etc. All track constructions heretofore bolted are being replaced by welded-together rolled structures, thus furnishing an excellent wearing material, proof against being thrown out of shape by loosening bolts or rivets. The latest application—one which has caused no end of discussion, and which is past the experimental stage—is the welding of rail sections into one continuous track for electric street car service. Mr. Moxham has demonstrated that a continuous rail can be made, buried in the ground and made to withstand the variations of temperature that are met with in this climate. At present he is carrying out the commercial laying of tracks electrically welded on the spot with apparatus furnished by the Thomson Electric Welding Company. Since this plant may be regarded as, in one sense, typical of the utilization of electrical energy furnished from a central point to metal working at any point within its distributing district, it may be well to briefly describe the apparatus.

The welding train is composed of a dynamo car, in which a continuous current of 500 volts and approximately 275 amperes is transformed into alternating currents of 300 average electro-motive force and 650 amperes, which currents, after passing through an adjustable reactive coil, enter the primary of the welding transformer, suspended from a boom in the welding car. The motor-dynamo is of peculiar construction, having only one winding It is a regular continuous-current motor with commutator having (in a two-pole motor) two of its commutator segments, 180 degrees apart, connected with two collector rings. It is virtually a revolving commutator, alternately connecting the two poles of the welder primary with the trolley and ground circuits in opposite directions. The efficiency of such a motor-dynamo is very high (about 92 per cent) and about 30 per cent. more energy can be transformed by its use, as compared with the mechanical energy that can be delivered by the pulley on armature shaft when used as a plain motor. This is because twice in each revolution there is a direct connection between welder and line, without using the armature windings.

The welder has two transformers with oil insulation and can be operated with immunity from electric shocks in pouring rain. A hydraulic jack operated by a hand-pump furnishes the necessary pressure. The cars are equipped with electric motors for hoisting and swinging welders, pumping water for water circulation in jaws, grinding the surface of the rail clean, and moving the cars on the track. The rails are butted against each other, and two chucks are welded from either side across the joint. These chucks are not only welded to both of the rails, but, by the lateral pressure exerted against the heated ends of the rails, force the latter into each other.

Experience has established the following facts: A continuous 70-pound rail requires about 150,000 pounds strength to withstand the maximum strain put upon it longitudinally by the variations in temperature from coldest winter to hottest summer. An electric weld will only break at 279,000 pounds strain. Four joints can be made in an hour, under proper conditions. The electric conductivity of the joint is as great as the rail itself.

To sum up, electric welding has these indisputable advantages: The heat is sharply localized to the joint and metal near it. The temperature obtained and required can be exactly regulated.

The rapidity of heating and its distribution can be controlled by simple means. Irregular forms can be welded in the desired relation of its various parts.

By this process all metals, as well as the alloys of all metals, are weldable.

The welding operation is carried on under the direct inspection of the operator.

The operation can be and often is made automatic, and the result is absolute uniformity; oxidized surfaces are excluded from the joint, and only clean metal unions made.

Pieces can be welded to exact size, and finished pieces may retain their finish during welding.

The process may be applied to pieces in place, as in track welding. Water power may be employed for the work, or the cheapest fuels of lowest grade.

The greatest convenience and cleanliness attends the practice of the process.

The cost of fuel is not greater and generally less than in forge welding, while the labor is reduced one-half.

THE CORROSION OF IRON PIPES BY THE ACTION OF ELECTRIC RAILWAY CURRENTS.*

BY D. C. JACKSON.

Though the corrosive action of the return current has been so frequently noticed and commented upon, no one has really determined what actually occurs in the ground under the conditions brought about by the operation of electric railway systems. Two theories have been put forward relative to the corrosion. First, that it is simply due to chemical action caused by ammonia, saltpeter, leakage from gas mains, etc., found in the earth; second, that it is the result of electrolytic action. While simple chemical action undoubtedly has much to do with shortening the life of a pipe, it cannot on the face of it produce effects of the magnitude of these noted above. The ordinary life of water and gas pipes where chemical action alone is met is said to be about 20 years, while the corrosive action with which we are dealing has destroyed new pipes in intervals having from a few weeks to half a dozen years' duration. In every case of the corrosion to which we refer an electric current has traveled along the pipe, and the corrosive action has taken place at the point where the current left the pipe. This is conclusive proof of electrolytic action. Secondary chemical reactions play an important part in the final decomposition of the pipe, and these are dependent upon the character of the salts in the soil, but the current sets the ball rolling. The electrolytic action of the current may occur by means of two processes—(1) direct electrolysis of iron and (2) electrolysis of chemical compounds which are held in the water of the soil, setting up secondary chemical reactions at the electrodes. In order to have electrolysis at all it is necessary to have the equivalent of an electrolytic cell. In the case of a current leaving a pipe at any point, the pipe is the anode or positive plate of such a cell, the waste of the soil containing the chemical compounds in solution is the electrolyte, and the rail is the cathode or negative pole of the cell. All corroded iron pipes taken from the earth present practically the same appearance. They are generally "pitted" in many places, and although the pipe is covered with a layer of reddish oxide, the bulk of the corroded metal has generally been entirely carried away in some form or other, presumably by a secondary chemical change.

In order to have the first electrolytic action go on (that is, direct electrolysis of iron), a soluble iron salt must be present in the soil, reaching from anode to cathode. The analysis of street soils shows no such salts, and hence we are safe in concluding that this factor does not enter into the corrosion to any practical extent. The point has been made by several writers on the subject that the phenomenon may be due to the electrolysis of water, the nascent oxygen set free at the anode attacking the iron directly, and forming iron oxide. An examination of the facts of electrolytic action shows that this is not an effect of practical magnitude. This leaves us but one hypothesis to work upon—that is, the electrolysis of substances held in solution in the water of the soils, with a resulting secondary chemical action on the pipes.

In order to determine as exactly as possible what occurs in the soil due to the return current, a series of laboratory experiments were performed, in which the practical conditions were reproduced as fully as possible.

Almost every chemical analysis of street soils shows the presence of some soluble salts of ammonia, potash, soda, and because of their common occurrence an experiment was performed to determine the effect of these salts on the electrolytic corrosion of iron plates per ampere hour. Six small electrolytic cells were run in series under an electric pressure of about 100 volts, with a current varying from .2 to .04 ampere. The cells contained clean glass and sand moistened with water containing the salts.

Cell 1 contained $NH_4\ NO_3$. (Nitrate of ammonia)
" 2 " NH_4 Cl. (Chloride of ammonia.)
" 3 " KNO_3. (Nitrate of potash.)
" 4 " KCl. (Chloride of potash.)
" 5 " $NaNO_3$. (Nitrate of soda.)
" 6 " NaCl. (Chloride of soda.)

After a run of 14¼ hours the number of ampere hours was .7465.

Loss of anode of $NH_4\ NO_3$ cell per am. hr. was .921 gr.
" " " " NH_4 Cl " " " " 1.314 "
" " " " KNO_3 " " " " 1.887 "
" " " " KCl. " " " " 1.346 "
" " " " $NaNO_3$ " " " " .729 "
" " " " NaCl " " " " 1.299 "

It had been shown by previous experiments upon cells containing these salts that iron was carried off from the positive plates but was not deposited on the

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* Abstract of a paper read before the Western Society of Engineers, July 11, 1894.

negative plates. The deposit of iron was made in the form of a layer of hydrate or hydroxide of iron near the middle of the cell. The same was true of experiments made with cells containing street soil where only a comparatively small percentage of carbonates was present. This explains the remark often made in reports of the corrosion of pipes that the products of the corrosion had disappeared. It was noticed during the experiments that all the cells containing a nitrate gave off a gas at the anode, and this, on being collected, was found to be oxygen. The same cells showed an acid reaction at the anode when tested with methyl-orange, and the reaction grew less in intensity as the current decreased. In cell No. 1 of the series already referred to, this acidity failed to show itself when the current fell to .6 ampere; in cell No. 3 at .045 ampere, and in cell No. 5 it was very faint at .04 ampere when the current was shut off. The acid reaction and the escape of oxygen in these cells seemed to be associated, and here it becomes necessary to refer to the losses of the anodes in the different cells. It will be seen that the chloride cells exhibit the greater losses, while the nitrate cells show the smaller. Moreover, the cell containing a nitrate in which the formation of acid and oxygen ceased first shows the greatest anode loss, and the one in which it continued to a slight degree to the end of the experiment shows the least. These facts point very strongly to the soundness of the theory of the corrosion which has been finally worked out; namely, in an electrolytic cell with iron electrodes and a soluble salt or salts of the metals of the alkalies or alkaline earths in solution in the electrolyte the salt is electrolyzed by the current, the acid radical attacks the anode, forming an iron salt, while the alkaline metal forms with water a hydroxide at the cathode, liberating hydrogen there. Finally, the meeting by diffusion of these two products precipitates ferrous hydroxide (FeOH). As the amount of electrolysis varies with the strength of the current, a comparatively high current will liberate the acid radical more rapidly than it can combine with the iron, the critical point depending upon the affinity of the acid for iron. When this excess is present, the radical forms an acid by combining with water and at the same time liberates oxygen. Neither the acid nor the oxygen can combine with the anode because that is already engaged in the formation of an iron salt with the acid radical, and hence the gas escapes into the air. If the acid is formed in sufficient quantity, it diffuses through the electrolyte, meets the alkaline hydroxide and forms the original salt and water. In the case of chlorides, the nascent chlorine liberated at the anode forms with it a chloride of iron, and if the current is strong enough to form an excess of chlorine it will be disolved in the water and may, under the influence of light and heat, form an acid and liberate oxygen; or, if enough heat is generated, free chlorine will be given off, as is shown by experiment. All conditions of these laboratory experiments are practically parallel in the earth, and hence it is safe to say that similar chemical reactions must go on there. Although the composition of street soils is more complex than the electrolytes of these experiments, they contain the same soluble salts, and as these are diffused through the moist earth they must lend themselves to exactly similar electrolytic influences and chemical changes. In fact where street soils were used in the experiments as the electrolytes of cells which were placed in series with cells containing known quantities of simple and mixed soluble salts, the losses of the anodes were entirely comparable. It is consequently seen that only such measures as will stop the electrolytic action on salts in solution in the soil can be relied upon to stop the corrosion of iron pipes.

The soil frequently contains carbonate of calcium and magnesium, which are dissolved by virtue of the carbonic acid in the water. When carbonates are present in the water to a considerable degree a reddish layer of iron carbonate is found on the pipe. This is generally mistaken by observers for oxide of iron, but we have never found the latter present as a result of electrolytic corrosion. To find the effects of carbonates upon the corrosive powers of soils we ran four electric cells in series. The first two had for electrolytes glass sand moistened with a ⅓ per cent. solution of chloride of soda in distilled water, and the other two had the same electrolyte with the addition of a solution of carbonate of magnesia and carbonate of lime of uncertain strength. The latter solution was obtained by passing carbonic acid for 1½ hours through water containing equal parts of these carbonates in suspension. The test current was kept at .09 ampere for 7 hours, making .65 ampere hour.

The average loss of the anodes of the cells containing chloride of soda alone was .6565 gramme, while that of the carbonate cells was .601 gramme. This makes it evident that the presence of the carbonates does not aid in the corrosion of the anode, and even the slight cathode loss, due probably to ordinary oxidation, is less in these cells than in those containing the chloride only. The difference in the losses of the anode is easily explained. In some previous experiments the loss of anode caused by the electrolysis of a nitrate, a chloride, and a mixture of the two was compared. The chloride caused the greatest loss of anode, the nitrate the least, and the mixture caused a loss betwen the two. In the same way in the case of the carbonate and the chloride, the chloride caused a certain loss of anode, and when mixed with carbonate the loss is somewhat less than when the electrolyte is a chloride alone. The fundamental effect of the carbonates is shown by a further description of the experiment. Soon after the current was turned on the chloride cells began to show the formation of the ferrous hydroxide layer between the electrodes which has been previously spoken of, while the other two cells showed a reddish layer formed at the anode, spreading toward the cathode as the action progressed. The reddish layer consisted of carbonate of iron, which was formed by the action of the carbonates upon the products of the electrolysis.

The results of many experiments and the condition of corroded water pipes, as observed, leads to the conclusion that under the conditions existing in street soils the corrosion will primarily go on by virtue of the acid radicals of the hydrochloric, nitric, sulphuric and other acids, the carbonates held in solution by virtue of the carbonic acid acting merely to change the ferrous salts to the normal iron carbonates, and the ferric salts to the ferric hydroxide. Should the carbonates in solution be electrolyzed in addition to the salts of the alkaline metals, the carbonic acid radical would not attack the iron, as the corrosive power of the other acids is so much greater, but would again form with the ferrous salts the iron carbonates.

Owing to the doubt which exists as to what minimum voltage is required to induce electrolysis of water pipes by the railway current, a series of determinations was made by means of the electrolytic cells. The iron electrodes were inserted in clean glass sand 1.5 centimeters apart, and had about 20 square centimeters' exposed area. In the first cell a one per cent. solution of nitrate of soda was used with a voltage of .2. As before, the hydroxide layer was formed. The electrolytic action was plain without any other tests. In the following cells the existence of action was shown by chemical tests for the iron salt and the alkaline hydroxide. In the second experiment, a ⅓ per cent. solution of nitrate of soda was used with 5 volts. The action was at once apparent.•

Cell 3.	Pressure	.25	volt.	Action in	3 min.
" 4.	"	.125	"	" "	5 "
" 5.	"	.125	" 1-6 per ct. sol.	" "	5 "
" 6.	"	.05	" " " "	" "	40 "
" 7.	"	.013	" " " "	" "	50 "
" 8.	"	.005	" " " "	" "	1 hour.

In cell 8 the hydroxide layer began to be apparent after one hour.

Cell 9. Pressure .001 volt 1-6 per ct. sol. Action in 1 hour.
" 10. " .01 " Action in 4 hrs. 45 min.

Cell 10: The electrodes were 20 mm. apart and were 40 mm. by 68 mm. in exposed surface. The electrolyte was street soil.

A surprisingly low voltage produced an appreciable electrolysis in the sand cells. The pressure on cell No. 10 might undoubtedly have been reduced to a millivolt without stopping the corrosion, but the resistance of the soil was so high and the percentage of soluble salts so low that the time necessary to produce action would have been considerable. A milliammeter showed a barely perceptible reading in the case of the experiments in which very low pressure was used. The observations plainly show that a mere directive force is necessary to produce electrolysis, and the corrosion is simply a question of current.

It is impossible to give in a reasonable space even a summary of the great number of experiments which were made, but the following conclusions are directly drawn from them:

1. In no case is the action due to the electrolysis of water; where oxygen is liberated at the anode it does not attack the iron.

2. Only a mere directive force in the nature of a pressure will cause electrolysis.

3. The actual corrosion is therefore only dependent upon the actual current which flows, and is as much dependent upon the resistance of the soil as upon the pressure tending to cause the current.

4. Only a minute quantity of soluble salt is sufficient to start the action, and it will then continue as long as a current flows.

5. The gravity of a corrosion of a pipe depends on the amount of current flowing from a given area and the nature of the salts present in the soil, the order of the activity of the salts being (1) chlorides, (2) nitrates, (3) sulphates.

ELECTRIC TRANSMISSION OF ENERGY.

Apart from matter, energy has in reality no existence. We cannot conceive of motion unless something moves, of warmth unless something is heated, or of any of the various states or conditions which are indications of energy unless immediately associated with matter. Hence the co-existence of energy with matter is to our minds an inevitable conclusion. But now, let us inquire, can matter for an instant be considered apart from energy? Can any one imagine a body neither hot nor cold, neither in motion nor at rest, and *not* under the influence of some attraction, some force or some other form of energy? No! should such be the case for a space of time inconceivably short, that time would suffice for the rending apart of the universe. Planets would fly asunder; life would be instantly destroyed. The very ether would become, in common with all else, at once disorganized, and the universe, filled once more with impalpable world matter, would recommence as it did millions of centuries ago, the building up of new systems, new worlds, and new men.

Energy manifests itself to us in various ways. To the physicist, light, heat, chemical action, and all other phenomena included in the category of the physical world, are exhibitions of transformation of energy from one form to another.

The sum total of energy in this world has never increased nor diminished. Like the matter in the universe it is and will always be an unchangeable quantity.

SKILLED AID TO INVENTORS.

It sometimes occurs that a skilled workman whom an inventor employs to embody and mechanically perfect his invention, comes to think when the work is done that he, the skilled workman, is an inventor, either sole or joint, of such thing. That kind of defence was made in a suit wherein Morse's telegraph patent was under consideration, and thereof the Supreme Court of the United States said: "Neither can the inquiries he made, nor the information or advice he received from men of science, in the course of his researches impair his right to the character of an inventor." In another case the Supreme Court said: "Where a person has discovered an improved principle in a machine, manufacture or composition of matter, and employs other persons to assist him in carrying out that principle, and they in the course of experiments arising from that employment make valuable discoveries, ancillary to the plan and preconceived design of the employer, such suggested improvements are in general to be regarded as the property of the party who discovered the original improved principle, and may be embodied in his patent as a part of his invention. Suggestions from another, made during the progress of such experiments, in order that they may be sufficient to defeat a patent subsequently issued, must have embraced the plan of the improvement, and must have furnished such information to the person to whom the communication was made that it would have enabled an ordinary mechanic, without the exercise of any ingenuity and special skill on his part, to construct and put the improvement in successful operation. Persons employed, as much as employers, are entitled to their own independent inventions, but where the employer has conceived the plan of an invention and is engaged in experiments to perfect it, no suggestions from an employee, not amounting to a new method or arrangement, which is in itself a complete invention, is sufficient to deprive the employer of the exclusive property in the perfected improvement. But where the suggestions go to make up a complete and perfect machine, embracing the substance of all that is embodied in the patent subsequently issued to the party to whom the suggestions were made, the patent is invalid, becanse the real invention or discovery belonged to another." The changes made by a workman or skilled assistant must, in order to constitute him the inventor, be such as totally reject the original idea and substitute one substantially new and different therefrom. If the change from the original plan be not as thorough-going as this, the invention which is the final outcome of the inventor's suggestions and the skilled workman's additions, is legally the sole invention of the original inventor.

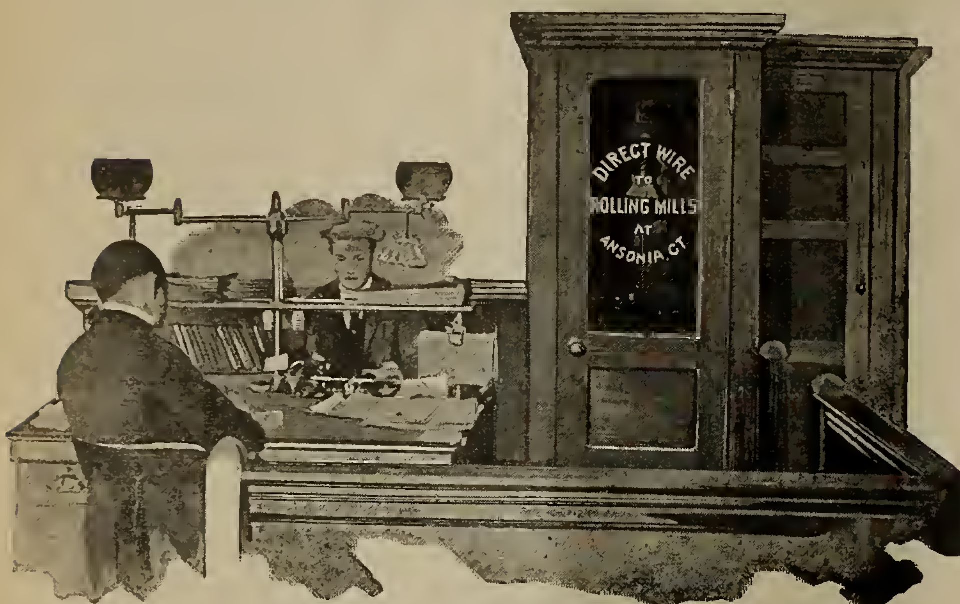
THE BELL COMPANY'S RECENT INCREASE IN CAPITAL.

It cost the American Bell Telephone Company nearly $50 000 to secure the $30,000,000 increase in its capital stock recently. Of this amount it is stated that $13,000 was paid to the Boston papers to secure the publication of the arguments in favor of the increase made before the Committee on Mercantile Affairs.

WALLACE & SONS' BRASS AND COPPER ROLLING MILLS.

Established 1848.

One of the oldest and best known copper rolling mills in the country is that of Wallace & Sons, at



TELEPHONE CONNECTION WITH MILLS.

Ansonia, Conn., with salesrooms and warehouse at 29 Chambers street and 5 Reade street, New York City.

Wallace & Sons, from the moment copper wire came into use in connection with electrical matters, Superior copper, especially selected for their use, and is manipulated by them in such a way that they get the very best results, both as to tensile strength and conductivity. Some of the largest consumers of electrical wire in this country confine their purchases entirely to their make, owing to its superior quality, etc.

Wallace & Sons, among other things, make a specialty of the manufacture of hard drawn wire for trolley work, and long distance telephone and telegraph wire. Their trolley wire is put up on reels in continuous lengths of half to two miles, according to requirements. They also largely manufacture soft drawn copper wire for underground circuits both plain and tinned; also copper track bonds, tinned or plain, with either iron or copper rivets.

This company keeps a large stock of material in process of manufacture, and is able to ship even large quantities of hard or soft drawn wire at short notice. Their selling department, at 29 Chambers street and 5 Reade street, is connected by long distance telephone with their mills at Ansonia, Conn , so that orders can be transmitted to the mill without delay.

In addition to making a specialty of copper wire, Wallace & Sons are largely engaged in the manufacture of a general line of brass and copper goods, and after glancing through their illustrated catalogue, we make special mention of the following articles: brass in rolls and sheets; copper in rolls and sheets; seamless brass and copper tubes; copper rods, all sizes from ¼ inch to 2 inches; brass rods, all sizes from ¼ to 2 inches; Star brand copper rivets and burs; mirror finish copper, etc., etc.

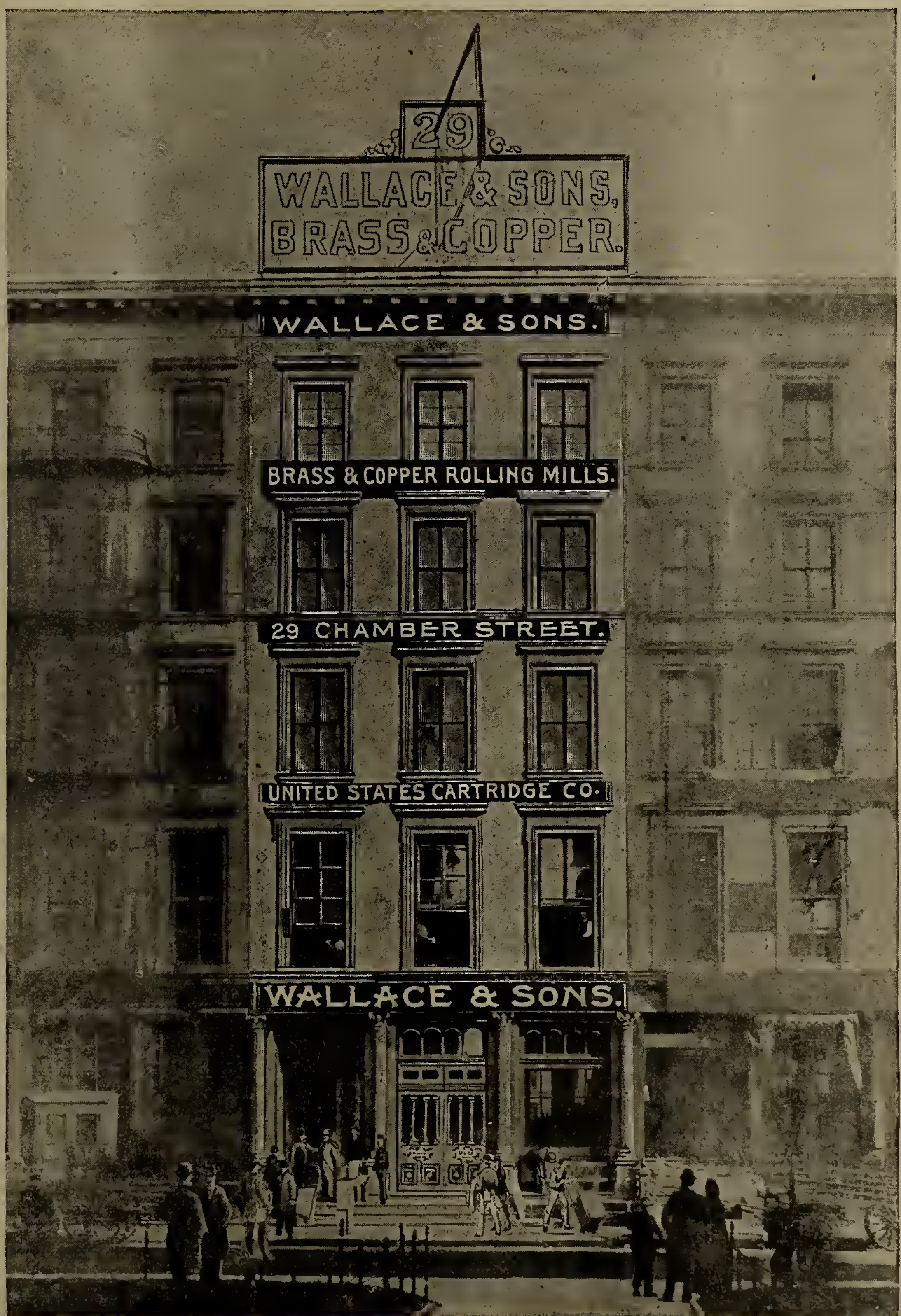
WALLACE & SONS' SHIPPING DEPARTMENT.

gave special attention to its production, and have probably made greater progress in the manufacture of purely electrical wire than any other concern in the country. Their wire is produced exclusively of Lake

A Kinetograph exhibition in this city attracts greater crowds than the phonograph or any other of Edison's inventions ever did. The secret of it is that it gives a prize fight exhibition, and place is always crowded.

THE CANADIAN ELECTRICAL ASSOCIATION.

This association will hold its next meeting in Montreal sometime during the latter part of September. Among the papers to be read will be the following:—"The Possibility of Securing Better Regulation at Central Light and Power Stations by means of Fly-wheel Accumulators of Improved Construction," by John Galt, and "A Method of Distribution with Equalization of Potential Difference," by D. H. Keeley.



WALLACE & SONS' WAREHOUSE AND SALES ROOMS.

JOINT INVENTIONS.

Whenever an invention is the joint product of two or more minds, a patent thereon must be jointly applied for by all the inventors, and if a patent for a joint invention is taken by any number of such inventors less than the whole number such patent is void. And if an invention which is the product of one mind be patented as a joint invention, that patent is void. "To constitute two persons joint inventors it is not necessary that exactly the same idea should have occurred to each at the same time, and that they should work out together the embodiment of this idea in a perfected machine. Such a coincidence of ideas would scarcely ever occur to two persons, at the same time. If an idea is suggested to one, and he even goes so far as to construct a machine embodying this idea, but it is not a completed and working machine, and another person takes hold of it and by their joint labors, one suggesting one thing and the other another, a perfect machine is made, a joint patent may properly issue to them. If, upon the other hand, one person invents a distinct part of a machine, and another person invents another distinct and independent part of the same machine, then each should obtain a patent for his own invention." "To overthrow the presumption of joint invention created by the filing of a joint application upon a joint oath, the evidence should be clear and unequivocal."

The Association of Edison Illuminating Companies held its annual meeting in Boston this week.

FLEXIBLE CONDUIT TUBING.

The flexible conduit tubing of the Goodyear Hard Rubber Company, and the India Rubber Comb Company, 9 and 13 Mercer street, New York, is attracting a good deal of attention in the trade. and meeting with large sales. This tubing is manufactured both armored and plain, and is at once air-tight and water-tight. It is endless; that is, it is all in one length, thus avoiding elbows, joints and tees.

Besides the conduit tubing, this company is a large dealer in submarine armored cables, lead-covered cables for underground service, braided and plain insulated wire for house wiring, flexible standard wires for electroliers, switchboards, etc., rubber-covered feed wires, and silk-covered wire for lamp cords, drop lights, etc. In Minneapolis, Minn., 200,000 feet, and in Chicago 200,000 feet of lead-covered and armored conduit are being installed.

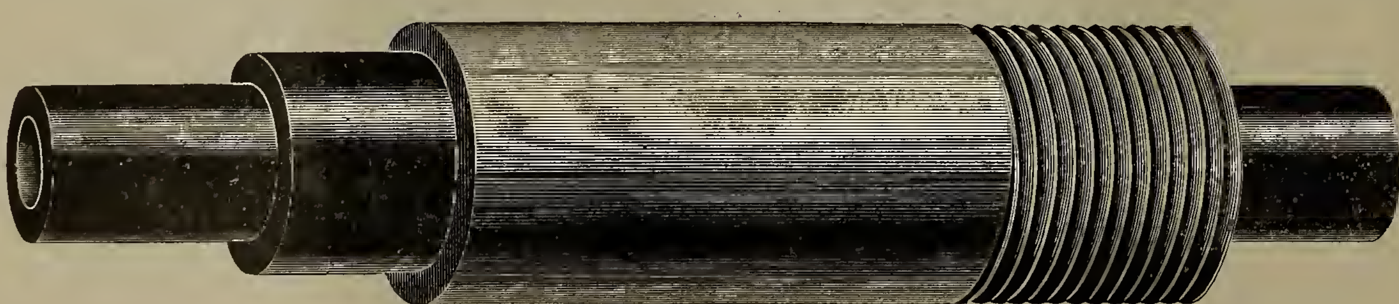
These goods are favorably known in the trade for

FLEXIBLE CONDUIT TUBING.

their quality and reliability, and the flexible tubing renders interior wiring safe and easy, the wires being always readily accessible for repairs and renewals.

IRON-CLAD TELESCOPIC INSULATING CONDUIT.

The accompanying illustration shows a section of the telescopic insulating conduit with iron armor, which the Interior Conduit and Insulation Company, of New York city, has just brought out in connection with its underground conduit system. The telescopic arrangement, whereby lengths of plain insulating conduit are slipped into lengths of the iron armored insulating conduit so that the sections break in the centres of the lengths, gives a double insulation, and at the same time an iron armor for protection. The lengths are coupled together by straight threading the ends, and abutting them in the centre of the coupling, thus producing an underground conduit that is thoroughly waterproof,



IRON-CLAD INSULATING CONDUIT.

lasting and possessing the highest insulating qualities, so high in fact that bare wires can be drawn in with the certainty of perfect results. This system is complete in details, including junction boxes, etc., and is now in actual use in the underground construction of the Johnson-Lundell Electric Railway at East 69th street and First avenue, New York. For a description of this railway see the Electrical Age of May 12, 1894.

DEATH OF MR. W. F. CULLEN.

Mr. William F. Cullen, of the E. P. Gleason Mfg. Co. of this city, died at his home, 258 East 7th street, New York, on August 9. He had been connected with the company 20 years, beginning as an errand boy. He gained the confidence of his employers and finally became city clerk for the house, which position is one of great responsibility. In this position he was in constant touch with the electrical department of the com-

W. F. CULLEN.

pany, and it was largely through his instrumentality that this department was so highly developed. He was widely known among the leading electric light companies, and particularly in the electric light and gas fixture trade in New York.

About three months ago the company granted Mr. Cullen a leave of absence, and took watchful care of him while he was away and sick. His remains were buried on Sunday, August 12.

Mr. Cullen was a member of the Jefferson Club and the Fabian Union, and was an active member of both.

A BIG COMBINE

A despatch from Chicago on the 10th inst. states that a combination has been effected between the Siemens-Halske Electric Company, the Wells-French Car Company and the Grant Locomotive works. The company will manufacture locomotives, railway and electrical equipments. The works are to be located at Cicero, where the Grant plant now stands, and operations are to commence at once. The capital stock is said to be $2,000,000.

THE MOST SUITABLE BATTERY.

Frequently we are confronted with the difficulty of selecting a battery best suited for the purpose we have in hand. In general, if the electric current must overcome high resistance, a battery of high internal resistance should be selected, and if the circuit has low resistance the battery should have a low internal resistance.

The following table will be an aid in the selection of a battery for any particular purpose:

Electric-Chemical Deposits—Daniell, Gravity, Smee, Bunsen, Carbon, Ætna.

Electric Lighting—Bunsen, Grove, Grenet, Carbon, Ætna, Edison-Lalande.

Induction Coils—Large carbon, Bunsen, Grenet.

Laboratory Experiments—Bichromate batteries, accumulators.

Medical Batteries—Bichromate batteries, Smee, chloride of silver, dry.

Long Telegraph Lines—Gravity, Daniell, Fuller.

Electric Magnets—Gravity, Daniell, Smee, Fuller, Carbon.

Electric Bells, Electric Gas-Lighting, Burglar Alarms, etc.—Daniell, Gravity, Leclanche, Carbon, Cylinder, Shaw.

Electrical Measurements—Daniell, Gravity.

Electric Motors—Edison-Lalande, Acid Carbon, Ætna, Grenet.

THE PHILLIPS ANNUAL CLAM BAKE.

The sixteenth annual clam bake of the American Electrical Works will be held on August 25. In connection therewith Mr. J. E. Cates has sent out the following circular:

10 Cortlandt Street.
New York, August 9, 1894.

Dear Sir:

A commodious ocean steamer has been chartered to run to Providence on the occasion of the Sixteenth Annual Clam Bake of the American Electrical Works, to be held August 25.

A number of gentlemen who are to attend thought it would make a pleasant outing to take a steamer, leave New York Friday, August 24, reach Providence Saturday morning early, attend the Clam Bake, leave Providence early Sunday morning and run to Newport, remaining until 7 or 8 P. M. Sunday, and arriving at New York about 7 A. M. Monday.

The idea being presented to me, I have chartered the steamer and will make the trip, providing there are a sufficient number who will signify their intention to take this trip by August 15. If by this time there are enough, subscribers will be notified and tickets must be purchased by August 20.

The price of tickets will be $20.00, and include stateroom for the trip.

Meals will be extra, and will be furnished at reasonable rates.

Itinerary and full particulars later.

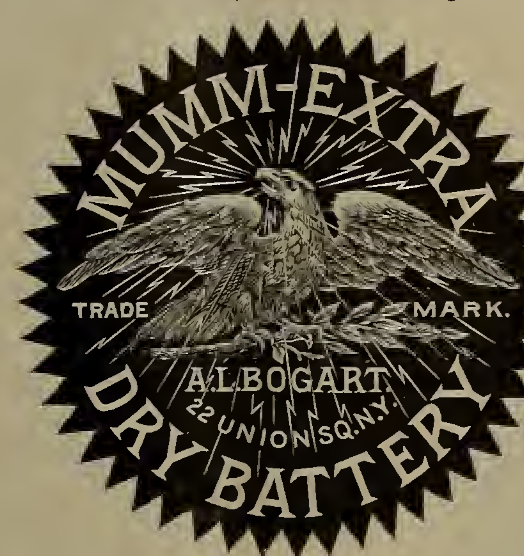
Kindly advise me at your earliest possible convenience of your intention of joining this party, and oblige

Yours truly,
J. E. Cates.

Mr. Cates has every assurance of success, twenty-five persons having already signified their intention of taking the trip. This trip should be availed of by every electrical man in this section who intends to take part in the efforts to annihilate the defenceless clam. Mr. Cates is an excursion agent well-known to electrical people in New York and Boston, and his plans are all right in every way, therefore, those who make the trip can feel assured that they will be comfortably provided for. Mr. Cates should be notified not later than the 20th instant by those who intend to go to the bake this way. His headquarters, at 10 Cortlandt street, are with the American Electrical Works.

"MUMM EXTRA DRY" BATTERY.

Mr. A. L. Bogart, the well-known electrician, 22 Union Square, New York city, is one of the most progressive manufacturers and dealers in electric gas lighting and household electrical goods that can be found anywhere on the face of this globe of ours. He is always bringing out new and useful things. Among the latest is the "Mumm Extra Dry" Battery, the trade-mark of which is shown in the accompanying illustration. This title is suggestive of something good, and it is not a misapplication of terms in the case of this battery, which is claimed to be superior to all other dry batteries on the market. It is a perfect dry battery for electric gas lighting, bell,



annunciator or other open circuit work, and is said to be an ideal battery of its class.

The Mumm Extra has an initial e.m f. of 1.5 volts, and on short circuit gives a current of 7 amperes. It does not depreciate in any manner by long disuse, its electromotive force and its internal resistance remaining unchanged. In the long run it is claimed to be the cheapest dr ybattery obtainable, and gives better satisfaction than any other. It has been tested for the past two years, and its performance more than justifies every claim made for it.

THE ROYAL ARC ELECTRIC CO.

Foster M. Voorhees, receiver of the Royal Arc Electric Company, U. S. A., will sell at public auction on Tuesday, August 21, 1894, at 10 o'clock in the forenoon at No. 73 Watts street, New York, a lot of office furniture and electrical machinery, apparatus and tools, and other articles of personal property of said company, a full catalogue of which may be seen at 73 Watts street, New York.

Said receiver will also sell at public auction on the same day at 12 o'clock at Taylor's Hotel in Jersey City, all the right, title and interest of said company of, in and to certain stock or the right to stock of the Connecticut Royal Arc Electric Company, and of the Ohio Royal Arc Electric Company, and also in three certain contracts made between the Royal Arc Electric Company, U. S. A., and the Belleville Gas Company, of Belleville, Ill., the William Barr Dry Goods Company, and Messrs. F. W. Humphrey & Co., St. Louis, Mo.

THE COLUMBIA TELEPHONE.

Since the expiration of the patent on the Bell telephone receiver, the number of telephones that have sprung into existence is legion. None is better known, however, than that manufactured by the Columbia Telephone Manufacturing Company, No. 136–140 Front Street, New York City.

This company has a complete and perfect system for telephone exchanges, factory, hotel and private use, which is fully covered by patents in every detail.

The receiver of the system is remarkable for its appearance; it is, however, a very sensitive instrument, and one of the handiest ever devised. As shown in the illustration, it has the general appearance of an insulator. The case is made of the best hard rubber, and all the connections are made inside. It is compact in construction, being 3⅝ inches long, by 2¾ inches wide at its broadest end. The eye at the left side of the illustration is used for hanging the telephone on the hook, when not in use, which hook makes the connections with the switch.

FIG. 1.

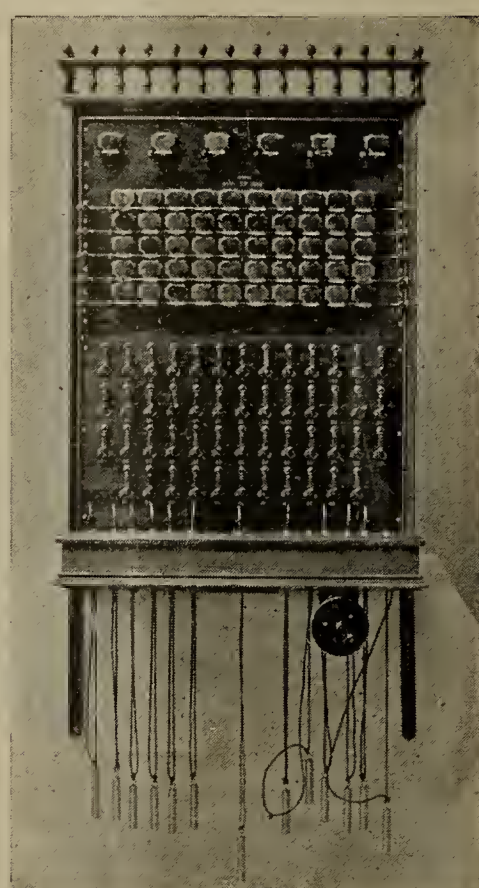


FIG. 2.

The transmitter used in this system is of the microphone pattern, without metal contacts or adjusting springs. The absence of these obviate the annoyances incidental to transmitters of many other patterns. The diaphragm of the transmitter is made of layers of thin veneer, and forms a part of the top of the battery box, resembling a panel therein The transmitter is a very simple and efficient arrangement, and gives remarkably clear transmission In general appearance the Columbia set resembles the Bell Company's standard instrument, and in every way it is first-class.

Our other illustration represents a switchboard for a 50-subscriber exchange. These boards are made in any size to order, and they are made in desk form for exchanges of 100 subscribers or over, when desired.

These boards are provided with clearing-out relays. The drops are arranged in 5 rows of 10 each, and are very compactly assembled. The connecting pins are arranged in a similar manner underneath the drops, the whole making a very convenient and serviceable board. Everything about its construction is of the best.

The Columbia Telephone Manufacturing Company is doing a large business with its system, and wherever it is possible improvements are being made.

THE PACIFIC CABLE PROJECT.

The government of the Dominion of Canada has called for tenders for laying a submarine telegraph cable across the Pacific Ocean. The tender must stipulate the cost of the following routes :

First—From Vancouver, B. C., via Necker Island, Fanning Island, Fiji, and Norfolk Island, with branches from Norfolk Island to New Zealand and Queensland, in Australia : total distance 7,145 knots.

Second—From Vancouver, via Necker Island, Fiji, and Norfolk, wiih branches to New Zealand and Australia ; total distance 7,175 knots.

Third—From Vancouver, via Necker Island, Gilbert Islands, Fiji, New Zealand, and the Solomon Islands, to Queensland ; total distance 8,264 knots.

Fourth—Via Necker, the Gilbert and Solomon Groups (omitting Fiji and New Zealand) to Australia ; total distance 6,246 knots.

Fifth—From Vancouver, via Necker and Fiji, to New Zealand ; total distance 6,127 knots.

Sixth—From Vancouver, via Honolulu (2,280 knots) and Fiji, to Norfolk Island, with branches to New Zealand and Australia ; total distance 7,078 knots.

Seventh—From Vancouver to Australia, via Honolulu and the Gilbert and Solomon Islands ; total distance 6,293 knots.

Eighth—From Vancouver to New Zealand direct, via Fiji, with a middle section if available ; total distance 6,030 knots.

Among other conditions it is stipulated that the cable must be able to transmit not less than twelve words a minute. Each offer must describe the character of the cable, its approaches, and cost of building, with provisions for repairs. Contractors are to state the number of steamships required, which, together with the stores, are to remain the contractors' property for three years, when they will be taken over by the Government at a valuation. Contractors are required to take all risks of landing places for the cable, the Government undertaking to secure landing places at the several points mentioned.

SUSPENSION OF QUEEN & CO.

A despatch from Philadelphia announces the assignment on August 8, of the well-known firm of Queen & Co. Mr. John C. Gray, the business manager, was appointed assignee. Inability to make collections is the cause given for the failure.

NEW BOOKS.

How to Build Dynamo Electric Machinery.—By Edward Trevert. Bubier Publishing Co., Lynn, Mass., 350 octavo pages, and many illustrations. Price, $2.50.

Of the large number of electrical books that are produced in the course of a given period a very small percentage are of a practical nature. While all books are good in their way, there is a great need for works that give practical instructions regarding mechanical details, etc. It is not enough to explain the definition of Ohm's law, discuss the magnetic field, saturation of iron, lines of force, etc., etc.; what the practical man wants is not so much theory but directions for the construction of a machine that he may desire to make. For such persons it is better to let them construct a motor or a dynamo after some approved form and type, and study the causes of its operation afterwards. They are more likely then to consider the machine in its theoretical aspect.

This book is just what has been looked for for a long time—a practical guide for the construction of electrical machinery. It contains working drawings, which any mechanic can use; and any machinist with a copy of this book at hand can make a dynamo or motor as well as the most expert electrical engineer.

The book contains seventeen chapters and three appendices, and as these indicate very clearly the practical value of the work we will give the subjects of each. 1, Historical Notes; 2, Principles of Dynamo-Electric Machines; 3, Methods of Field Magnet Winding; 4, Forms of Field Magnets; 5, Armatures; 6, How to Make a Toy Electric Motor; 7, How to Make a Small Dynamo; 8, How to Build a Two Light Dynamo; 9, How to Build a one-half Horse Power Motor or Dynamo; 10, How to Build a One Horse Power Motor or Dynamo; 11, How to Build a Twenty-light Dynamo; 12, How to Build an Alternating Current Dynamo or Motor; 13, Types of Commercial Dynamos. (Direct Current); 14, Types of Commercial Dynamos. (Alternating Current); 15, Types of Commercial Stationary Motors; 16, Types of Commercial Railway Motors; 17, Management of Dynamos and Motors. Appendix A, Tables of Wire Gauges; B, Some Practical Directions for Armature Winding; C, Some Practical Directions for Field Magnet Winding.

The diagrams are well executed, and as far as we can judge from a careful perusal of the book, it is a safe guide for the construction of dynamos and motors, within the limits laid down.

No doubt the book will meet with a large sale, because there is a demand for such a work.

This book and all others on electrical subjects can be had of the Electrical Age Publishing Co., on receipt of price.

POSSIBLE CONTRACTS.

The Franklin Mfg. Co., of Kansas City, Mo., has been awarded a contract for the erection of an electric light plant and water works, in Bethany, Mo.

The Consolidated Engineering Co., St. Louis, Mo., has received a franchise for the installation of an electric light and water-works system in Wichita Falls, Tex.

An electric fire alarm system is to be installed in Hagerstown, Md. For further information address the Mayor of that city.

A company has been organized in Brookhaven, Miss., to construct and operate a telephone line to Fair River and Monticello.

W. T. Hughes & Co., Lewisburg, N. C., have a contract for an electric bell installation for a hotel, the equipment for which is yet to be purchased.

The Columbus Railroad Company, Columbus, Ga., is soon to change its motive power to electricity.

The Mayor of Greenville, Tex., can give information concerning a purchase for an electric road just granted by the city.

Hughes & Co., South Framingham, Mass., are in the market for an isolated electric light plant for their harness factory.

Nicholas S. Hill, Jr., engineer, Baltimore, Md., can give information regarding the contract to be awarded September 1, for an underground system of police and fire alarm telegraph.

Secretary of Agriculture, J. S. Morton, Washington, D. C., can give information regarding the contracts to be awarded for material for a telegraph line between Wilmington and Southport, N. C.

NEW CORPORATIONS.

Chevy Chase and Kensington Railroad Co., Chevy Chase, Md., to build an electric railroad. Oliver R. Harr, president; Alfred Ray, vice-president; W. H. Walker, secretary.

Chelsea Electric Light Co., Chelsea, Mich. Capital stock, $25,000.

The Groff Telephone Co., Chicago, Ill., by Geo. Filbert, of Womelsdorf, Pa., president; W. B. Brissel, vice-president; Wm. Filbert, secretary; J. B. Tabor, assistant secretary, and W. F. Bigelow, attorney. Capital stock, $1,000,000.

The Randallstown, Harrisonville and Granite Road Transit Co., Pikesville, Md., to build an electric road from Pikesville to Randallstown, employing the system invented by C H Barrow. The system employs only one rail.

The Westminster and Union Mills Electric Railway Co., Westminster, Md , by T. Herbert Shriver of Union Mills, Chas. E. Stewart, W. B. Thomas and others of Westminster, and Frank Brown, of Baltimore, president of the Baltimore Traction Co. The company proposes to construct an electrical railroad from Baltimore to Gaithersburg.

The United Telephone and Telegraph Co., Chicago, Ill , by Donald McDonald, John G. Earle, and Edward T. McConnell. Capital stock, $1,000,000.

Robertson Insulated Conduit Co., Chicago, Ill., by J. Luttrell, Murphy Smith, H. Bracey, Hamilton B. McMillan, Bernice W. Sherman, Wm. O. Osgood, and Chas. A. Dye.

Seattle Home Telephone Co., Seattle, Wash., by John H. McGraw, J. D Lowman, A. B Stewart, A. M. Brooks, Geo. Gunds, to operate telephone and telegraph lines. Capital stock, $100,000.

Bluff City Electric Street Railway Co., Waukegan, Ill., by Dewitt L. Jones, S. D. Talcott, and Chas. Whitney, to construct and operate street railway. Capital stock, $200,000.

Central Bell Telephone Co., of Venezuela, Chicago. Ill., by Jacob K. Myers, Frank Amermann, Timothy J. Fell. Capital stock, $400,000.

Mattoon Telephone Co , Mattoon, Ill., by James H. Clark, Geo. N Buck, I. N. Lumpkin, John W. Gay, Lewis Ketz, A. Hamilton and F. M. Hendley. Capital stock, $10,000.

Eastern Ohio Telephone Co., East Rochester, Ohio. Capital stock, $5,000.

Bucks County Railway Co., Doylestown, Pa., by Francis Finnegan, St. Davids, Wm J. Fell, M. S. Lynch, S. A. Hamilton and R. C. Fulton, of Philadelphia, to construct railway through the principal streets of Doylestown, to Centreville and Newton. Capital stock, $100,000.

The Monroe Electric Company, Key West, Fla., by E. H. Gatto, president; F. H. Gatto, secretary; Jose Albertus, treasurer. Capital stock, $15,000; to establish an electric light plant and operate electric street railway.

The Rockford Electric Power, Light and Heat Co., Kittery, Me., by R. H. Tarr, of Rockport, Mass.; J. B. Stevens of Lynn, Mass., and others, to furnish light and heat by electricity. Capital stock, $50,000.

Graysville Telephone Co., Graysville, Ohio. Capital stock, $4,000.

The Solano Electric Light Co., Benicia, Cal., by T. McKay, K. Chism, K. McArthur, P. Pry, of Benicia, and G. Frame, of Elmira Capital stock, $10,000.

Santa Fé Gas and Electric Company, Santa Fé, New Mexico, by S. F. Day, P. B. Coffin and E. L. Bartlett, of Santa Fé; Chas. H. Coffin and J. M. Howles, of Chicago. Capital stock, $100,000.

Eureka Electric Co., San Francisco, Cal., by Harper A. Smith, J. H. Lawrence, M. S. Lawence, A. Hough and E. S. Hough, of Alameda County.

The Electrical Advertising Co., San Francisco, Cal., by F. Brant, F. Waibel, O. Waibel, G. A Paul, G. L. Schneider, C. E. Fisher, and A. H. Paul.

Citizens' Light and Ice Co., Woodbury, N. J., manufacturing electric light and power, ice, etc. Capital stock, $50,000.

PERSONAL.

E. I. Garfield, formerly treasurer of the Thomon-Houston Electric Company, has taken the management of the New England agency of the Fort Wayne Electric Corporation, and will at once open offices at 17 Federal street, Boston.

NEW YORK NOTES.

Office of the Electrical Age,
World Building, New York,
August 13, 1894.

Mr. George L. Colgate, of the George L. Colgate Company, 136 Liberty Street, has just returned from an extensive trip in the West. He went as far as the Mississippi, taking in all the principal cities, and had very good success in a business way. He secured some fine orders for electrical supplies and specialties. The Colgate Company report a very favorable outlook for business. It is alive to the needs of central stations and is kept busy, orders for the Swinging Ball lightning arrester alone keeping the firm quite active.

The Phoenix Glass Co., 42 Murray Street, manufacturers of fine incandescent rich cut glass shades, etc., etc., has just brought out a large line of new and beautiful patterns in ground and frosted glass, in very unique and artistic designs. Mr. Peck is showing these goods to excellent advantage, with the result of large orders.

Mr. Charles D. Shain, the eastern agent for the Siemens & Halske Electric Company, sustained an injury to his right knee a few days ago, through a fall, while trying to board a street car. The injury is sufficient to keep Mr. Shain at home for a few days. His many friends will be glad when he gets out once more.

Mr. Geo. W. Walker is now connected with the Manhattan General Construction Co., 50 Broadway, and looks after the incandescent arc-lamp department.

Mr. Henry Miller, Jr., secretary and treasurer of the New York Carbon Works, has resigned. Mr. Miller is one of the pioneers in the business, having entered the service of the above-named company 10 years ago.

Mr. Jas. B. Olsen, manager of the Chicago salesroom of the New York Insulated Wire Co., 15 Cortlandt street, has returned to the New York office. This change was made necessary on account of the health of Mr. Olsen's family. His many friends in New York will be glad to have him back East again, and hope that the climate here will be more favorable for his family. Mr. James Woolf takes Mr. Olsen's place in Chicago.

Mr. James W. Gladstone, manager Edison Mfg. Co., 100 East 23d street, New York city, has returned from the meeting at Old Point Comfort, Va., of the American Dental Society, which was held on August 7, 8, 9 and 10. The Edison dental battery outfit was exhibited at the meeting by the S. S. White Dental Mfg. Co., and it attracted a good deal of attention from the members present.

Arrangements have been made to continue the manufacture of Waddell-Entz dynamos and motors in Bridgeport, Conn. The enterprise is headed by Mr. Waddell, and the shop in which he will carry on the business is fully equipped with modern tools and machinery. It is the intention to make these machines second to none of their class. Mr. J. A. Machado will be at the head of the sales department. He will represent the new concern at 203 Broadway, New York City.

W. R. Ostrander & Co., 204 Fulton Street, manufacturers of electric bells, annunciators, electric light goods, speaking tubes, etc., etc., are meeting with excellent results in their recent departure in handling electric light goods. This branch of their business has grown to such an extent that they are now engaged in the preparation of a catalogue of electric light goods in general. This firm is the largest concern in this section of the country, which manufacture special goods in the electrical line, and their reputation is national. All goods bought of this house can be depended upon.

J. Jones & Son, 67 Cortlandt Street, have just completed the installation of a 25-light plant on the steam yacht "Lorna," owned by Mr. Stowe, a prominent Wall street banker. The plant includes a search light of 600 c.p., the current for which is supplied by storage batteries. The old dynamo was taken out of the boat and repaired, a new switch-board put in, and the yacht re-wired throughout. The "Lorna" was sunk about a month ago in Long Island Sound. She was raised and all of the work mentioned above completed in the short space of time elapsing since the collision which sent her to the bottom. J. Jones & Son have taken the agency for C. Keil & Son, for the new Reliance Door Opener. This device will be sold at very low prices in order to meet the market. This firm carries a complete line in everything electric, including electric light, electric railway, telegraph, telephone and general electrical supplies.

The Livgro Incandescent Lamp Co., of Harrison, N. J., is now taking orders for Livgro lamps. These lamps have very successfully passed through a long experimental stage, and the Livgro company is now in position to say that it has the best incandescent lamp on the market. The Livgro lamps have been fully tested for life and efficiency, and give a pure white light. They are guaranteed a life running into the thousands of hours. The New York headquarters are at Room 525, Cable Building, Broadway and Houston street.

Mr. G. A. Mullen, formerly manager of the Southern Electric Co., Baltimore, Md., has just opened an office at Room 415, Electrical Exchange, as the New York manager of the Brooklyn Electric Manufacturing Co. He will carry a complete line of samples of the Brooklyn Company's improved Quick-break Baehr switches; panels and cutout boards. This company makes a specialty of fitting out marble and slate switchboards, complete, with instruments for isolated electric light plants. They have just completed a marbleized slate board with all necessary instruments, including Weston ammeters of 1,500 amperes' capacity, for the Gerlach Hotel, New York; also one of the same capacity for the Hotel

Majestic, New York. They are now working on a large Tennessee marble board for the Academy of Music, New York. H. Ward Leonard & Co. are installing the Gerlach plant; Mr. Chas. L. Eidlitz, the Hotel Majestic, and the Brooklyn Electric Equipment Company, the Academy of Music.

Mr. Mortimer Norden, electrical engineer, 136 Liberty street, met with a severe accident a few days ago. He was riding his bicycle and collided with the pole of a wagon. His breast-bone was broken, and while he is now improving, he will be compelled to remain at home for a couple of weeks. W. T. H.

BUSINESS NOTES.

The Portland Electric Company, Portland, Me., which has been shut down for several months, has resumed operations.

It is reported that the Standard Electric Company, of Detroit, Mich., has gone into the hands of a receiver.

The Harrison Water, Light and Power Company, Harrison, Ohio, has, it is reported, gone into the hands of a receiver.

TRADE NOTES.

The Goodyear Gossamer Co., Hudson, Mass., has one of the Eco-Magneto Watchman's Clocks.

In a letter that company says: "we have had one of your clocks in use for more than a year, and it has given entire satisfaction." Mr. C. D. Bernsee, Vanderbilt Building, New York City, is the sole agent for these valuable clocks.

The National Conduit Manufacturing Company seems to be doing the majority of the underground work in this country and Canada this year. They have just closed a contract with the Boston Electric Light Company, of Boston, for all their subway work for this year; they have also contracted with the Nebraska Telephone Company for all their conduits for the Lincoln subway, which is to be built this year.

Electrical and Street Railway Patents.

Issued August 7, 1894.

523,986. Process of Electric Metal-Working. Hermann Lemp, Lynn, and Walter S. Moody, Chelsea, Mass., assignors to the Thomson Electric Welding Company, of Maine. Filed Oct. 20, 1890.

523,987. Electric-Welding Machine. Hermann Lemp, Lynn, Mass., assignor to the Thomson Electric Welding Company, of Maine. Filed Jan. 19, 1891.

523,995. Electrical Motor. Henry B. Porter, New York, N. Y. Filed Dec. 5, 1893.

523,998. Dynamo-Electric Machine. Gustaf Rennerfelt, Lynn, Mass. Filed Mar. 6, 1894.

524,003. Electric-Arc Lamp. George G. Stout, Parkersburg, W. Va. Filed June 19, 1894.

524,009. Telephone Annunciator and Call-Bell. Frederick G. Warrell, Philadelphia, Pa. Filed June 25, 1891.

524,011. Electric Motor. Frederic C. Whitmore, Lynn, assignor to the General Electric Company, Boston, Mass. Filed May 5, 1893.

524,014. Trolley-Wire Support. Levi Yakel, Allegheny, Pa. Filed Apr. 15, 1893. Renewed Dec. 27, 1893.

524,017. Trolley for Electric Cars. George C. Bourdereaux, Peoria, Ill. Filed Mar. 12, 1894.

524,020. Dynamo-Electric Machine. Rudolf Eickemeyer, Yonkers, N. Y. Filed Oct. 7, 1891.

524,025. Conduit Electric Railway. Rudolph M. Hunter, Philadelphia, Pa., assignor to the Thomson-Houston Electric Company, of Connecticut. Original application filed Nov. 30, 1886. Divided and this application filed Sept. 12, 1891.

524,037. Railway-Brake. Robert H. Bulloch and John W. Mallard, Savannah, Ga. Filed Feb. 15, 1893.

524,038. Railway Signaling Device. William Daves, Jersey City, N. J., assignor of two-thirds to Samuel S. Bogart, Schraalenburgh, N. J., and Benjamin Price, Baltimore, Md. Filed Aug. 3, 1892.

524,040. Adjustable-Gate for Street-Cars. Lorenzo R. Godwin, Memphis, Tenn. Filed Mar. 5, 1894.

524,044. Electric Pump. Frank W. Merritt and Arthur R. Roe, Duluth, Minn., assignors to the Electric Motor Company, same place. Filed Nov. 6, 1893.

524,050. Air-Brake for Cars. Jeremiah F. Voorhees, Philadelphia, Pa. Filed July 11, 1893.

524,062. Electric Heater. Jesse F. Kester, La Grange, Ill., assignor to the F. B. Little Electrical Construction and Supply Company, Buffalo, N. Y. Filed Apr. 29, 1893.

524,066. Waterproof Insulated Electric Conductor. Duncan Macfarlan, Philadelphia, Pa. Filed May 17, 1894.

524,075. Reflector for Electric or Other Lamps. Ernest Tilmann, New York, N. Y., assignor of one-half to Charles K. Lexow, same place. Filed Dec. 1, 1893.

524,098. Annunciator. Philipp Weber, Nuremberg, Germany. Filed Jan. 16, 1894.

524,100 Supporting-Insulator for Electric Wires. Lauren S. Beardsley, Naugatuck, Conn. Filed June 11, 1894.

524,109. Rosette for Electric-Light Wires. Charles N. Hammond, Boston, Mass. Filed Dec. 7, 1893.

524,116. Electric-Arc Lamp. William S. Pendleton, New York, assignor to Edmund D. Davidson, Huntington, N. Y. Filed Mar. 6, 1894.

524,117. Motor-Suspension for Railway-Work. Edwin W. Rice, Jr., Lynn, Mass., assignor to the Thomson-Houston Electric Company, of Connecticut. Filed Aug. 15, 1889.

524,118. Printing-Telegraph Instrument, James H. Rogers, Bladensburg, Md. Filed Dec. 12, 1893.

524,119. Dynamo-Electric Machine. William B. Sayers, Glasgow, Scotland. Filed Jan. 6, 1894.

524,120. Electric Hand Appliance for Massage. Andrew J. Speare, Thayer, Mo., assignor of one-half to H. J. F. Davis, same place. Filed Apr. 16, 1894.

524,136. Regulator for Dynamo-Electric Machines. Thomas A. Edison, Menlo Park, N. J., assignor to the Edison Electric Light Company, New York, N. Y. Filed Nov. 11, 1881.

524,156. Thermo-Electric Volatilizing Obtunder. Otto B. Bachman, Minneapolis, Minn. Filed Apr. 6, 1893.

524,165. Circuit-Breaker for Electrotherapeutic Apparatus. Louis W. Downes, Providence, R. I. Filed Jan. 21, 1893.

524,168. Guard for Globes of Electric Lights or Lamps. John C. Galster, Philadelphia, Pa. Filed Feb. 10, 1894.

524,175. Car-Fender. Alexander Kidd, Brooklyn, assignor of one-half to Robert Wood, New York, N. Y. Filed May 11, 1894.

524,188. Electric Transformer. James J. Wood, Fort Wayne, Ind. Filed Mar. 19, 1894.

524,190. Life-Saver for Cars. Frank M. Chapman, New York, N. Y., assignor to Stella F. Chapman, same place, and Charles B Jefferson Buzzard's Bay, Mass. Filed Feb. 15, 1894.

524,198. Fender for Tram-Cars. William Dryden, Brooklyn, N. Y. Filed Nov. 3, 1893.

524,200. Car-Axle Box. John F. Gallagher, Forest City, Pa. Filed May 10, 1894.

524,202. Electric Signal for Steamboats. Robert H. Gruschow, Chicago, Ill Filed Jan. 30, 1894.

524,207. Street or Railway Car Fender or Guard. Emil Kemnitz, Memphis, Tenn. Filed Oct. 27, 1893.

524,229. Primary Battery. William Walker, Jr., Birmingham, Frank R. Wilkins, Handsworth, and Jabez Lones, Smethwick, England. Filed Feb. 27, 1894. Patented in Belgium Feb. 7, 1894, No. 108,431, and in Austria-Hungary. Apr. 27, 1894, No. 1,246.

524,232. Insulating Trolley-Wire Support. Frank M. Zimmerman, Detroit, Mich. Filed Nov. 2, 1893.

524,250. Electric Sash-Balance. Wm. C. Hodgkins, Washington, D. C. Filed Oct. 26, 1893.

524,282. Electric Railway Pole-Ratchet. Thomas J. McTighe, New York, N. Y., assignor, by mesne assignments to Frederick K. Fitch, same place. Filed Jan. 23, 1893. Renewed Jan. 22, 1894.

524,283. Trolley Wire Circuit-Breaker. Thomas J. McTighe aud Sumner W. Childs, New York, N. Y., assignors, by mesne assignments, to Frederick K. Fitch, same place. Filed Jan 23, 1893. Renewed Jan. 22, 1894.

524,291. Primary Voltaic Battery. Wm. Walker, Jr, Birmingmam, and Frank R. Wilkins, Handsworth, assignors of one-third to Jabez Lones, Smethwick, England. Filed June 4, 1894. Patented in Belgium Feb. 7, 1894, No. 108,431, and in Austria-Hungary Apr. 27, 1894, No. 1,246.

524,293. Splice or Support for Railway-Rail Joints, Lell H. Woolley, Oakland, Cal. Filed May 15, 1893.

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NEW YORK, AUGUST 25, 1894.

CONTENTS.

SUPPLY OF PLATINUM.

How long will the supply of platinum hold out against the increasing demand, is a question that possesses considerable importance to those interested in the use of that metal. Mr. B. T. Vetterlein, in an article on another page, gives some facts concerning the production and consumption of platinum. Russia, it is thought, is now on the descending grade as regards supply, and other fields will have to be explored. British Columbia and the United States, however, are likely to meet the emergency.

INCANDESCENT ARC STREET LIGHTING.

Mr. W. C. Barstow, of Brooklyn, read a paper at the convention in Boston, last week, of the Association of Edison Electric Illuminating Companies, on the low tension arc lighting system as operated by the Edison Company in Brooklyn. This method of street lighting, Mr. Barstow said, had never before been attempted in America, and this was the first instance where automatic street lighting on a large scale had been undertaken from the low tension mains of the regular Edison underground system. No doubt this paper was full of interesting facts, but those who are unfortunate enough to be on the other side of the high fence between the Edison family and the rest of the world can not hope to be enlightened in these matters, for the present at least. We are, however, able to present to our readers, elsewhere in this issue, some facts concerning the lighting of Brooklyn by incandescent arc lamps, and give a beautiful picture of one of the main residence streets of that city, showing the artistic arrangement and appearance of the new lamps and posts. The system, we understand, is a perfect success, and it opens up a wide field for the extension of the low tension service.

THE DESTRUCTION OF UNDERGROUND PIPES.

The destruction of metallic pipes laid underground in proximity to electric street railways where the rails are used as part of the circuit, has, for the past few years, caused a great deal of apprehension in the minds of those directly concerned. The discovery of the fact of such destruction at once led to the conclusion that the action was electrolytic in its nature, and that the conditions of such action were similar to those existing in a galvanic cell. The rails formed one electrode of this imperfect cell, the pipes the other electrode, and the intervening earth represented the electrolyte. Accepting the correctuess of this theory, it was easy to understand how pipes could be thus destroyed. Some doubt existed in some quarters, however, regarding the true cause of the trouble, and another theory was put forward to account for the dissolution of the pipes. The latter theory assumed that the action was chemical in its nature, and due to ammonia, saltpeter, leakage from gas mains, etc., while the opponents—who are unquestionable more numerous—held that electrolysis was the real cause. With a view to settling the question as to whether the action was chemical or electrical in its nature, experiments were made at one of our universities in the West, the results of which were embodied in a paper read by Prof. D. C. Jackson, before the Western Society of Engineers, on July 11, an abstract of which appeared in our last issue. Prof. Jackson describes the manner in which the tests were conducted and points out that the proof is conclusive in favor of the electrolysis theory. From the tests made these facts have been deduced—that only a mere directive force in the nature of a pressure will cause electrolysis; that the actual corrosion is dependent only upon the actual current which flows, and that only a minute quantity of soluble salt in the earth is sufficient to start the action, which will then continue as long as a current flows. These tests are valuable in positively determining the cause of the destruction of pipes. The cause now being known, what is needed is some reliable means of avoiding the effect.

INCANDESCENT ARC STREET LAMPS IN BROOKLYN.

BY W. T. HUNT.

The turning of night into day by the use of electric light is now accomplished to a considerable degree in Brooklyn, where many of the streets are resplendent with the glory of electric light displayed to the best advantage.

It will be remembered by our readers that, some months ago, the ELECTRICAL AGE mentioned the fact that the Edison Illuminating Company, of Brooklyn, had after years of effort finally succeeded in getting a city contract for the lighting of the streets through which its mains ran. The officials of this company about six years ago conceived the idea that arc lamps could be used economically, with advantage to both producer and consumer, and at once carried the idea into effect. Gradually at first, but steadily the arc lamps grew into favor among private customers, and at the present time there are no less than 2,000 of these lamps in use for commercial lighting alone on Edison circuits in Brooklyn.

The idea in the first place had to be backed up by a lamp that would do the work and could be relied on, and in the selection of such a lamp those manufactured by the Electric Construction and Supply Company, of New York, were determined on. When, after a long experience with these lamps the Edison Company found them so economical to operate, and so satisfactory as light givers, the extension of the field of operations became desirable, and then the illuminating company began its efforts to secure a city contract.

For various reasons, mainly of a political nature, the company did not succeed in impressing the city fathers, or perhaps the latter would not be impressed with the advantages offered by these lamps for street lighting. As the cause was a worthy one, however, and there being a determination on the part of the Edison Company's officials to succeed in their efforts, the contract was finally secured, and this year, for the first time, Brooklyn enjoys the distinction of being one of the most artistically and brilliantly lighted cities in the land. The old arc light companies were fairly and squarely beaten and the arc lights have been called in. The economy of the incandescent arc lamp is responsible for the change, and from all appearances, and judging from expressions heard, the incandescent arc lamp is in Brooklyn streets to stay. The people are very well pleased with them, and it is doubtful if they would consent to a change to the old system. But there is no danger of such a proposition, as the new system is too successful in its operation.

The lamps are suspended from poles of handsome design and 16 feet in height. There are single bracket and double bracket poles. From each of the single brackets hangs one "Twin" lamp, and from the double brackets, two single lamps in series, one on each side of the pole. The combination structure of the poles and brackets is extremely artistic, and really adds to the appearance of the streets. In the case of the Twin lamps, the two carbons give the full 2,000 c.p., the same amount of illumination being given by the two single lamps.

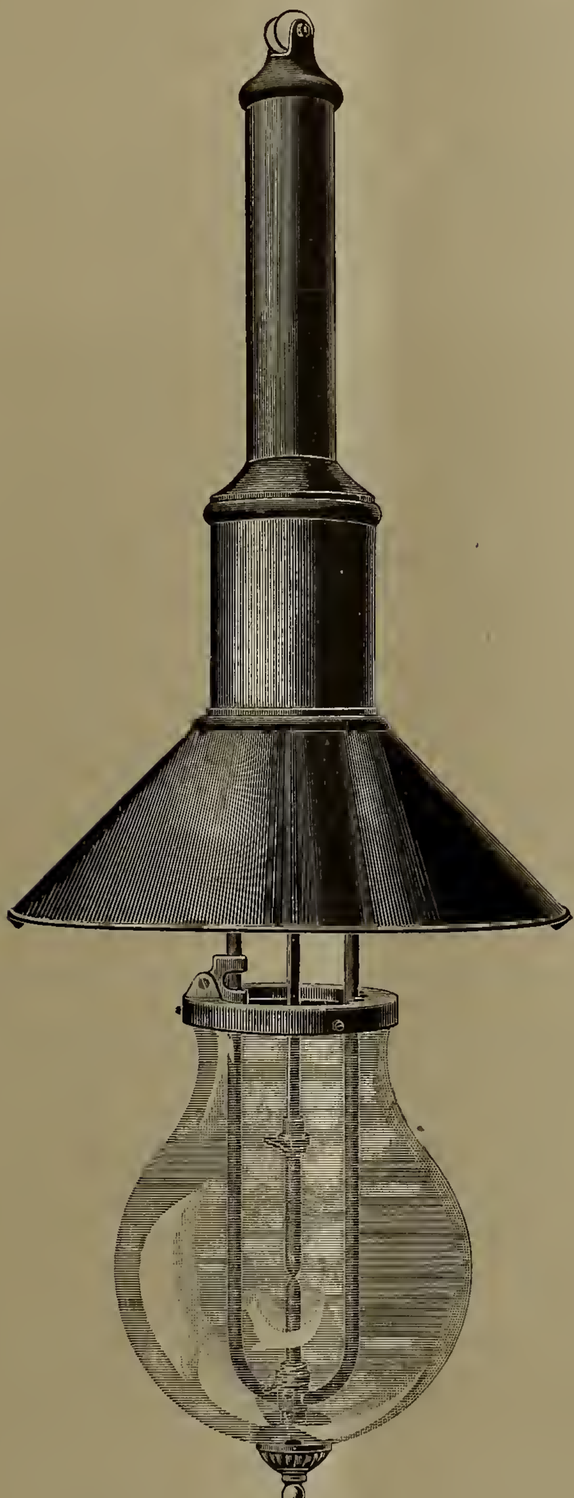
VIEW OF CLINTON AVE., BROOKLYN, SHOWING INCANDESCENT ARC LAMPS.

The Twin lamps on single bracket poles are used under the elevated railroads and in the main avenues of the city where there are trees.

The two single lamps take four amperes of current and the Twin lamps the same amount. All lamps are operated by clock mechanism connected with automatic switches. The trimmers are required to set the clock so it will turn on the current at a given time. Part of the clock mechanism was constructed by the General Incandescent Arc Light Company and the rest by the Seth Thomas Clock Company and the Edison Illuminating Company. The pole brackets are of different lengths to suit the different situations.

The incandescent arc lamps were made by the Electric Construction and Supply Company of New York. There are between 800 and 900 of them now in use in Brooklyn. This make of lamp was selected after a long competitive test, proving that it was unequalled in steadiness of operation and softness of light, besides being economical to maintain.

The Twin lamp, it may be explained, has two carbons, both being in use at the same time; it is practically two lamps, in series, with one globe, and under one cover.



SINGLE INCANDESCENT ARC LAMP.

Our illustration gives a view of Clinton Avenue, showing the lamps suspended from single bracket poles This avenue, which is the finest in the city, is flanked on either side by a row of shade trees, and in order to avoid interception of the light, the poles are set low, the bracket arms carrying the lamps well out. At night this street looks very beautiful in its brilliancy, the lamps being regularly disposed along its length.

All of the circuits are run underground, thus there are no wires above ground, which is an important feature of the Edison system.

There seems to be a fitness of things even in electric lighting. Hon Charles A. Schieren, Brooklyn's enterprising Mayor, lives on Clinton avenue (his residence being shown at the left of our illustration), and it is notable that the new departure in the city's lighting should be coincident with the beginning of Mayor Schieren's administration. This is a practical lesson, and shows how a town will prosper under the leadership of an honest business man.

The citizens of Brooklyn were loath to traverse Clinton avenue before the electric lights were installed, on account of its gloominess; now things are changed, night has been turned into day, and this avenue has become a popular evening promenade.

Under the new system, Brooklyn seems to have good ground for the claim that it is one of the most brilliantly lighted cities of the continent.

PRINCIPLES OF DYNAMO DESIGN.

BY NEWTON HARRISON, E. E.

INTRODUCTORY.

To design is to originate. The creation of a new type or of an improved part is classed in the category of design as an invention. By following laws which are applicable to all cases of design, we are assisted in the production of a machine which otherwise only a most extensive experience could enable us to produce.

With a groundwork which is purely scientific in its character, we can elaborate upon those branches of the work which require the aid of experience, in order to effect a result in harmony with our object.

Calculations which take into consideration every minute change experienced by the material under the varying conditions to which it is exposed, would necessarily lead us to absolute results; but such a system is too laborious for usual practice and is generally supplanted to a greater or less extent by a certain amount of empiricism or rules of experience.

A scientific method in design is very necessary because rules of thumb fail when special cases are to be considered; they generally apply to a certain run of machines and are but the outcome of a limited experience extremely beneficial in the consideration of details, yet a drag when the whole is to be investigated and differentially developed.

Aside from the usual treatment of the subject, it is generally considered that the best and most logical method of procedure is to carefully examine into the principles underlying the design and construction of a dynamo, and then to pass onward to an analysis of the motor The reason for such a system is obvious. A motor from the first instant of motion is, with respect to its internal action, indisputably a dynamo. We have a similarity of conditions such as exists in the dynamo, and furthermore, the more nearly its action accords with that of the dynamo, the more effectively is the object accomplished of producing an efficient motor.

A dynamo is a generator of electricity, not in the sense that from the machine itself can be produced electric manifestations, but by applying power to such a device we are made capable of effecting a transformation of such power into electricity. Were the dynamo a perfect machine in which no losses occurred of any description, we would obtain a quantity of electrical energy exactly equal to the power or kinetic energy applied. But when such a transformation takes place losses are inevitable. Constant subtractions from the seemingly original source of power occur all along its path.

These differences do not represent cases of the entire annihilation of energy; they in themselves are simply cases of the transformation of part of the energy into heat in the conductors and iron, or friction at the bearings of the dynamo.

Such losses being impossible to prevent, must be reduced to as low a value as is consistent with good practice. We now reach a stage in design where we are dependent upon empirical rules, and, in order to pass from ideal conceptions to actual conditions, we must be governed by suggestions which arise from the past experience of others.

Chapter (I)—The Magnetic Field.

The dynamo has for its primary object the production of electromotive force.

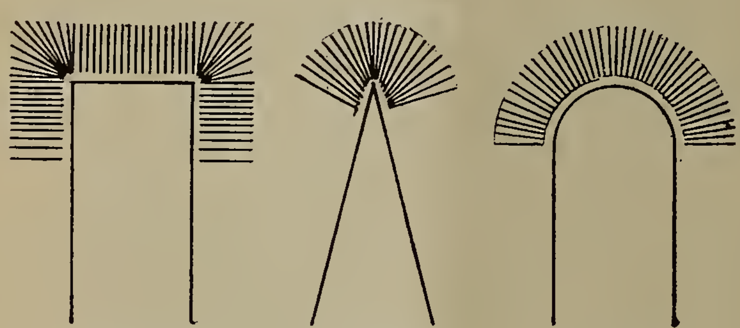
Electromotive force can only be generated by a variation of the lines of force with respect to a conductor.

Either a conductor is moved so as to cut, thread or enclose lines of force; or the lines of force are changed in position so as to cut the conductor.

In either case lines of force change their position with respect to the conductor—or the converse.

Under these conditions E. M. F. is always generated.

E. M. F. depends upon an additional factor for its production. The conductor may be at rest, while the lines of force may be varying simply because the current is changing. The E. M. F. in a transformer is generated in the secondary coil because the varying alternating



Leakage at Corners. Leakage at Points. Uniform Distribution.

FIG. I.

current in the primary is causing a corresponding change magnetically in the core of the secondary and hence producing E. M. F.

LINES OF FORCE.

Every line of magnetic force is a closed loop. A definite relationship exists between the current flowing in a coil of wire and the number of lines of force it is capable of producing.

Whenever a conducting circuit is linked by lines of force, an electromotive force is developed in strict proportion to the number of lines of force it encloses.

The magnetic effect in a coil of wire acts along certain lines, axes or paths, thus producing for a limited area a concrete effect.

As a means of understanding and measuring this action quantitatively, a standard or absolute line of force was adopted.

A unit line of force is one of such strength that a unit pole placed on it will be urged along with the force of one dyne.

This line of force possesses as real a value as a unit of current or electromotive force, representing the integral effect over a certain area.

All standards used in science are taken from the absolute or centimeter-gram-second system; and the intensity of a magnetic field is measured by the number of lines of force per square centimetre.

A magnetic field as graphically illustrated by the sifting of iron filings over a magnet brings to view magnetic lines; but they are not identical with those under present consideration. They represent the streaming and non-uniform distribution of the magnetic force according to the shape of the magnetized material; very useful, as will be observed later on, when the question of leakage is investigated.

A line of force, by its definition, can represent a certain quantity of mechanical energy.

A *uniform magnetic field*, that is to say, a field each square centimeter of which possesses the same number of lines of force, will exert a uniform pull at every point

In the design of electrical machinery a field of the above description is, in a majority of cases, absolutely necessary.

The shape of the iron has everything to do with the field, as regards its uniformity or distortion. (See Fig. 1)

A distorted field generally causes excessive leakage, which, from the standpoint of economic design, is wasteful and injurious.

(*To be Continued.*)

PRODUCTION AND CONSUMPTION OF PLATINUM.

BY B. T. VETTERLEIN.

With the introduction of the electric lamp into practical use in 1881, the consumption of platinum rapidly increased, though the quantity required for each lamp was gradually reduced. The first Edison lamp contained .8162 grains (53 mg) platinum; the first Sawyer-Man over 1.52 grains (150 mg); the former now barely contains .1232 (8 mg) grains, and the latter none at all. Likewise Siemens and Halske have reduced the quantity in their lamps to a minimum. Notwithstanding, the consumption of platinum for electric lamps has risen in 1892 to 3758.843 pounds (1705 kg). Whatever has been or may be done to dispense with its use in electric lamps, its entire abandonment is improbable, since the many lamp factories are arranged to make use of it and the cost is but a trifling addition to that of the completed lamp; it is therefore more likely that the future consumption for this purpose will be rather larger than less, due to the increased demand for lamps.

Two other important uses for platinum absorb very considerable amounts. One is the construction of vitriol-concentration stills, and the other dentistry. It is estimated that (2480 kg) 5467.408 pounds per annum are required for these two industries in Germany. The manufacture of acid appears also to be on the increase, and though to some extent glass has been substituted for it, the general belief is, that more and more platinum will be required. It may also be assumed that dentists will always continue to use it, since it is the only metal which combines the greatest infusibility with flexibility and strength. In England and America alone 4100.556 pounds (1860 kg) are used, and the quantity increases yearly from 2 to 3%. For crucibles and the like at least (620 kg) 1366.852 pounds are required. To recapitulate, there will be needed for all purposes at the present moment:

	lbs.	kg.
For lamps....................	3759	1705
For stills and dentistry.........	9568	3840
For crucibles, etc...............	1367	620
	14694	6165

This amount to the extent of 30 to 40% is covered by old platinum, leaving from (3705 to 4316 kg) 8817 to 10,286 pounds to be provided.

For many years the Ural mines supplied the largest proportion (92%), but how long will this continue? According to the official statistics of the Russian Government, the production of platinum reached its height in 1887; then it fell to 5952 pounds (2700 kgs), and remained without change at these figures till 1891, in which year, owing to the abnormally high prices current, it rose to (4226 kgs) 9317 lbs. But many of the Ural mines are now exhausted, and it is believed that the culmination point of the Russian platinum production has passed. New sources of supply have been looked for, and it is hoped that these have been found in Columbia, S. A ; British Columbia and in the United States. As yet the production in Columbia amounts to a little more than (125 kgs) 276 lbs., obtained by placer mining. The platinum bearing territory is very extensive, though not rich, and is in part well adapted for placer mining. Considerable American capital has been invested there, and it is among the possibilities that this country may become an important producer. In British Columbia, the only appreciable finds have been made near the Talamee River, but only about (25 kgs) 55 pounds have thus far been credited to this section. In the United States many attempts have been made to find platinum. In the California and Oregon placer mines it has been found. The census bureau returns the amount for the year from 1880 to 1889 at 2491 Troy ounces, and for 1892 at 80 ozs. The imports into the United States, according to the same source, foot up for 1890, at 123.143 ozs., and for 1892, to 86,000 ozs.

THE ELECTRICITY OF DROPS.

Drops afford many advantages for the investigation of electrical effects, especially of those which involve the contact of dissimilar substances. Perhaps the greatest of these advantages is that when the drops are formed they present a perfectly clean surface to the gas by which they are surrounded, so that the conditions are much more definite than they can be when the surfaces have been long exposed, and have had time to get contaminated by dirt or coated with films. These advantages have commended the study of the electricity of drops to Prof. J. J. Thomson, of Cambridge, who contributes an exceedingly interesting paper on his results to the April issue of the *Philosophical Magazine*, says the *Electrical Review*, London.

The subject has already received some attention from Lenard (*vide Wiedemann's Annalen*, xlvi., p. 584), and Prof. Thomson has largely made use of the methods of experiment adopted by this physicist. The experiments described by the latter relate to the electrical effects which occur when a drop of liquid falls upon a plate already coated with a film of the same liquid.

At the foot of waterfalls, as is well known, peculiar electrical effects occur. Here the normal distribution of the atmospheric electrical potential is disturbed in such a way as to indicate a distribution of negative electricity in the region at the foot of the fall. The effects cannot be due to the waterfall acting like the falling drops in Lord Kelvin's water-dropping electrophones ; for they are found to occur when the waterfalls are inside caves whose sides are dripping with moisture, in which case the water would be falling inside an equipotential surface. This notion is the starting-point of Prof. Thomson's investigation.

Without following the professor through the details of his exhaustive experiments, we may turn with advantage to his results. They show that the electrification developed by the drop depends (1) on the nature of the gas surrounding the drop ; (2) on the nature of the drop itself. On the drop side of the surface of separation of the gas and drop there is a coating of one kind of electricity close to this, but in the gas there is a coating of the opposite kind of electricity. The quantity of positive electricity on one coating is equal to the quantity of negative electricity on the other.

Experiments with liquids of various chemical constitutions point clearly to the conclusion that the *electrification owes its origin to chemical processes.* Over the surface of the drop a substance is formed which is in a state intermediate between that of complete chemical combination and complete separation between the surrounding gas and the liquid forming the drop ; a state in which the constituents have electrical charges of the same sign as in actual chemical compounds, but in which the connection between the constituents is so loose that they can easily be shaken apart. The greatest electrical effect will occur when there is a tendency towards chemical combination, though not of sufficient intensity to result in the time taken by the drop to fall from its starting-point to the plate, in the formation of a definite chemical compound.

The quasi-chemical action which produces the electrification is greatly influenced, if not altogther determined, by the solvent.

Prof. Thomson argues that distilled water, concerning which electricians have hitherto held pronounced views, is a substance which is far from being chemically saturated and inert but that, on the contrary, it can by its chemical action set up those chemical changes in the gas by which it is surrounded or in substances dissolved in it which give rise to electrification. This argument is illustrated mathematically by curves.

There seems no reason for limiting the possession of this double coating to liquids. It is possessed by liquids of the most diverse characters, as is shown by the electrification developed by drops of water, mercury, molten metals, turpentine, etc. If, however, we suppose that solids possess such a coating, it is evident that the rubbing off of part of one of these coatings when two solids are rubbed together, would show itself as electricity developed by friction. Indeed, it seems possible that a large part, if not the whole, of the electricity developed by friction may be due to this cause.

The professor concludes his paper with some speculations (this is scarcely the right word) concerning the electrification of metals, etc., when exposed to the influence of ultra-violet light, and concerning the origin of the large drops of rain which frequently accompany thunderstorms.

LIGHTING POWER OF INCANDESCENT LAMPS.

A lecture was recently delivered by M. Larnaude before the Société Internationale des Electriciens in Paris on the subject of incandescent lamps. The lecturer, who is the manager of the Société Générale Incandescente Edison, dealt first with the improvements made in the manufacture of this type of lamp, and stated that it is easy to understand whether there is any advantage in using lamps run economically with a short life. As an instance he gives the following comparative table, which is based on the unit price of 1f. per lamp and on the corresponding lives at different conditions of working the lamps :

1,200 hours for lamps of 4 watts per candle.
800 " " 3.5 "
400 " " 3 "

Cost per kilo-watt-hour in francs.	Cost price per 16-candle lamp hour in centimes. 4 watts per candle.	3.5 watts per candle.	3 watts per candle.
.50f.	3.28c.	2.92c.	2.65
.75f.	4.88c.	4.32c.	3.85
1.00f.	6.48c.	5.72c.	5.05

NEEDED MODIFICATIONS IN OUR PATENT LAWS.

BY WALTER S. LOGAN.

(*Concluded from page 75.*)

As property in inventions is the way the world has of paying a reward to the inventor, and as the world needs the work of inventors more than it needs the work of any other class of its citizens, we may fairly conclude that property in inventions will last longer and be more desirable than any other kind of property. The talk of repealing our Patent Laws is the veriest nonsense. They are not to be repealed; at least while other kinds of property than patents continue. Sooner will the world abolish property in land, property in flocks, property in goods, property in everything else. If there is to be a survival of the fittest, it must be the fittest that survives, and property in inventions must last longest and be most honored, because it is most needed and produces the best results. We have outgrown the old idea that patents are monopolies, a survival of a little that is good from the mass of the selfish, unrighteous monopolies of the time of Queen Elizabeth. Whatever the theory originally was, and however the right first grew into the system of the Common Law, a patent is now nothing but a species of property, as well recognized and understood as property in lands or chattels. There is no more monopoly about it than there is about the ownership of a house or a horse. It is a monopoly in the same sense that all property is a monopoly, and in no other sense. If we go back to first principles and discuss the question of ethics, we shall find quite as much reason for giving a man property in the labor of his brain as in the labor of his hands, quite as much to justify ownership in thoughts as in things. But it is not necessary to discuss the question of abstract right and justice. We have no need to appeal to religion or morality. We really give the inventor a property in his invention, not so much because he has earned it, not so much because it is his due and right, as because we, the rest of the world, advantage by his enjoyment of his own profits, and because we want every man, by seeing his prosperity, to be stimulated to do as he has done, and by the expectation of similar results in his own case, to himself be moved to invent or discover something that the world needs.

Our patent laws should be formulated in view of this fact. They should be so drawn as to give the greatest stimulus to inventors, and at the same time let the world in general get the greatest benefit at the least cost. It isn't necessary that we should pay too lavishly in order to give most munificent rewards to the men who render the greatest service in the way of invention. All that is needed is to see that what the world does pay, the inventor gets.

The problem before us is to so pay a little that the inventor may get much. What we have been doing is to pay much, so that the inventor might get a little. Industries have been paralized by patents while patentees have remained poor.

The objects of the modification of our patent system which I propose is to enable the world to get more benefit from the invention, while the inventor gets more profit from the patent; to make property in patents more valuable to the patentee and, at the same time, less onerous to the public; to punish ourselves less and profit him more.

Our patent laws now require that the invention shall be absolutely new, and this requirement is most strictly and (as many of us practicing patent lawyers sometimes think) oppressively enforced by the courts. The inventor may devote the best part of a lifetime to the perfection of some improvement he sees to be necessary in a vital machine or process employed in some important industry. He succeeds in his efforts. He produces a better result at half the previous cost. He introduces his improvement into every factory in the land. The whole nation profits by being able to get some important product of human industry or vital necessity of life at a much lower price; and then the inventor is defeated, either in the Patent Office in his application for a patent—or more likely in the Courts in trying to enforce it—by something that was never reduced to practice, was never brought to the attention of the world, and never did any one any good, but which appeared in some obscure publication, published in a foreign language, perhaps little understood and less read, at a period so remote that the present generation knew nothing of it; or perhaps it is by some insignificant experiment, made by one utterly ignorant of its importance, in some distant region, never made known and entirely forgotten; but the enterprising lawyer for the defendant spends his client's money with a lavishness which, if the real, meritorious inventor was the object, would enable him to live on a bed of roses the rest of his life, and succeeds in getting on the track of it, and wrests the old evidence from the oblivion to which it rightly belonged; and the life of a man who has devoted the highest of talent to the noblest of purposes is a wreck and a ruin; and on the other side, the chance is that not even the infringing defendant gets any good of all this, for when he has paid the cost of the litigation, he most likely finds that it exceeds the net proceeds of his piracy, and that he had much better have paid a fair license to the patentee and been himself protected by the patent.

Any lawyer who is familiar with the decisions of the Supreme Court of the United States for the past twenty years knows that I am not overdrawing the picture or stating an exceptional case.

The result is that mothers are wont to warn their children against the development of inventive genius, as in olden times they did against the black man in the closet; bankers refuse to loan money to an inventor; and patentees and paupers are apt to be classed in the same category.

And this is the way the world, which needs more than it needs anything else the services of the inventors, encourages invention.

There is no logic in the requirement of technical novelty. The man who actually invents a thing the world needs, and teaches the world to use it when it did not use it before, is an inventor who is entitled to the world's gratitude and its best rewards, and should not be defeated because some one else may have previously stumbled on the same thing without knowing its value or putting the world actually in possession of it.

An invention should be new enough for a patent if the inventor, actually and independently inventing it, brings it for the first time to the world's actual knowledge.

I submit that section 4886 of the Revised Statutes should be amended so as to read like this—

"Any person who has invented or discovered any useful art, machine, manufacture, or composition of matter, or any useful improvement thereof, not theretofore generally known or used, may, upon payment of the fees required by law and other proceedings had, obtain a patent therefor."

—with appropriate amendments in the language of the other sections to conform.

The section as it now stands, is substantially as it stood in the statute of 1836, and is therefore something over half a century old. During that half century the number of patents in the United States has increased from a few paltry thousands to more than half a million, and in other countries in a like ratio. There were few scientific publications then, where there are multitudes now. The chance of finding an anticipation of a valuable invention then was very small compared to the strong probability of finding it now. It was not much of a hardship to require absolute novelty in the invention then, but to require it now makes the inventor not only a gambler with fortune, but a gambler playing against loaded dice. The section as drawn in 1836 may have been the embodiment of wisdom, but now, in our totally changed conditions, it seems the embodiment of folly.

My second proposed modification relates to dividing the profits of the invention, where bona-fide, independent inventors independently reach the same useful result in ignorance of one another.

In my own practice, I happen to have had a little personal experience which seems to me to emphasize the importance of this proposed reform.

Three honest, bona fide meritorious inventors, each in absolute ignorance of the work and even of the existence of the others, undertook to make an improvement, of such a nature that it was revolutionary in its effect, in a very important industry. They all devoted long years of labor, study and experiment to the matter. They all passed a good share of a lifetime in poverty, devoting their time, their talents and their money to the work. They all reached substantially the same result in substantially the same way. They all arrived at the point of invention within, at the most, the same two months of time. Within a year after that the invention was in use in every civilized country, and was an assured success, and of almost incalculable value to the world. There was no question as to the honesty or merit of all the three inventors or the absolute independence of their work, and of their ignorance of each other, previous to their invention.

It cost a tolerably good-sized fortune to litigate the question as to which of the three, within that little space of two months, actually reached the stage of invention first. My client won. He won only by a neck—but he won. After paying all the expenses of the litigation, including a fee to myself of which I have no cause whatever to complain, he realized a fortune from his invention within a few years. The cost of the litigation to the other inventors left them and their backers financial wrecks, and the nervous strain during the ordeal, and despondency over the result, completely broke them up so that they died, poor and broken-hearted.

The fate of these men is not such as to encourage others to seek to benefit the world by the exercise of inventive genius.

Under the law as it exists today, every man who is trying by invention to solve a problem, whose solution will benefit humanity no matter how much, is only tempting Providence, and although entirely successful, he may lose all his rewards because he comes only a day too late.

Let us change our laws so as to make the inventor's life, if we can, a little less of a lottery and his reward, if successful, a little more sure, and we will have more and better inventors.

These changes I have been so far advocating are apparently for the benefit of the patentee. It is true, nevertheless, that whatever benefits the inventor stimulates invention, and so benefits the public, and I think it cannot be fairly said that the reforms, in any sense or in any way, benefit the patentee at the expense of the public. The public can hardly be said to have generally gained when the courts have decided, as they so often have, that some otherwise valid and valuable patent was void, because while the patentee was a bona fide and meritorious inventor, he had been anticipated by some obscure and unappreciated experiment, made and forgotten long years before. Some infringer may have got off with a whole skin, when otherwise he would have had to pay heavy damages, but it can hardly be said that his fate, so far as his own fortune was concerned, was a matter of public concern. The public are not interested in seeing one man profit by pirating the genius of another.

If inventors were required to divide the rewards of something which they all independently invented, individuals might have to be content with lesser fortunes, but the public would be quite as well served.

The last two of the amendments I propose are decidedly and positively in the interests of the public, and of the public alone.

It is in the interests of the public that an inventor should be required to reduce his invention to actual practice, and bring it into public use, or give up some portion of his reward to the practical man who does this, and it is likewise in the general interests that the inventor should be required to manufacture the patented articles and to supply them to the public, so that the public demand is fully met, at fair rates—that is, at rates which give him a liberal reward as an inventor in addition to a fair profit as a manufacturer—or that he should give licenses on fair terms to others who will.

The inventor should not be allowed to pursue, as he is sometimes inclined under the present laws, a dog-in-the-manger policy. He must either do something himself or allow others to do it. He gets a valuable grant from the public and a reward for a supposed public service. He must render his service or give up the reward. The public, if they give him his patent, may fairly see to it that they get the fruits of the invention.

There will be found, I think, no practical difficulty in fixing the amount of a proper license fee or percentage for a fair division of profits. Such questions would not ordinarily be as difficult as the questions which come before the courts every day in patent cases under the present law, and the courts can easily devise some convenient and expeditious way of reaching a fair determination.

Such, gentlemen of this Association, are my reasons for advocating the proposed changes in our patent legislation. With the reforms adopted, the aggregate burden of the Patent Laws upon the industrial public and the general community would, I think, be lessened rather than increased, while it seems very clear that property in patents would be subjected to much less hazard, and therefore would be much more desirable and valuable; the security of the inventor would be much increased and invention in every way stimulated.

While the public would give less, the inventor would get more.

A Compliment.—In an article by H. D. Wilkinson, published in the *Electrical Engineer*, London, entitled: "Notes on Electric Tramways in the United States and Canada," that gentleman has this to say regarding our electric railroads: "As a means of travel, I have not experienced in the States anything so pleasant as their well lighted and fast moving electric street cars; and I cherish the hope that ere long this public boon may be extensively put into action along the streets and lanes of our own country."

The best type of engine for railway power stations is the compound condensing engine, and the engine capacity should be from twenty to twenty-five horse power per car operated. The actual amount required varies from fifteen to eighteen horse power per car.

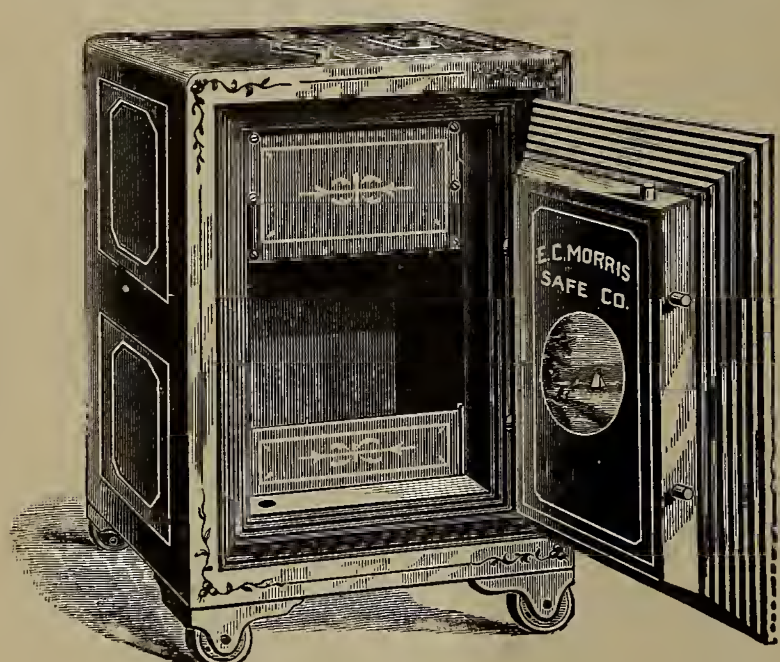
AUTOMATIC RAILWAY SAFE.

The object of this safe is to provide a receptacle into which conductors can drop their trip slips and cash returns at night or other times when there is no clerk on duty to receive the same. It offers a secure depository for such records and deposits, its contents being quite as secure against unlawful access or removal as they would be in a regular safe.

The safe is provided with a combination lock, which can be opened only by those in possession of the combination, and it is fire proof.

The deposits are made in an opening on the top of the safe. They fall into a sliding box without a bottom; this box is then drawn forward and the package drops through an opening into the interior of the safe. When desired it can be so arranged that a bell may be rung when a deposit is made.

Our illustration gives a view of this safe, showing the openings on the top plate through which the deposits are made, and the interior construction. In general appearance there is no difference from the standard



AUTOMATIC RAILWAY SAFE.

safe. Its dimensions are, outside, 43 inches high, 30 wide and 25¼ deep. The inside dimensions are 18 inches high, 18 wide, 13 deep.

This valuable device which is manufactured by J. H. Bunnell & Co., 76 Cortlandt street, New York city, is the invention of Mr. Charles McLaughlin, of that firm.

AMERICAN ELECTRO-THERAPEUTIC ASSOCIATION.

The American Electro-Therapeutic Association will hold its fourth annual meeting at the New York Academy of Medicine, New York City, on September 25, 26 and 27 next. The following is the preliminary programme.

President's Address—Dr. W. J. Herdman, Ann Arbor, Mich.

THE CONSTANT CURRENT.

Physics: Current Distribution—Mr. W. J. Jenks, New York.

Physiological Effects—Prof. A. E. Dolbear, Boston, Mass.

Therapeutic Uses, General—Dr. A. D. Rockwell, New York.

The Galvanic Current in Catarrhal Affections of the Uterus—Dr. G Betton Massey, Philadelphia.

Suites e'loignees du traitement electrique conservateur gynæcologie grossesses consecutives—Dr. Georges Apostoli, Paris.

Metallic Electrolysis—Dr. George Gautier, Paris; Dr. W. J. Morton, New York; Dr. Margaret A. Cleaves, New York; Dr. A. H. Goelet, New York.

Treatment of Urethral Stricture (report to date)—Dr. Robt. Newman, New York.

Diseases of the Eye, Electro-Therapeutics of—Dr L. A. W. Alleman, Brooklyn, N. Y.

Notes on Goitre and Improvements in Apparatus for Treatment of Same—Dr. Chas. H. Dickson, Toronto

Diseases of the Throat—Dr. D. S. Campbell, Detroit, Mich.

The Action of Electricity on the Sympathetic—Dr. A D. Rockwell, New York.

Diseases of the Nervous System: The Treatment of Neuritis by the Galvanic and Faradic Currents—Dr. Landon Carter Gray, New York.

Electric Sanitation—Prof. John W. Langley, Ph. D., Cleveland, O.

Physics of the Electric Light in Relation to Organized Matter—Prof. John O. Reed, Ph M.

Hydro-Electric Methods: Physics and Appliances—Mr. Newman Lawrence, London.

Special Hydro-Electric Applications—Dr. Margaret A. Cleaves, New York.

The Hydro-Electric Therapeutics of the Constant Current—Dr. W. S. Hedley, Brighton, England.

INDUCTION CURRENTS.

Interrupted Currents: Physics. ———

Physiological Effects—Dr. W. J. Engelmann, St. Louis, Mo.

Therapeutic Uses: General, ———. General Faradization—Dr. A. D. Rockwell, New York; Gynæcological—Dr. A. H. Goelet, New York; Dr. H. E. Hayd, New York; Dr. A. Lapthorn Smith, Montreal.

SINUSOIDAL CURRENT.

Physics—Mr. A. E. Kennelly, F. R. A S., Philadelphia.

Physiological Effects—Dr. W. J. Herdman, Ann Arbor, Mich.; Dr. J. H. Kellogg, Battle Creek, Mich.

Therapeutic Uses—Dr. Margaret A. Cleaves, New York; Dr. Wm. James Morton, New York; Dr. J. H. Kellogg, Battle Creek, Mich; Dr. Holford Walker, Toronto; Dr. A. H. Goelet, New York.

Le Courants Alternatifs; leur transformation; leur mesure et leurs applications therapeutiques—Drs. Gautier and Larat, Paris.

On the Sinusoidal Current Method of Regulation, the E. M. F. and Resultant Current—Dr. Lucy Hall-Brown, Brooklyn, N. Y.

STATIC AND STATIC INDUCED.

Physics—Prof. Edwin Houston, Ph. D., Philadelphia.

Physiological Effects. ———

General Therapeutic Uses—Dr. W. J. Morton, New York.

The Treatment of Chorea—Dr. D. W. Brower, Chicago.

Static Induced—Dr. Margaret A Cleaves; New York.

High Frequency Currents Derived from Static Machines as per Method d'Arsonval—Dr. J. H Kellogg, Battle Creek, Mich.

IN MEMORIAM.

Dr. Wm. F. Hutchinson, Providence, R. I.; Dr. John Chambers, Indianapolis, Ind.; Dr. Robt Newman, New York; Dr. Plymon S. Hayes.

American Street Railway Association.—We have received a copy of the proceedings of the twelfth annual meeting of the American Street Railway Association, which was held in Milwaukee, Wis., October 18 and 19, 1893. It makes a volume of 210 pages.

CONVENTION OF THE ASSOCIATION OF EDISON ELECTRIC ILLUMINATING COMPANIES.

The convention of this association was held at the Hotel Vendome, Boston, August 14 and 15.

First Session.—The following companies were admitted to membership:—Toronto Incandescent Light Company, Toronto, Ont.; Cleveland Electric Illuminating Company, Cleveland O.; Atlantic City Electric Light Company, Camden, N. J.; Edison Electric Illuminating Company, Cincinnati, O; Edison Electric Illuminating Company, Atlanta, Ga.; United States Electric Light Company, Washington, D C., Union Electric Light Company, Seattle, Wash

The first business of the meeting was the reading of a report by Mr. A. E. Kennelly, chairman of the committee on "Lightning Protection; Crosses with High Tension Wires and Grounding the Neutral Wire on the Three-Wire System" He gave a summary of the experiences of Edison stations up to date from these dangers, with suggestions as to the means of preventing them. The report was accepted and the subject was considered of sufficient importance to continue the committee.

The reading of this report was followed by an exhaustive discussion, in which Prof. Marks, C. P. Gilbert, John I Beggs and C. L. Edgar participated.

Prof. Mark's paper on "A Board of Control for Central Station Management, Composed of the Heads of the Different Departments Making up the Organization" was then read. This subject was considered by Prof. Marks in very great detail fully elaborating all the important elements which enter into the complications of this question of business. The discussion which followed indicated the interest evinced by the representatives of other illuminating companies present, and also developed the fact that many differences of opinion existed as regards not only the details, but the general principle upon which this board of control is based.

Mr. Hale then read a paper on "Boiler Testing." This paper was the result of a series of tests made at the new station of the Edison Illuminating Company, Boston, and gave the convention some facts which have never been previously published in America. The paper was discussed at considerable length by the technical men present, who took a strong interest in the subject

Second Session.—After the formal opening of the session, Mr. John Van Vleck, of the Edison Electric Illuminating Company of New York, read a paper on "The New York Electric Illuminating Company's Switchboard." This paper started with a discussion of the switchboard in its earliest and most primitive forms, and ended by giving, in contrast, the well worked out plans of the regulating gallery at present being installed in the Duane street station of this company.

The paper induced many questions from interested persons, especially in connection with the edgewise system of electrical instruments developed by the author.

Following Mr. Van Vleck, Mr. A. D. Page read a paper on "Incandescent Lamps," which was the same as that read at the recent convention in St. Paul of the Northwestern Electrical Association, which has already been published.

Mr. W. C. Barstow, General Manager of the Edison Electric Illuminating Company of Brooklyn, then read a paper on "Low Tension Arc Lighting System," which is now used by his company in lighting the central portion of Brooklyn from its low tension mains. This system, it was said, has never before been attempted in America, this being the first instance where automatic street lighting on a large scale has been undertaken from the low tension mains of the regular Edison underground system. This being the case, it had to be developed in all its details, including lamp posts, automatic clocks and kindred devices.

Mr. Barstow presented some data which showed conclusively to the members present that this form of lighting would be a valuable adjunct to their central station business. The paper called forth many questions.

Mr. A. G. Pierce then read a paper on "Methods of Electrical Distribution adopted by the Boston Electrical Illuminating Company." This paper was presented as an introduction to the visit which the members were to make at the station in question, the following day, and simply called the attention of the delegates to the various points of interest, which they might desire to look at during their visit.

On Wednesday, at 8 o'clock in the morning, the members boarded tally-hos and carriages and were driven through Boston and the suburbs, and on their return at 11 A. M business was resumed. The first paper on the programme was one by Mr R. R. Bowker, of the Edison Electric Illuminating Company, New York, on "Storage Batteries," which paper all the members of the association had looked forward to with a great deal of interest. In Mr. Bowker's absence, the paper was read by Mr J. W. Lieb of the same company.

Mr. Lieb, in conjunction with this paper, presented one of his own on the same subject. Nearly the entire session was taken up with an exhaustive discussion for and against the storage battery as adapted to central stations, which proved to be one of the most interesting and valuable of the entire convention. A special committee was appointed by the president to consider the report.

Fourth Session.—This meeting was devoted entirely to matters connected with and appertaining to the relations between the various companies and the General Electric Company, and included an address by President C. A. Coffin, and an exhaustive paper by one of the General Electric Company's engineers, Mr. W. L. R. Emmett. This paper, which was on "The Relative Advantages of Alternating and Direct Current Apparatus for Central Station Working," was discussed at great length, and many interesting facts were brought out in connection with the new "monocyclic system" of the General Electric Company.

The committee of officers for the ensuing year reported the following names, and the nominees present were declared duly elected. President, C. L. Edgar (re-elected); Vice-President, A. L Smith, Appleton, Wis.; Secretary, W. S. Barstow, Brooklyn; Treasurer, J. W. Lieb, New York. Executive Committee: John I. Beggs, Cincinnati, O., chairman; C. L. Edgar, Boston, *ex-officio;* C. P. Gilbert, Detroit, E R. Weeks, Kansas City, Mo., W. D. Marks, Philadelphia, George R. Stetson, New Bedford, Mass

At the urgent invitation of Mr. C. P. Gilbert, of the Detroit Edison Company, it was unanimously resolved that the next convention of the association be held in that city, August 14, 1895.

A vote of thanks was then tendered to the West End Street Railway Company, the Boston Illuminating Company, the New England Telephone and Telegraph Company and others, for courtesies received, and the meeting adjourned.

On Thursday, sight-seeing was the order of the day. The party visited the power-house of the West End Street Railway Company, the station of the Edison Illuminating Company and the Lynn works of the General Electric Company. After this they proceeded to Marblehead, as guests of the General Electric Company, where an elegant dinner was served.

Following is a list of the names of those present :

Wm. Anthony, Chicago Edison Co., Chicago, Ill.

E. A. Armstrong, Camden Electric Light Co., Atlantic City, N. J.

W. S. Barstow, Edison Electric Illum. Co., Brooklyn, N. Y.

M. A. Beal, Forest City Electric Light and Power Co., Rockford, Ill.

George Cato, Detroit Illuminating Co., Detroit, Mich.

W. S. Clark, General Electric Co., Schenectady, N. Y.

J. A. Colby, Des Moines Edison Light Co., Des Moines, Ia.

C. L. Edgar, Edison Electric Illum. Co., of Boston, Mass.

H. T. Edgar, Edison Electric Illum. Co., of Atlanta, Ga.

W. L. R. Emmet, General Electric Co., Schenectady, N. Y.

Louis A. Ferguson, Chicago Edison Co., Chicago, Ill.

A. W. Field, Edison Electric Light Co., Columbus, O.

W. H. Francis, Edison Electric Illum. Co., of Boston.

C. P. Gilbert, Detroit Illum. Co., Detroit, Mich.

S. D. Greene, General Electric Co., Schenectady, N. Y.

R. S. Hale, Edison Electric Illum. Co., of Boston.

Caryl D. Haskins, General Electric Co., Boston.

A. L. Hawley, Union Electric Co., Seattle, Wash.

Albert B. Herrick, General Electric Co., Schenectady, N. Y.

Chas. T. Hughes, General Electric Co., New York.

F. E. Jackson, Edison Electric Illum. Co., Brooklyn, N. Y.

W. J. Jenks, General Electric Co., New York.

A. E. Kennelly, Philadelphia, Pa.

A. S. Knight, Edison Elec. Illum. Co. of Boston.

J. W. Lieb, Jr., Edison Electric Illum. Co. of New York.

R. Lindsay, Cleveland Elec. Illum. Co., Cleveland, O.

J. R. Lovejoy, General Electric Co.

John R. Markle, Edison Light Co., Grand Rapids, Mich.

William D. Marks, Edison Elec. Illum. Co., Philadelphia.

J. Willard Morgan, The Electric Light Co. of Atlantic City, Camden, N. J.

I. E. Moultrop, Edison Elec. Illum. Co., Boston.

A. D. Page, General Electric Co., N. Y.

Charles E. Pattison, Edison Electric Illum. Co., Boston.

A. G. Pierce, Edison Electric Illum. Co., Boston.

Chas. R. Price, New Bedford Gas and Edison Light Co., New Bedford, Mass.

J. B. Pyle, Edison Electric Illum. Co., West Chester, Pa.

Warren B. Reed, Edison Electric Co., New Orleans, La.

Howard Rinck, Edison Electric Illum. Co., Easton, Pa.

A. L. Smith, Appleton Edison Elec. Co., Appleton, Wis.

George R. Stetson, New Bedford Gas and Edison Light Co., New Bedford, Mass.

N. C. Stevens, Edison Elec. Illum. Co., Brockton, Mass.

Luther Stieringer, New York.

Adolph Theobald, Edison Elec Light Co., Columbus, Ohio.

Francis A. Upton, General Electric Co., Harrison, N. J.

J. Van Vleck, Edison Electric Illum Co. of New York.

E. R. Weeks, Edison Electric Light and Power Co., Kansas City, Mo.

Charles Wirt, Chicago, Ill.

W. H. Wofrekamp, Edison Electric Illum. Co., Lawrence, Mass.

John Wolff, Edison Co., Brooklyn, N. Y.

E. W. Rice, Jr., Schenectady, N Y.

P. H. Alexander, Electric Selector and Signal Co., N. Y.

R. B. Corey, Electric Construction and Supply Company, New York.

Sigmund Bergmann, General Incandescent Arc Light Co., New York.

P. H. Klein, General Incandescent Arc Light Co., New York.

H. W. Weller, Solar Arc Lamp Co., New York.

H. S. Kaliske, Beacon Lamp Co., Boston.

F. B. Parsons, Davidson Ventilating Fan Co., Boston.

George J. Jackson, Norwich Insulated Wire Co., New York.

George M. Phelps, New York.

R. R. Ross, New York.

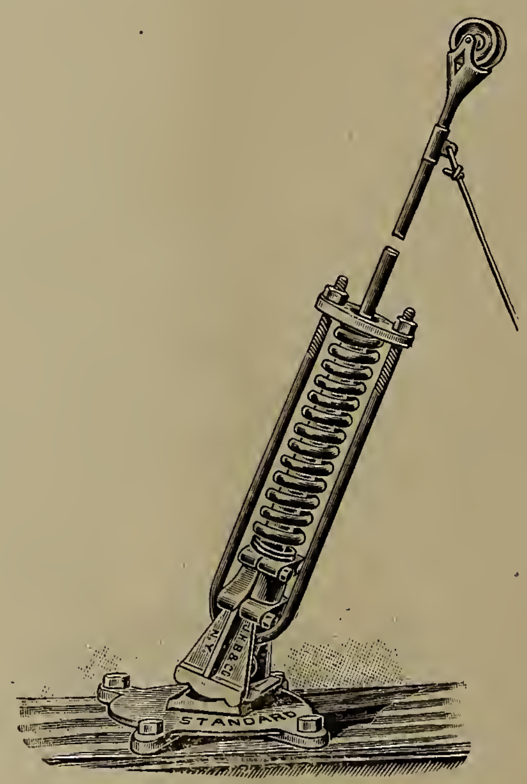
F. L. Perry, New York.

B. E. Greene, New York.

BUNNELL & CO.'S STANDARD TROLLEY.

The trolley shown in the accompanying illustration has some features that deserve special mention. It is simple in construction, light, strong and desirable. The contact is positive whatever position the arm may be in, from horizontal to perpendicular.

The wheel follows the trolley wire in any direction, and is not liable to jump when passing frogs, trolley ears and cross-overs.



STANDARD TROLLEY.

The base is so constructed as to admit of the arm following the wire with great ease, and all strains are taken up by the spring. It is claimed to be the best all-round trolley yet produced, and testimonials from users show that it is all that is claimed for it. It is used with entire satisfaction on the Yonkers Railway, Yonkers, N. Y.

The Standard Trolley is made by J. H. Bunnell & Co., 76 Cortlandt street, New York city.

In electric lighting in Great Britain, the average cost of coal is about four-tenths of the total working expenses of a station.

CATALOGUE OF ELECTRICAL BOOKS.

(*Continued from Page* 79.)

The following is a catalogue of books on every electrical subject, complete to date. It is classified according to subjects, which arrangement will facilitate the finding of a book on any particular subject, without having to go through a long list, and then, as is often the case, give it up in disgust.

Preserve this list!

Haskin's Galvanometer and its Uses $1 50
Haskin's Transformers; their Theory and Practice. Simplified for the Use of Students 1 25
Heap's Electrical Appliances of the Present Day: A Report of the Paris Electrical Exhibition 2 00
Hering's Table of Equivalents of Units of Measurements 50
Hobb's Arithmetic of Electrical Measurements, with numerous Examples 50
Hopkins' Experimental Science 4 00
Hospitalier's Domestic Electricity 2 50
Houston's Dictionary of Electrical Words, Terms and Phrases 5 00
Houston's Electricity and Magnetism 1 00
Houston's Electricity One Hundred Years Ago and Today 1 00
Jamieson's Elementary Manual of Magnetism and Electricity 1 50
Jeans' Lives of the Electricians: Prof. Tyndall, Wheatstone and Morse. First Series 2 25
Jenkin's Electricity 40
Jenkin's Electricity and Magnetism; with Appendix on the Telephone and Microphone 1 50
Jones' Logarithmic Tables 1 00
Kapp's Alternate Current Machinery 50
Kempe's Electrical Engineers' Pocketbook of Modern Rules, Formulæ, Tables and Data 1 75
Kempe's Handbook of Electrical Testing 7 25
Keasby's Law of Electrical Wires in Streets and Highways 3 50
Kennelly & Wilkinson's Practical Notes for Electrical Students 2 50
Kirwan's Modern Electricity 30
Kohlrausch's Physical Measurements 2 50
Lardner's Handbook of Electricity, Magnetism and Acoustics 2 00
Le Van's Steam Engine and the Indicator 4 00
Liebig & Rohe's Practical Electricity in Medicine and Surgery 2 00
Lightning Flashes and Electric Dashes. A Volume of Choice Telegraphic Fun, Wit and Wisdom 1 50
Lock's Workshop Receipts Relating to Electrical Subjects 2 00
Lockwood's Electricity, Magnetism and Electric Telegraph. Cloth, 376 pages; 152 illustrations. 2 50
Lockwood's Electrical Measurements and the Galvanometer 1 50
Lodge's Modern Views of Electricity 2 00
Lodge's Lightning Conductors and Lightning Guards 4 00
Lloyd's Treatise on Magnetism, General and Terrestrial 3 75
Martin's Inventions, Researches and Writings of Nikola Tesla; with special reference to his work in Polyphase Currents and High Potential Lighting. 496 pages 4 00
Massart & Joubert's Treatise on Electricity and Magnetism, General Phenomenæs and Theory. 2 volumes 15 00
Maycock's Practical Electrical Notes and Definitions 1 25
Maxwell's Scientific Papers. 2 vols 25 00
Maxwell's Treatise on Electricity and Magnetism. 2 vols 8 00
Maxwell's Elementary Treatise on Electricity 1 90
McClure's Edison and his Inventions 1 00
Meadowcroft's A B C of Electricity 50
Mendenhall's Century of Electricity 1 25
Miller's Magnetism and Electricity 2 50
Morgan's Electro-Therapeutics and Physics 6 50
Munroe's Electricity and its Uses 1 40
Munroe & Jamieson's Electricians' Pocket Book of Electrical Rules and Tables 2 50
Murdock's Notes on Electricity and Magnetism, Designed as a Companion to S. P. Thompson's Elementary Lessons, with Illustrations 60
Nipher's Theory of Magnetic Measurements 1 00

LARGE ROTARY CURRENT PLANT.

The central electric light station at Chemnitz, Saxony, which has been carried out for the municipality by Siemens and Halske, has been arranged on the high-tension rotary-current system in consequence of the large extent of the district to be served with both light and motive power. It is noteworthy that the station is the largest in Germany which has been designed according to this system. The works, which are situated on the outskirts of the town, contain three fixed triple expansion condensing engines. Each engine, when running at 150 revolutions, and with an initial pressure of 165lb, gives from 150 h. p. to 220 h. p. Each engine drives a rotary current dynamo, which is direct coupled, as is also the exciter. At 150 revolutions, and when fully excited, each generator yields 180,000 watts at from 2,000 to 2,200 volts. The current is conveyed to the points of consumption by triple concentric cables, and here it is reduced by transformers to 120 volts. Provision has up to the present been made for 19 transformers of outputs ranging from 10,000 to 50,000 watts. The low-pressure current is again transmitted by triple concentric cables to places outside the inner town, where it is distributed by bare copper conductors. The most distant part to which current is led is about two miles from the central station, but future extensions provide for the transmission of current over a distance of four miles. A special feature of the station is the fact that there has been a large demand for motive power, and of the total output of the generators about one-third is required for this purpose. The working of the rotary current machines is satisfactory, especially in the case of parallel running.—*Electrical Engineer*, London.

CLAM BAKE.

We have received an invitation to be present at the Sixteenth Annual Rhode Island Clam Dinner to be tendered to the electrical fraternity by the American Electrical Works, of Providence, R. I., on Saturday, August 25. The dinner will take place at Haute Rieve. The Honorary and Reception Committees for the occasion are as follows:

Honorary Committee: Nelson W. Aldrich, Providence; S. S. Wheeler, New York; F. A. Gilbert, Boston; E. B. Baker, New Haven; Lemuel Bannister, Pittsburgh; Henry F. Woods, Boston; John I. Sabin, San Francisco; A. C. White, Providence.

Reception Committee: W. A. Hathaway, C. H. Wagenseil, F. B. Baker, W. H. Sawyer, C. R. Remington, Jr., A. L. Capper, P. C. Ackerman, F. E. Donohoe, John Carroll, E. Rowland Phillips.

NEW YORK NOTES.

Office of the Electrical Age,
First Floor, World Building,
New York, August 20, 1894.

John N. Beckley, president of the Rochester Street Railway Company, Rochester, N. Y., was in town last week and stopped at the Imperial Hotel. It is stated that he was after street railway supplies.

Lord & Bacon, electrical engineers, have opened offices at 203 Broadway, City.

Mr. Richard H. Hill, general sales agent of the James Hunter Machine Company, North Adams, Mass., was in town last week.

Thos. I. Stacey, secretary and treasurer of the Electric Appliance Co., Chicago, was in town last week.

A game of baseball was played on Saturday last, August 18, at Williamsbridge, between nine of Hatzel & Buehler's employés and nine employés of the Cassidy & Sons Mfg. Co. The game was exciting and enjoyable, and resulted in favor of the Hatzel & Buehler nine, by a score of 25 to 8. The features of the game were two double plays by Sheridan, Ruckle and Kennedy, and one triple play by Morley and Bowen, all of the Hatzel & Buehler nine. A number of the electrical fraternity were present, including Mr. Olsen, of the New York Insulated Wire Co., Messrs. Doubleday and Mitchell and a large number of the employés of both firms. Another game is talked of between the Hatzel & Buehler nine and the Western Electric Co. nine. The Hatzel & Buehler nine stand ready to receive challenges from any nine in the electrical fraternity.

An electrical storm prevailed on Sunday night and Monday morning, with the usual demoralizing effects on telegraph wires. Many of the circuits of the great telegraph companies were practically "tied-up," while the storm was at its height. This storm was coincident with the appearance of sun-spots, as is always the case.

W. T. H.

POSSIBLE CONTRACTS.

An electric light plant is to be established in Otsego, Mich., by George C. and B. E. Nevins, who are now in the market for the necessary equipment.

John H. Hoffman, Hagerstown, Md., president of the Pikeville, Reistertown & Emory Grove Railway Company, can give information regarding the new power house to be erected by that company.

Address the secretary of the Young Men's Business League, Oxford, Miss., for information regarding an electric light plant which is to be established.

An electric light plant is to be installed in Lockhart, Texas. The Mayor of that place can give further information.

The Columbus Railway Company, Columbus, Ga., is negotiating for the equipment of its lines by electricity.

J. F. Scott and others have been granted a franchise for the construction and operation of an electric railway in Knoxville, Tenn.

An electric light plant is to be established in Crowley, La. Address the Mayor for particulars.

An electric light plant is to be installed at the Government Mint in New Orleans. R. L. Schroeder can give further information regarding the same.

Address E. O. Davison, Oxford, Miss., for information regarding an electric light plant.

The Lockhart Electric Light Company, Lockhart, Tex., is about to construct an electric light plant.

L. C. Ketcham, of Palestine, Tex., is in the market for material for the construction of a telephone plant.

Clark Rude, of Knoxville, Tenn., has been awarded a franchise to extend the electric railway on West Main and other streets.

Julian Fishburne, Charleston, S. C., has received a franchise to build an electric railroad.

NEW CORPORATIONS.

Eureka Electric Company, San Francisco, Cal., manufacturing electrical apparatus. Capital stock, $100,000.

Illinois Electro-Medical & Optical Institute, Chicago, Ill. Capital stock, $1,000.

Pontiac Telephone Company, Pontiac, Ill. Capital stock, $3,000.

Crown Point Electric Company, Crown Point, Ind., operating light, heat and power. Capital stock, $10,000.

Boston Automatic Fire Alarm Company, Portland, Me., manufacturing electric fire and burglar alarms. Capital stock, $250,000.

Seashore Electric Light & Power Company, Asbury Park, N. J. Capital stock, $100,000.

The Arkansas Valley Electric Co., Denver, Col., furnishing electric light, heat and power. Capital stock, $50 000.

Citizens' Electric Light & Power Company, Appleton, Wis. Capital stock, $10,000.

The Sturgeon Bay Water Works and Electric Light Company, Sturgeon Bay, Wis. Capital stock, $35,000.

The Electric Light, Power & Water Co., of Sea Isle City, Sea Isle City, N. J. Capital stock, $50,000.

The Akron Insulator & Marble Co., Akron, O., manufacturing electrical machinery, appliances, etc. Capital stock, $20,000.

The Taylorsville Milling and Mercantile Co., Taylorsville, Ky., by W. P. Beard and others, to erect a dam across Sald River, and establish an electric light plant. Capital stock, $25,000.

Electric Advertising Co., San Francisco, Cal., advertising by electrical devices. Capital stock, $100,000.

The Trojan Telegraph Company, Troy, N. Y., to connect Troy by telegraph with Brooklyn, New Orleans, Memphis, Nashville, Louisville, Covington, Lexington, St Louis, Roby, Ind., Saratoga and Gravesend; capital stock, $5,000. Directors, J. F. Cleary, J. W. Dwyer, M. J. Duffy, J. J. Cleary, F. H. May, E H. Grennan and John W. Kenny of Troy.

The Gilmour Water and Electric Light Company, Independence, Ore., by A. S. Locke, L. C. Gilmore and others, to establish and maintain water and electric lights and power works and railways. Capital stock, $30,000.

American Friction Motor Company, East St. Louis, Ill., by William B. Wolcott and others. Capital stock, $2,000,000.

The Mercantile Carbon Co., New York, N. Y., by

Albert C. Seibold, of Mount Vernon, N. Y., and Henry Hoyt, S. M. Comstock, of New York city, to manufacture a new arc lamp. Capital stock, $50,000.

TRADE NOTES.

The Gilliland Telephone Co. of Chicago are meeting with good success in the introduction of their telephone. The instrument is made in a substantial manner and is artistic in form, consisting of a magneto mounted on back-board with desk, bi-polar magneto transmitter, and telephone receiver with cord, and is sold outright at a fair price. Their central office and exchange system for towns and small cities is complete and comprehensive. The president, Mr. W. H. McKinlock and the General Manager, Mr. J. J. Nate, have spent the greater portion of their lives in telephone and kindred electrical interests.

J. H. Bunnell & Co., 76 Cortlandt street, New York, have just issued a catalogue of electric railway supplies.

The Metropolitan Electric Company, of Chicago, received some pretty good orders for I. X L. triple braid wire during the last week, among the number being one for thirteen miles and one for ten miles, large sizes. This wire is coming into prominent notice in the West, being already a favorite in the East, and the Metropolitan Electric Company carries a large supply always on hand to enable it to fill orders without delay.

"We have had your clock in operation for nine months working eighteen stations, and have found it a valuable detector," writes Lawrence B. Elder, Superintendent Galveston Cotton and Woolen Mills, Galveston, Tex., regarding the Eco-Magneto Watchman's Clock. C. D. Bernsee, Vanderbilt Building, New York city, is the general agent of this valuable apparatus.

Walter L. Isaacs, 41 Cortlandt street, New York city, is general importer and exporter, and among the goods handled by him are electrical instruments of all kinds. He does a large export trade.

Mr. C. H. W. Copeland, 141 Liberty street, New York city, who represents the J. H. McEwen Manufacturing Company, of Ridgway, Pa., reports a good demand for his company's engines. The McEwen company are builders of high grade automatic engines, simple, tandem and cross compound. The guarantee of this company regarding its engines is, that they shall not run one revolution slower when fully loaded than when empty, and the reduction of boiler pressure from the greatest to that necessary to do the work will not reduce the speed of the engine one revolution.

Electrical and Street Railway Patents.

Issued August 14, 1894.

524,305. Arc-Lamp Post. Richard R. Bowker, New York, N. Y. Filed June 22, 1894.

524,316. Car-Fender. James T. Duff, Pittsburgh, Pa. Filed May 24, 1894.

524,318 Car-Axle Lubricator. John E Gill, Franklin, Pa Filed Apr. 8, 1893.

524,329. Brake-Operating Mechanism for Cars. Thos. F. Kenney, Darby, Pa. Filed Dec 14, 1893.

524,343. Electrical Conductors. Edwin D. McCracken, Alpine, assignor to the Norwich Insulated Wire Company, Harrison, N. J. Filed Nov. 29, 1893.

524,352. Wire-Stretcher. Levi Roadhouse, DeKalb, Ill., assignor to Abram Ellwood, same place. Filed Apr. 20, 1894

524,355 Railway-Car. Calvin A. Smith, East Orange, N. J., assignor of two-thirds to John A. Hill, Augus Sinclair, Frank W. Coolbaugh, and Lewis R. Pomeroy, same place Filed Dec. 1, 1893.

524,357. Electric-Arc Lamp Otto H. Swoboda, New York, N. Y., assignor to Sigmund Bergmann, same place. Filed July 19, 1893.

524,366 Electric-Railway System. Theodore B. Wilcox and Henry Wilcox, Newark, N. J. Filed Aug. 1, 1893.

524,367. Electro-Magnetic Contact-Making Device for Electric-Railway Systems. Theodore B. Wilcox and Henry Wilcox, Newark, N. J. Filed Aug 1, 1893.

524,368. Electric-Railway System. Theodore B. Wilcox and Henry Wilcox, Newark, N. J., Filed Aug. 16, 1892. Renewed Aug. 1, 1893.

524,373 Regulation of Dynamo-Electric Machinery. Edward M. Bentley, Boston, Mass. Filed Dec. 26, 1890.

524,374. Battery-Changer for Electric Circuits. Charles Bernhardt Chicago, Ill., assignor of one-half to Wm. H. Altman, same place. Filed Nov. 23, 1891 Renewed Jan. 19, 1894.

524,376. Compounding Motor-Generators. James Burke, Schenectady, N. Y., assignor to the General Electric Company, Boston, Mass. Filed June 5, 1894.

524,378. System of Electrical Distribution. Thos. A. Edison, Llewellyn Park, N. J. Filed Dec. 6, 1886.

524,382. Rheostat. Albert B. Herrick, Schenectady, N. Y., assignor to the General Electric Company, Boston, Mass. Filed May 22, 1893.

524,383. Bus-Bar Switch for Central Stations. Albert B. Herrick, Schenectady, N. Y., assignor to the General Electric Company, of New York. Filed June 9, 1894.

524,384 Double-Throw Snap-Switch. Edward M. Hewlett, Schenectady, N. Y., assignor to the General Electric Company, of New York. Filed July 2, 1894.

524,385. Controller for Electric Motors. Joseph H. Jenkins, Lynn, assignor to the General Electric Company, Boston, Mass. Filed Feb. 3, 1894.

524,386. Electric Time-Recorder. Harry T. Johnson, Elizabeth, N. J. Filed Dec. 26, 1893.

524,387. Telephone-Switch. Harry T. Johnson, Elizabeth, N. J. Filed Feb. 1, 1894.

524,388. Electric Search Light. Edward R. Knowles, Middletown, Conn., assignor to the Schuyler Electric Company, of Connecticut. Filed Jan. 9, 1893.

524,396. Controller for Electric Motors. William B. Porter, Lynn, assignor to the General Electric Company, Boston, Mass. Filed Dec. 21, 1893.

524,402. Radial Car-Truck. William Robinson, Boston, Mass Filed May 12, 1882.

524,407. Electric Motor. William L. Silvey, Dayton, Ohio. Filed Mar. 2, 1894.

524,426. Electro Magnetic Motor. Nikola Tesla, New York, N. Y., assignor to the Tesla Electric Company, same place. Filed Oct. 20, 1888.

524,434. Conduit-Cleaning Device. Charles O. Ehlert, New York, N. Y. Filed Aug. 22, 1893.

524,462. Arc-Lamp. Robert Drysdale, Everett, Mass. Filed Jan. 14, 1893.

524,480. Telephonic System. Henry A. Chase, Boston, Mass , assignor to Albert Watts, same place. Filed Apr. 16, 1894.

524,503. Car-Fender. Joseph F. McDonough, Providence, R. I. Filed May 28, 1894.

524,517. Trolley-Wheel and Support. David R. Thomas, Baltimore, Md., assignor of one-half to William F. Harendt, some place. Filed May 26, 1894.

524,524. Telephone-Transmitter and Resistance-Varying Material Therefor. Frank R. Colvin, New York, N. Y. Filed Oct. 10, 1893.

524,532. Switch for Electric-Railway Cars. Timothy A. Remsen, Brooklyn, N. Y. Filed June 2, 1893.

524,533. Dynamo-Electric Machine or Electric Motor. Alonzo B. See and Walter L. Tyler, Brooklyn, N. Y. Filed May 10, 1894.

524,534. Alternate-Current Motor. William Stanley, Jr., Pittsfield, Mass , assignor to the Stanley Laboratory Company, same place Filed Apr. 13, 1892.

524,540. Device for Operating Street-Railway Switches. Carl E. R. Christensen, Brooklyn, N. Y. Filed Nov. 15, 1893.

524,615. Motor-Regulator. Joseph F. Sheahan, New York, N. Y. Filed May 28, 1894.

524,630. Automatic Circuit-Breaker. Antaloe C. Carles, Portland, Me. Filed Apr. 14, 1894.

524,635. Telegraphic Transmitter. Frank F. Howe, Marietta, Ohio. Filed Jan. 15, 1894.

524,636. Induction-Coil. Charles L. Jaeger, Maywood, N. J. Filed Jan. 18, 1894.

524,646 Electric Heater. Charles H. Newbury, St. Paul, Minn., assignor of one-half to John J. Borum, same place. Filed Apr. 19, 1894.

524,656. Electrical Storage-Battery. Burton C. Van Emon, San Francisco, Cal., assignor to Geo. H. Roe and Gustav Sutro, same place. Filed Nov. 6, 1893.

524,659. Insulator. George H. Winslow, Pittsburgh, Pa. Filed Dec. 8, 1893.

524,672. Trolley-Wire Switch. Johan M. Anderson, Boston, Mass., assignor of one-half to Albert Anderson, same place. Filed Apr. 26, 1894.

ELECTRICAL AGE

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NEW YORK, SEPTEMBER 1, 1894.

CONTENTS.

FORT WAYNE AND WENSTROM COMPANIES.

A despatch from Baltimore announces the completion of the deal between the Fort Wayne Electric Corporation of Fort Wayne, Ind., and the Wenstrom Electric Company of Baltimore, by which the former concern acquires control of the latter. It is stated that the Fort Wayne Company will at once take steps against infringers of the Wenstrom patents.

THE NEW TARIFF.

We publish on another page in this issue a list of materials used in the electrical industries in this country that are affected by the tariff bill which became law recently. This list will no doubt be valuable to those interested, for reference, showing, as it does, the former tariff rates, the new, and the reduction in the new rates as compared with the old. In only three items is there an increase over the old rates, and these pertain to galvanized iron wire of certain sizes, all others showing a material reduction. A number of articles are placed on the free list.

THE CONSUMPTION OF CLAMS.

Last Saturday was a clammy day in Providence. On that day three thousand, more or less, of the electrical fraternity indulged in a contest to see how many clams could be devoured in a given time. We did not hear who won this particular distinction, but each one did his best to make himself satisfied. As there is now an upward tendency in the price of clams, it is reasonable to infer that the consumption on this occasion was of monstrous proportions.

CONVENTION OF FIREMEN.

At the convention in Montreal, Que., on August 14, of the National Association of Fire Engineers, electrical matters received a great deal of consideration. Indeed, several papers of this character were read by well-known electrical authorities for the enlightenment of the fire departments represented by the association. Fire departments in every town in the country have, by force of circumstances, become intimately concerned with electrical matters in their respective localities, and it is quite natural that a knowledge of the laws of electricity should become a necessity in the proper discharge of the duties of firemen. The firemen's association have made a wise move in taking this matter up, as it is one of utmost importance to them.

REVIVING TRADE.

We read at different times conflicting reports regarding the state of trade at the present time. Such reports of course are colored by the human factor, which is necessarily a part of trade, and as all men do not look alike upon the same subject there must naturally be difference of opinion. Some are pessimists and others are optimists, and a pessimist cannot be expected to contemplate human affairs with a great deal of favor. On the other hand the optimist sees hope and light in the future and believes that everything will turn out right. In respect to the electrical trade there is of course not a unanimity of opinion regarding its condition. We are glad to say, however, that in a great majority of cases favorable conditions seem to prevail and the feeling is of the most buoyant character. The advertisers of the ELECTRICAL AGE seem to be particularly sanguine, and look for an early revival of business. They are all doing a good present business, owing, no doubt, to the fact that they advertise in the ELECTRICAL AGE, and are looking forward to great activity in trade in the near future. As far as we are able to discern every obstacle to general revival has been removed, and we share the belief with our patrons that the season of prosperity is again at hand.

PRINCIPLES OF DYNAMO DESIGN.

BY NEWTON HARRISON, E. E.

(*Continued from Page 102.*)

Oersted enunciated a law regarding a coil of wire carrying a current as follows:

A loop through which a current is circulating will act upon a magnetic needle just as if the loop were an infinitely thin magnet, having the same bounding line, and whose magnetic moment is equal to the current. (Fig. 2.)

If the current circulates through a coil of wire a succession of magnetic shells is produced, each acting in combination with the next to intensify the general mag-

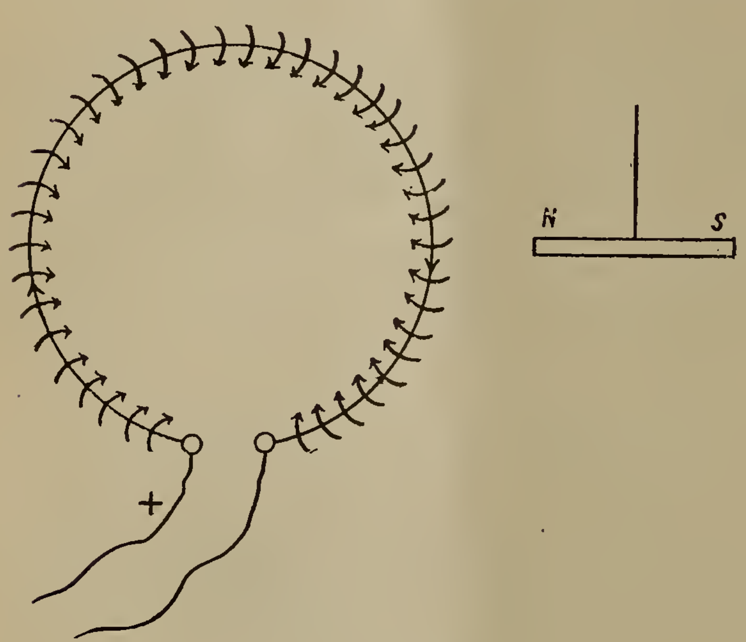


FIG. 2.

netic effect; the magnetic moment of such a system is $C \times N$. (Fig. 3.)

By the introduction of a bar of iron into this coil the coöperative effect of the loops is enormously increased. (Fig. 4.)

It can be shown by experiment that the increase is in the actual number of lines of force. The iron has caused a multiplying effect which disappears upon its removal.

THE POLARIZATION OF IRON.

Many theories have been proposed to account for the

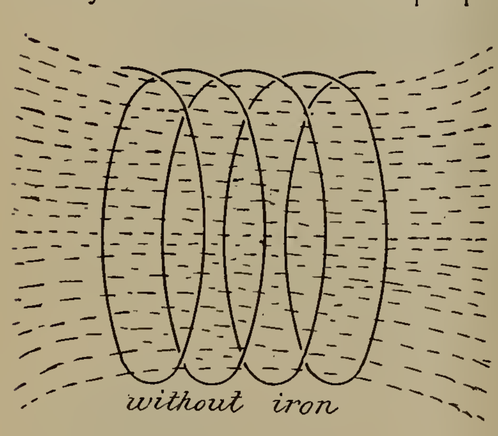


FIG. 3.

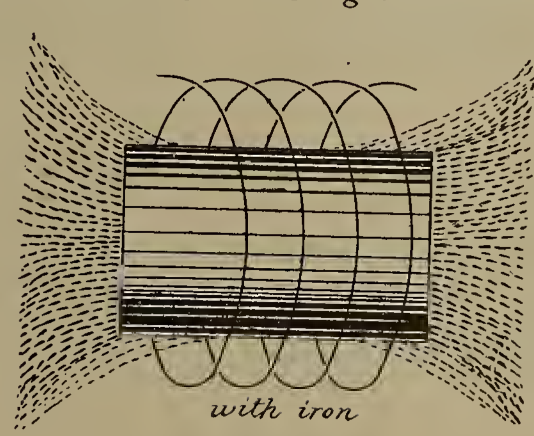


FIG. 4.

remarkable increase in the number of lines of force in a coil when iron is introduced.

That particular and most acceptable theory of all, which has been supported by the experiments of Joule, is the polarization theory.

Faraday and others have produced polarity in every substance; so that it seems as though the molecules of all bodies possessed in some degree this particular qualtity.

When we consider that some of the best explanations of the phenomena of chemical affinity tend toward, and are in reality an hypothesis of this nature, the acceptability of the theory from any standpoint is almost of a conclusive nature.

The realms of theory are necessarily of a shadowy nature, and it is always best to accept that particular hypothesis which is best substantiated by practical experiments. Therefore the opinion of the many eminent scientists regarding the strongly magnetic condition of the molecules of iron is best to us because the most plausible; though why so strongly developed in the Ferric group alone it is impossible to explain.

Each molecule of iron is supposed to be an infini-

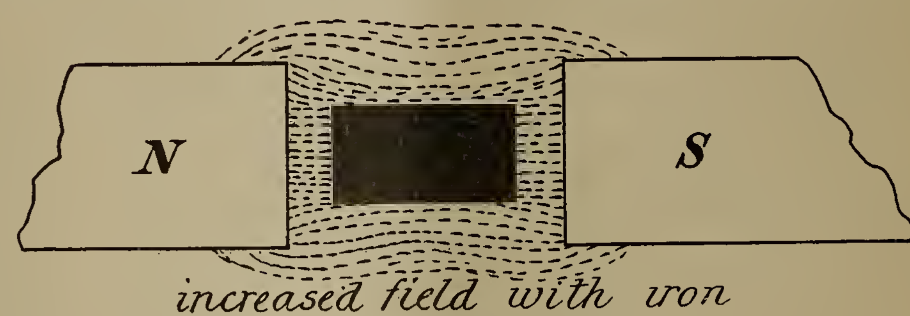


FIG. 5.

tesimal magnet. When a mass of iron is in its normal condition, exhibiting no magnetic effect, it is because the molecules have no systematic arrangement; they are irregularly arranged, and due to this perfect irregularity and absence of grouping there is a complete annulment of any magnetic effect.

By taking a mass of iron and subjecting it to a magnetic force, we arrange the molecules in systematic order by turning them on their axes.

Being now regularly arranged, the molecules independently give forth their latent magnetic force and create a new field.

Joule found by experiments of a most delicate nature that bars obeyed a law, when under magnetic influence, such that "the elongation is proportional to the square of the magnetic intensity." By direct measurement the bars increased by $\frac{1}{720,000}$ of their length; when the force was removed the molecules immediately formed closed magnetic circuits amongst themselves, thus removing—according to the softness of the iron—every trace of the previous magnetization.

The softer the metal the greater Joule found the elongation to be. Thus, in total, we see the gounds on which to support this theory of polarized molecules; the continued polarization is supposed to be due to an electric current flowing unceasingly around the molecule. It cannot stop because the molecule offers no ohmic resistance; the resistance is considered as only being experienced when the current passes from molecule to molecule.

Hence the theory is, from a logical standpoint, quite supportable as regards the molecular change giving rise to elongation, also as a reason, quite interesting in itself, for the permanent polarization of the molecules of the iron. Perhaps the inter-molecular spaces of a metal has more to do with its specific resistance as a conductor than its other physical qualities. The stratum of ether surrounding an iron molecule is probably in a most abnormal condition as compared to that of other substances. The electric and magnetic effect, though produced in a manner indicating a strong relationship between the two, expresses the result of a great difference of conditions.

Whereas iron is the best known medium for the development of magnetic lines of force, silver and copper are conductors unexcelled for the passage of an electric current, though both may, when peculiar conditions are imposed, become almost non-conductors—the one for magnetic force, the other for electricity. (Fig. 5.)

If in a constant field different grades of iron be respectively inserted the resulting magnetic fields will be different for each sample of iron.

The multiplying effect of the iron when exposed to different field strengths is measured by the ratio of

$$\text{Permeability} = \frac{\text{Strength of Field with Iron}}{\text{Strength of Field without Iron,}}$$

or more concisely expressed

$$\left(\mu = \frac{B}{H}\right)$$

It is necessary in order to intelligently use these quantities for the purpose of design to understand them apart from their purely physical meaning.

Formulæ as a rule are deduced from ideal conditions; and in this particular case, although we are confronted

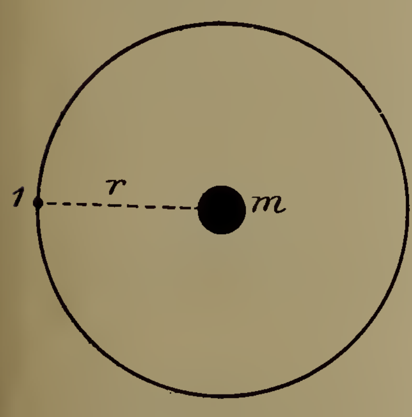


FIG. 6.

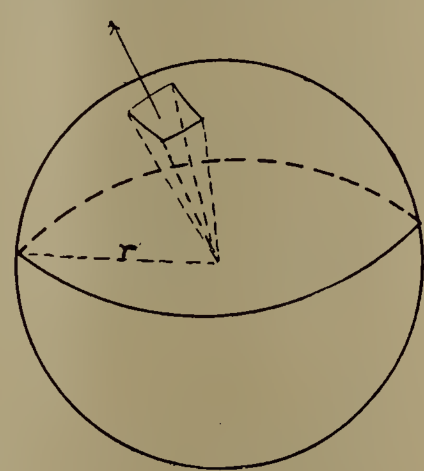


FIG. 7.

with a similar basis for our equations, they will present a very simple aspect if closely followed.

Imagine a magnetic pole of any strength at all. Emanating and spreading from this pole in all directions are lines of force. They spread equally, so that any area of a sphere surrounding this pole as a centre will contain the same number of lines of force as any other equal area.

If this pole be supposed to be the centre of a sphere of any size whatsoever, whose radius we call r, then the surface of the sphere is $4\ \pi\ r^2$ by the laws of geometry.

If, as a second supposition, the strength of this pole be called m, then the magnetic force at a distance r from this pole equals $\frac{m}{r^2}$ = Magnetic force at a distance r on the surface of this imaginary sphere.

The inquiring mind immediately asks for an explanation of the expression $\frac{m}{r^2}$. This is given as follows:

The magnetic force with which the pole m (Fig. 6) would act upon a unit pole at a distance r is equal to the following:

$$\text{Force} = \frac{\text{The product of their strengths}}{\text{The square of the distance between them ;}}$$

but by our supposition one pole is of unit value, therefore:

$$f = \frac{m \times 1}{r^2} = \frac{m}{r^2}$$

We can therefore say that any unit area on the surface of this sphere contains $\frac{m}{r^2}$ unit lines.

If the surface of the sphere be

$$4\ \pi\ r^2$$

and the specific strength is $\frac{m}{r^2}$, then the total number of lines of force spreading from the pole m at a distance r is

$$4\ \pi\ r^2 \times \frac{m}{r^2} = 4\ \pi\ m.$$

If the pole m was of unit strength, then the number of lines of force issuing from a unit pole would be $4\ \pi$ — $4\ \pi$; thus giving another definition for a unit pole.

Iron when placed in a field of strength H has a specific induction B induced in it.

There are now practically two fields in one; the field due to the ampere turns and the superposed field due to the iron, and for an area a

$$Ba = Ha + 4\ \pi\ m$$

$$B = H + \frac{4\ \pi\ m}{a} \times \frac{l}{l}$$

but ml = magnetic moment and
al = volume of magnet, therefore

$$B = H + 4\ \pi \frac{ml}{al} = H + 4\ \pi\ I$$

we call the $\frac{\text{magnetic moment}}{\text{volume}} = I$ (the intensity).

The intensity I and the strength of field H bear a direct relation to each other.

$$\text{Susceptibility} = \frac{\text{The induced magnetization}}{\text{The magnetic force}} = k$$

$$k = \frac{I}{H} \text{ or } I = k\ H$$

In the formula $B = H + 4\ \pi\ I$ we have by substitution, remembering that $I = \text{k}\ H$ $= H + 4\ \pi\ (kH)$
if $I + 4\ \pi\ k = \mu$ then $= H(1 + 4\ \pi\ k)$
$B = \mu\ H.$

The quantity $I + 4\ \pi\ k$ or μ expresses the ratio of the magnetic induction to the magnetizing force producing it, and it is called the magnetic permeability of the iron.

Some tables are given below showing the values of B, μ and H for square inch and square centimeter areas.

SQUARE INCH UNITS.

B	μ	H	B	μ	H
30,000	4,650	6.5	25,000	763	32.7
40,000	3,877	10.3	30,000	756	39.7
50,000	3,031	16.5	40,000	258	155.
60,000	2,159	27.8	50,000	114	439.
70,000	1,921	36.4	60,000	74	807.
80,000	1,409	56.8	70,000	40	1480.
90,000	907	99.2	......	...	......
100,000	408	245.	......	...	......
110,000	166	604.	......	...	......
120,000	76	1581.	......	...	......
130,000	35	3714.	......	...	......
140,000	27	5185.	......	...	......

SQUARE CENTIMETER UNITS.

B	μ	H	B	μ	H
5,000	3,000	1.66	4,000	800	5.
9,000	2,250	4.	5,000	500	10.
10,000	2,000	5.	6,000	279	21.5
11,000	1,692	6.5	7,000	133	42.
12,000	1,412	8.5	8,000	100	80.
13,000	1,083	12.	9,000	71	127.
14,000	823	17.	10,000	53	188.
15,000	526	28.5	11,000	37	292.
16,000	320	50.	......	...	.....
17,000	161	105.	......	...	.....
18,000	90	200.	......	...	.....
19,000	54	350.	......	...	.....
20,000	30	666.	......	...	.....

Ampere considered the magnetic effect of a current in a coil of wire, not as Oersted did, but differentially. The absolute unit of current which is obtained by sending a current into an arc of wire is that which will effect a unit magnetic pole with the force of one dyne, if the wire be of one cm. radius and one cm. length.

(*To be Continued.*)

THE TARIFF BILL.

HOW IT AFFECTS ARTICLES AND MATERIALS USED IN THE ELECTRICAL INDUSTRIES.

Following is a table showing the changes in the rates of duty on articles and materials of foreign production used here in the various electrical industries, as effected by the tariff bill recently passed by congress and become a law without the President's signature. The first and second columns show the *ad valorem* duties under the McKinley bill and the new bill respectively; the third column shows the reduction per cent.

	McKinley Rate.	New Rate.	Per Cent. Reduction.
Chromic acid.............	32.69	21.80	33.31
Potash, Chromate and Bichromate of............	36.72	25.	31.92
Iron bars or rails for railways, flat rails punched, iron or steel............	44.38	25.88	41.69
T rails or other railway bars, iron..............	50.09	29 22	41.67
Steel or in part steel.....	58.24	33.99	24.47
Wire rope and wire strand, made of iron wire—smaller than No. 10 and not smaller than No. 16 wire gauge........	73.94	60.49	18.19
Smaller than No. 16 and not smaller than No. 26 wire gauge.............	57 56	44.27	23 09
Smaller than No. 26 wire gauge..................	26 50	19.87	15 35
Galvanized, smaller than No. 10 and not smaller than No. 16 wire gauge..	88.85	68 35	23.07
Smaller than No. 16 and not smaller than No. 26 wire gauge.............	53.60	55.	.... (Increase p. c.) 2 61
Smaller than No. 26 wire gauge..................	86.72	59.27	31.65
Made of steel wire, not smaller than No. 10 wire gauge................	66.98	60.61	9 51
Smaller than No. 10 and not smaller than No. 16 wire gauge.............	57.02	55.20	3.19
Smaller than No. 16 and not smaller than No. 26 wire gauge.	47 66	51.21	.... (Increase p c.) 7.45
Smaller than No. 26 wire gauge..................	13.67	42 73	.... (Increase p.c.) 212.58
Galvanized—not smaller than No. 10 wire gauge..	80.65	61.61	23.75
Smaller than No. 10 and not smaller than No. 16 wire gauge.............	109.25	65.71	39.85
Smaller than No. 16 and not smaller than No. 26 wire gauge.............	77.40	56.29	27.27
Smaller than No. 26 wire gauge...................	80.84	54.70	32 34
Not smaller than No. 5 wire gauge, cold rolled, cold hammered, or polished..................	96.15	40.	58.40
Railway fish plates or splice bars, of iron or steel..................	72.18	25.	65.36
Aluminum—In crude form and alloys of any kind, in which aluminum is the component material of chief value...........	22.28	14.85	33.35
Lead, pigs and bars—molten and old refuse lead, run into blocks and bars, and old scrap lead fit only to be remanufactured	49 13	24.56	50.
Mica..	35.	20.	42.85
Zinc or spelter, and manufactures of—			
In blocks or pigs........	32.32	18.47	42.85
In sheets..	29.19	14 59	50.
Old and worn out fit only to be remanufactured .	21.99	13.19	40.

The following named articles will be admitted free of duty:

Asbestos, unmanufactured.

Blue vitriol, or sulphate of copper.

Copper imported in the form of ores.

Old copper, fit only for manufacture, clipping from new copper and all composition metal of which copper is a component material of chief value not specially provided for in this act.

Copper, regulus of, and black or coarse copper and copper cement.

Copper in plates, bars, ingots or pigs and other forms, not manufactured but specially provided for in this act.

Gutta-Percha, crude.

India rubber, crude and milk of, and old scrap or refuse India rubber, which has been worn out by use and is fit only for remanufacture.

Paraffine.

Platina, in ingots, bars, sheets and wire.

Platinum, unmanufactured, and vases, retorts and other apparatus, vessels and parts thereof composed of platinum adapted for chemical uses.

Plumbago.

Sulphuric acid, provided that upon sulphuric acid imported from any country, whether independent or a dependency, which imposes a duty on sulphuric acid exported from the United States, there shall be levied and collected the rate of duty existing prior to the passage of this act,

Potash, caustic or hydrate of, refined, in sticks or rolls.

LIQUID RHEOSTATS.

Merrill gives the following data for liquid rheostats, showing the resistance of ordinary hydrant water, and that of water diluted with commercial table salt and sulphuric acid at different degrees of solution. A body of water a square foot in cross section and one foot long has an approximate resistance of 100 ohms.

The following table shows the effect of common salt on the resistance of the water, the percentages of salt in solution being by weight.

Per cent. of salt.	Resistance.
(Clear water.)	100.
.23	7.84
.46	4.65
.70	3.12
.93	2.38
1.16	1.9
1.39	1.48

LATEST DEFINITION OF AN ELECTRIC STREET CAR.—An enclosed space moved by electric power.

OLAN'S ELECTRIC CURRENT RECORDER.

The question and problem of measuring electrical energy in such a way that the record may serve as a basis for a just and satisfactory regulation of accounts between the supplying company and the consumer, is as old as the application of electricity itself. Up to the present time, however, no one seems to have produced an instrument that has given results satisfactory to both parties.

To be fair to both supplier and consumer, an instrument should measure and record the tension of the current, as well as the quantity, and it is a peculiar fact that so far as we know, no one has ever successfully produced an instrument that would do this; the necessity for a separate and correlative record of tension and of quantity does not seem to have been appreciated as it should be. That measurements of both dimensions should be made is evident when the matter is given proper thought. Suppose a customer is using a lighting current and his lamps call for 120 volts; if he should get but 60 volts from the circuit he will get no light at all, although an Edison chemical meter, and other meters in use, would record such current and the customer would have to pay for it, although he derived no benefit from it whatever. Should the current be reduced to 100 volts, two 120-volt lamps will give scarcely as much light as one with normal current, but the current consumed by the two lamps will be from about 60 to 70 per cent. greater than that required for one lamp properly fed and. in this case, the customer will be required to pay correspondingly more for the light he gets. The same conditions apply equally as well to electro-platers as others using current for commercial purposes. It is evident, therefore, that a perfect instrument should record these irregularities, in order that the proper charges should be made.

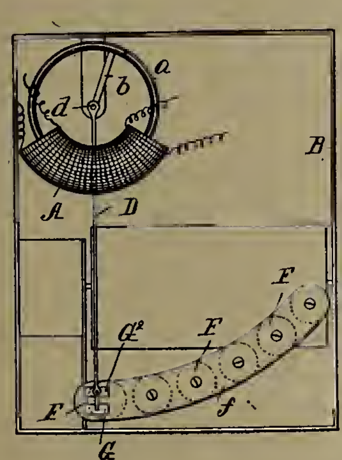


FIG. 1.

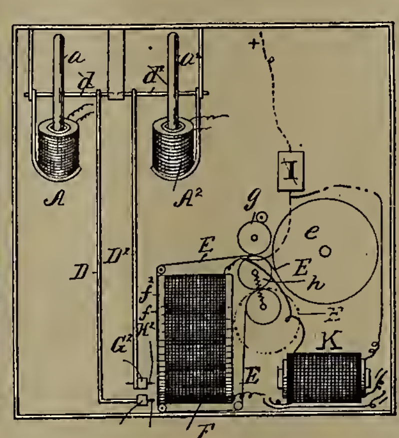


FIG. 2.

On April 17, 1894, a patent was issued to J. W. Th. Olan, the well-known inventor, on an instrument of this class, which seems to meet these requirements. It accounts not only for all regular conditions of the current, but also for variations and irregularities in connection therewith, and makes a visible and permanent record of the same.

Mr. Olan's instrument consists substantially of a combined voltmeter and ammeter, under one cover, the pointers of which in moving over properly graduated and by time mechanism moving paper make a record corresponding to the quantity and tension of the current as well as to time.

By this means, when the quantity as well as the tension of the current that have passed through the circuit in a given time are shown on the record sheet, the corresponding resistance is practically known, and the whole of Ohm's law with relation to the current in the circuit is therefore practically recorded. From the fact that both tension and quantity are recorded at the same instance, it follows that accurate calculations can be readily made.

The accompanying illustrations will facilitate a better understanding of Mr. Olan's Recorder.

Fig. 1 is a face view, the front plate, *f*, being removed and Fig. 2 a side view. A and A^2 represent the energizing coils, and a and a^2 armatures of the same. D and D^2 represent the pointers which are arranged to make record marks on the sheet, a section of which is shown in Fig. 3. This is accomplished by energizing the magnets, *F*, *F*, at proper intervals by current from the main line or other source, which, in attracting the armatures, G G^2, arranged on the pointers, cause the pin points of the pointers to perforate the record sheet.

When the pin points perforate the sheet, they come in contact with ink pads of a distinctive color, and in this way the voltage is recorded in one color while the amperes are marked in another. Other means are provided for distinguishing records of the different needles; one, for instance, uses a large and small pin, giving large and small perforations.

The pole plate, f', is common to all the magnets and effects a proper distribution of the magnetism produced by any one magnet, so that the armatures of the pointers may be acted upon in whatever position they may be when an impulse acts upon them.

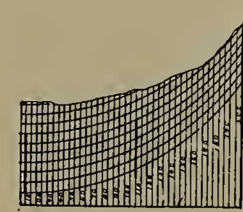


FIG. 3.

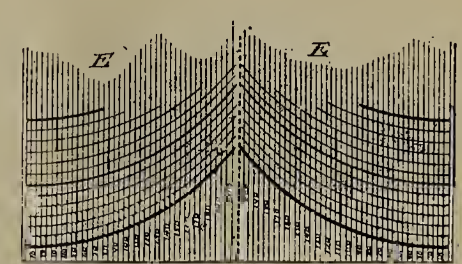


FIG. 4.

Fig. 4 shows a section of record sheet adapted to a Recorder of a modified form.

The instrument is completely described, in principle, in Claim 1 of the patent, which is as follows:

"An instrument for making a unitary and correlative record of the quantity and tension of an electric current, comprising a record sheet, time mechanism for moving said record sheet, recording needles adapted to move in concentric arcs across the sheet and governed respectively by variations in the quantity and tension of the current, the path of movement of each of said needles being obstructed by the other and a support for the sheet sufficiently flat to retain the sheet within operative range of the needles at all points of the deviations of the latter produced by the current; substantially as described."

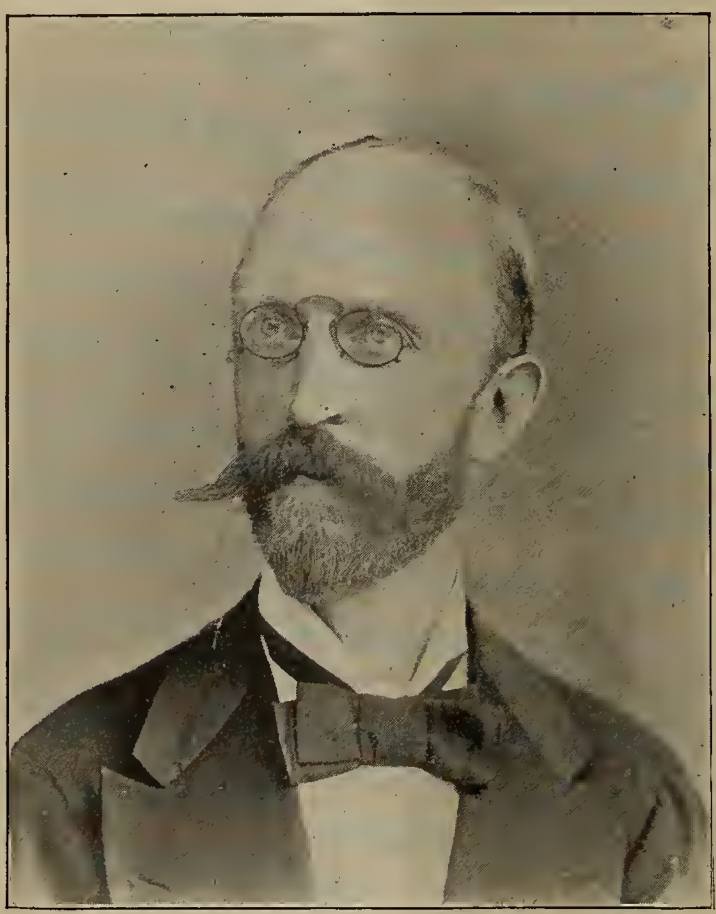
MECHANICAL AND ELECTRICAL POWER.

A steel cable one and one-half inches in diameter, traveling at the rate of twelve miles per hour, can transmit nearly 2,000 horse-power. But by taking a copper wire, one square inch in section and applying to it a potential equal to that which is in use today in at least one place in this country, viz: 10,000 volts, at 1,000 amperes per square inch, we find we are transmitting in an invisible form over that wire more than 13,000 horse power, which is enough to rupture instantly six such cables as are ordinarily used in operating a cable railway. As much power can be transmitted through such a copper wire under the conditions named as through six such belts as was seen at the World's Fair, six feet wide and running at the rate of a mile per minute.

BIOGRAPHICAL.

MR. J. W. TH. OLAN.

Mr. Olan's native land is Sweden. Like many other professional inventors, Mr. Olan's course of life has not always gone in one direction. Originally educated with a view of becoming a clergyman his philosophical aspect of life carried his refined mind in another direction, and after four years of training at the Elementary School of State, and seven years of classical studies at the high college in Gothembourg, he entered the philosophical faculty of the University of Upsala. In order to perfect himself in mathematics and natural sciences and languages, he later went to the south of Europe, remaining for longer periods at the University of Geneva, Paris and various other places. Returning to Sweden, he finished his studies at the Polytechnicum in Stockholm, where he adopted mining engineering as



J. W. TH. OLAN.

his speciality of profession. With the object of entering into the service of the Panama Canal Company, we find him again in Paris just at the time of the first international electrical exhibition in that city, in 1881.

The Swedish section at the Palais de l'Industrie was at the opening of the exhibition, the only one where an electric light could not be seen. But one day it was lighted by a charming electrical Christmas tree, which attracted visitors by the thousands. It was Mr. Olan's work, and it brought him in contact with the Edison people, for whom he afterwards worked at the International Exhibition in London. In 1882 he returned to Sweden as superintending electrical engineer, to introduce the incandescent light system in that country. The second plant he installed there was in the Royal Palace, and an incident in connection therewith put Mr. Olan's ability as a technical and electrical expert to a severe test, but he was triumphant. Skilled workmen not being available, he was obliged to complete the plant with entirely unexperienced help. The progress of the work therefore went somewhat slower than those interested had anticipated. One day Mr. Olan met the King. "Ingenieur Olan," said the King, "when will this be ready? If not soon it will be as it reads in the nautical almanac—'The light nights will conceal the beams of the moon.'"

"On Thursday, your Majesty, it will be ready."

"That is good," replied the king.

Thursday morning came and the plant was not ready; but at 3 o'clock the last branches were put up and the final connections made. Mr. Olan having sacrificed that day's breakfast and forgotten the lunch, had just ordered his men to keep instruments ready for a thorough test of the plant, and was about to leave for dinner, when in came into the engine-room the superintendent of the palace.

"His Majesty sends orders that the electric light plant shall be lit at 7 o'clock," remarked that official.

Mr. Olan did not answer; after some hesitation, however, turning to the machinist, he said, "75 pounds steam at quarter to 7,"—and this was all he uttered. The superintendent went away. Mr. Olan's workmen looked at each other in a derisive and astonished way. They knew that not a single branch of the plant had yet been tested, and that no time was left for a thorough test, and they apparently thought that the superintendent wassent away with a bluff. They were, however, still more surprised when the engineer not returning until shortly before 7 and without any test whatever of the plant, half a minute before seven called out to the machinist, "let go," and, when, as the clock was striking, the entire plant beamed in brilliant light.

Not a lamp failed; not a fuse went off. The test was made, the only conclusive one, and no other was ever necessary.

That the pioneer work, after this success, should be comparatively easy, follows without saying.

Mr. Olan came to America in 1890, and he is an active member of the American Institute of Electrical Engineers.

The last few years Mr. Olan has devoted to invention. The very difficult problem he has apparently definitely solved is the Recorder described on another page in this issue. This we understand is only one of a large series of important inventions.

Mr. Olan is at present one of the leading spirits of the Swedish American Engineering and Art Company, a concern formed by Swedish and American civil engineers and experts for the purpose of carrying on a general engineering business and promoting important inventions. This corporation has, we understand, for a considerable sum secured the control of the Olan Recorder.

ELECTRICITY IN MINING.*

BY CHARLES E. BOWRON.

The author held that of all the forces at command in the science of mining, electricity seems to be the most adaptable and more nearly fulfils most of the conditions demanded, viz.: Safety, efficiency, reliability, simplicity and flexibility on the one hand, on the other the economic necessity of a minimum of cost in application and production. Risks to life and property are very great in mining, and the dictates both of humanity and economy will be best subserved by the adoption of any agent which will tend to minimize these risks. The great ease of production and application in the first instance, then its great flexibility and efficiency give electricity a strong claim for our careful consideration.

Its competitive forces are steam, compressed air, hydraulic power and wire rope transmissions. As to hydraulic power, its application (except as a prime agent) is evidently so costly and limited, while wire rope transmissions beyond a comparatively short limit are entirely out of the question and cannot be used ex-

*Abstract of paper read before the Alabama Industrial and Scientific Society.

cept for special purposes, that we may limit the discussion to steam, compressed air and electricity.

Considering the demands of a mining plant, we see power consumed in winding, outside and inside hauling, coal cutting, coal and rock drilling, pumping, ventilation, lighting, signaling and explosive firing. Regarding the prime source of energy for such power, it may be either hydraulic or steam power (leaving gas engines out of the question in their present state.) In either case electricity comes to the front. In many cases the topographical surroundings and the location of fuel and water limit the location of a steam plant, which may have to be so far away as to be very inefficient, where the steam is to be used at the mines; with electricity we generate it at these same boilers, and placing them where they will suit the economic conditions of best service, convey the power to its work with but slight loss These conditions very often obtain in the western mining states, the location of a steam plant perhaps being a matter of great mechanical difficulty in transpoitation and erection in the first place, and where the site of water for the boilers and the haulage of costly fuel prescribe the limits. With this agent, though, we erect our steam plant and dynamos at the most advantageous site and take the electric cable to the mines, elevation and distance no longer almost insuperable obstacles. An instance of this kind is the plant at the Virginius mine in Colorado, at an elevation of 12,000 feet. The cost of fuel there, which had to be packed up the mountain on "burros," was stated to be $18 per ton, amounting in a year to some $80,000. The present source of power is Red Canyon Creek, four miles distant from the openings, where 300 horse-power are generated and carried to the mines at a pressure of 800 volts; the saving of fuel in one year alone paid for the electric plant.

Difficulties occur in mining in proportion to distance, and except for short distances, say up to two miles, neither steam nor compressed air can be considered dangerous rivals of electricity, on account of its high efficiency for long distance transmissions, the comparison growing the more favorable to the latter as the distance increases. We may use steam at the pit mouth for hoisting or running a fan and take it underground for a short distance for pumps, drills and rope-hauling engines, but when we wish to take it several miles away for drilling, coal cutting, etc., its use is entirely out of the question, unless another plant be erected, either underground, which is often objectionable, or at the expense of another surface plant and a shaft or bore hole to take the steam underground.

The efficiency of steam is low because dependent upon its retention of heat, which is continually lost by radiation and condensation no matter how well protected the pipes by covering, and it loses quickly also by friction and leakage. In the use of compressed air there is a large initial loss of the heat of compression, and as in the case of steam further large losses in friction and leakage. In the case of both steam and compressed air, the loss increases much more rapidly than the proportional increment in distance. Here is one of the strongest points of electricity, and it is the only power so far which meets what we may call the "distance emergency" in mining. from an economical standpoint. Here we have no losses analogous to the losses mentioned in the case of steam and compressed air to the extent that there prevail in their transmissions. When not at work, no power is consumed in electrical apparatus, the prime generator producing just what is consumed, automatically. At a Michigan mine 175 horse-power are transmitted three miles by compressed air, with an efficiency at the mines of only 35 per cent. —thus showing a 65 per cent. loss in transmission. With electricity these figures would, beyond doubt, be reversed. One electric company guaranteed an efficiency of 73 per cent., based upon an initial efficiency of 100 and successive losses of 10 per cent. in dynamo conversion, 10 per cent in line transmission, and 10 per cent. in reconversion at the motor. An ordinary efficiency of compressed air is from 20 to 40 per cent., rarely 50. The cost of conductors for carrying an equal amount of power at average pressures has been stated by Prof. M. C. Ihlseng, in the case of electricity, steam and compressed air, to be as 1 to 27 to 19.

An invaluable feature of an electrical mining plant is its great flexibility and the great ease with which changes in the distribution of energy can be made. It is but a few hours' job to branch and take a wire to any part of the mine to a motor, compared with an equal number of days to lay heavy, cumbersome and expensive pipe line for the same purpose. With greatest ease we lead a wire round a corner, take it up or down a shaft or slope, in and through places where it would be dangerous and difficult to lay a pipe line. Simplicity and completeness commend themselves at all times to the miner, and nothing can be more complete than the different ways in which we can harness electricity to our various uses in this direction. We may use it for lighting our tipple or breaker, hoisting the mineral, ventilating apparatus, inside and outside hauling, cutting, drilling, underground lighting, signaling by bell or telephone, and for explosive firing. It is also adapted to outside operations and is applied to them in such lines as crushing, stamping, jigging, concentrating, etc., and further along in metallurgical operations upon the mineral, such as the production of aluminum by the Cowles process.

The impediments in the way of the adoption of this agent in mining have been several. Mr. Pocock says: "Electrical engineers are not familiar with the routine of practical colliery workings and are, therefore, placed at a disadvantage by not knowing the actual requirements of mining engineers and the many little difficulties to be met with in underground workings; and until mining engineers have acquired the necessary knowledge and a confidence in electricity, it is only natural that they will continue to follow the beaten path. Experiments in mining are costly, necessarily, and until a method or appliance can hope to compete with the older way it has to be brought to a "hard pan" basis, before it will receive the consideration due to its merits, however pronounced or enticing. While an electrical mining plant as a whole is comparatively simple, yet the details of the mechanism of the different machines, locomotives, etc., remain to be considerably simplified to withstand inevitable hard usage to which they will be subjected."

The Manufacture of Carbons.—MM. Despretz and Berthelot described before the Paris Academy of Science some time ago some experiments which they instituted with the object of studying the conditions under which carbon fuses and sublimes. *Inter alia*, they discovered whilst engaged in this investigation, that when exposed to the action of high temperatures the various kinds of carbon pass into the graphitic condition. This result possibly did not strike anyone at the time as being capable of commercial application; it appeared what it professed to be, a piece of pure research. MM. Girard and Street, however, have succeeded in basing upon this result the manufacture of graphitic carbon suitable for various electrical purposes. Carbons made in the ordinary way are subjected to such a temperature as will soften, weld, and even fuse and sublime the material. The temperature is kept up until they are converted into graphitic carbon or graphite. To obtain the necessary heat, the carbon that is being converted is made part of an electric circuit, or else an arc is caused to play over its surface, in which case the graphitic character is produced to a certain depth. Granular and powdered carbon is similarly altered by passing it between electrodes, the rate of flow being adjusted so that the whole of it is brought up to the requisite temperature. Such graphitic carbon may be used in the manufacture, by agglomeration, of the various "carbons" which are used in electrical work.

THE MANHATTAN INCANDESCENT ARC LAMP.

The accompanying illustration is that of the incandescent arc lamp manufactured by the Manhattan General Construction Co., of New York city, which was

MANHATTAN INCANDESCENT ARC LAMP.

described and illustrated in considerable detail in the Electrical Age of June 30, last.

This lamp is the most recent of its class to appear on the market, and it possesses some remarkable features, one of the principal of which is that it will burn eighty hours without retrimming.

Usually it is necessary to place two arc lights in series on incandescent circuits, but this lamp burns singly and economically. It takes only 4 amperes of current to produce an illumination of 2,000 candle-power, and gives a perfectly white and steady light, one free from shadows.

The most important feature of the lamp is the enclosed globes. The outer globe is air-tight at all points except at the bottom, where there is a hand-hole large enough to permit of cleaning and trimming the lamp. The upper opening of the outer globe is secured to the carbon frame and there made air-tight by asbestos gaskets, the globe and frame screwing into the body of the lamp.

Within this enclosing globe, and immediately surrounding the arc, is a smaller globe into which the carbons are fed, there being, however, no air-tight bearings. The inside globe acts as a chamber of high rarefaction, while the outer globe is a storage for the products of combustion, or diluting chamber, thus preventing access of air containing oxygen to the carbon points. On the formation of an arc, the enclosed air is heated and rarefied, the surplus air escaping through the lower vent. The contained oxygen is soon reduced by combustion with the carbon points to carbon monoxide, and this, with the remaining nitrogen, surrounds the arc and protects the points from further combustion.

By this system of burning of carbons in these enclosed chambers, half-inch carbons will burn eighty hours without retrimming, and without any blackening or discoloration of the globe.

For the inside lamps a rheostat of enameled iron is provided, in the shape of a head-board with binding posts, hanging straps and switch complete. When not desirable to secure the rheostat directly to the ceiling, the lamp may be suspended from a ring.

Lamps for out-door service are provided with weather-proof tops. The rheostats of these outside lamps usually are placed under cover and wires led from them to the lamp. When necessary, the resistance may be placed within the lamp.

This lamp has few parts, and the cost of repairs is consequently low; and it is regular in feed and positive in cutting out.

In the outside lamps the main line circuit runs through a switch in the cap, and the lamp may be removed and the circuit left to pass uninterrupted. The wires enter the cap through inclined insulated openings which exclude the weather.

To shorten the lamp, the customary carbon rod has been dispensed with and a thin sheath or holder feeding through the clutch rings with the bare carbons substituted.

The mechanism contains neither clock-work, levers, dash-pots, racks nor carbon rods, and the many advantages presented by this lamp will certainly commend it to popular favor.

STORAGE BATTERIES IN ELECTRIC LIGHTING.

In the city of London there are eight stations supplying current for lighting, in which storage batteries are depended upon for part or the whole of the load carried. The aggregate actual capacity of these stations is some 200,000 16-c. p. lights. In many cases the batteries are not located in the generating station, but at sub-stations suitably located with reference to the consumers. The charging current is sent to the batteries at high potential, several sub-stations being joined in series for the purpose of charging.

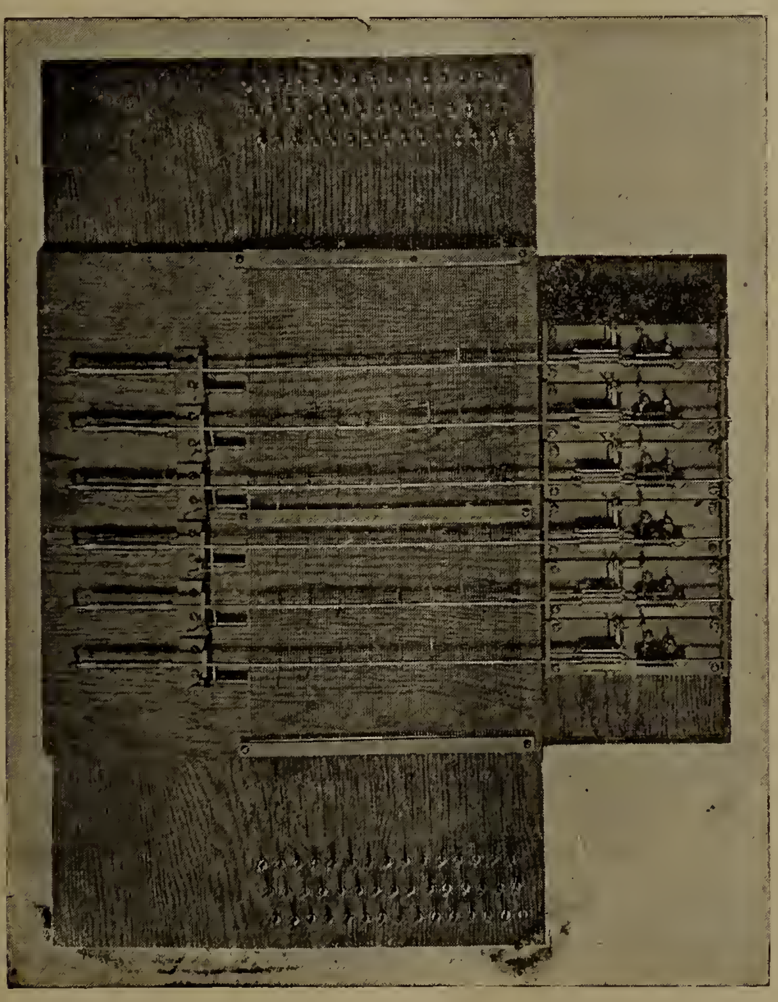
In Paris there are some twenty-eight or thirty such sub-stations located in various parts of one section of the city, and all charged from the same central station. In the "Edison section" of the city an interesting application is made of a large (2,800 ampere hours) battery which is located at a point somewhat distant from the central station, and connected with the mains from which it is charged at those hours when the load is light, by taking current from the mains themselves; the potential being regulated by means of a continuous transformer. In this way a considerable amount of energy can be sent at a low rate and, therefore, at small loss of drop of potential. This energy is used for maintaining the pressure in that portion of the mains and for delivering a certain amount of current, which would otherwise have to come from the station over heavily loaded feeders (in the busy hours) and a greater loss of potential. Thus the battery, in this case, saves the cost of larger feeders, while it also furnishes a load for the hours of small load.

AUTOMATIC TELEPHONE EXCHANGE.

Owing to the great expense of installation and maintenance of central telephone exchanges, much thought has been given by inventors to the problem of reducing this expense to a minimum.

The solution of the problem was not an easy task at first, but it was finally accomplished in the invention of the automatic exchange.

We give herewith an illustration of the automatic telephone exchange of the Eastern Automatic Telephone Company, of New York City. This apparatus dispenses entirely with the services of the central station operators, and its operation does not depend upon human agency, except to start and control it from a distant point.



AUTOMATIC TELEPHONE EXCHANGE.

A subscriber in his own office is enabled to put himself in direct and immediate communication with any other subscriber. This is accomplished by a key-board with an automatic release. For instance; suppose subscriber No. 142 is wanted; the person desiring to communicate with this number goes to his telephone, presses once on the 100 key, four times on the 10 key, and twice on the unit key, rings his magneto bell which sounds the alarm in the office of 142 and attracts the attention of subscriber 142. When through conversing, by placing the earphone on the hook, automatic disconnection is immediately made and the instrument is ready for another call.

The instrument is always ready for use, at night as well as by day, and saves the expense of maintaining a central office with its corps of contact makers and expensive help. It adds to the convenience of the subscriber by saving much time, annoyance and delay, as he is enabled by it to make his own telephone connection instantly and automatically.

This system is claimed to be much cheaper than any other, and is especially adapted to small cities, towns, villages, warehouses and hotels, as systems of two can be erected which will work as satisfactorily as any larger number.

The Eastern Automatic Telephone Company, which has its offices at 136–140 Front street, New York City, controls the latest and best inventions and patent in the line of non-infringing telephones, with fundamental patents on automatic exchanges. It is the sole licensee for the States of Massachusetts and Rhode Island under fundamental patents for automatic exchanges, and is prepared to build, operate or sub-license the use of the same in these states.

The system may be seen in operation at the company's headquarters.

LEGAL ELECTRICAL UNITS.

The following is a copy of the act now before Congress having for its purpose the definition of the legal units of electrical measurements in the United States:

First. The unit of resistance shall be what is known as the international Ohm, which is substantially equal to one thousand million units of resistance of the centimeter gram-second system of electro-magnetic units, and is represented by the resistance offered to an unvarying electric current by a column of mercury at the temperature of melting ice fourteen and four thousand five hundred and twenty-one ten-thousandths grams in mass, of a constant cross-sectional area, and of the length of one hundred and six and three-tenths centimeters.

Second. The unit of current shall be what is known as the international Ampere, which is one-tenth of the unit of current of the centimeter gram-second system of electro-magnetic units, and is the practical equivalent of the unvarying current, which, when passed through a solution of nitrate of silver in water in accordance with standard specifications, deposits silver at the rate of one thousand one hundred and eighteen millionths of a gram per second.

Third. The unit of electromotive force shall be what is known as the international Volt, which is the electromotive force that, steadily applied to a conductor whose resistance is one international Ohm, will produce a current of an international Ampere, and is practically equivalent to one thousand fourteen hundred and thirty-fourths of the electromotive force between the poles or electrodes of the voltaic cell, known as Clark's cell, at a temperature of 15 deg. centigrade, and prepared in the manner described in the standard specifications.

Fourth. The unit of quantity shall be what is known as the international Coulomb, which is the quantity of electricity transferred by a current of one international Ampere in one second.

Fifth. The unit of capacity shall be what is known as the international Farad, which is the capacity of a condenser charged to a potential of one international Volt by one international Coulomb of electricity.

Sixth. The unit of work shall be the Joule, which is equal to 10,000,000 units of work in the centimeter gram-second system, and which is practically equivalent to the energy expended in one second by an international Ampere in an international Ohm.

Seventh. The unit of power shall be the Watt, which is equal to 10,000,000 units of power in the centimeter gram-second system, and which is practically equivalent to the work done at the rate of one Joule per second.

Eighth. The unit of induction shall be the Henry, which is the induction in a circuit when the electromotive force induced in this circuit is one international Volt, while the inducing current varies at the rate of one Ampere per second.

It shall be the duty of the National Academy of Sciences to prescribe and publish, as soon as possible after the passage of this act, such specifications of details as shall be necessary for the practical application of the definitions of the Ampere and Volt, and these shall be the standard specifications.

THE CLAM BAKE.

The American Electrical Works, Providence, R. I., gave its sixteenth annual Rhode Island dinner to the electrical fraternity, at Haute Rieve, on Saturday, August 25. The weather was all that could be desired for the occasion, and an extremely enjoyable time was had by all. There were about 250 persons present, including many of the shining lights in the electrical world, and every one laid aside all dignity and business and indulged in sports of all kinds and the other usual accompaniments of these celebrated clam dinners.

Among the athletics indulged in was a game of baseball between teams from Boston and Providence. Whether or not it was a concession to the visitors the Boston team was triumphant by a score of 26 to 6. The foot-ball was also sent scurrying through the air, and the kicking that was accomplished during this period of activity would have done credit to any vaudeville stage.

President Eugene F. Phillips, with his usual smile of happiness, did not omit anything to contribute to the pleasure of his guests.

After the clams and other things had disappeared, speeches were made by various gentlemen, after which the aggregation resolved itself into individual units, and the units scattered in every direction towards their respective habitations.

Limited space prevents our giving a list of those who were there. The photograph taken on the occasion will tell that part of the story.

Electric Traction in Madrid. —The Madrid Tramway Co., Madrid, Spain, has decided to introduce electric traction on its lines. The system will be that of the Allgemeine Elektricitats Gesellschaft of Berlin.

NEW CORPORATIONS.

Citizens' Electric Light & Power Company, Pensacola, Fla., operating electric light, heat and power plant. Capital stock, $20,000.

Co-operative Electric Railway Company, Chicago, Ill.. Capital stock, $1,000,000.

Chicago Harrison Telephone Company, Chicago, Ill. Capital stock, $4,000,000.

The O'Fallon Electric Light, Power, Heat and Water Company, O'Fallon, Ill. Capital stock, $20,000.

Viscosity Oil Company, Chicago, Ill., manufacturing and dealing in lubricating oils, greases, steam and electrical supplies. Capital stock, $10,000.

The Jacksonville Electric Light and Power Co., Jacksonville, Ill., by G. D. Staffert, Sam'l H. Trude and William H. Lee. Capital stock, $100,000.

The Atkinson Railway Electric Light and Power Co., Atkinson, Kan., by H. O. Odell, Geo. W. Riggs and A. E Cullingworth, of Chicago, and W. P. Waggener, Elsworth Engels, C. C. Hetherington and S. E. Harburger, of Atkinson, to do a general electric business and build an electric street railway. Capital stock, $300,000.

The Chicago Oak Park and Harlem Street Railway Co., Chicago, Ill. The incorporators are John C. Schumacher, John Guaedinger, Gustav A. Pudewa, Frank Proost and Henry D. Schumacher.

The Altham International Motor Co., Portland, Me., for the purpose of carrying on the business of generating, applying and in any other manner using motive power of all kinds. Capital stock, $5,000,000. Incorporators: President, Geo. J. Altham, of Lawrence, Mass.; Treasurer, Wm. M. Coe, of Somerville, Mass.

The Ziegler Electric Co., Boston, Mass. Capital stock, $25 000. A. A. Ziegler, president, Alfred Ziegler, treasurer.

The Farmers' Telephone Co., of Massillon, O., to build and operate lines through Hamilton, Summit, Stark, Wayne, Holmes, Coshocton, Locking, Franklin, Madison, Green, Montgomery and Butler Counties. Incorporators are Martin S. Card, Nathan F. Moffet, J. H. Fisher, William Maxheimer, Andrew J. Gordon, F. Seghoff, Robert A. Perin and Azaria Short.

The Scott Electric Lamp Company, New York, N. Y., to manufacture electric lamps and other electrical apparatus in New York. Capital stock, $25,000. Directors, Richard Outcault and Ed. M. Brown, of New York city, Bertram H. Herbert, of Hoboken, N. J., Falcon Bridge Plante, of Brooklyn and Palmer Brown, of Woonsocket, R. I.

POSSIBLE CONTRACTS.

Henry W. Sawtelle, of the Marine Hospital Service, Boston, can give information regarding an electrical outfit, for which bids are now being invited.

An electric light plant is to be established in Henderson, Minn. For further particulars address the Mayor of that place.

The high school building, Topeka, Kansas, is to be lighted by electricity. Address H. W. Farnsworth concerning the same.

Address C D. Hills, Lancaster, Ohio, concerning an electric light plant to be purchased for the Boys' Industrial School in that place.

An electric light plant is to be constructed at Estherville, Iowa, having a capacity of 30 arc lights and 1,000 16-c. p. incandescent lights. Address N. B. Egbert, city clerk, for further information.

The City Council of Jacksonville, Fla., has voted $75,000 for the construction of an electric light plant. For further particulars address D. U. Fletcher, Mayor.

Fuller & Moss and H. F. Auten have applied to the Little Rock, Ark., city council for a franchise to build and operate an electric railway.

An electric light plant is to be constructed by the city of San Diego, Cal. For further information regarding the same address the Mayor of that city.

The W. Warren Thread Works, of Westfield, Mass., is in the market for a 250-electric light plant.

The Interior Department, Washington, D. C., is inviting proposals for the construction of the telephone exchange system for that department.

THE STATE OF TRADE AND WHAT OUR PATRONS ARE DOING.

In the rounds of the trade, our representative finds a few who persist in complaining of dulness. Among our advertisers, however, we find a hopeful state of mind, and they all look forward with the utmost confidence to an early improvement in business. At the present time they are all having a good trade. Many contracts are being closed for isolated electric light plants, central stations, and a large number of electric railway plants.

Mr. J. W. Clark, of the General Electric Company, reports that he is selling on an average 250 electric railway motors a week, which speaks as well for Mr. Clark's enterprise as it does for the reputation of the General Electric motors.

Messrs. Schmerber & Du Vall, of 30 Cortlandt street, representatives of the Ball Engine Co., Erie, Pa., have closed several contracts for electric railway and isolated electric light plants, and they are satisfied with the outlook in business They are busy figuring on several new contracts.

The Electric Construction and Supply Company, 18 Cortlandt street, have no difficulty in keeping up their large average in sales of incandescent arc lamps for low tension and alternating circuits. The value of these lamps for low tension circuits was especially referred to in our issue of last week. Success seems to be the portion of this company, and a bright outlook lies before it.

In view of the rapid increase in the sales of the Fleming woven wire dynamo brush, the Manhattan General Construction Co., 50 Broadway, call special attention to station managers and others to the importance of placing their orders early for the fall requirements, so as to avoid delay in shipment.

Mr. Paul Dreher, Room 525, Cable Building, Broadway and Houston street, the sole New York agent for the Livgro Incandescent Lamp Co., reports an excellent demand for this lamp, which has already become popular. Inquiries regarding this lamp are coming from all parts of the country. The Livgro lamp does not infringe any existing lamp patents, and is made in a manner entirely different. It is adapted for all systems, and is made of any required voltage. It is, without doubt, the best now on the market.

Hugo Riesinger, 38 Beaver street, reports a big demand for imported Nurnberg electro carbons.

The Safety Insulated Wire and Cable Co., 254 W. 29th street, are kept busy filling orders for their celebrated wires and cables. They have done well through the hard times, and are looking forward to a very early improvement in business.

Kerite wires and cables received a great boom through the receipt of the highest award at the World's Fair, for electric light wires and cables, and the only award for high grade insulated wires and cables. Mr. W. R. Brixey, of 203 Broadway, is satisfied with the outlook, and expects an early improvement in the trade all around.

Mr. C. F. Splitdorf, 17 Vandewater street, is one of the fortunate ones, and is receiving the average number of orders for magnets for all kinds of electrical apparatus, induction coils, motors, etc. He has large facilities for the quick production of these goods and the workmanship bestowed upon them is of the best quality.

The Columbia Telephone Manufacturing Co., 138 Front street, New York, have bought the factory at Red Bank, N. J., of the Electric Manufacturing Co. of America, where they will manufacture their phones and other goods to meet the large demand. The Columbia telephone outfits are giving excellent satisfaction, and the demand for them is continually increasing.

Mr. J. P. Hall, the electrical contractor, 143 Liberty street, has recently closed some large contracts for electric light plants. He manages to keep busy all the time.

The National Conduit and Manufacturing Co., Times Building, is kept busy in laying hundreds of thousands of feet of its celebrated cement-lined underground conduit, in some of the principal cities of the country. Complete satisfaction and the cement-lined pipes of this company always go hand in hand, and still the orders continue to come in.

The W. C. Vosburgh Manufacturing Co., (Ltd.), 269 State street, Brooklyn, and 114 Wabash avenue, Chicago, is running its factory on full time to keep up with the demand for special goods. This company manufactures electric and gas combination fixtures, which are celebrated all over the country for excellence of design, quality and workmanship.

The Vetter Incandescent Current Tap is taking the trade by storm on account of its convenience and usefulness in taking current from incandescent circuits for small motors and the charging of storage batteries. It is an excellent device, and the demand for it increases as it becomes better known. J. C. Vetter & Co., 104 E. 23d street, are the manufacturers of this valuable apparatus.

Vulcanized Fibre is the only article that takes the place of hard rubber for all kinds of electrical work. It is largely and very extensively used in electrical apparatus of every description. The Vulcanized Fibre Co., 10 Dey street, reports that there has been a steady demand for its goods, and the outlook is very promising.

McLeod, Ward & Co., 91 Liberty street, report having had a steady business all summer. There is an apparent increase in their business of wiring, and the demand for light and power plants is becoming more active.

Julien Scholl & Co., New York agents for the Weston engines, are receiving a goodly share of orders. Mr. F. H. Hayward, the representative of the company, is constantly alive securing orders, and sees a big demand ahead for his company's well-known engines. He is laying plans for the capture of big game this fall.

B. W. Payne & Sons, 41 Dey street, manufacturers of the well-known Payne automatic high speed engines, are satisfied with the amount of business they have had during the hard times. They anticipate a large business this fall. They have just closed a contract with Hilton, Hughes & Co., the dry goods house, corner Broadway and Ninth street, for four 150 H. P. Payne automatic high speed engines, to be connected direct to four 100 K. W. General Electric multipolar dynamos, also six 125 H. P. boilers. This will be the largest private isolated electric light plant in the United States. The plant will include 500 incandescent arc lamps and 3,000 16 c. p. incandescent lamps.

Innis & Company, 120 William street, find lots to do in supplying the trade with sal-ammoniac. Although the price of this chemical has advanced three-fourths of a cent per pound in Germany, Innis & Co., by reason of having laid in a large stock prior to the advance, are able to undersell the German dealers. The demand for sal-ammoniac, which is extensively used for fertilizing purposes, is the cause for the recent advance in price. It pays the producers better to put the ammonia into sulphate, which brings more as a fertilizer.

The Law Battery Company, 85 John street, are doing an extensive trade in their well-known batteries. The demand during the month of August was especially good, and the company reports a gradual increase in orders. They look forward to business with a good deal of enthusiasm. The signs augur well, they say.

Otis Brothers & Co., Potter Building, manufacturers of the celebrated Otis electric elevators, Otis electric pumps, hoists, etc., say that business is very good with them, and are confident as regards the future.

L. J. Wing & Co., 109 Liberty street, manufacturers of Wing disk fans and high speed engines, report a growing business, with a very satisfactory outlook for the future. As the summer is drawing to a close, they will dispose of their left-over small fan motors at half the usual price. This concern contracts and installs electric light and power plants, in which it does a large business.

The Scott Electrical Mfg. Co., 126 Liberty street, are moving along in the even tenor of their way and continue to receive a goodly number of orders for search lamps, photo-engraving lamps and theatre arc lamps with slides. They were sending to Miner's theatre a large outfit, when our representative called there last week. The Scott Company have no reason to complain of the present state of business, and the future looks bright to them.

The Clark Electric Company, 192 Broadway, manufacturers of incandescent arc lamps, dynamos, etc., do not understand how people will persist in buying shoddy lamps. Such lamps apparently give satisfaction for a short time, but they soon begin to give trouble, and finally end in total collapse. Mr. Chas. Seymour, president of the Clark Company, in passing along Broadway, pointed out some of their lamps used in a clothing store opposite the City Hall park, and said the mechanism of these lamps had not been looked at since they were first put up, nearly two years ago.

Mr. James Schawel, 29 John street, manufacturer of platinum wire for incandescent lamp manufacturers and platinum vessels, is supplying several of the large lamp manufacturers with wire. He reports a gradual increase in the consumption of wire, and is looking forward to a good business this fall.

O. C. White Company, Worcester, Mass., is doing well with its adjustable holders for incandescent lamps, and is receiving many orders for the same. This holder is especially valuable in factories, drafting rooms, etc.

Palmer Bros., Mianus, Conn., are doing a good business in telephones, dynamos and general electrical supplies and discern a better feeling in business.

The Sauquoit Silk Mfg. Co., Philadelphia and New York, manufacturers of braiding and insulating silks for all electrical purposes, especially for insulating wires, have maintained a good business right along. They manage to always keep busy with their electrical specialties.

Geo. L Colgate Co., 136 Liberty street, report a growing business. Swinging ball lightning arresters meet with a steady sale, as does the general line of goods carried by this company. The McNut incandescent lamps are meeting with much favor, and the sales of the same are increasing steadily.

W. W. Tupper & Co , 39 Cortlandt street are having a steady sale for their celebrated rocking and dumping grates. These grates are the best manufactured and give excellent satisfaction.

C.-S. flush switches made by the Cutter Electrical and Manufacturing Co., of Philadelphia, are the only goods of real merit in their line and there is a constantly growing demand for them. All first-class architects specify them.

"Premier Products" is the popular name given to the manufactures of R. M. Rodrigues, of Brooklyn, N. Y. His miniature electric railway is meeting with a large sale in anticipation of the holiday season, and his "Premier" closed circuit cell for power purposes is unsurpassed; it is meeting with a constant demand. Mr. Rodrigues reports a growing business generally.

Fulton Foundry and Machine Works, 21 Furman street, Brooklyn, N. Y., is experiencing a growing business in castings for dynamos and motors. The very best goods in this line are turned out from this establishment. It makes a specialty of models and special machinery.

W. E. Jones, 14 Water street, Brooklyn, N. Y., makes the best tools, presses, dies and special machinery. He makes the only automatic armature disk stamping machine in this country, and in proof of its value it may be stated that his competitors are copying the machine. He is receiving a large number of inquiries regarding this apparatus, and is engaged in the manufacture of some of the machines for large dynamo makers.

W. R Ostrander & Co., 204 Fulton street, is the oldest and largest house engaged in the manufacture of electrical goods, speaking tubes, whistles, bells and annunciators, etc. They report a good business and excellent prospects as regards the future.

The Belknap Motor Co., Portland, Me., manufacturers of the well-known B. C. standard dynamos and motors, illustrations of which can be seen on page ix, have recently increased their factory space in order to be able to supply the demand for their celebrated products. The new multipolar dynamo, made by this company, is meeting with an excellent demand, and the company is receiving a large number of orders for this machine. They look into the future with great hopes.

The Interior Conduit & Insulation Co., 44 Broad street, manufacturers of interior conduit and underground armored conduit, continue to receive a great many orders for these celebrated goods. So successful are they, that their competitors are doing their utmost to effect an entrance into the business, but the Interior Company is so well established that the efforts of these other concerns do not seem to make much of an impression.

The Nassau Electrical Company, 126 Liberty street, is doing more business than ever before with their popular capo-farad batteries, and reports the demand for the same increasing. This company manufactures several electrical specialties, concerning which the attention of our readers is called to the advertiisement on page v.

Morris, Tasker & Company's wrought iron poles are used by all electric railway and electric lighting companies. They are the best and cheapest made, and the company's factory is kept busy filling orders. The company's head-quarters are in Philadelphia, and its name is familiar all through the country among electrical interests.

The Garvin Machine Co., Laight and Canal streets, New York, are very busy filling orders for special tools for electrical manufacturers, and the demand is constantly increasing. In all well equipped factories Garvin tools and machines may be found, and they are always well spoken of.

Weston electrical instruments continue to maintain their reputation as standards all over the world, and the demand is increasing to such an extent that the company is contemplating the enlargement of its factory. This company's headquarters are at 114–120 William street, Newark, N. J.

The fact that Peckham trucks are seen under most all electric and cable cars in and about New York city tells a story plainer than words. These celebrated trucks are meeting with a constantly growing demand, and the Peckham Motor Truck and Wheel Co. are kept busy turning them out to keep up with the demand. The company's office is at 1006 Havemeyer Building, New York city.

The Clonbrock Steam Boiler Works, of Brooklyn, have plenty of orders to keep them busy for a long time to come for Morrin "Climax" safety water-tube boilers. Over 200 electric railway and electric light companies in the United States are using these celebrated boilers.

The Shultz Belting Co., St. Louis, Mo., and 119 Liberty street, New York city, report a good trade for their new dynamo belting. The Shultz raw hide belts are meeting with a constantly growing demand, and they have become the standard for dynamos. Mr. A. B. Laurence is the New York manager of this company.

The Consolidated Electric Storage Battery Co., 44 Broad street, is the headquarters for storage batteries, and they report that the demand is improving very perceptibly. This company's batteries are about the only ones that have survived the test of time, and when customers purchase goods of this concern they can depend upon getting what they expect.

(*To be Continued.*)

Solar Arc Lamps.—The solar arc lamp for incandescent circuits is now ready for the market. The Solar Arc Lamp Company's office is at Room 60, Stewart Building, Broadway and Chambers street, New York.

TRADE NOTES.

Phœnix Glass Company, 42 Murray street, manufacturers of electric globes, shades, etc., have no superior in their line. This house is very popular among the electric light companies and others buying this class of goods. The popularity of its representatives has been one of the main stays, and Mr. F. H. Baker, representing the company, stands very high in the esteem of its patrons. He takes great pains in showing samples, and many of the patrons depend upon him to send them all his newest designs, trusting in his taste to fill their orders.

Mr. C. S. Van Nuis, of 136 Liberty street, has just returned from an extended business trip.

The Metropolitan Electric Co., Chicago, are having considerable call for their Kester compound, station engineers finding it to be just what is needed in the preservation of the commutator and prevention of sparking.

Wallace & Sons, 29 Chambers street, city, are making a specialty of the manufacture of silver solder, which they guarantee to be unsurpassed. They carry it in stock ⅞ in. wide × .004 = No. 36 Stub's gauge thick, put up in neat boxes containing one ounce each, also in cartons containing 16 one-ounce boxes.

The Buckeye Electric Company's addition to their factory at Cleveland, Ohio, is about completed. After the first of October next this company will be able to manufacture from six to eight thousand lamps per day. Preparations are being made for a red hot campaign for business the coming season.

Electrical and Street Railway Patents.

Issued August 21, 1894.

524,706. Electric-Light Support. William H. Connell, Wilmington, Del. Filed Jan. 24, 1894.

524,707. Electric-Lamp Holder. Fay O. Farwell, Dubuque, Iowa, assignor of one-half to the Adams Company, same place. Filed Mar. 6, 1894.

524,710. Method of Producing Electrodes. Desmond G. Fitz-Gerald, London, England. Filed Nov. 7, 1893.

524,711. Printing-Telegraph. Robert A. Fowden, Philadelphia, Pa., assignor to the Fowden Printing-Telegraph Company, Trenton, N. J. Filed Dec. 22, 1893.

524,717. Safety-Switch for High-Potential Circuits. Samuel Harris, Cleveland, Ohio. Filed June 14, 1894.

524,734. Street-Car Fender. Thomas C. Rice, Worcester, Mass. Filed Nov. 18, 1893.

524,735. Sanding Device for Cars. Henry F. Rooney, Randolph, assignor of one-half to Mary Chisholm, Boston, Mass. Filed Apr. 13, 1894.

524,749. System of Electrical Distribution. George Westinghouse, Jr., Pittsburg, Pa. Filed June 16, 1890.

524,558. Electrical Railway-Signal. Lawrence Dornberger, Highland Falls, N. Y. Filed Apr. 17, 1894.

524,773. Electric-Railway Supply System. Malone Wheless, Washington, D. C. Filed July 7, 1894.

524,783. Railway-Track Sander. William G. Middleton, Atlanta, Ga. Filed Apr. 20, 1894.

524,785. Controller for Electric Cars. Marion B. Monroe, New Orleans, La. Filed Feb. 28, 1894.

524,788. Cable Railway. Nicholas D. Polites, Philadelphia, Pa. Filed Mar. 7, 1894.

524,789. Electrical Subway System. John C. Reilly, Brooklyn, N. Y. Filed May 28, 1894.

524,808. Circuit-Controller. Edward J. McEvoy, New York, N. Y. Filed July 7, 1894.

524,823. Electric-Railway Car John C. Henry, Westfield, N. J. Filed Aug. 27, 1892.

524,841. Car-Fender. James Rumrell, Boston, Mass. Filed Apr. 16, 1894.

524,843. Separator for Battery-Plates. William L. Silvey, Dayton, Ohio. Filed Feb. 12, 1894.

524,844. Electrical Testing-Switch. Henry Smith, Buffalo, N. Y. Filed Mar. 29, 1894.

524,845. Automatic Regulator for Dynamos. Henry D. Symmes, St. Catharines, Canada. Filed June 6, 1894.

524,852. Motor-Generator. John C. Henry, Westfield, N. J. Original application filed Dec. 18, 1891. Divided and this application filed Jan. 28, 1893.

524 881. Electric Heater. Tapley W. Young, Washington, D. C., assignor to David R. McKee, trustee, same place. Filed Oct. 6, 1893.

524,883. Fender for Trolley or Other Cars. Elmer Bockman and Joseph E. Hagan, Philadelphia, Pa. Filed Feb. 21, 1894

524,884. Commutator for Dynamo-Electric Machines. George F. Card, Covington, Ky., assignor to the Card Equipment Company, Mansfield, Ohio. Filed Jan. 8, 1894.

524,911. Apparatus for Transforming Continuous Electric Currents into Alternating Currents. Franz S. F. Schneider, Fulda, Germany. Filed Mar. 20, 1894.

524,918. Car-Fender. Robert Thomson, Brooklyn, N. Y., assignor of one-fourth to Joseph Norwood, same place. Filed Feb. 8, 1894.

524,925. Coin-Controlled Telephone Apparatus. Byron C. Wolverton, Elmira N. Y., assignor to the New York and Pennsylvania Telephone and Telegraph Company. Filed May 12, 1894.

524 940. Tank or Cell for Electrolytic Purposes. Francis E. Elmore and Alexander S. Elmore, Leeds, assignors to the Elmore's American and Canadian Patent Copper Depositing Company, Limited, London, England. Filed Nov. 25, 1892.

524,947. Electric Danger-Signal for Railways. Archibald B Murray, San Rafael, assignor of one-half to James W. Moyle, San Francisco, Cal. Filed Mar. 17, 1893.

524,953. Electric Meter. Carl D Babb, Kaiserslautern, Germany. Filed Jan. 18, 1894.

524,961. Street-Railway Motor. William H. H. Stineman, Hick's Mill, assignor of one-half to Edward I. Clark, Baltimore, Md. Filed Feb. 23, 1894.

524,973. Fire-Alarm System. Joel W. White, Providence, R. I., assignor of one-half to Ashbel T. Wall and George A. Wall. Filed May 28, 1894.

524,976. Electric-Railway Supply System. James F. Cummings, Detroit, Mich., assignor of one-half to Eugene M. Engelman, Milwaukee, Wis. Filed Sept. 22, 1892. Renewed Jan. 17, 1894.

524,977. Underground Conduit for Electrical Conductors. James F. Cummings, Detroit, Mich., assignor of one-half to Eugene M. Engelman, Milwaukee, Wis. Filed Jan. 17, 1893. Renewed Jan. 17, 1894.

524,980. Electric Wire Coupling. Charles K. Hall and William B. Lillard, New Orleans, La., said Lillard assignor to said Hall. Filed Dec. 8, 1893.

524,981. Electric-Arc Lamp. Rudolf H. Jahr, Opladen, Germany, assignor of one-half to Carl Ferdinand Schoeller, same place. Filed Apr. 19, 1894.

524,983. Apparatus for Supplying Electricity for Light and Power Purposes. Milton M. Kohn, Chicago, Ill., assignor to himself and Siegfried M. Fischer, same place. Filed Sept. 24, 1891. Renewed Feb. 17, 1894.

ELECTRICAL AGE

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NEW YORK, SEPTEMBER 8, 1894.

CONTENTS.

THE ATLANTA CONVENTION.

In less than six weeks from this time the convention of the American Street Railway Association will be held in Atlanta, Ga., and already active preparations for the event are beginning to manifest themselves. Two enterprising railroads announce that they will run special trains from New York, and in the trade we hear some preliminary talk. From all indications it will be a very successful meeting. The revival of business will no doubt encourage many to put forth extraordinary efforts to make the convention a success. The exhibition of supplies, which is always a prominent feature at these meetings, promises to be larger than ever, and we trust that the gathering in every respect will be a boundless success.

NEW YORK AS A CABLE TERMINUS.

During the present week New York received a distinction that it never before enjoyed—it was made the western terminus of an Atlantic cable. It will be possible now to work direct from New York to Ireland and England, through a submarine cable the entire distance, although, we understand, this will not be the regular practice. Regular business will be relayed once on this side after leaving New York, at Canso, N. S.

FIRE FROM INCANDESCENT LAMPS.

Some interesting experiments were made in St. Louis recently to ascertain the conditions under which an incandescent lamp would ignite materials of an inflammable nature, with which it might come in contact. These tests were the outcome of a fire in that city, which, it was alleged, was started by an incandescent lamp lying against two wooden poles. Some doubts existed as to the possibility of such an occurrence, and it was for the purpose of proving or disproving the truth of the claim that the experiments were conducted. The results of these tests were reported to the chief engineer of the St. Louis fire department, who read the report at the recent convention in Montreal, of the Association of Fire Engineers. This report is interesting, and we reproduce it on another page in this issue. It shows that it is possible under certain conditions to start a fire by contact with bulbs of lighted incandescent lamps. On general principles it is dangerous to place a body having a continuously maintained high temperature against another that is of an inflammable nature, whether the heated body be an incandescent lamp or a piece of iron. In the case of a lamp the danger is liable to be underestimated or entirely disregarded, for the reason that it is usually looked upon as giving light without a flame, in contradistinction to a gas jet. Its heating properties are not considered and it is right at this point where the danger lies, and the mistake is made. Heat is really more dangerous than flame; if continued a sufficient length of time it will ignite materials that a flame would not; its action is not always so rapid as that of flame, but it can do infinitely more damage if not properly watched and controlled. Fortunately, however, the practice of allowing lamp bulbs to come in contact with materials or fabrics is not a common one. The extreme portability of the electric lamp renders it possible to use it for purposes that would be impossible with gas or other form of light, and under such circumstances, in careless hands, it may become a source of danger, as is proved by the report referred to. It is well to know all these things, and the Firemen's Association did a good thing when it brought this matter to the attention of the public. It must be borne in mind, however, that this is not a "new danger" in electric lighting. The fault is not with the electric lamp, or the electricity that produces the light; it is with the one who is careless in handling it.

SOME ADVANTAGES OF ALTERNATE CURRENTS.*

BY PROF. SILVANUS P. THOMPSON, D. SC., F. R. S.

At the Electrical Congress of Chicago, in the debate on a paper by Mr. Scott of the Westinghouse Company on polyphase systems, the writer expressed the opinion that while a polyphase system was adapted to the case of the transmission of power from a single generator to a single motor, in the generality of cases in which the power was to be not only transmitted, but distributed to a number of motors at independent points, greater simplicity of the simple alternating current would render it preferable now that self starting motors were in the market. Bearing, however, in mind the advantages to be derived in the possibility of using two and three-phase motors, the author gave considerable thought during the winter to the problem of transformation, and particularly to the question whether it might not be possible to transform alternating currents from two phase to three-phase, or from either of those to single-phase, or *vice versa.* No mode of doing this was known save by the combination of motor generators as running machines. As one result of his cogitations, he found that such transformation might very readily be effected by stationary transformers, or in the least easy case by stationary transformers with a revolving iron core. The simplest case—that of transforming three-phase currents into two-phase (or *vice versa*)—involved no moving parts being effected by using a ring coil (or its magnetic equivalent) with connection made appropriately. For example : If a Gramme ring is connected, as shown in fig. 1, to a two-phase system with 100 volts between A, A, and 100 volts in quadration between B, B, a three-phase set of alternate currents may be taken off from the same winding at three equidistant points, P, Q. R, at pressure of 66 volts between each of the three wires. The magnetic field across the coil revolves, and it is preferable to provide a laminated core to complete the magnetic circuit. Such a core may be stationary, or may revolve. A simple ring transformed like the above (without revolving coil) was shown by the author at his lecture on the transformations of electric currents, at the Royal Institution on February 23, 1894. It is of some interest to note that on March 7 Mr. Scott read an elaborate paper to the American Institution of Electrical Engineers, in which he gave an independent solution to the very same problem, using two sets of winding (instead of one) but working out in detail many possible applications. It is no exaggeration to say that an electrical engineer starting, let us say, with three-phase alternate currents as the method of supply, is in a position to furnish any customer who may desire either two-phase currents or single-phase currents with what he desires, by merely putting in a small appropriately connected transformer. Another advantage, about which even electrical engineers are as yet almost wholly unenlightened, arises in the application of alternate currents to electromagnets. Great as have been the services of electromagnets as used with continuous currents since their invention in 1825, they are destined to fulfil wider services than ever in the practical problems of an electro-mechanical nature now that their properties, when supplied with alternate currents, are becoming known. In 1887, Prof. Elihu Thomson discovered a number of singular properties of alternate-current magnets in producing repulsion of copper disks and rotation of cylinders and balls by reason of the eddy currents induced in them. During the past winter the author has been studying the design, construction, and properties of alternate-current magnets, and recently, in conjunction with his assistant, Mr. Miles Walker, read a paper on the subject before the Physical Society of London. A few words on this topic will emphasize the advantages offered by alternate currents in this application. It has long been known that the magnetic forces of a magnet fall off very rapidly at small distances from their poles. For steel magnets in those cases in which the poles can be considered as points, the force falls off inversely as the square of the distance, other things being equal. In the case of soft iron electromagnets operated by continuous currents, the pull on their armature falls off much more rapidly than this. The forces when in contact may be relatively enormous, and yet the magnet may have no range of attraction worthy of mention. A pull of 150 lbs. in contact may dwindle to a few ounces at a distance of a couple of inches. But with alternate currents supplied at constant voltage from the mains, the author finds all this to be different. With a properly-designed and well-constructed electromagnet, the pull on its armature can be kept fairly

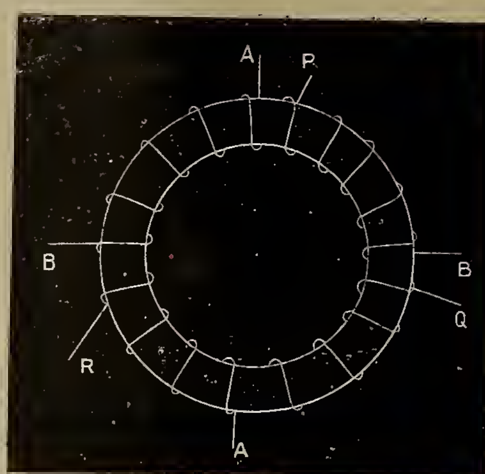


FIG. 1.

constant over a considerable range—nay, in some cases can be caused to be greater at a distance than when near. For example, the author has lately had an alternate-current magnet constructed for him by Mr. Walker, the pull of which, when excited at 50 volts, was 8 oz., when the armature was closely in contact with the core, but which exercised a pull of 32 oz. when the space between them was 3 in. This obviously introduces into electric mechanism a new element hitherto undreamed of.

The secret of these things is that in the case of alternate-current electromagnets, the self-induction reaction of the system, and not the mere electric resistance of the wires, is that which governs the flow of current, whereas Ohm's well-known law for continuous current is

$$\text{Current} = \frac{\text{Electromotive force}}{\text{Resistance}}, \text{ or } C = \frac{E}{R},$$

The rule that governs the alternate current in these cases is different, being

$$\text{Current} = \frac{\text{Electromotive force}}{\text{Reactance}}, \text{ or } C = \frac{E}{pL},$$

where p is the pulsation of the alternate current—*i. e.*, the number of radians per second in the revolutions of the circle of reference—and L the inductance.

As the armature of the alternate-current magnet is withdrawn from the core, the reactance diminishes and more current flows, making the pull greater at a distance instead of less.

Another curious point about alternate-current magnets relates to their winding. In the case of electromagnets supplied with continuous currents, it is well known that the more turns of wire that are wound on

* Abstract of paper read before the British Association at Oxford.

the core the more powerfully is it magnetized. But with alternate-current magnets this is not so. There is one particular number of windings for each magnet (generally a small number) for which the magnetism is a maximum, and any additional wire wound on above this number diminishes instead of increasing magnetic power.

Returning from this digression respecting magnets to the general question of the supply of alternate currents, the author has finally to point out one further set of advantages hitherto both neglected and unknown in this country, though known to a few and actually in use in the United States.

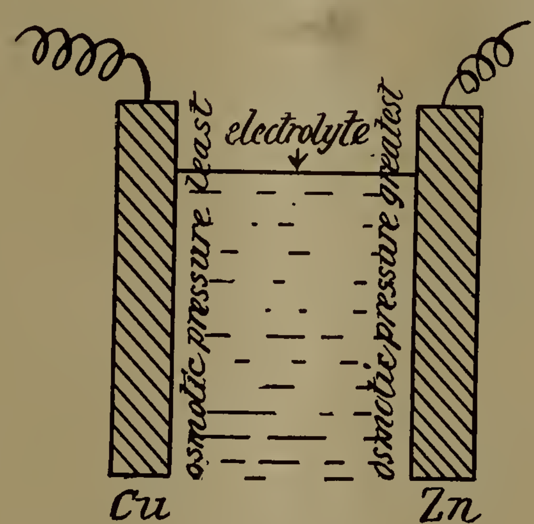
(*To be Continued.*)

THE GREATEST OF MODERN PROBLEMS.

BY NEWTON HARRISON, E. E.

The problem of mankind—the economical production of energy—has been attacked on all sides by some of our most eminent scientists. It is openly confessed that some other method than the mere combustion of a fuel is necessary in order to obtain a greater percentage of its stored energy.

Osmose—hitherto a superficially treated subject—is a rich field for the investigator. The pressure set up by a body when dissolving in a liquid, or a solution when mixing with water, may assume an enormous value.



THEORY OF THE DANIELL CELL.

Common sea water acts with a pressure of 300 pounds per square inch in its tendency to mix with pure water. It is the substance in solution that causes this pressure and is true for all dissolved substances.

The resolution of the theory of the primary cell to such a basis, places us on a more substantial footing than ever before. Dr. Ostwald shows the parallel relationship existing between osmotic and electrical pressure. In other words, to obtain great E. M. F. from a cell we must select two materials as elements with the greatest difference of osmotic pressures.

As Dr. Ostwald states,* "The zinc and copper of the Daniell cell are two such sources of current of different potential and the difference of their electrical pressure is based on the difference of osmotic pressure with which the zinc ions and copper ions are respectively endowed." A factor that will affect these conditions is the electrolyte. An electrolyte must be chosen whose reactive effect when charged with zinc ions will be least, while for the other electrode it will be greatest. By this means we are best prepared to make the most efficient combination with the elements at our command.

In this introduction to the subject of coal consumption, the inefficiency of a steam plant, the loss of 90 per cent. of the energy of the fuel is due to the difference in temperature between the fire and boiler.

Upon presenting this fact to our recollection, Dr. Ostwald points out a method for obtaining the chemical energy of the coal without heat. He shows that the application of an acid to the zinc in a zinc and platinum cell is not productive of the greatest E. M. F. The greatest electrical effect is produced by the acid being applied to the passive electrode.

From this principle he contemplates the possibility of oxidizing coal, not by the oxygen in direct contact with the coal, but by the interposition of an unconsumable electrolyte. By this unexpected means, the entire chemical energy of coal may be utilized, and in a manner so subtile and refined that no visible sign will appear of such an intense action.

The searchers after gold—the plodders of an early age—have been succeeded by more apt investigators—animated by a loftier purpose; they seek not to make gold, but to save it.

* The Engineering Magazine, August, 1894.

DO INCANDESCENT LAMPS START FIRES?

At the convention of the National Association of Fire Engineers which was held in Montreal, August 14, last, chief John Lindsay, of the St. Louis fire department, referred to a fire in that city which was supposed to have been started by an incandescent lamp lying against a couple of wooden poles. "The question was," said he, "did the lamps set fire to the poles? It did not seem that they did, but after the investigation we made experiments by bringing incandescent lamps in contact with paper and wood, and other fabrics, and we found that in a short time it ignited. I have a report of experiments made by our Mr. O'Reilly in that connection. I will read it:

'ST. LOUIS, AUG. 9, 1894.

JOHN LINDSAY, ESQ., Chief of Fire Department.

DEAR SIR: In compliance with your request I made fourteen experiments to ascertain under what conditions an incandescent lamp will set fire to inflammable material which it may come in contact with. I found in several cases where the material was in a vertical position and the lighted lamp simply resting against it, the following results: White pine, spot one inch in diameter, discolored to light brown after four hours. Varnished oak, well seasoned, the varnish became blistered in three minutes and blackened in fifteen minutes. The wood had the appearance of being charred at and near point of contact, but was not ignited. Pine board (dry white pine) in forty minutes began to smoke, but at this juncture lamp film burned out, terminating the experiment. Lamp incased in muslin, two thicknesses, in one minute commenced to scorch, in three minutes gave off considerable smoke, and at end of six minutes when the muslin bag was removed from the lamp and fresh air reached its interior, it burned into a flame. Where a lamp was laid on inflammable material the effect seemed to be more rapid, being probably due to the additional pressure on account of the weight of lamp. A newspaper was carbonized in three minutes and ignited in forty-five minutes, by laying a lighted incandescent lamp on it.

Sixteen C. P. 100 volt and 16 C. P, 50 volt lamps were used. Old lamps are more apt to start a fire than new ones.

I will give you further information on this subject as additional experiments are made.

Very respectfuliy,

(Signed) A. J. O'REILLY,

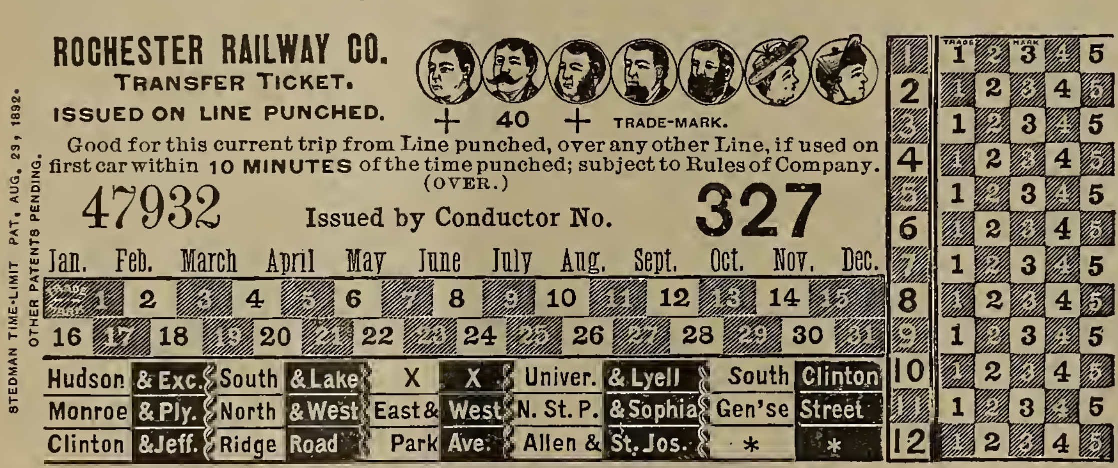
Supervisor of City Lighting.'

"We have had some half dozen fires from this cause," continued Mr. Lindsay, "and, until recently, they were classed among the unknown. These experiments satisfied us that the fire originated from the incandescent lamp in coming into contact with the material as described."

IDENTIFICATION TRANSFER TICKET.

The propensity of a large portion of human nature to get something for nothing crops out in every line of activity. It shows itself in many forms, and the result is that one part of the community is compelled to adopt protective measures against the schemes and depredations of the other part.

In the transfer system, now in general use on street railways throughout the country, there is opportunity for the practice of dishonesty by holders of transfer tickets. The main idea in giving a transfer ticket is, of course, that the person paying the original fare, and no other, shall be entitled to ride on the ticket. Right at this point, however, the chance for fraud and dishonesty appears, and it is not always that the receiver of the ticket uses it himself, but some one else gets the benefit of the ride which, of course, practically entails a loss to the railroad company.



IDENTIFICATION TRANSFER TICKET.

Many ingenious devices have been produced with the object of avoiding the illegitimate use of transfer tickets, and one of the best we have seen is that illustrated herewith.

In this form, the ticket is provided with a means of identifying the person to whom the ticket is issued. There is delineated on the margin a series of seven faces representing the general hirsute characteristics of male passengers and the head covering of females. The object of this is that when a passenger receives a transfer ticket the conductor in issuing it punches the face on the margin as nearly as possible corresponding in appearance with that of the person receiving the ticket—that is, as far as males are concerned. In the case of females, the hat and the bonnet are the only distinguishing means of identification. Closer identity can, however, be established by punching one of the arbitrary signs "+ 40 +" which characters represent "young," "middle age" and "old" respectively. On receiving such ticket the conductor compares the face of the passenger with the one punched on the ticket for evidence that the ticket has not been improperly used.

It is stated that the moral influence of such a ticket is powerful, and that it enforces honesty to a great degree. The punching of the ticket is not intended to be carried on continually; intermittent use has been found to work satisfactorily. Its special function is exercised usually during the noon hour, when most frauds are practiced.

The checker-board arrangement of time-table and days is designed to insure greater accuracy in punching, by making each number more conspicuous. The "A. M." and "P. M." are distinguished by punching the light or dark portion of the name in the "destination" block.

This ticket, which is the invention of Mr. J. H. Stedman, of Rochester, N. Y., is used on a large number of the street railways throughout the country.

TAXATION.

Below we give a copy of a communication from Mr. Allen R. Foote to the *Journal of Commerce and Commercial Bulletin* of this city, which appeared in the issue of August 27 last. It contains a suggestion to the constitutional convention now being held in Albany, on the subject of taxation, and shows the importance of the question to the industrial, commercial and financial interests of this state.

Editor "Journal of Commerce and Commercial Bulletin:"

The power of an unjust system of taxation to drive business out of a city or state, or of more favorable conditions to attract business to a state, is illustrated by the well defined tendency of corporations to evade the laws of the State of New York and to take advantage of the laws of the State of New Jersey.

I have given much thought to the tax systems of several states, and therefore regard with great interest the work of the Constitutional Convention on this subject. The revision of the constitution affords the citizens of New York an opportunity to base their tax system on sound economic principles, which will assure the state and the commercial centre of the nation a position of commanding advantage in the world-wide competition for commercial supremacy. Full advantage should be taken of this opportunity, not only for the direct benefit of the citizens of the state, but also to furnish an example for other states whose citizens rightly look to New York for guidance in sound industrial, commercial and financial policies.

After spending several weeks in studying the proposals made and debates upon the questions of taxation and public service corporations as they have been developed before the convention, I have suggested to several members of the convention the following article to be incorporated in the new constitution on the subject of taxation:

Section 1. All taxes shall be assessed on property. All property shall be assessed for taxation at its full value in current funds, and shall be entered on the assessment list in the tax district in which it is located, in the name of the owner, manager, agent or person having the property in charge.

Section 2. The rate per cent. of the tax levy on valuation for any tax shall be uniform for all classes of property within the same tax district, so that all property shall be taxed equally. This section shall not prohibit the assessment and levy of special taxes for special benefits from public improvements.

Section 3. Tax bills shall be a lien upon property and may be sold as provided by law.

Section 4. Property shall not be taxed in any way other than as provided in this article, except for special benefits from public improvements. Tax assessments shall be made but once in the same year. Charges shall not be made by state, municipal or other authorities intrusted with the exercise of the power of taxation in any manner, except a property tax, for the right or privilege of engaging in any industry or business unless it be for the purpose of regulation to protect the morals or the health of the people.

Section 5. Evidences of ownership. indebtedness or credits not being property shall not be taxed, but the payment of a tax bill by the person in whose name it is made shall be a payment upon any mortgage, deed of trust, contract or other form of evidence by which a debt or a credit is secured, for the same proportionate amount of the tax bill as such security bears to the assessed value of the property affected by it.

Section 6. The Legislature may exempt the whole of any class of property from taxation, but it shall not make any partial exemption by authorizing a decrease of the rate per cent of a tax levy for one or more classes of property less than the unexempted whole, or for a part of a class, nor shall it exempt a part of the property of any class.

Section 7. Bills for taxes shall be made in the name of the owner, manager, agent or person having the property in charge, as entered on the assessment list, and the payment of the same shall be a legal payment for the full amount of the tax bill of any debt or obligation of any kind due from such person to the true owner of the property upon which the assessment was made.

A measure of this importance demands most careful consideration. Judging from what I find before the convention on this subject, I believe a measure of this character will be most willingly adopted. especially if the constituents of each member lose no time in impressing him with the desirability that such action shall be taken.

As my interest in the question is purely that of an economist, I shall be very glad to have any person send me any suggestion intended to make this measure more just, accurate in purpose, or less complicated.

Allen R. Foote.

24 Dove street, Albany, N. Y., Aug. 24, 1894.

ATLANTIC CABLE DIRECT FROM NEW YORK.

The Commercial Cable Company's repair steamer Mackay-Bennett arrived at New York harbor on the morning of August 28, to lay a section of cable from this city to Coney Island, thus giving a direct cable connection between this city and Ireland. The new stretch of cable will save one retransmission of business between here and England, and consequently some valuable time.

The cable station in this city will be located somewhere in the vicinity of Pier A, North River. The section of cable is 14 miles in length. It is two inches in diameter and has four conductors.

The cable was laid during the latter part of the week in the channel from the Narrows up to the city. This location was selected as offering the least danger of injury from anchors of vessels.

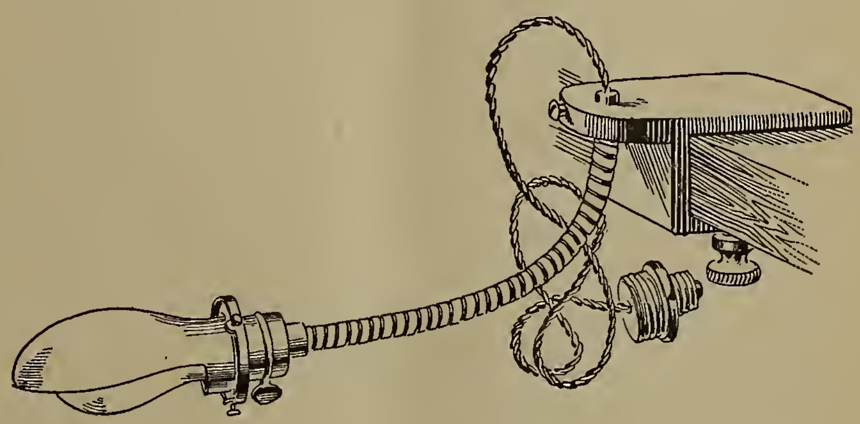
Where the Rain Goes.—A correspondent of the New York *Sun* has evolved a theory to account for the lack of rain in the eastern section of the country in late years He thinks the large number of dynamos in operation sap the electricity from the air, and this is the cause of the droughts. If it could be arranged, he says, to stop all the dynamos at the same time for a short period rain would be the result.

Continuous vs. Alternating Currents.—Prof. Silvanus P. Thompson is authority for the statement that it is now established that the danger to life, for equal voltages, is greater with continuous currents than with alternating, as their destructive action on the tissues is greater.

HANDY DESK LAMP.

The illustration given herewith shows specialty No. 26, of A. A. McCreary, the well-known manufacturer of electrical specialties, at 136 Liberty street, New York City. It is a desk lamp with a flexible arm and half shade, and is designed for the desk, table, typewriter table, etc., etc. It is portable, and can be attached to pigeon-hole partitions, sliding shelves, or other convenient places. When used on roll-top desks the flexible cord is passed into the interior through the letter hole at the side. This avoids the necessity of having to remove the lamp in closing the desk. It forms an excellent reading lamp, and by means of the flexible arm can be set in any position desired. The shade can be moved so as to throw the light where needed.

The clamp and the flexible tube used in this outfit



M'CREARY DESK LAMP.

constitute its most important features. They render the lamp applicable anywhere, where a grip for the clamp can be found.

The illustration shows a lamp attached to a pigeonhole partition of a desk.

These lamps can be made to order with any length of flexible tube, the standard length being nine inches.

THE HEATING POWER OF SMOKE.*

BY R. R. TATLOCK.

It appears to be generally understood that a large percentage of fuel is lost in the smoke which issues so abundantly from most chimneys, and random statements have been made to the effect that the loss in heating-power due to this passing away of combustible matters in smoky furnace gases may reach as high as 30% of the whole. A little consideration, however, will show that the loss of any large percentage of combustible matter, and consequently of heating-power, is quite out of the question. This may be proved in two ways—(1) by calculation of the two sources of heating-power as shown by an analysis of coal or dross used for steam-raising; and (2) by actual analysis of the furnace gases for combustible solids and gases.

In the following paper are given the results of these two methods of observation, the same dross being analyzed and also employed as fuel in a works furnace, from which smoky gases were given off which were tested for combustible matters.

1. The following is the analysis of the dross employed :

	Per cent
Gas, tar, etc	37.63
Fixed carbon	49.97
Sulphur	0.40
Ash	2.72
Water	9.28
	100.00

* *The Chemical News.*

Heating-power (practical) due to gas, tar, etc...	1.16
" " " " fixed carbon...	6.49
	7.65

The points to be observed are the relative proportions of heating power (represented in the analysis by the number of pounds of water at 212° F. capable of being evaporated to dryness by 1 lb. of the fuel) given out respectively by the combustion of gas, tar, etc., and by the fixed carbon. These are calculated according to Playfair's well-known formula, which was practically tested on coals intended for the British Navy, and which shows that while 1 lb. of fixed carbon is capable when burned of evaporating 13 lbs. of water at 212° F. to dryness, 1 lb. of the gas, tar, etc., will only evaporate 3.1 lbs. From these figures it appears that in the coal or dross the gas, tar, etc., only contribute 15% of the total heat given out during the combustion, and that the fixed carbon produces the remainder, or 85%. In coals with less of the former ingredients and more of the latter, which is commonly the case, the proportion given out by the volatile constituents would be considerably reduced. It is thus perfectly clear that even though the whole of the volatile matters (which can alone be accountable for any loss of combustible material) escaped combustion, there could not possibly be a greater loss of heat than 15% of the whole, even in such an extreme case as this represents.

2. An analysis was made of the furnace gases given off during the burning of the dross, of which the results are given above, with the following results:

	Gases very smoky Per cent. by volume.	Gases almost free from smoke. Per cent. by volume.
Carbonic acid	5.0	3.5
" oxide	none	none
Hydrocarbons	trace	none
Nitrogen	79.9	79.9
Oxygen	15.1	16.6
	100.00	100.00

It has been asserted that carbonic oxide is given off in considerable quantity when much smoke is being produced, but it does not appear in this case; and Hempel, in his work on "Gas Analysis," comes to the conclusion that little or no combustible gases are present in furnace gases. He says: "Furnace gases usually contain only carbon dioxide, oxygen and nitrogen. All other gases are present in but very small amounts. In oft-repeated analyses the author has always found only traces of carbon monoxide, methane and the heavy hydrocarbons." This is in complete accord with the analyses given above, and it may be taken for granted that the presence of carbonic oxide or other combustible gases in furnace gases is a most unusual occurrence. This is quite conclusive evidence that no appreciable loss of heat, even when the furnace gases are smoky, can be attributed to the passing away of the products of imperfect combustion in the gaseous form at least.

That there is loss of combustible matter in the smoke is an undoubted fact, but the quantity seems also to be greatly magnified in certain random statements. In the experiment referred to above, the soot was also collected during one hour and a half with the following results:

	Grains per 100 cu. ft. of furnace gases.
Carbonaceous matter	30.81
Ash or mineral matter	20.65
Total soot	51.46

It will be observed that the soot collected consisted largely of mineral or incombustible matter. In several experiments to estimate the soot in furnace gases similar results to those were obtained, and the average would come very close to the quoted results of this special test.

To find how much carbonaceous matter was actually lost as smoke, it will be necessary to know the number of cubic feet of furnace gases given off by the combustion of, say, one ton of the dross. If the percentage of carbonic acid in the furnace gases is taken at five per cent., the total volume of these given off from one ton of dross would be about 940,000 cu. ft. measured at the ordinary temperature and pressure, and this would contain 41 lbs. of carbonaceous matter and 27 lbs. of mineral matter. This would represent 1.83 per cent. of the volatile matter (gas, tar, etc.), given in the analysis of the dross: and if from this is now calculated the heating power according to Playfair's formula, it will only come to 0.057. This figure, compared with the practical heating power (7.65) of the dross, goes to show that the solid combustible matter of the smoke can only account for the very small percentage of 0.74 of the total heating power which can be obtained from the coal.

From the results of these experiments it is evident that the loss of combustible matters in smoke is very small indeed, and that the belief in immense loss by this cause is simply a fallacy, and it is decidedly not corroborated by experiment. In adopting methods of removing the smoke nuisance, it must therefore be borne in mind that there is little or no gain in burning smoke, and that other methods of dealing with the problem, such as Dulier's smoke absorption process, ought also to receive consideration.

PRINCIPLES OF DYNAMO DESIGN.

BY NEWTON HARRISON, E. E.

(*Continued from Page 116.*)

Any wire containing a current is surrounded by magnetic whirls. The greater the length of the wire the greater will be the collective effect of the whirls.

By bending the wire into a loop, the issuing magnetic force is centered in the middle of the coil.

It is evident that the greater the diameter of such a coil the greater will be the number of lines of force it will produce, while a corresponding increase in potential will be necessary to send the same current over the greater length of wire.

The effect at the *center* of an ampere—turn, no matter of what diameter, is always the same. Place a piece of iron in such a series of unequally sized loops, however, and the magnetic fields resulting will possess unequal numbers of lines of force.

If the same current passes through all the coils, the number of lines of force produced by each respectively will be in proportion to their circumferential lengths.

In other words, if the magnetic effect of a length of wire of 1″ be called 10 when one ampere passes, the magnetic effect of 2″ with the same current, would be doubled, or 20

If the magnetic effect of a wire in which a known current passes is proportional to its length, then, instead of considering the length, we need only consider the number of turns which surround an iron core and thus measure the magnetic force.

MAGNETO-MOTIVE FORCE.

The similarity in many respects of the physical relation existing between the lines of force and other important quantities in a magnetic circuit are such that an expression like Ohm's law has been used as a means of representing this relationship.

$$\text{Lines of Force} = \frac{\text{Magneto-Motive Force}}{\text{Reluctance}} \qquad B = \frac{M.\ M.\ F.}{R}$$

Generally speaking, by magneto-motive force is meant that force by whose immediate means the lines of force spring into existence.

The symbolic representation of all the quantities involved in the production of lines of force is of a simple nature.

$n\,c$ = ampere turns
μ = permeability
q = cross section
e = length
B = lines of force

$$B = \frac{4\,\pi\,n\,c\,\mu\,q}{10\,l}$$

It is of course to be understood that the quantity μ, though of a changing value for magnetic substances, is of a fixed value for air.

The standard of comparison being air, the value of μ in such calculations is 1.

The formula, arranged as the above, would assume the form $B = \dfrac{\frac{4\,\pi}{10}\,n\,c}{\left(\frac{l}{\mu\,q}\right)}$ in which $\frac{4}{10}\pi\,n\,c$ is the value of the *M. M. F.*, and $\frac{l}{\mu\,q}$ the reluctance; $\frac{4\,\pi}{10}$ can be called 1.257 for ease in calculations, then only the permeability and the geometrical dimensions of the iron must be determined to find ampere turns.

The reluctance of any magnetic body is determined by its geometrical proportions and its permeability.

The reluctance *decreases* as the permeability increases, or as the cross section increases; it *increases* as the length increases.

The reluctance of air is enormous as compared to iron. The lines of force resulting from the application of ampere turns to air and iron are about in the proportion of 1:1000 for equal volumes at low inductions.

Spec. Induct.	N. C. for Iron.	Air.	Ratio.
16000	45	5120	113
15000	26	4600	177
14000	16	4480	280
13000	13	4160	347
12000	8	3890	480
11000	6	3520	586
10000	5	3200	640
9000	4	2880	720

Quite a celebrated writer and authority on this subject remarks: "The continuous flow of magnetism through a piece of iron does not produce heat and does not absorb energy; and it is on account of this property of the magnetic circuit that some scientists have suggested to discard the term "magnetic resistance." As a result of this and other formidable criticisms by able authorities, the term "reluctance" as given above has greatly displaced the other more doubtful expression.

In the formula

$$B = \frac{M.\ M.\ F.}{R}$$

we have by transposition

$$R = \frac{M.\ M.\ F.}{B}$$

By the above formula a comparative table can be drawn up, showing the reluctance of the iron for different permeabilities, in the C. G. S. system and the English measure.

The permeability is a coefficient of magnetic conductivity, changeable by heat or cold; and assumes for each sample of wire or steel a different initial value.

Magnetic Reluctance in C. G. S units magneto-motive force — total magnetic flux.		Magnetic Reluctance in inch units—ampere turns—the total magnetic flux. Slab—1-inch thick.	
Reluctance.	Permeance.	Reluctance.	Permeance.
0.2461	4.068	0.0771	12.968
0.3404	2.938	0.1066	9.377
0.4084	2.449	0.1280	7.815
0.4628	2.161	0.1450	6.897
0.5084	1.967	0.1593	6.278
0.5470	1.825	0.1717	5.825
0.6140	1.629	0.1924	5.198
0.6681	1.497	0.2093	4.777
0.7144	1.400	0.2238	4.571
0.7550	1.324	0.2365	4.228
0.7903	1.265	0.2476	4.039
0.8220	1.217	0.2575	3.883
0.8511	1.202	0.2667	3.750
1.0500	0.952	0.3290	3.040
1.1710	0.854	0.3669	2.726
1.2624	0.792	0.3955	2.528
1.3250	0 755	0.4151	2.409

The coercive force of a magnetizable metal determines its ability to hold its residual magnetism after the magnetizing force has been removed.

The retentivity of wrought iron is greater than steel while its coercive force is less. The magnetic induction in a sample of steel and wrought iron will be greater in the wrought iron when the *M. M. F.* is removed, due to its retentivity being greater; but if both samples be then jarred and shaken, the superior coercive force of the steel will enable it to retain a higher magnetic induction than the wrought iron. The permeability of iron in general is very high. Wrought iron of the soft annealed kind has the greatest permeability of any known metal. Following this comes the mild steel product which affects a compromise between cast iron and wrought iron, then following in succession come the alloys.

If a sample of steel be produced containing a very small proportion of carbon a commercial article superior to wrought iron would result.

Cast iron possesses magnetic proportions that are but little more than one-half those of wrought iron.

Its permeability is of a more changeable nature than in either steel or wrought iron, and the least impurities makes its magnetic value a question of great uncertainty.

Different grades of iron are valuable in proportion to their permeable qualities.

(*To be Continued.*)

HOW TO MANAGE DYNAMOS AND MOTORS.

Everyone having charge of a dynamo or motor should know how to manage these machines properly. Trouble is liable to occur at any time, and to be able to determine the cause by the symptoms and how to apply the remedy is a knowledge that every operator should possess. The book entitled "Practical Management of Dynamos and Motors," and written by the well-known electrical authorities, Prof. F. B. Crocker and Dr. S. S. Wheeler, gives plain directions for the management of these machines. It costs but $1.00 a copy, and can be purchased at the office of THE ELECTRICAL AGE, New York.

TELEGRAPHIC COMMUNICATION BY INDUCTION BY MEANS OF COILS.*

BY CHARLES A. STEVENSON.

In 1892, I suggested that communication could be established between ship and ship by means of coils, and as a trial of the system on a large scale has recently been made with the view of establishing communications between North Unst lighthouse, situated on Muckle Flugga and the mainland, thence to the lighthouse station at Burrafiord, a distance of two miles, a record of the trials may be of interest to the society.

The induction of one spiral on another has been long known, but with a very strong battery current it has been found impossible to bridge a greater distance than 100 yards, so that as a means of practical communication it was impossible. It has also been long known that communication could be established by means of parallel wires, and disturbances in wires no less than ten miles apart had been detected. For many years this system has been under discussion, and only last month a series of elaborate experiments at Loch Ness has been made by Mr. Preece on this parallel wire system on the most approved methods; but I trust to be able to show that the parallel wire system ‡ must give place to the method of communicating by coils.

It is evident that if two coils are placed so that their axes are coincident, their planes being parallel, or if they be placed so that their planes are in the same plane, they will be in good positions to expect electric currents sent in one to be apparent by induction in the other. For a given diameter, and where the electrical energy is small and the number of turns small, the first position is best, but where the energy is great and the number of turns great—in fact, when it is wished to carry the induction to many times the diameter of the coils—then it will be found that it is better to let the two coils be in the same plane, as, when the axes are coincident and the coils a great distance apart in comparison with the diameter, the difference of distance from one side of the coil, say top of primary coil to top and bottom of secondary, becomes almost a vanishing quantity; whereas, when the coils are lying on their side in the same plane. the difference of distance from back of primary to back of secondary, and from front of primary to front of secondary, does not fall off so fast, and consequently is more efficacious. Besides, it becomes impracticable to erect coils of large diameter with their planes vertical, but it is easy to lay them on their sides. It is almost impracticable to introduce a core in these large coils, although the effect would thereby be intensified, and where compactness is necessary a core is advantageous. A number of experiments were made in the laboratory to discover the laws of the action of coils on each other, with a view of calculating the number of wires, the diameter of coils, the number of amperes, and the resistance of the coils that would be necessary to communicate with Muckle Flugga, and, after a careful investigation, it was evident that the gap of 800 yards could, with certainty, be bridged by a current of one ampere with coils of nine turns of No. 8 iron wire in each coil, the coils being 200 yards in diameter.

Two coils, about 850 yards centre to centre, were erected at Murrayfield, one coil being on the farm of Damhead, and the other on the farm of Saughton, and as nearly as was possible on a similar scale, and the coils of similar shape,† as was wished at Muckle Flugga.

On erecting the coils, communication was found impossible, owing to the induction currents from the lines from Edinburgh to Glasgow, the messages in these lines being quite easily read, although the coils were entirely insulated and were not earthed. The phonopore which the North British Railway Company have on their lines kept up a nearly constant musical sound, which entirely prevented observations. On getting the phonopore stopped, it was found that 100 dry cells, with 1.2 ohms resistance each and 1.4 volts, gave good results, the observations being read with great ease in the secondary by means of two telephones. The cells were reduced in number to 15, and messages could still easily be sent, the resistance of the primary being 24 ohms, and the secondary no less than 260 ohms. If the circuit had been of good iron, with soldered joints, and well earthed, the resistance should have been only 60 ohms. The induced current therefore generated in the secondary would therefore be in the ratio of 480 to 210, or with this great resistance, allowing for the resistance in the two telephones in multiple, we got practically only half the current we would have got if the line had been a permanent in place of a temporary one.

A trial was made of the parallel wire system, and with 20 cells the sound was not heard, and with 100 cells it was heard by me as a mere scratch in comparison with the sound with the coil system with 15 cells. A trial was made with a phonopore, and the coils worked with 10 cells with perfect ease, and a message was received with only five cells Speech by means of Deckert's transmitter was just possible, but it is believed that if the hearing circuit had been of less resistance it would have been easy to hear.

It is difficult to understand how this system of coils, in opposition to the parallel wire system, has not been recognized as the best For, assume that with the arrangements we had, we heard equally well with 100 cells by both systems, both having the same base (200 yards), then by simply doubling the number of turns of wire, and using thick wire of low resistance, the effect would have been practically doubled, whereas, by the parallel wire system, there is nothing for it but to increase the battery power, which, for practical working, becomes an impossibility. The difficulty of the current is thus removed by using a number of turns of wire. The secret of success is to apportion the resistance of primary and secondary and the number of turns on each to a practical battery power.

Coil System.—(1) At 850 yards from centre to centre of coils averaging each 200 yards diameter, it was found that, with a phonopore, messages were sent with five dry cells. The resistance in primary being 30 ohms, and the resistance of secondary 260 ohms, the current being .23 amperes which, with nine turns, gives two ampere turns. (2) With a file as a make and break it worked with ten cells, giving .4 ampere or 3.6 ampere turns.

Parallel Wire System.—(3) With a file as a make and break, and with parallel lines earthed, it was heard with 100 cells, giving 1 1 ampere.

The calculation of the diameter necessary to hear a given distance is simple, from the fact that the hearing distance is proportional to the $\surd$ of the diameter of one of the coils, or directly as the diameter of the two coils, so that, with any given number of amperes and number of turns to hear double the distance requires double the diameter of coils, or double the number of turns, and so on. But this is within certain limits, for when the coils are close to one another the law does not hold.

There is one point which seems to have been cleared up by these trials, which has even this month been a subject of discussion in London, and that is, whether or not the parallel wire system is actuated by induction

* From the proceedings of the Royal Society of Edinburgh.

‡ *British Association Reports*, 1886, p. 546; 1887, p. 611.

† Shape of coil, circle, square, or rectangle, etc., is not very material, and in practice must be altered to suit circumstances, as for instance in a ship (Fig. 2).

or conduction, and there is little room for doubt, from the fact that both circuits were insulated, and was thus a case of pure induction, that to a large extent it is induction; in fact, that they act together, and it will depend how the ends are earthed, or, in short, what is the distance bridged in comparison to the breadth of base, which predominates. Where the wires are long in comparison with the distance bridged, conduction will be the main working factor, but when the base is small and the distance bridged is large in comparison, induction will be the main factor, and the number of turns then increases the effect.

The primary coil was insulated in the Murrayfield trials. as at Muckle Flugga it must be so, the impracticability of making and maintaining the sea connections necessitating this, and the secondary was earthed, as is most convenient at Muckle Flugga. When the secondary was also made a complete insulated metallic circuit, there seemed to be little difference in the result.

There is one other point to which reference must be made. Mr. Preece has been repeating the experiments brought before this society on January 30, 1893, and he found, if rightly reported, that when the hearing wire was floating he got results, but when it was allowed to descend that no observations could be got; he attributes this to reflection from the surface of the water; this, however, is unlikely, as the reason that no sounds were then heard was that the major part of the wire lay on an equipotential line. Electro-magnetic waves enter or leave salt water practically unimpaired. On trial it was found, as stated in my paper read before this Society in January, 1893, that there was no practical difference in air or salt water to the propagation of electro-magnetic waves, in or out the distance to which waves went—*i.e.*, the distance to which the currents could be heard being immaterial whether the detector was sunk or in air.

It has been attempted to be shown that the coil system is not only theoretically but practically the best. This system is also applicable to our warships, to assist in their manœuvering, by the establishment of instantaneous communication unaffected by wind or weather.

The application of the coil system to communication with light vessels is obvious, namely, to moor the vessel in the ordinary way, and lay out from the shore a cable, and circle the area over which the lightship moorings will permit her to travel by a coil of the cable the required diameter, which will be twice the length of her chain cable. On board the vessel there will be another coil of a number of turns of thick wire. Ten cells on the lightship and ten on the shore will be sufficient for the installation. The system erected at Kentish Knock and other light-vessels is expensive in moorings, and is liable to derangement, and requires special appliances; whereas, by the coil system, there can be no derangement, and the vessel can be moored in the ordinary way. A call arrangement and telephones complete the installation

ELECTRICAL TABLES.

"Electrical Tables and Memoranda," is the title of a valuable little reference book for engineers, electricians and others interested in the electrical science. It contains a great deal of valuable information and a number of illustrations and diagrams. It is only 1⅞ by 2⅝ inches in size, and can easily be carried in the vest pocket. The author of this convenient little work is Prof. S. P. Thompson, and the price is only 50 cents per copy. For sale by the Electrical Age Publishing Co., World Building, New York.

PRODUCTION OF MINERAL COLORS BY ELECTROLYSIS.

Scheele Green—An electric current is caused to pass through an eight per cent. solution of sulphate of soda, by means of two copper electrodes immersed in the solution. The tank containing the solution must be heated by means of spiral steam pipes. A bag of arsenious acid suspended in the warm solution will dissolve and react on the soluble copper salt formed by the action of the current.

According to the *Revue de Chimie Industrielle*, the electrolyzed sulphate of soda yields sulphuric acid and oxygen, which oxidizes the copper.

The oxide of copper dissolves in the acid, while the soda combines with the arsenious acid at the negative pole to form arsenite of soda. The reaction of the arsenite on the sulphate yields a precipitate known as Scheele's green. In order that the process should be continuous, it is only necessary to renew the copper plates from time to time, and to refill the bags with arsenious acid.

Mitis Green.—By replacing the arsenious acid in the above process by arsenic acid, arsenate of copper will be obtained, which is known as Mitis green. As arsenic acid is very soluble, it is slowly added in solution to the bath.

For 100 grammes of copper, 100 grammes of arsenious acid are necessary to produce Scheele green, and 125 grammes of arsenic acid for Mitis green.

One horse-power dissolves 150 grammes of copper per hour, and precipitates from 200 to 225 grammes of green.

Cadmium Yellow is obtained by electrolyzing a solution of chloride of sodium, and using cadmium electrodes. A current of sulphuric acid must be passed through the bath during the process of electrolysis.

Sulphate of cadmium of various tones can be obtained by this method.

Vermillion.—In a wooden bath, about one metre in diameter and two metres in height, are placed two circular plates, on the top of which is a layer of mercury about 1 centimetre thick. These plates constitute the positive pole of a dynamo. The bottom of the tank is fitted with a plate of steel-plated copper and forms the negative pole. The solution contains 8 per cent. of nitrate of ammonia and 8 per cent. of nitrate of soda. A perforated spiral tube is placed in the bath to allow of a current of sulphuretted hydrogen to pass. Red sulphide of mercury is thus obtained.

An attempt has been made to dispense with the currents of gas by using the following bath:

Water..................	100 litres.
Nitrate of ammonia......	4 kilogrammes.
Nitrate of soda..........	4 "
Sulphide of sodium......	4 "
Sulphur.................	4 "

Vermillion of very fine quality can be obtained by this process, provided the quantity of mercury and its equivalent of sulphur be maintained.

Japanese Red.—This color is a lake of oxide of lead colored with eosine. It can be economically prepared by electrolyzing a 10 per cent. solution of acetate of soda with two lead electrodes.

The eosine must be run into the bath, and the oxide of lead which is formed will absorb the coloring matter, and can be finally separated by decantation. By varying the strength of the eosine solution, varying depths of color can be obtained. The eosine can be substituted by other colors, such as rodamine. Also, the lead may be replaced by zinc, in which case oxide of zinc would be formed. The acetate of soda can be replaced by nitrate of soda, or a mixture of nitrate of soda and ammonia.—*La Lumière Electrique.*

POSSIBLE CONTRACTS.

The Navy Department, Washington, D. C., is inviting proposals for the installation of electric light plants in the navy yards at Boston and Philadelphia.

An electric light plant is to be established in Cuthbert, Ga., for which $50,000 have been appropriated. Address the Mayor of that place for further particulars.

The Mayor of Jackson, Tenn., can give information concerning the letting of an electric light contract.

Fitzgerald & Limerick, Maysville, Ky., are to construct a telephone system.

Mr. J. M. Hering, Westminster, Md., is interested in the movement to build an electric road to Reistertown and Union Mills.

The Mayor of Vicksburg, Miss., can give information regarding contracts to be awarded on October 1 for the lighting of the city for five years with 75 to 100 arc lights.

V. H. Vogle, of Neosho, Mo., has made a proposition to that city to supply electric lights.

An electric road between Americus and Magnolia Springs, Ga., is talked of. The distance is ten miles. Bascom Myrick, of Americus, can give information regarding the project.

The Columbus Railroad Co., Columbus, Ga., contemplates the erection of a power plant.

The Piedmont Construction Co , Charlottesville, Va., will extend its line and equip it with electric motors. Jos. E. Willard is president of the company.

NEW CORPORATIONS.

Camden Light and Power Co., Camden, Ark., operating electric plants. Capital stock, $10,000.

The Lockport City & Olcott Electric Railroad Co., Albany, N. Y. Incorporators are Wm. T. Holt, M. E. Stone, Adrien G. Funck, Jacob I. Toch, Edward J. Cunningham, Thos. J. Agnew, Noel Gale, Geo. E. Dunscombe and F. Eugene Crasson of New York City. Capital stock, $200,000.

Montgomery Electric Light and Power Co., Montgomery, Ala. Capital stock, $10,000.

The Pana Telephone Co., Pana, Ill. Capital stock, $5,000.

Acme Electric Co., St. Louis, Mo., manufacturing electrical supplies and apparatus. Capital stock, $3,000.

The Mercantile Carbon Co., New York, N. Y., manufacturing new patent electrode for arc lamps. Capital stock, $50,000.

Southwestern Suburban Rapid Transit Co., Chicago, Ill. Capital stock, $1,000,000. Incorporators: A. H. Minassiam, Newton Wilcoxin and Frank M. Sherman.

Citizens' Telephone and Telegraph Co., Hagerstown, Md. Capital, $25,000. Incorporators: J. W. Emmert, Wm. H. Armstrong, Chas. W. Sebold and Phillip W. Avirett.

Hempstead Traction Co., Hempstead, Queens Co., N. Y. Incorporators: Charles L. Barker, Abraham Barker, Miles C. Palmer, E. R. Tilton; T. H. Kilduff and Wm. Kennelly of New York City; John S. Lawrence and D. L. Lewis of Hempstead, and John F. Davis of Brooklyn.

The Caldwell Electric Light and Water Co., Caldwell, Ohio. Capital stock, $10,000.

Farmers' Telephone Co., Massillon, Ohio. Incorporators: Martin S. Card, Nathan F. Moffat, J. H. Fisher, William Maxheim, Andrew J. Gordon, F. Z. Groff, Robert A. Pinn and Aazaria Short. Capital stock, $10,000.

The Factoryville Light, Heat and Power Co., Factoryville, Wyoming County, Pa. Capital stock, $7,000.

Nicholson Light, Heat and Power Co., Nicholson, Wyoming County, Pa. Capital stock, $7,000.

Chicago and Grand Avenue Street Railway Co., Chicago, Ill. Incorporators: John Gnaedinger, H. F. Kolz, Lesser Franklin, Cassius C. Clark and Elwyn D. Seaton. Capital stock, $50,000.

The Home, Sweet Home Improvement Co., Billings, Mont. Incorporators: M. D. Jeffers and others. Capital stock, $50,000. One of the objects of the company is the building of electric street railways, dealing in franchises, etc.

The Petersen Underground Conduit System.—The Petersen Electric Conduit Railway Construction Co., which was recently organized in Milwaukee, Wis., will manufacture underground conduits for electric railways under the patents of H. Petersen. The Petersen underground conduit system was fully described and illustrated in the Electrical Age of March 24, 1894. The incorporators of the new company are A. E. Smith, William Meyst and H. Samuel Esch, and the offices are in the Montgomery Building, Milwaukee.

RECEIVER FOR H. WARD LEONARD & CO.

On August 30, the Court of Chancery of New Jersey appointed a temporary receiver for H. Ward Leonard & Co , of 136 Liberty street, New York, in the creditors' suit of the Interior Conduit and Insulation Company, of New York city. Mr. H. Ward Leonard was appointed temporary receiver. On September 11, argument will be heard by the Chancellor at the Chancery Chambers, Newark, N. J., on the question of making the receivership permanent. H. Ward Leonard & Co. is a New Jersey corporation.

A statement issued to the creditors of the concern shows that the nominal assets amount to $177,641.10, and the liabilities about $64,000. Of the assets, $109,000 is impounded in a suit against the Cayadutta Electric Railway Co., the remainder being insufficient to meet maturing liabilities. The application for a receiver was made for the protection of the creditors and stockholders and not for their injury.

NEW YORK NOTES.

Office of the Electrical Age,
First Floor, World Building,
New York, September 4, 1894.

The Gamewell Fire-Alarm Telegraph Co., 1½ Barclay street, had a large exhibit of its celebrated fire-alarm apparatus at the convention of the National Association of Fire Engineers, which was held in Montreal last month. Mr. J. W. Stover, president of the company, was present, with several other officials and representatives of the same concern. The exhibit attracted a great deal of attention.

Mr. H. C. Whitney has resigned his position as motor salesman of the Interior Conduit and Insulation Company, of this city. W. T. H.

A SIMPLE TIME RECORDER.

The New National Time Recorder Co., of Milwaukee, Wis., has put on the market, in addition to the "Bolte Automatic" and Autographic Recorders, its latest style recorder, which the firm has called "The American."

Fig. 1 shows the complete recorder, which will take a 21-inch record dial. Fig. 2 shows a portion of the record dial after a day's registration has been made. The heavy lines are hour lines and the lighter ones five minute lines. Thus it may be seen at a glance any time during the day, by the employer or any one interested, that No. 2 is fifteen minutes late, No. 9, ten minutes late, and No. 10 is absent—not being registered.

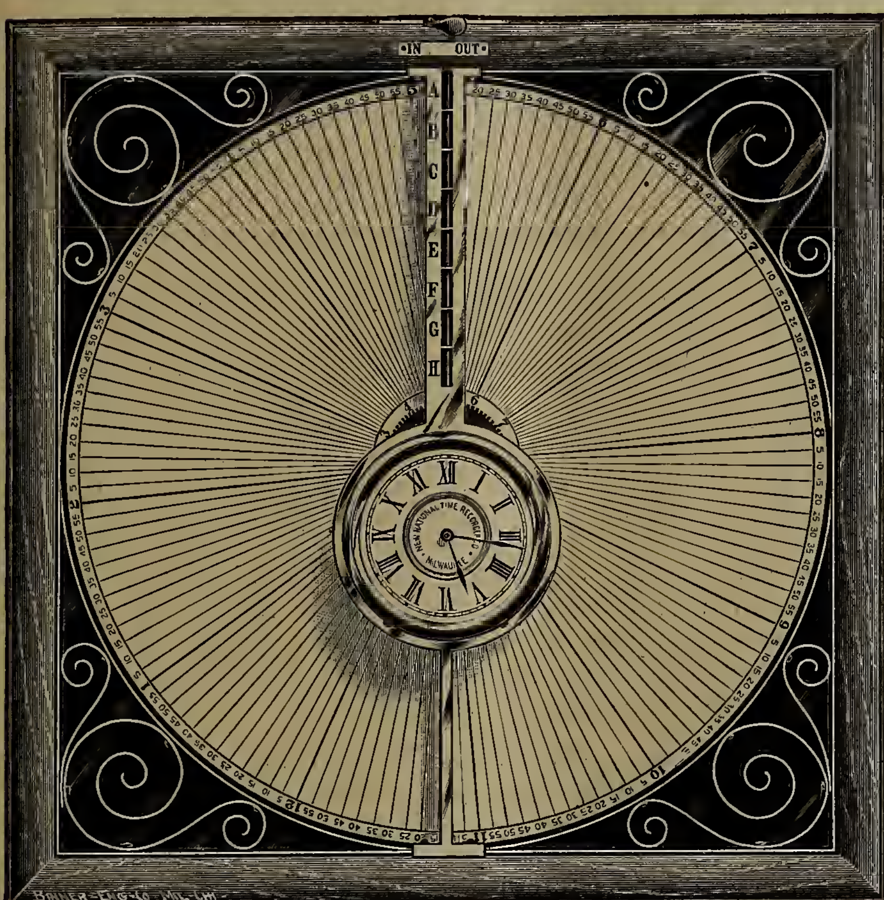


FIG. I.

By a novel arrangement the numbers come consecutively on the record dial and the key, or check, (Fig. 3) will enter only the hole for which it is intended. A slight pressure on the key will ring the bell and indicate that a registration has been made. The arrival of employés is indicated by the numbers appearing in red and the departure in blue This is accomplished by moving a small lever at the front of the clock, above the key-holes, either to IN or OUT. This lever shifts the record ribbon through which the registrations are made.

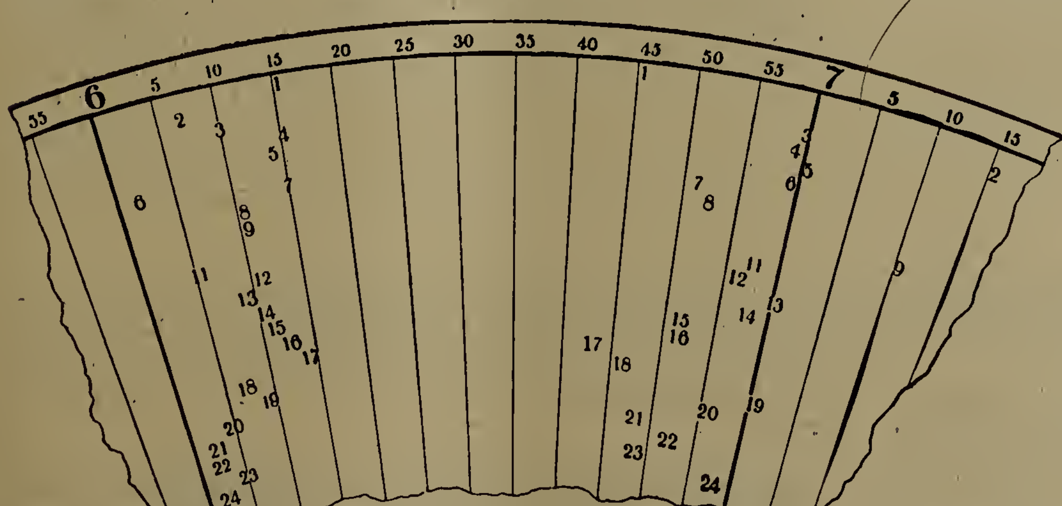


FIG 2.

The recorder will register 100 employés; however, by using a number of recorders, which is generally preferable in large establishments, as many as 1,000 can register, the numbers coming consecutively.

ELECTRIC LIGHT PLANT SOLD AT AUCTION.

The plant and franchise of the Potomac Electric Light Co., Washington, D. C., has been sold at auction for $15,500, and purchased by Mr. Wilder, of St. Paul, Minn., who had advanced the money on the company's bond. The Potomac Electric Light Company was organized about three years ago, with J. C. O'Gorman, president; G. W. Baird, vice-president; Neil Dumont, (deceased) secretary; Harry P. Gilbert, treasurer, and M. I. O'Donnell, manager. A receiver was appointed in July, 1893, in whose charge it remained until sold at auction. The capital stock of the company was placed at $25,000, though it went further and spent money until $85,000 was sunk in the scheme.

STORAGE BATTERY CASE.

INJUNCTION DENIED.

Judge Green of the United States Circuit Court at Trenton, N. J., on August 27, refused to grant a preliminary injunction restraining the Electric Storage Battery Co., of Gloucester City, from infringing patents of the Brush Electric Co. in the manufacture of chloride accumulator storage batteries. The opinion is based partly on the doubt that there is infringement. Profs. Morton, Chandler, Houston, and Dr. Barker testified that there was, and Profs. Brackett, Thomson, Cross, and Mr. Van Size that there was not.

In view of the conflicting testimony, Judge Green decided that further investigation was necessary before the defendants are put to the inconvenience of a preliminary injunction. Another reason for refusing the injunction was that the plaintiffs had not been diligent in asserting and vindicating their rights, the defendants having been permitted to carry on business since 1888.

ELECTRICIAN-IN-CHARGE.—Mr. Herbert Laws Webb is the author of an interesting story in *Scribner's* for September, entitled "Electrician-in-Charge."

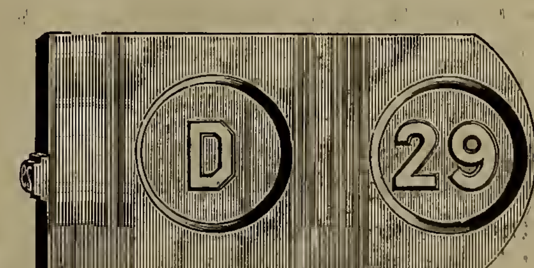


FIG. 3.

HOW THE ELECTRICAL AGE IS APPRECIATED.

A gentleman well-known in the incandescent lamp trade in a letter of recent date says: "Thank you very much for present and past courtesies. Your journal deserves all the business you get, and more too, in my judgment."

FOREIGN CARBONS.—It appears to be generally admitted that the carbons made in Germany and Austria are, as a rule, far superior to those produced in this country.

THE STATE OF TRADE AND WHAT OUR PATRONS ARE DOING.

(*Continued from Page 125.*)

Sprague, Duncan & Hutchinson, electrical engineers and experts, Postal Telegraph Building, Broadway and Murray street, are the supervising engineers of the installation of the complete electrical plant of the new Congressional Library Building, Washington, D. C. All the labor is done by day work and all the material has been contracted for. Orders have been placed for simplex wire, and the Interior Conduit and Insulation Company's new armored tubing. Bids will be opened on September 10 for three 100 K. W. dynamos required for this installation. Specifications have not yet been prepared for the engines. Mr. S. R. Green is the superintendent and engineer of the Congressional Library.

Dr. Cary T. Hutchinson has severed his connection with the firm of Sprague, Duncan & Hutchinson, and opened offices in the Postal Telegraph Building, where he will do a general electrical engineering business. He is prepared to draw plans and specifications for any system of applied electricity, also the supervision and installation of electrical plants for all purposes. Dr. Hutchinson, as a member of the firm of Sprague, Duncan & Hutchinson, is the supervising electrical engineer of the electrical installation of the new Congressional Library in Washington. He is an ex-professor of physics in one of the largest colleges in this country, and is one of the best informed men in the electrical science. Dr. Hutchinson will make professional and expert examinations of electrical apparatus and plants in the interest of investors.

Mr. John A. Seely, 121 Liberty street, the well-known electrical engineer and contractor, is kept busy making bids and estimates on electrical installations. He takes contracts for the installation of plants that have the proper financial backing, and no others. He has just closed a $450,000 contract for a 35-mile electric street railway, which will pass through twenty-four cities, towns and boroughs in Pennsylvania, and will be built for the Clearfield Traction Co., of Phillipsburg, N. J. Mr. Seely has also closed a contract for five miles of double-track electric railway for the Syracuse Street Railway Co., Syracuse, N. Y., and he is just finishing a 5 mile road in Lockhaven, Pa., including the power house and electrical equipment. In this plant he put in Westinghouse generators and T. H. motors on the cars.

Mr. C. A. Benton, of the Sprague Electric Elevator Co., Postal Telegraph Building, has lately closed a contract for the installation of improved Sprague elevators in the new Astor residence in this city. The elevators will have a rise of eighty feet, which is said to be the highest private installation in this city.

At the Western Electric Co.'s headquarters, on Thames and Church streets, business is active, and the managers report an improved tone in business.

H. McL. Harding, Postal Telegraph Building, representative of the Walker Manufacturing Co., Cleveland, Ohio, reports an increasing demand for his company's electric railway equipment. Many orders have been closed for motors and generators.

Hine & Robertson, 55 Cortlandt street, feel much encouraged with the outlook. They are receiving many inquiries about their celebrated indicators, planimeters, Eureka and Garlock packing, etc.

Rudolph Brandt, 38 Cortlandt street, reports an increasing demand for Selden's patent packing for stuffing boxes on engines, pumps, etc. This packing prevents leakage, with the least possible friction.

Norman Hubbard, 93 Pearl street, Brooklyn, manufacturer of Packard vacuum pumps, designed especially for the manufacture of incandescent lamps, looks on the fall business with a good deal of encouragement. His is the only mechanical pump that exhausts lamp-bulbs with any satisfaction.

Bateman & Miller, 143½ East 23d street, city, contractors for electric light wiring and the installation of isolated electric light plants, are busy on several contracts recently taken. They report a favorable outlook for fall business.

H. J. Jaeger, 173–183 Pearl street, Brooklyn, is the principal manufacturer in this country of mercury pumps for incandescent lamp manufacture. He also makes miniature lamps and does glass blowing for experimental work of all kinds for inventors. Business is excellent with him. The tariff, he says, does not affect him, as he does not fear competition.

J. Jones & Son, 67 Cortlandt street, report an increasing business and easier collections. Every buyer should see their list of supplies, that are being sold at less than cost. The firm has added to their stock many new lines of electric light and electric railway supplies.

C. H. Hirlimann, Laight street near Canal, manufacturer of the celebrated Hirlimann batteries, is doing an excellent business. Orders do not diminish, he says. A gradual improvement in business is noticeable.

Prentiss Tool and Supply Co., 115 Liberty street, dealers in metal working machinery, both new and second-hand, report an improvement in business. Inquiries and orders are increasing in number daily, which is a sure indication of a revival.

The Riker Electric Motor Co., 45 York street, Brooklyn, report an increasing demand for their improved multipolar generators. They are now finishing several 1,500 lighters. They had a large run on the $15 high grade fan motors during the present season.

P. Claus, 333 East 107th street, city, manufacturer of Claus dynamos and generators, reports having a very good business for this time of the year. He has orders and contracts enough on hand now to keep him busy for some months to come. They are for plants in New York, Philadelphia and other places.

Empire China Works, 144 Greene street, Brooklyn, N. Y. (Greenpoint). produce the finest line of hard porcelain for cutouts, switches, switch bases and insulators of all sizes. Special goods are made to order at the shortest notice. This concern is doing a good business, and is greatly encouraged with the outlook for fall trade. The works have had a good business all through the period of depression.

C. D. Bernsee, Vanderbilt Building, the popular Eco-magneto Watchman's-Clock man, is doing the largest business of any individual or firm in his line. Orders do not diminish, and the future looks very encouraging for him.

H. Senior & Co., the well-known wood-engravers for electrical concerns, etc., 10 Spruce st., does the very best work in the art of wood-engraving. Those for whom he has done work, speak in the highest praise thereof, and all desiring first-class work in this line cannot do better than by going to Mr. Senior.

De Veau & Co., 32 Frankfort street, report an improvement in business in telephones, transmitters and complete outfits. These goods are of superior make and give the best of satisfaction to users.

The Okonite Company, Ltd., 13 Park Row, New York city, is doing a good business in its famous insulated wires and cables, and reports the August sales far ahead of those of any other month during the current year. The outlook for a brisk fall and winter business is very bright.

Mr. E. S. Wallace of The Columbia Telephone Manufacturing Co., of No. 136, 138, 140 Front street, said:—"The electrical industries of the country, like all others, have been seriously affected by the long, tedious tariff discussion. Capital, always conservative and cautious, has for months been unusually timid. New enterprises and business extensions have long been dormant, but we believe business will revive. A new impetus is already perceptible in the electrical pulse. Our company has within the past week increased its capacity by starting a new factory at Red Bank, N. J., and is preparing for an increased Fall trade.

ATLANTA CONVENTION OF THE AMERICAN STREET RAILWAY ASSOCIATION.

The Royal Blue line and the Shenandoah Valley route will run a vestibuled train of Pullman sleeping cars and dining car through from New York to Atlanta for the especial accommodation of delegates and visitors to the Convention, which meets in Atlanta, October 17, 1894. The train will leave New York, October 15, at 3:00 P. M.; Philadelphia, at 5:35 P. M.; Baltimore, at 7:30 P. M.; Washington, at 8:30 P. M.; arriving at Atlanta at 6 P. M., next day. The route South of Washington is via Harper's Ferry, Luray Caverns, the Grottos of the Shenandoah, the Natural Bridge of Virginia, Roanoke, Bristol, Knoxville, Cleveland, Chattanooga (Lookout Mountain), Dalton and Rome. South bound, the train will not go into Chattanooga, but to save time will take a short cut from Cleveland to Dalton. On the return trip the train will go into Chattanooga, so that occupants can visit Lookout Mountain and the National Park. The train will also stop at Natural Bridge Station and Luray, so as to enable those who desire to do so to visit the Bridge and Luray Caverns. Those not caring to stop can go through on regular trains.

The couutry through which this train passes is most historic, and the most beautiful of the South as well as its most prosperous section. The scenery is not excelled in this country. The track over which it runs is the best in the South—the best built and the best ballasted, with less dust than that of any other route to the South.

A special car will be provided for ladies.

This train will be under the personal escort of Mr. L. J. Ellis, eastern passenger agent, Norfolk and Western Railroad, and all communications relative to it should be addressed to him at the office of the company, 317a Broadway, New York, or to Mr. C. P. Gaither, New England, agent, 290 Washington street, Boston, Mass., or Mr. Lyman McCarthy, passenger agent, B. & O. R. R., 415 Broadway, N. Y., W. B. Bevill, G. P. A., Roanoke, Va.

A special rate of one and one third fare for the round trip on the certificate plan has been made. The regular fare, one way from New York, is $24.

Obituary.—William J. Stephenson, president of the Metropolitan Street Railway Company, of Washington, D. C., died in that city on September 1. He was 53 years of age. He was taken ill in Chicago, where he went to investigate the rents of certain underground conduit systems of railway, in the interest of his company. Mr. Stephenson was one of the best known business men of Washington.

TRADE NOTES.

The Pumpelly-Sorley Storage Battery Co., 474 The Rookery, Chicago, has just issued circular No. 1, describing its well-known storage battery. These batteries are highly efficient, have large capacity and are very durable.

We have received from the Harrisburg Foundry and Machine Works, Harrisburg, Pa., an elegantly gotten up catalogue of the Harrisburg double-engine steam road roller, and a portfolio with leaflets with illustrations of that company's automatic engines. The portfolio and leaflets are gotten up in an extremely artistic manner, and all the types of this company's celebrated engines are represented.

WHAT WILL THE NEW YORK CENTRAL DO NEXT?

After having his thirst whetted, like a tiger by the taste of blood, by the wonderful performances of Engine No. 999, the *genie* who presides over the transportation department of the New York Central Railroad is rampant again, and laboring persistently to find means of attaining the speed of lightning. He is at work in his cell, by stealth and at midnight, and before many moons have passed we expect to see a terrible apparition coming up the Hudson River like the war chariot of Jove.

We may expect a monster engine, with double boilers of enormous power and wheels as tall as a shot tower, which will trot up to Albany in an hour, skip over to Utica or Syracuse at half an hour schedules and cover the distance from New York to Buffalo in three hours. Then we shall need some means of artificial respiration. —*Medford* (*Mass.*) *Mercury*.

Electrical and Street Railway Patents.

Issued August 28, 1894.

525,000. Electrically-Operated Wind-Vane. Lynde Bradley, Milwaukee, Wis. Filed Jan. 31, 1894.

525,001. Insulator. Leonard W. Bradley, Cleveland, Ohio. Filed Feb. 13, 1894.

525,007. Manufacture of Carbon Filaments. Thomas A. Edison, Llewellyn Park, N. J. Filed Dec. 15, 1886.

525,015. Trolley. Naaman W. Haskins, Brooklyn, N. Y. Filed Dec. 1, 1893.

525,016. Trolley-Wire Switch and Crossing. Naaman W. Haskins, Brooklyn, N. Y. Filed Apr. 23, 1894.

525,017. Storage-Battery. Henry K. Hess, Syracuse, N. Y. Filed Oct. 11, 1892.

525,018. Storage-Battery. Henry. K. Hess, Syracuse, N. Y. Filed Feb. 13, 1893.

525,020. Electrical Fire-Alarm Apparatus. Ernst W. Jungner, Stockholm, Sweden. Filed Nov. 8, 1893.

525,034. Electric-Arc Lamp. Elihu Thomson, Lynn, assignor to the General Electric Company, Boston, Mass. Filed Jan. 24, 1894.

525,035. Electric-Arc Lamp. Elihu Thomson, Swampscott, Mass., assignor to the General Electric Company, of New York. Filed May 16, 1894.

525,055. Device for Prevention of Accidents on Street-Cars, Etc. Alexander McKerlie, Hamilton, Canada. Filed Aug. 30, 1893.

525,071. Combined Car Fender and Brake. Hampton W. Evans, Philadelphia, Pa. Filed Mar. 29, 1894.

525,092. Fluid-Operated Electric Switch. Jean J. P. Clariot, Paris, France. Filed Aug. 5, 1893. Patented in France, Feb. 16, 1893, No. 227,987.

525,094. Coin-Controlled Lock for Telephones. Pitt Cooke and Joseph L. Harley, Washington, D. C. Filed Jan. 30, 1894.

525,108. Electric Motor. Abraham V. Meserole, New York, N. Y. Filed Jan. 8, 1894.

525,115. Safety-Guard for Street-Cars. William H. Rice, Rochester, N. Y. Filed Nov. 21, 1893.

525,134. Circuit-Breaker. Cummings C. Chesney, Pittsfield, Mass., assignor to the Stanley Laboratory Company, same place. Filed July 6, 1894.

525,145. Electromagnetic Call-Bell. John J. Geary, Chester, Pa., assignor of one-half to John J. Mossop, same place. Filed Jan. 26, 1894.

525,167. Car-Fender. Charles E. Struck, Newark, N. J., assignor of one-half to John A. Baldwin, same place. Filed Feb. 1, 1894.

525,169. Electric Bell. Richard Varley, Jr., Englewood, N. J. Filed Sept. 21, 1893. Renewed July 10, 1894.

525,201. Telephone-Transmitter. John Goodman and Henry M. Goodman, Louisville, Ky. Filed May 1, 1894.

525,233. Safety-Fender for Tram, Electric or Cable Cars. Henry S. Robins, Philadelphia, Pa. Filed Sept. 15, 1893.

525,235. Dry Battery. John L. Solomon, New York, N. Y., assignor to the Infinity Manufacturing Company, same place. Filed Apr. 11, 1894.

525,277. Electric Time-Signal for Railways. Robert D. Patterson, Lawrence, Mass. Filed Jan. 2, 1894.

525,284. Street-Car. William F. S. Robinson, Somerville, Mass. Filed Dec. 7, 1893.

525,290. Electrical Railroad-Signal. William F. Seymour, Mansfield, assignor of one-half to Mary E. Seymour, Mount Vernon, Ohio. Filed June 30, 1894.

525,291. Electric Alarm-Lock. John Slater, Hutchins, Pa. Filed Nov. 9, 1893.

525,293. Incandescent-Electric-Lamp Cut-Out. Walter F. Smith, Philadelphia, Pa., assignor to the Heisler Electric Company, Gloucester City, N. J. Filed Aug. 23, 1889.

525,315. Rosette for Electric-Light Wires. David J. Cartwright, Boston, Mass. Filed Jan. 16, 1894.

ELECTRICAL AGE

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NEW YORK, SEPTEMBER 15, 1894.

CONTENTS.

PROF. HELMHOLTZ.

In the death of Professor von Helmholtz, which occurred in Berlin on the 8th instant, the scientific world loses one of the most brilliant minds that has ever exercised its influence in behalf of the advancement of the human race. Prof. Helmholtz was an original thinker; his ideas were his own, and his achievements will stand as imperishable monuments to his name. While in this country last year he won a host of admiring friends through his gentleness of manner and unassuming bearing. He was a learned man, yet he was free from even a suspicion of pedantry; his personality stood out in bold relief against the background of science, and shone forth in a lustre of its own; his brilliancy was not reflected; it was inherent and natural; and his fame was achieved on pure merit. The name of von Helmholtz will forever shine as a star of the first magnitude in the realms of science.

ELECTRICAL COMMUNICATION WITH VESSELS AT SEA.

Some electrical experiments are to be conducted by the Lighthouse Board, near the Scotland Lightship off New York harbor. The officials in charge of the experiments maintain some secrecy as to the nature of the same, but it is hinted that the object is to test a system of communication by telephone with vessels off shore. A cable is to be laid to a point near the lightship, where it will be buoyed. The experiments are to be conducted this and next month.

ELECTRIC POWER ON SHIPS OF WAR.

A dispatch from Washington states that the naval authorities favor the substitution of electric for steam power, wherever practicable, on board of the ships of the navy. Last week tests were made with the view to moving the turrets in which the heaviest guns are installed. The tests were so successful that the officials have decided to use electric motors for this purpose on all the new vessels which are not too far toward completion to prevent it. The test was made on the monitor Montauk, the turret being arranged to approximate the actual conditions under which the modern eight-inch turrets are operated, and, according to reports, it was successful in every way. By the use of a single operating switch, requiring the use of one hand, the operator is enabled to at once elevate and train the gun, leaving the other hand free to fire the gun or give the sight-bar without interrupting the operation of pointing the gun. This application of electric power is the idea of Captain Sampson, and it is said will undoubtedly increase the accuracy of fire and otherwise increase the efficiency of the service.

ELECTROLYSIS OF WATER PIPES.

At the convention of the American Waterworks Association in Minneapolis, Minn., last month, the subject of the disintegration of underground pipes by electrolysis received a good deal of consideration. Two or more papers on this topic were read and discussed. One delegate from Milwaukee explained to the meeting how water-pipes could be tested to determine whether they were being attacked by electric currents. The tests are confined to those pipes running in proximity to electric roads, and the *modus operandi* consists in forming an electrical connection between the pipe and the railway track, said connection including a voltmeter or ammeter for the purpose of measuring the vagrant current. He gave some interesting and valuable hints as to how to modify or obviate the troubles complained of. Apart from the physical aspect of the situation, it may be truly said that electricity is inevitably subjecting every other useful agent to its own power.

DUNCAN METER FOR ALTERNATING CURRENTS.

BY WM. S. RESOR, B. S.

One of the problems which has confronted electrical engineers has been the invention of a commercial alternating current recording meter, which will record "all" loads correctly.

The credit of having solved this problem must be given to Mr. Thomas Duncan, of the Fort Wayne Electric Corporation, Fort Wayne, Ind.

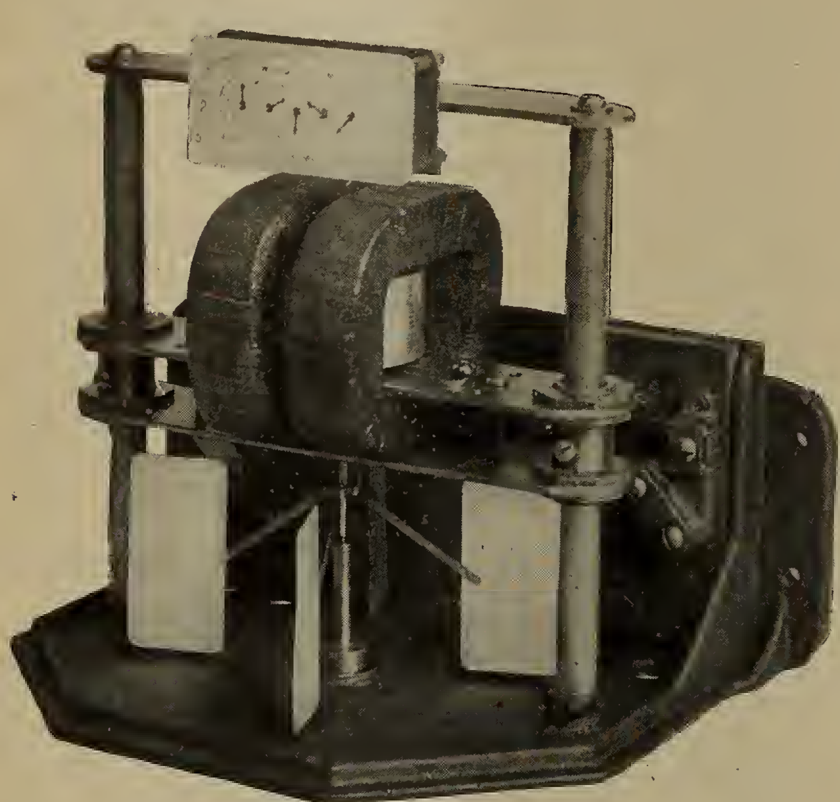


FIG. I.

In the early days of electric lighting it was customary to charge so much per lamp per week, month or year, because there were no practical recording meters. This was of course most unsatisfactory both to supply companies and to consumers. A recording meter was the dream of both.

Before long various types of recording meters appeared, which recorded, it is true, but gave no satisfaction; for the greater part of them made electric light very cheap for the small consumers, and very expensive for the large, on account of the slow speed on a small number of lights, and the high speed on a large number. But each has in turn been succeeded by others, claimed to be better, and now the Duncan meter seems to have reached the end of the line, and combines the virtues of all and, let us hope, the defects of none.

This meter is dependent on the principle of the repulsion of a closed secondary from its primary, and is a thoroughly practical and efficient development of Prof. Elihu Thomson's classical experiments on that principle.

The essential parts of the meter are the primary or field coils a, a′ (see fig. 2), which are connected in series with the lamp circuit; the secondary or armature C, consisting of an aluminum cylinder, a magnetic path diverter d, made of laminated iron, and carrying a closed secondary S, which consists of several copper punchings; the aluminum fans, the registering train and the spindle which carries said armature and fans.

A very important feature of this meter is, that there are no brushes or commutator to get out of order, or other contacts to become dirty and oxidized.

The armature has no electrical connection with the circuit.

The motion of the armature or cylinder is due to the repulsion set up against it as a closed secondary, from the primary or field coils a and a′.

The action is explained more fully as follows: When the lamps are turned on the current flows through the coils a and a′, and an alternating field is set up. This field is distorted or diverted from its natural direction, along the axis of a and a′, by the diverter d, and assumes a form similar to that shown in figure 3. Foucault currents are generated in the armature and also in the closed secondary on the diverter.

The use of this secondary on the diverter is to reverse its polarity.

Suppose we consider the instant when the polarity of the primary or field coils a and a′ are as shown in figure 3, the flux as it cuts through the cylinder obliquely, and as shown by the dotted line, will develop Foucault currents in it, which will have poles as shown in the diagram, i. e., a south pole on the outside circumference of the cylinder and facing the south pole S of the primary coil a, thereby setting up a repulsion, due to their being of the same polarity. Again the north pole n, which is shown on the inner circumference of the cylinder, will be attracted by the south pole S of the diverter d. Therefore, the rotation is due to the repulsion set up by the two south poles on the outside of the cylinder, and the attraction between the two unlike poles inside. The same condition exists on the other or right hand side of the cylinder, only differing in the change of polarity.

The closed secondary which is divided into two, each half being placed upon the respective poles of the diverter d, is for the purpose of changing the original or induced polarity of said diverter, so as to obtain a maximum torque in effecting an attraction between the induced poles on the inner surface of the cylinder and the diverter.

If the axis of the diverter be placed along the axis of the coils a and a′, or at right angles to it, there will be

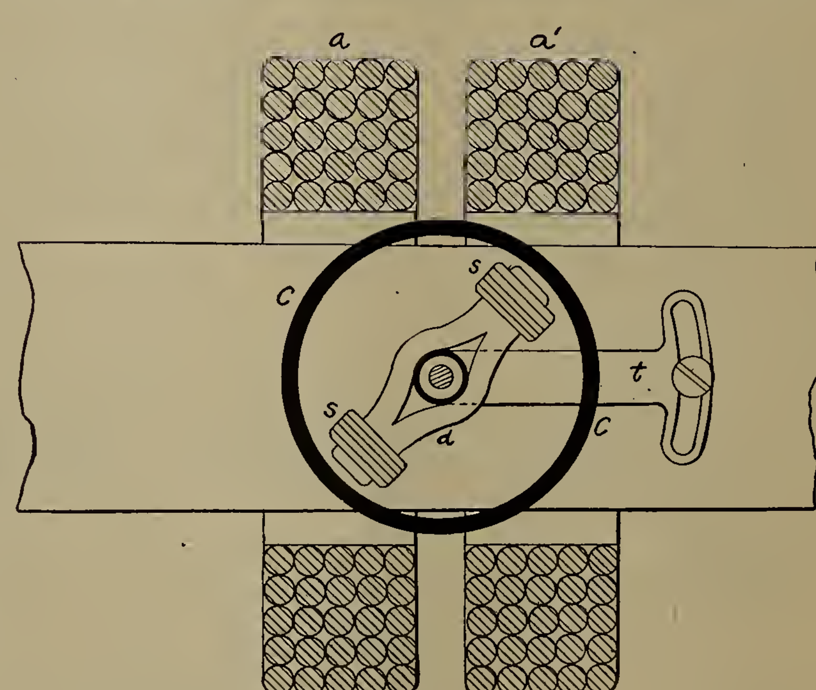


FIG 2.

no motion, all the energy being expended in producing a lateral pressure on the shaft, but as soon as we move it from either of these positions, the force acts along a line which does not pass through the vertical axis, hence we have motion whose speed depends on the size of the angle formed by the two axes. Forty-five degrees gives the greatest speed.

This meter is the only one upon the market whose speed curve is a straight line.

The following table contains the results of a test on a twelve-light Duncan meter:

NO. OF LAMPS.	REVS. MIN.	INITIAL SPEED.	PER CENT. ERROR.
1	14	14	—6.6
2	30	15	0
3	45	15	0
4	60	15	0
5	75	15	0
6	90	15	0
7	105	15	0
8	120	15	0
9	135	15	0
10	150	15	0
11	165	15	0,
12	180	15	0
13	195	15	0
14	210	15	0
15	225	15	0

The speed on one light is a few per cent. slow, on some as low as two per cent., but in all other loads the meter is correct.

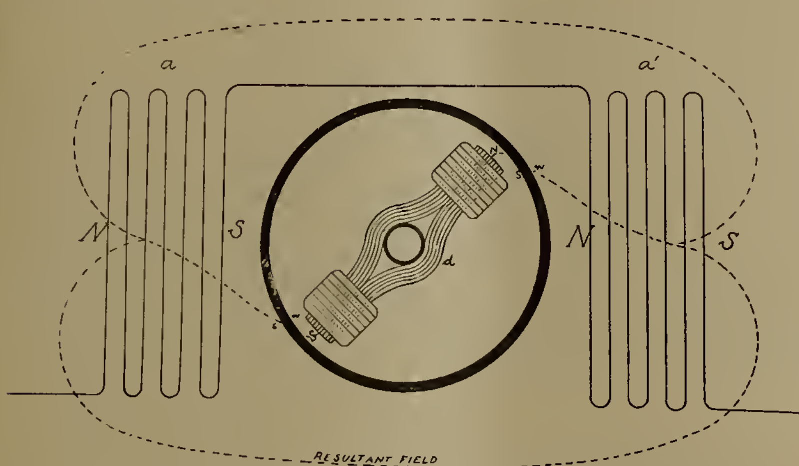


FIG. 3.

Mr. Duncan has also applied this principle to meters for measuring and recording multiphase currents. and with particular success in the cases of two and three-phase currents, also as a wattmeter for measuring the total energy.

Figure 4 shows a three-phase meter.

A striking peculiarity of the multiphase-current meter is, that it can be operated with single-phase currents by simply connecting its field coils in series or multiple arc, and in series with the lamps.

Figure 1 shows a complete meter.

OBITUARY.

PROF. H. VON HELMHOLTZ.

A few days ago Professor Hermann von Helmholtz, of of Berlin, Germany, world renowned scientist, received a second stroke of paralysis, from the effects of which he died on September 8. A few weeks ago Prof. von Helmholtz suffered an attack of paralysis from which he gradually recovered. The second stroke, however, proved fatal.

Hermann Ludwig Ferdinand von Helmholtz was born in Potsdam, Prussia, on Aug. 31, 1821. He showed a taste for science from infancy, and he began a preparation for the medical profession as soon as he was old enough to study. The family being poor, that was his only opening, and that was possible because the Government gave free instruction in medicine on condition that the recipient would serve the State without pay for several years after graduation.

At the age of seventeen, therefore, Helmholtz entered the royal military school at Berlin, from which he was graduated four years later. He became assistant physician at the Charité Hospital in Berlin the same year. Prof. Rudolf Virchow was there in the same capacity, and these two men were brought into companionship at the very outset of their brilliant careers.

Helmholtz remained at the Charité only one year and then went back to Potsdam, where he became an army surgeon. For the five years following he practised

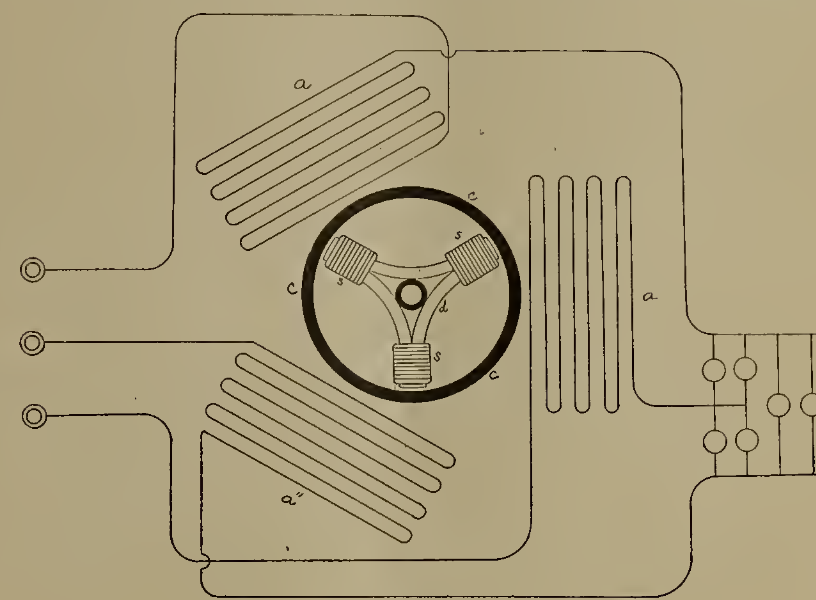


FIG. 4.

medicine and contributed many articles on mathematical and physical science to various periodicals. It was at this time that he laid the foundation of his scientific reputation by a paper entitled "On the Conservatism of Force," which was published in Berlin in 1847. The theory of Helmholtz on this subject—that nothing exists in the outer world but matter, and that matter in itself is capable of no alteration but motion in space, and that these motions are modified only by fixed attractions and repulsions, and that this is true everywhere, even in the actions of animals and men—was regarded as daring, and opposed to every kind of philosophy. But many looked upon it as the epoch-


PROF. H. VON HELMHOLTZ.

making work from which must date the greatest scientific discovery that man has made, and it was accepted.

In 1848 he returned to Berlin, where he became prosector and tutor in the Academy of Arts. He then for the first time proved by actual experiments a difference of chemical composition in the active and quiescent muscle. A year afterward he was appointed professor of physiology at Königsberg, and began investigations as to the rapidity of propagation of nerve excitation, which made him famous. He published three reports on this subject between 1850 and 1852. By means of ingenious methods for ascertaining exceedingly small differences of time, he demonstrated that thought is not instantaneous, but that when a person touches anything it takes a definite period to become conscious of it, and that a certain time elapses between the willing and the execution of a movement.

About 1852 he began the study of electrodynamics, and shortly he was promoted to a regular chair in the university. His discourse upon his installation dealt with peripheral sensations, particularly those of sight and hearing, and was a comparison of the relationship existing between the vibrations that excite a given sense and those existing between the sensations themselves. In 1855 he became professor of anatomy and physiology in the University of Bonn, but three years later left this chair for that of physiology at Heidelberg. The same year he surprised the mathematical world by his great memoir on eddies, or vortices, a matter of fundamental importance in hydrodynamics. During the next two years his acoustical researches were very prolific, and he published some remarkable papers upon color blindness and upon the contrasts of colors.

It was while at Heidelberg that Helmholtz's most important work was given to the world. In 1862 appeared "Die Lehre von den Tonenempfindungen, als Physiologische Grundlage für die Theorie der Musik," which is known all over the civilized world. In it Helmholtz threw the light of natural science upon the inmost principles of music and æsthetics. Helmholtz discovered that the difference of quality or timbre of the sounds of different musical instruments is due to the fact that different compound tones may contain the same fundamental tone, but differently mixed with other tones. He also discovered the acoustic cause of the vowel sounds of human speech, and not only analyzed them into their constituent elementary tones, but also artificially produced vowel sounds from the elementary tones of tuning forks.

In 1871 Helmholtz succeeded Gustave Magnus as Professor of Physics at the University of Berlin. In 1873 the Copley medal of the Royal Society of London was awarded to him in recognition of his eminent services to science. He had already been admitted to foreign membership at the French Academy. In 1883 Emperor William I issued a decree by which he was raised to "the status of nobility." Finally, in 1891, he was made President and Director af the Imperial Technical Institute of Physics at Charlottenberg, a foundation under the control of the Department of the Interior for the experimental furthering of exact natural inquiry and the technics of precision. The government, in a professional way, could confer upon him no higher honor.

The life of Helmholtz was devoted wholly to scientific work. He never took any interest in politics, as many other German men of science have done. Not the slightest allusion to any moral or religious problem ever appeared in his writings. Although entirely wrapped up in his work, he was not an egotist. He was never guilty of the claims of priority in his discoveries; in fact, he several times published notes to show that his own results were not so new as he and the scientific world believed them to be.

Helmholtz was aristocratic in tastes and in appearance. Physically he was tall, with unusually broad shoulders, and a well-built figure. He was very popular among the students and beloved by the German people of all classes.

On the occasion of Helmholtz's seventieth birthday anniversary in 1891 he received honors which few men have won. Addresses, honorary titles, and presents were showered upon him seemingly in endless procession. Every civilized land paid its tribute to his genius. A celebration was given in his honor jointly with that of Virchow, who was also 70 years old the same year, when the greatest sons of Germany joined in singing the praises of the two men who stood at the head of science.

Helmholtz came to this country last year to see the World's Fair, and delivered a lecture on his discovery of the ophthalmoscope at the College of Physicians and Surgeons in this city, on October 3. He spoke in English. He remained here several days, and many receptions were given in honor of himself and his wife.

PRINCIPLES OF DYNAMO DESIGN.

BY NEWTON HARRISON, E. E.

(*Continued from Page 133.*)

When an iron circuit, that has been magnetized, be interrupted by an air gap, a strong field is at once apparent at the points marking the separation. (Fig. 8.)

Although it appears to be the strongest point in the circuit, in reality it is the weakest; and in order to bring the strength of field at that point to a stage of magnetization equal to that of the iron at any point, additional ampere turns must be employed. These turns can be calculated by the formula:—

FOR AIR.

NC = Amp. turns
B = Total flux
L = Length in cms.
Q = Cross sections in sq. cms.

$$NC = .8\,B\frac{l}{q}$$

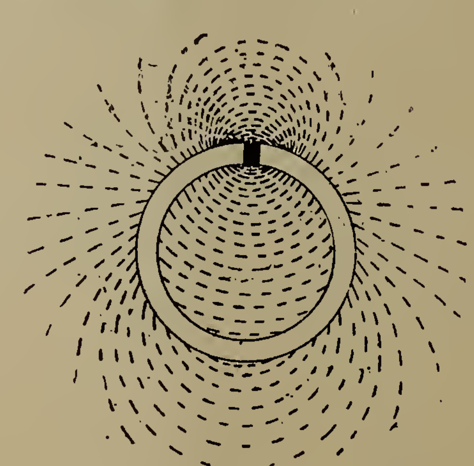


FIG. 8.

in which l is in centimeters a q in square centimeters.

For the convenience of those unaccustomed to the French system the formula is given for inches and square inches.

FOR AIR.

L = Lengths in inches
Q = Cross section in sq. in.

$$NC = B\,.32\,\frac{L}{Q}$$

It must not be forgotten that these two formulas are only used for a medium whose permeability is constantly one as air.

In all calculations involving lines of force and ampere turns, it is taken for granted that ampere turns are to be obtained. In order to use the formula, therefore, it is necessary to know the number of lines of force required. As an example, if it is required to know how many ampere turns must be used to force 100,000 lines of force through a body of air 1 inch long and 5 inches in cross section—

$$NC = .32 \times 100{,}000 \times \frac{1}{5}$$
$$= 6{,}400 \text{ Ampere Turns.}$$

Saturation. As the iron becomes more highly magnetized a peculiar condition results. Iron cannot be magnetized to an indefinite extent. After the specific induction has passed a certain point of high value, the *M.M.F.* required for but a slight addition in the field constantly increases until the iron does not answer any more than the air, to an increased *M.M.F.* When such is the prevailing state of affairs the iron is said to be "saturated" or incapable of efficiently using further ampere turns.

As the iron becomes heavily magnetized, its permeability drops in inverse proportion. The magnetization curve clearly shows the bend at which any increase of lines of force is only obtained at a great sacrifice.

The point considered as most economical is at the knee or bend of the curve; from this point on the dis-

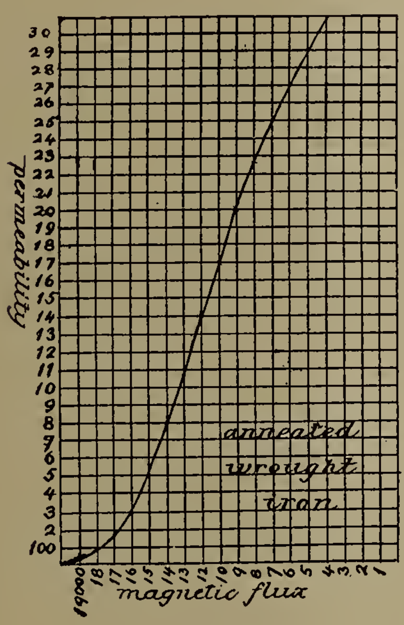


FIG. 9.

FIG. 10

proportionate increase in *M.M.F.* for slight increments of field begin.

The condition of annealed wrought iron when approaching this stage of strong magnetization can be made evident by its permeability curve.

The value of μ is least when B is greatest, and in the curve shows the rapid decrease from its maximum value of 3,000 when the induction increases from 4 to 19 000 per sq. cm.

Cast iron, by its inferior qualities as compared to wrought iron, can only be magnetized sufficiently within small limits. Its specific induction is generally about one-half that of wrought iron or steel, because a higher magnetization is commercially impossible, due to its less permeable properties.

The two curves, Fig. 9 and 10, show a great correspondence but a great difference in scope; the final magnetization of the cast iron being but the point from which, in the wrought iron, the permeable quality begins to strongly exhibit itself.

It is impossible to give a formula for the exact calculation of lines of force without any previous knowledge of the iron used.

Kapp makes this remark in his book on "Transmission of Power," Chapter IV, page 105. As yet no formula rigorously true for all degrees of magnetism has been found, and the difficulty is principally due to the fact that the chemical composition and the molecular properties of the iron play an important part which is not easily determinable beforehand. He adds to this statement by admitting the possibility of formulæ being used (with a magnetization below saturation point) that are sufficiently approximate for practical purposes.

Fleming in his "Alternate Current Transformer," Chapter II, page 27, remarks as follows: "Experiment shows that the ratio of B to H expressed by the quantity μ is not of a determinate character, and that the value of μ, so far from being constant, is dependent on the whole previous history of the iron, on the value of B, and on the nature of the magnetic changes the iron is undergoing, viz: whether H is increasing or diminishing.

Faraday called the permeability *the conducting power of a magnetic medium for lines of force.*

There are many things that change the permeability of iron. Of a series of samples cast at the same time in the foundry there will be striking differences in their respective specific inductions when exposed to the same magnetizing force. These differences may be traced to general causes, such as blow holes in the iron or steel and different rates of cooling.

As these differences may throw out an engineer's calculations regarding his field it may become necessary at some future date for the foundries to cast their metal so as to have it at a fixed initial permeability, and each foundry could circulate these facts for its own benefit to those interested commercially.

The same practice is carried on today as regards the conductivity of copper at a fixed temperature. As a parallel case, the iron could be tested and advertised as capable of a certain specific induction at a rated magnetizing force.

Of all methods used for the design of a magnetic circuit, there is none less tinctured with empiricism than that of Hopkinson.

Frölich employed a system involving the use of certain constants which has practically fallen into disuse on account of the difficulty of applying it.

Hopkinson, however, takes the standpoint of differentially considering the magnetic circuit. He treats the armature, air gap, magnet cores, yoke and pole-pieces separately, and having obtained the ampere turns necessary for each respective part, makes a sum total of them and applies that number of ampere turns to the magnets.

The leakage coefficient is also considered to complete the method, which is so exact, that according to Thornburne Reid, between the calculated and actual results in a special case a difference of only three per cent. occurred.

This formula, by which electro-magnetic design may be said to have been put upon a sound basis, is given as follows:

$$\text{Total ampere turns} = \left\{\begin{matrix}\text{Ampere Turns}\\ \text{for Armature}\end{matrix}\right\} + \left\{\begin{matrix}\text{A. T.}\\ \text{for Magnet Cores}\end{matrix}\right\} + \left\{\begin{matrix}\text{A. T.}\\ \text{for}\\ \text{Keeper}\end{matrix}\right\} + \left\{\begin{matrix}\text{A. T.}\\ \text{for}\\ \text{pole pieces}\end{matrix}\right\} + \left\{\begin{matrix}\text{A. T.}\\ \text{for}\\ \text{Air Gap}\end{matrix}\right\}$$

This is an unsymbolic exposition of the formula, which is used in connection with curves, or tables containing the same data.

It must be remembered that the only indeterminate quantity about iron is its permeability. Were this of a fixed and definite value as for air and the majority of the non-magnetic metals, the calculations of lines of force would be an exceedingly simple process. This has already been referred to in another portion of this paper.

This changeable condition of iron with its enormous variations in magnetic output when under the influence of different ampere turns, is such that unless some curves, tables or something equivalent be consulted, it is a most difficult thing to predict the magnetic strength at all without experiment.

If a certain sample of iron be tested for its permeability or an experimental machine be built, it becomes possible to approximate the permeability of the iron at different periods.

Therefore the use of curves taken from samples of the same kind though not of that particular quality will be of the utmost advantage in this respect.

(To be Continued.)

SOME ADVANTAGES OF ALTERNATE CURRENTS.*

BY PROF. SILVANUS P. THOMPSON, D. SC., F. R. S.

(Continued from page 129.)

One of the difficulties which beset the distribution of electric currents on the large scale is that of maintaining constant, at all points of the network of conductors, the voltage or pressure at which the current is delivered to the consumers. Between the generating station and the centre of distribution there occurs a loss of pressure (comparable to the loss of head in the case of water power), and beyond the centre of distribution, between it and the points of consumption in the house lamps, there is a further drop in the voltage. The former drop in the voltage can be compensated for by due arrangements at the central station, but the further drop between the distribution centre and the consumers' houses, though it may be guessed at and partially compensated by some system of over-compensating at the distribution centre, cannot be accurately compensated. The result is that the consumers' lamps do not receive their supplies of current at an unvarying pressure. Now in the case of continuous current distribution, the only cause for drop in the voltage at distant points is the resistance offered by the conducting wires leading to those points. The drop due to such resistance—or ohmic drop—is proportional to the ohms of resistance and to the amperes of current. Suppose a group of lamps requiring 20 amperes at some outlying point, the wires to which have a total resistance of only one-tenth of one ohm. The drop in voltage due to the ohmic resistance will be $20 \times 1\text{-}10 = 2$ volts. The lamps, which ought to receive their currents at a pressure of 100 volts only, return it at 98, and burn dimly in consequence. But in the case of alternating currents there is a second or additional cause of drop, which has hitherto been held to be a serious disadvantage in their use—namely, a drop due to the self-inductive action of the lines reacting and setting up back E.M.F.'s and tending to choke the current. In general, this second or inductive drop is not serious, the main and branches being arranged concentrically for the purpose of avoiding it as far as possible; but it may become serious when motors as well as lamps are employed upon the circuit, because of the considerable inductive reactions that are set up in the electromagnetic operations of these machines.

Alternate-current motors are of many sorts, but may be grouped under two chief classes—the synchronous and the asynchronous. Synchronous motors are those which only run at one fixed speed, determined for them irrespective of their load—a speed determined solely by the number of their own poles and the number of the alternations imposed upon the current by the generating machinery at the station. They must either run in synchronism with the pulsation of the current or else not run at all. The other class, the asynchronous, are mostly polyphase machines requiring two-phase or three-phase currents to operate them. The phase currents led into a suitable armature, there combine to produce a rotating magnetic field, and in this rotating field masses of iron or iron carrying closed circuits of copper are set into rotation, being magnetized inductively, and dragged round by the reaction of the eddy currents induced in them. The rotor, or rotating part, of the asynchronous motor may be regarded as a revolving field magnet not magnetized by any special exciter or initially, but magnetized only by the eddy currents induced in it. Now, if it could spin at the same rate as the revolving magnetic field that surrounds it, there would be no relative motion, no eddy currents, no reactions, and no driving force. It is driven by forces which depend for their existence upon the rotations not being synchronous with the pulsations of the currents in the circuits. Within certain limits it adjusts its speed so that its magnetic slip is proportional to the turning moment which it is called upon to exert.

Now, owing to these necessary reactions, the asynchronous motors produce upon the mains which supply them an inductive drop, and cause the pulsations of current to lag in phase behind the impressed pulsations

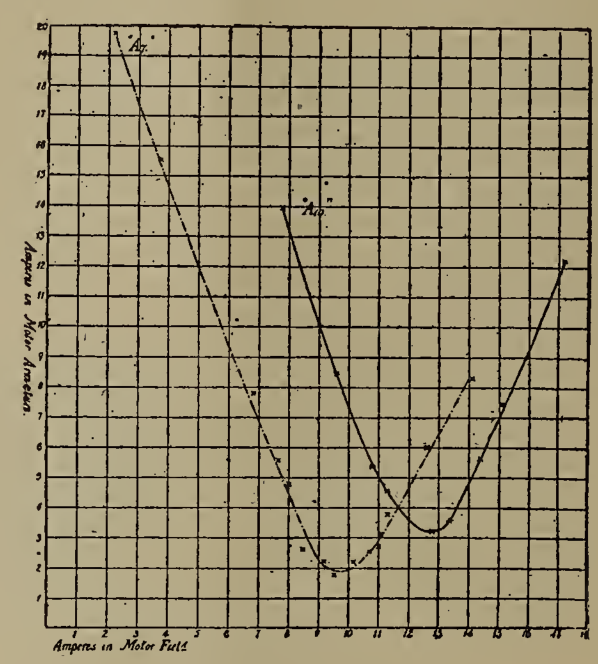


FIG. 2.

of voltage. Whereas the ohmic drop is not accompanied by any lag of phase in the current, the inductive drop is so accompanied. Happily, with alternate currents, there exists more than one remedy. It has long been known that a condenser exercises a reaction of another kind, which, though it tends to choke the current, does so not by retarding the phase of the pulsation, but by accelerating it. This precious property has long been known and used in submarine telegraphy to compensate, by the use of condensers, the retardations of the signals. But to apply condensers to systems of alternate-current supply for the purpose of counteracting the inductive drop when motors are used, would be a rather formidable task; the remedy is too heroic for the malady. A remedy of a different kind is, however, possible, and must before long become general when its advantages are known. To explain it we must return to the subject of synchronous motors, about which little has been said. It was shown in 1868 by Wilde, and in 1879 by Hopkinson, that two alternate-current machines could run together synchronously, one as generator, the other as motor, the one which served as motor adjusting itself so that its pulsation of E. M. F. tended (as in all motors) to oppose those of the impressed E. M. F. In 1884, Dr. Hopkinson further predicted that an alternate-current machine could run as a motor even if its mean E. M. F. was higher than that of the circuit, a result verified in practice by Mr. Mordey in 1890. In 1892, Mr. Mordey gave at the Institution of Electrical Engineers some further results of alternate-current working, including a very remarkable curve, here reproduced, showing the dependence of the armature current upon the excitation of the field magnets of the motor when loaded with a given load. To this curve and its meaning the author directed attention at the time, and he has since given much thought to it. It will be found to be most significant. The curve presents the form of a letter V. The lowest point corresponds to a particular state of things—namely, that the motor having its magnetism excited to a practical degree, draws a certain minimum amount of current from the mains in order to drive its mechanical load at the speed imposed upon it. But to do the same work, drive the same load at the same speed, will take more current from the mains if the excitation of the magnets is either more or less than this particular amount. This seems very strange, but the explanation and its consequences are no less so. The particular stage of excitation which makes the armature current a minimum for the particular load in question, is that stage which corresponds to there being no difference of phase between the pulsations of impressed voltage and those of the resulting current. Suppose, for example, the armature had a resistance of ½ ohm, and that the current was supplied at 100 volts, and that a current of 10 amperes was found the minimum current that would drive the load. It would be found (approximately) that the excitation corresponding to this minimum current would be such as would make the motor work with a back E.M.F. of 95 volts, for then by Ohm's law (100—95) ÷ ½ = 10 amperes. But now suppose the excitation is lessened, the machine, acting at the same unalterable speed, will generate less than 95 volts. Suppose it drops to 90 volts. Then, if nothing else happened, the current would increase to (100—90) ÷ ½ = 40 amperes. But 40 amperes at 90 volts is much more power than 20 amperes at 95 volts, and is more than is wanted for the load. What must happen? The machine is synchronous and cannot—physically cannot—run faster so as to take up this power. It tries to do so, with the result that it shifts the phase of its readings, the current now lagging in phase behind the E.M.F.—choked down, in fact, from the 40 amperes to something more than 20. Choked down, in fact, in such an amount as would, if multiplied by the cosine of the angle of lag and by the 90 volts, come up to the same product as the original volts and amperes—viz., 95 × 10 = 950. The synchronous motor, if *under*-excited, acts, then, as a choking coil, producing a reaction drop, But continue the experiment the other way. Suppose the excitation is increased so that the 95 volts becomes 100 volts (100—100) ÷ ½ = 0, and there would be no current at all to drive did not an adjustment of phases come into play. Instead of the current dropping to zero, more current than before now comes into play, and that current has its pulsations in advance of those of the impressed voltage, there being now an angle of *lead* in the phase relations. In other words, the synchronous alternating motor, if *over*-excited, acts as a condenser, and instead of producing a drop in the voltage tends to raise it by compensating the inductive drop due to self-induction in other parts of the circuit. When the importance of this deduction from Mr. Morley's curve dawned upon the author, he began to prepare to test it upon the mains of the City of London Electric Light Company. But before any experiments could be even arranged he learned that the same conclusions had been arrived at by the officials of the General Electric Company at Lynn, Massachusetts, and that they had found it in practice to work out favorably. By the courtesy of Mr. W. F. Parshall, one of the engineers of that company who has been associated for long with Prof. Elihu Thomson, Mr. Steinmetz and other engineers, the author is able to state the following particulars. They found that in a line where self-induction played the part of a choking coil, it did not matter very much whether the voltage needed for driving the current through the line and machine were situated mainly in the generator or in the motor, as the mean voltage in the line was not far from a mean between that of the two. Accordingly, in a three-phase power transmission at Hartford, Conn., of 300-Kilowatt output the motor was arranged to be over-excited. Later after Mr. Steinmetz had submitted the question to calculation, this feature was introduced into the synchronous motors used in all their recent power transmissions, so that by proportioning the armature reaction and the over-excitation to the self-induction likely to arise, the voltages on the circuit remain quite constant regardless of load within the capacity of the machines. In thanking Mr. Parshall for his information, I may add two points of comment. The advantage so to be derived from over-excitation have indirectly another advantage—viz., that for single transmission cases the motor and the generator may be designed and constructed as identical machines, instead of the motor being made smaller than the generator. Further, the regulation of the voltages in such a network as that of the City of London Electric Light Company, instead of being made more difficult when motors are much used—as was feared by some engineers—will be more easy, provided the motors are of the over-excited synchronous type. For the acceleration of phase these produce in the current not only tends to compensate for the inductive drop in mains and transformers, but tends to reach right back through the system to the generators in the central station, acting on them as a compound winding would, and assisting them, not only to counteract the inductive drop, but also the ohmic drop, both between the consumers' lamps and the distributing points, and also between these points and the generating station.

So manifest is this advantage, that it would seem worth while to erect at one or possibly more points of the network, as remote as possible from the generating station, synchronous motors over-excited to act as condensers in compensating the inductive drop, or in the primary circuit, also to furnish the idle currents for magnetizing the transformer primaries.

With such possibilities open in the future for alternate-current working, and with such advantages in respect of motive power over continuous-current working, it can hardly be doubted that, save in a few special cases, the vast majority of central stations will henceforth be operated by alternate currents.

THE CANADIAN ELECTRICAL ASSOCIATION.

The annual meeting of the Canadian Electrical Association will be held at Montreal, on Wednesday, Thursday and Friday, September 19, 20 and 21. The sessions will be held at the Mechanics' Institute Building. The headquarters of visiting delegates will be at the Queen's Hotel, on Windsor street, a special rate having been secured for accommodations.

The following is the programme of the meetings:

Wednesday, 11 A. M.—Paper "The Application of Electricity for Medical and Kindred Purposes, from Light and Power Circuits," by W. B. Shaw, Montreal.

Paper "Electrolysis," by J. A. Baylis, Bell Telephone Company, Toronto.

Paper "Alternating Motors," by L. M. Pinolet, Montreal.

Thursday, 11 A. M.—Paper "Electric Brakes," by Elmer A. Sperry, Cleveland, Ohio.

Paper "A Method of Distribution with Equalization of Potential Difference," by D. H. Keeley, of the government telegraph service, Ottawa.

Paper "The Possibility of Securing Better Regulation at Central Light and Power Stations by Means of Fly-wheel Accumulators of Improved Construction," by John Galt, C. E. and M. E., Toronto.

Paper by John Langton, Toronto.

Friday, 10 A M.—Paper "Municipal Electric Lighting," by E. Carl Breithaupt, Berlin, Ont.

Paper "Telephone Cables, their Construction and Maintenance," by F. J. Schwartz, Bell Telephone Company, Montreal.

Paper by T. R. Rosebrugh, lecturer in electricity, School of Practical Science, Toronto.

Election of officers.

The committee on entertainment has arranged a trip to Lachine for Wednesday afternoon, returning by way of the Lachine Rapids. On Thursday morning at 9:30 o'clock the members will visit McGill University, by invitation of the faculty of applied science and Prof. Charles A. Carus-Wilson of the electrical department. The visitors will be given an opportunity to inspect the electrical laboratories and witness a practical test on a transformer of apparatus for the measurement of alternating current. In the afternoon at 4:30 o'clock there will be a special excursion on the Montreal Park and Island electric railway to Back River. Dinner will be served at Pelequin's Hotel, Back River, at 6 P. M. On Friday afternoon, by courtesy of the Eugene F. Phillips Electrical Works, the visitors will be driven to Mount Royal Park, and they will also be afforded an opportunity to inspect the Montreal street railway power house. In addition to these features the committee announces that Ahearn & Soper, of Ottawa, have extended the visitors an invitation to visit Ottawa and examine the points of interest and the electrical features of the town.

THE NEW YORK ELECTRICAL SOCIETY.

Through the courtesy of the Edison Electric Illuminating Company, of Brooklyn, a large number of the members of the New York Electrical Society, on the evening of September 6, inspected the Ambrose Park (Buffalo Bill's Wild West show) lighting plant, and afterwards witnessed the performance of this wonderful exhibition of rough riding, shooting, etc., etc.

Just before the performance an open-air meeting was called together by President Mailloux, who introduced W. S. Barstow, the general manager of the Illuminating Company. Mr. Barstow briefly described the main features of the plant and the system of illumination of the arena. The principal object that was sought to be attained in the illumination of this large space was to provide sufficient light so that the out-door performance could be carried on at night as well as by day, and, at the same time avoid the casting of shadows. The public stands are arranged in the form of an immense letter U, at the open end of which the performers enter the arena. Around the inside edge of the roof of the stands are arranged fifty 4,000-candle-power focussing lamps, all throwing their rays into the central space. The effect of this arrangement is to give a remarkably well-diffused light, which illuminates the arena to a very great degree, without casting any shadows whatever. In addition to these lamps, there are three 10,000-candle-power searchlights on the roof, over the grandstand, which are used for special illumination, such as for throwing light on the glass balls used in the exhibition of skill in the use of fire arms and other like features of the performance.

The grounds, which are 22 acres in extent, are illuminated by 77 2,000-candle-power arc lights and 800 16-candle-power incandescents, most of the latter being used for the illumination of the interior of the stands.

The generating station was completed in four weeks' time and is built on piles. The plant consists of four 100-K. W. Edison dynamos, driven by two 300-H. P. cross compound horizontal Ball engines, each engine driving two dynamos. The steam generating plant consists of two 250-H. P. Morrin "Climax" safety water tube boilers, built by the Clonbrock Steam Boiler Works, Brooklyn. The details of the plant were fully explained by Mr. Barstow and M. B. Bailey, the electrical engineer-in-charge.

The use of the electric light for the illumination of large spaces out of doors is a problem that electrical engineers have been for a long time trying to solve, and the members of the society were surprised to see how satisfactorily it has been accomplished in the case of the Wild West Show. The results are a complete success, and it is no longer a mere figure of speech to say that night can be turned into day—it is now actually possible for all practical purposes.

To the Hon. W. F. Cody, the great "Buffalo Bill," and Nat Salsbury, vice-president and manager of the "Wild West Show," belongs the credit for the conception of this scheme of illumination, and to W. S. Barstow the honor of carry-ing it into practical effect. It was a large undertaking, but the results show what human thought and skill can accomplish when both work in harmony with one object in view.

At the conclusion of the performance the members of the party assembled in the centre of the arena, where they were photographed by the aid of electric and magnesium flash lights.

A hearty vote of thanks and three cheers were given to Mr. Barstow and "Buffalo Bill" for the courtesies extended to the Society, and the members individually expressed themselves well pleased with the evening's entertainment.

Many of the members were accompanied by ladies, who apparently enjoyed the novel sights. They were immersed in an atmosphere which constantly vibrated with the sounds of electrical jargon, but no *resistance* was offered, and they went *ohm* happy over their entertainment.

MULTIPLE FUSE ARRESTERS.

The function of lightning arresters, on electric circuits, is well known and appreciated by a large majority of those operating electrical plants having overhead conductors, and but few such plants are now operated through thunder-storms without some sort of protection against lightning discharges. Occasionally one finds a station that is always shut down at the approach of a thunder-storm, and is not started again until the danger is past; but by this means of protecting electrical apparatus, large revenues are annually lost to companies who thus render their plants inoperative many times during the season of storms. The first cost of a full equipment of arresters is seldom the cause of such a state of affairs, for frequently a single stoppage means a loss to the company exceeding the entire cost of arresters.

Lightning arresters differ, as do the circuits they are intended to protect, or according to the ideas of their designers as to the best means of preventing, or rupturing the arc which may follow a lightning discharge across the air gap between the discharge points.

In view of the difficulty attending the preservation of the discharge points of any arrester with a small air gap (and arresters must have small gaps to protect the finely wound coils of measuring instruments, as well as armatures and field coils), an idea presented itself that a succession of very sensitive discharge points, one for each discharge, might be made more efficient and reliable for a given number of discharges than any one pair of points could be.

The Ajax arrester, illustrated herewith, is of the latter type, and consists chiefly of a porcelain arrester box, with a fibrone cover containing eleven fuse dischargers.

The fuse (Fig. 1) consists of two pieces of No. 26 brass wire, each 3 inches long, having a single silk insulation and laid side by side for about one inch. This one inch lap of the wires offers abundant surface for the discharge gap, which is formed by the two thicknesses of silk, and amounts to little more than .002

FIG. 1.

of an inch. The wires are held in this position by small pellets of insulating wax and a small glass tube is hermetically sealed over this part of the fuse to keep the dischargers clean and dry until used.

The soft rubber plugs serve to hold the fuse in the corrugated cover of the arrester and the bare ends of the wire project through the cover, ready to be brought into contact with the line and ground terminals.

Into the back of the cover are pressed two strips of metal; one a plain flat strip, to which is connected by a long clamp one end of each fuse; the other strip is U-shaped, and into it the remaining ends of the fuses project, but do not make contact with it, except as the carbon ball completes the connection.

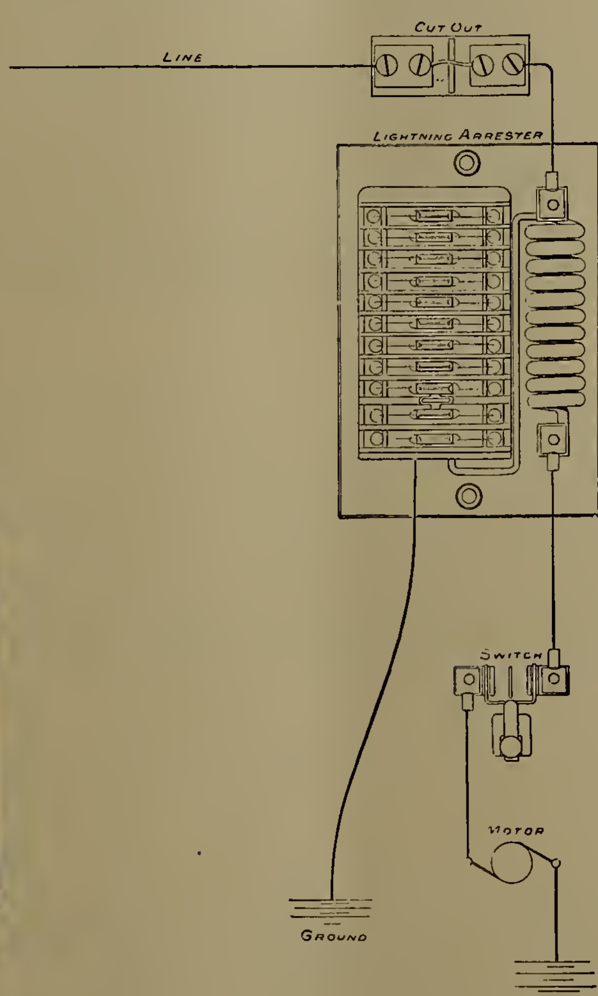


FIG. 2.

FIG. 3.

In Fig. 2 the carbon ball is shown making contact between the top fuse and the U-shaped strip, which, when the cover is inserted in the porcelain back of the arrester, will receive metallic connection with the line terminal through the flat spring provided for that purpose in the channel at the right in the porcelain. A similar spring is in the left channel to connect the flat strip in the cover to the ground terminal.

The line and ground terminals and flat contact springs in the porcelain backs are well illustrated in Figure 3.

With the arrester thus assembled, it will be seen that only the top fuse has connection with the line terminal, and consequently is the only one that can be operated upon by a lightning discharge. The fuse may, or may

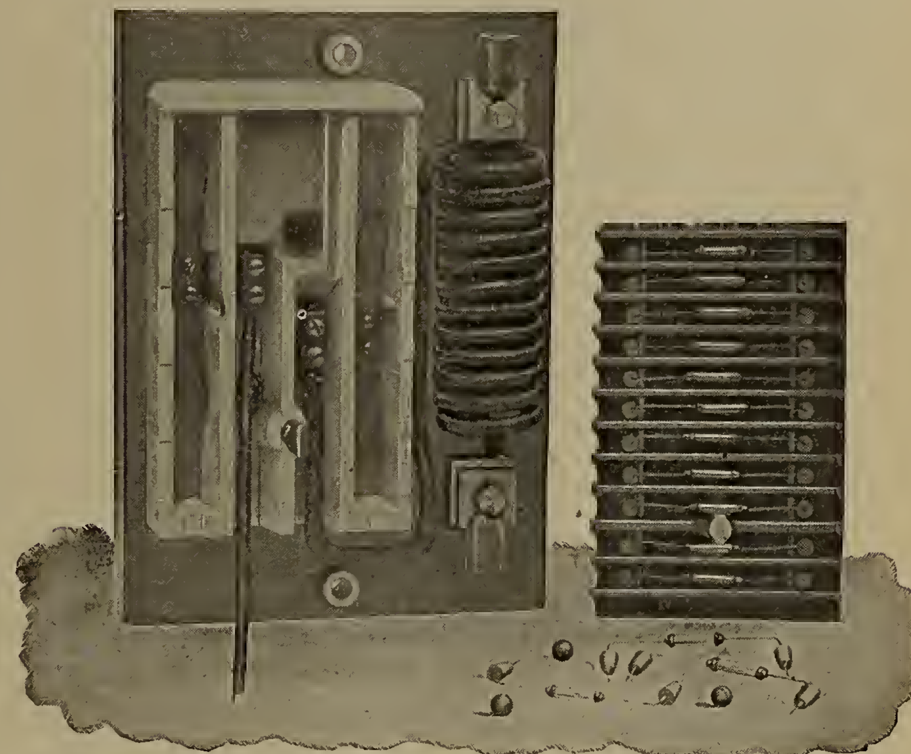


FIG. 4.

not, be destroyed, depending upon the severity of the discharge and the condition of the line. If the line has a high potential and ground return, such as used on single trolley railway circuits, the static discharge will short-circuit the generator current at the discharge points and the fuse will be completely vaporized by the current following the discharge, which will permit the carbon ball to fall to the next fuse, bringing it into circuit automatically, ready to receive a second discharge.

If a low potential metallic circuit is thus protected, one fuse may take care of several discharges, providing

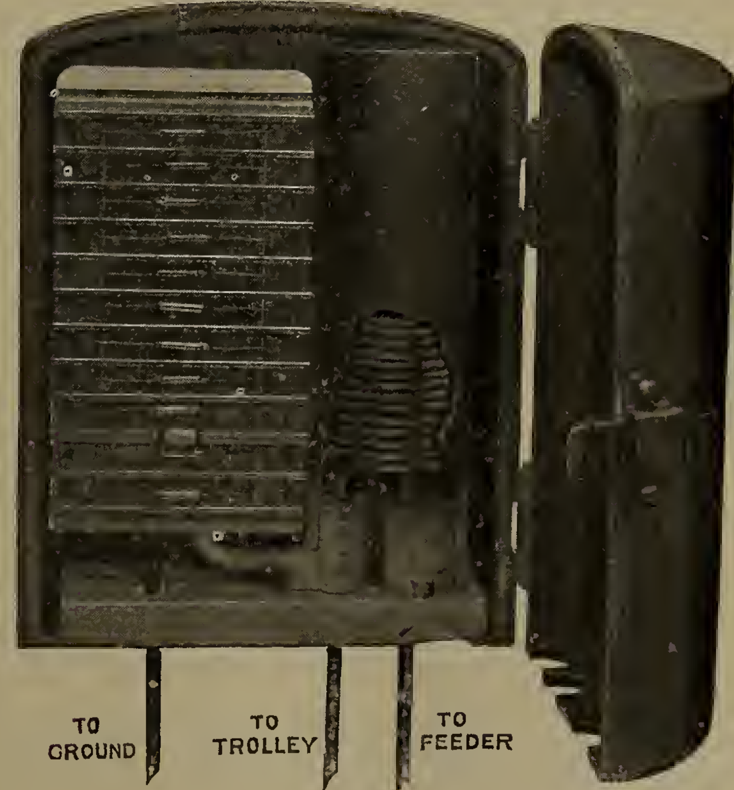


FIG. 5.

the circuit is perfectly free from grounds. If an accidental ground exists at the time of the discharge, the action will be the same as in the case of the railway circuit with the ground return. Or, if only a partial ground should exist at such time, the destruction of the fuse might not be complete; but the relative conductivity of the contact between the carbon ball and the small brass wire, as compared with the rest of the fuse, is so inferior in the former that the end of the wire supporting the ball is always the first to disappear, and is sure to allow the ball to drop and reset the arrester, even though the fuse should be only partially destroyed.

The standard types of Ajax arresters are adapted to all currents up to 1,000 volts, whether having metallic or ground returns, but for higher potentials fuses with a slightly wider gap are used. They are provided with a choke coil in the main circuit, so as to divert the lightning discharge from it into the lightning arrester and thence to ground. The coils are furnished in any capacity, to suit the conditions of the circuit upon which they are to be used.

In a station the arrester may be placed on the front of the switchboard or any other convenient location. Its dimensions are 7 inches by 4½ inches by 2¼ inches.

Fig. 4 shows the type of arrester used for protecting stationary motors or isolated plants. The regular size is made with a 100 ampere coil.

The Ajax electric car or pole line arrester (Fig. 5) is enclosed in an asbestos-lined iron box, to protect it from dust and external injury.

Double arrester pole boxes of this type are also made for street railway use. One arrester on each side of the coil protects the trolley and feed wires respectively.

The Ajax Lightning Arrester is adapted to protect electrical apparatus on all circuits up to one thousand volts potential. It is made by C. S. Van Nuis, 136 Liberty street, New York City.

ELECTROLYSIS OF WATER PIPES.

The annual meeting of the American Waterworks Association was held in Minneapolis, August 21 and 22 last, at which were read some papers of interest to electrical people "Electrolysis Affecting Water Mains," was the subject of a paper by G. H. Benzenberg, of Milwaukee, Wis. Other papers of a like character were presented.

Mr. Benzenberg supplemented his paper with some remarks of general interest. He told how a waterworks engineer could determine whether or not his pipe was being acted upon by electric currents, by using a sensitive voltmeter and ammeter. Any of the employés "can, at the time they tap the main along the lines of a street railway, or occasionally with a hydrant, connect the same, one end with the water pipe and the other with the rail. If it indicates that the pipe is positive there is danger to that pipe. If the pipe shows it is negative to the rail, there is no possible danger. The information can be easily and quickly obtained. It does not need an expert.

"As soon as it is indicated that the pipe is positive to the ground, further investigation should at once be made, first, as to whether the soil contains any of the salts heretofore mentioned; and if it does, there is no question but what electrolysis is taking place and corrosion of the pipe is occurring at some point There is no necessity of opening your trench to ascertain where this electrolysis is taking place; all it needs is to establish the proper equilibrium at that point between the pipe and the rail by making a connection, with a good clamp and sufficient copper bond, between the pipe and the rail. At that point, at least, and for a long distance your pipe is immediately made negative and freed from all danger. It is surprising how quick the change takes place, and yet it is not surprising—because, as has been stated, the flow of the current is instantaneous. I have known where a tap had been made and the voltmeter showed the pipe of five-tenths of a volt positive, sufficient to produce corrosion if the salts of the earth were of such a nature as to cause electrolytic action. A bond was placed around that pipe by our own man—keeping the volt ammeter in connection—and the moment the connection was made with the rail the pipe became negative.

"I think it is well for the waterworks engineer to be in possession of this information, and to make these tests for himself."

In answer to an inquiry from a delegate Mr. Benzenberg stated that the voltmeter test is applied "at such times as the pipes are uncovered in the regular work. Trenches are not opened for that particular purpose, but as it happens here and there, the observations are made in a few minutes."

PRIOR PATENT OR PUBLICATION.

Section 4,886 of the Revised Statutes requires that a thing, in order to be patentable, must be "not patented or described in any printed publication in this or any foreign country before his (the inventor's) invention or discovery thereof." Section 4920 specifies as a defense to an action for the infringement of a patent, this: "Third, that it (the patented thing) had been patented or described in some printed publication prior to his (the inventor's) supposed invention or discovery thereof. * * And in notices as to proof * * the defendants shall state the names of patentees and the dates of their patents, and when granted * *" Such prior patent or printed publication may be a home or foreign production; section 4886, above quoted, distinctly says so. Such prior patent or printed publication must precede the patentee's date of *invention*; to merely precede the date of the patentee's application for patent will not suffice; not only do the above sections of statute distinctly say that, but the Supreme Court has had occasion to as distinctly decide it. So far as a prior patent is concerned it makes no difference what the *claims* of the prior patent are or whether or not it is an expired patent; in this regard a prior patent, expired or unexpired, and a prior printed publication, all stand on the same footing; the vital question as to each is: What does it show and describe?

Telephony in Italy.—The project for the erection of telephone lines between the chief Italian cities is ready. The lines will be: Rome—Naples; Rome—Genoa, Turin; Rome—Florence, Milan; Turin—Milan; Turin—Genoa; Rome—Florence—Venice. It is subsequently intended to construct lines in connection with Paris, Berne, Berlin, Vienna and Trieste. The Italian Minister of Posts and Telegraphs has decided to send an ins pector to Germany to study and report upon the organization of the telephone service in that country.

TO THE ATLANTA CONVENTION.

Quite a party of New York electrical people will go to Atlanta next month on the special train from New York, over the Royal Blue Line and the Shenandoah Valley route. The train will be composed of vestibule sleeping cars and a dining car, and will run through without change, leaving New York, October 15, at 3 P. M., and arriving at Atlanta early the next evening. Among the New Yorkers who have signified their intention of going by this route are the following named:—Wm J. Richardson, secretary of the American Street Railway Association; J. A. Seely, J. H. McGraw, C. O. Baker, Jr., George F. Porter, A. D. Newton, T. E. Crossman, P. C. Ackerman.

Personal.—N. S. Possons, president and general manager of the Universal Electric Co., Cleveland, O., is in town this week.

THE AMERICAN STREET RAILWAY ASSOCIATION.

ATLANTA CONVENTION, OCTOBER 17–19.

Extraordinary preparations are being made for the next meeting of the American Street Railway Association, which will be held in Atlanta, Ga , on October 17, 18 and 19, next. It is just about a month from now, and those who have had experience know the vast amount of labor that is entailed in making preparations for a big meeting; so there is not too much time left.

Everyone seems to think that the selection of Atlanta as the place of next meeting was a fortunate one. Atlanta is the queen city of the South, and the most enterprising. Except for the characteristic southern pronunciation which is heard south of Mason and Dixon's line, no one in Atlanta would ever suspect that he was in the heart of the great South. The streets of the city are busy thoroughfares, and the buildings are modern. Atlanta is a pleasant place in October, and this fact, in addition to that that the meeting promises to surpass all its predecessors in importance and interest, will undoubtedly bring out a large gathering

The Aragon Hotel, at the corner of Peachtree and Ellis streets, will be the Association's headquarters, and the meetings will be held in Machinery Hall, at the exposition grounds, where, also, the exhibition of street railway supplies will be held. The exposition grounds are about three miles distant from the centre of the city, and are reached by two lines of street cars, and by the Richmond and Danville R. R. The exhibition hall is amply large for the exhibits, and every convenience will be provided to render this feature of the convention a complete success.

Among the rules governing the exhibits are the following.

All goods shipped to the Exhibition should be plainly marked "Street-Railway Exposition, Atlanta, Ga." It is advisable to secure a time-limit delivery. Be sure to allow plenty of time for transportation.

On and after October 10, exhibitors and their agents and workmen will be admitted to the building for the purpose of preparing necessary structures.

The general reception of articles for exhibition will commence on October 10.

Exhibitors of machinery in operation must have everything in running order, in readiness to start their machinery on the morning of the opening day.

All goods intended for exhibition must be on the premises and properly displayed on or before Tuesday evening, October 16.

Exhibitors must provide all counter-shafts, pulleys, belting, switches, switchboards, etc., necessary for the operation of their machinery.

No platform or other structure must be nailed to the floors or walls.

Exhibitors must not place any sign or circulate advertisements, except such as pertain to their own business (and those only in their own space) without written permission from the Secretary.

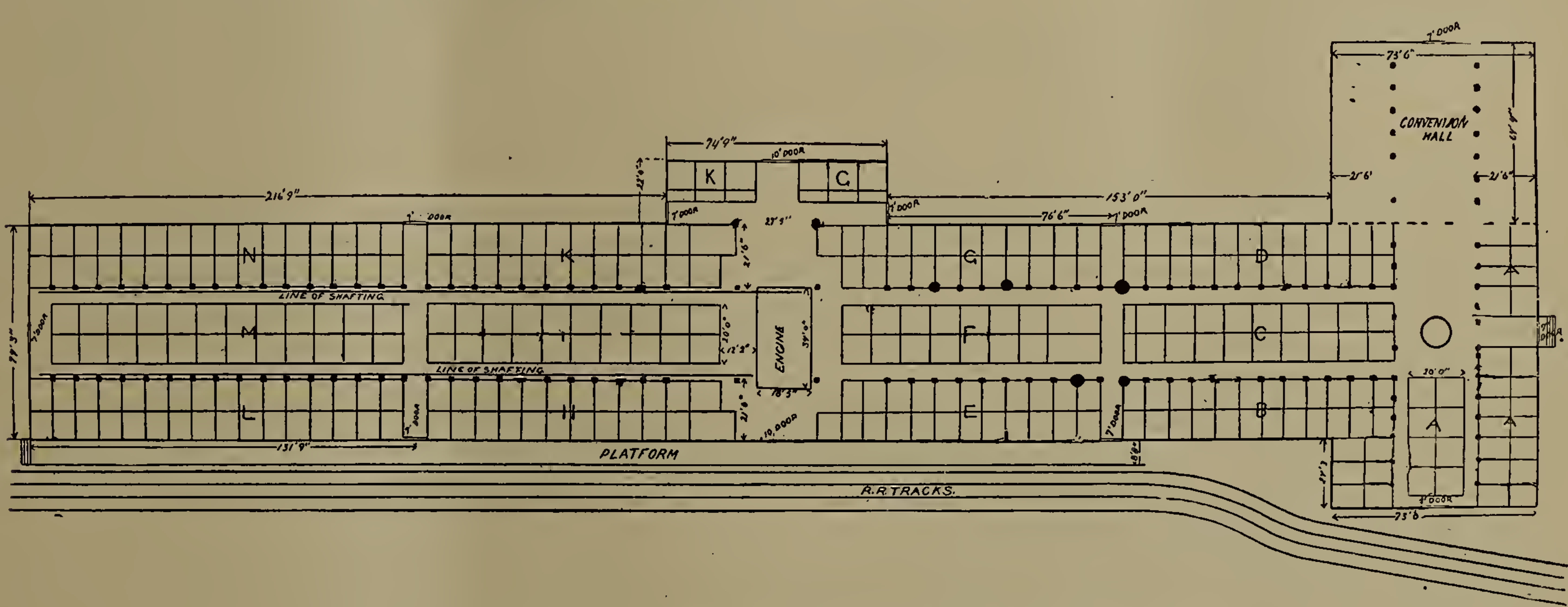
Electric power will be furnished to those who use power. The charge therefor, during the entire time of the Exposition, will be 45 cents per rated K. W. of machine actually using current. The minimum charge for power will be fifteen dollars.

All machinery will, if possible, be exhibited in motion, and should be kept in motion at regular work during the hours 9 to 12 A. M., 2 to 6 and 7 to closing P. M.

Sale privileges. Parties desiring to sell and deliver in the building any articles whatever, must first obtain a written permit from the Secretary, for such consideration as may be determined upon.

Any permit to sell may be revoked at any time at the pleasure of the Association.

Every possible precaution will be taken to guard against fire, and a full corps of watchmen will be on duty day and night; but the Association will not be responsible for loss or damage to articles on exhibition by theft, fire or otherwise.



ATLANTA CONVENTION—PLANS OF CONVENTION AND EXHIBITION HALLS.

The Association reserves the right to charge an admission fee to the citizens of Atlanta should it so determine, but the admission of exhibitors and their agents will be free.

For further particulars address N. W. L. Brown, Chairman, Committee on Exhibits, Equitable Building, Atlanta, Ga., or W. J. Richardson, Secretary, American Street Railway Association, 166 Montague street, Brooklyn, N. Y.

The following is a programme of the business to come before the convention:

"Can the T-Rail be Satisfactorily Used in Paved Streets?" Joel Hurt, President Atlanta Construction Street Railway Co., Atlanta, Ga.; S. Hendrie, Manager Wyandotte and Detroit River Railway Co., Detroit, Mich.; H. J. Crowley, Engineer Atlanta Construction Street Railway, Atlanta, Ga.

"City and Suburban Electric Railways." Edwin C. Foster, Supt. Lynn and Boston R. R., Boston, Mass.

"Mail Express and Freight Service on Street Railway Cars." Richard McCulloch, Electrical Engineer Citizens' Railway, St. Louis, Mo.

"The Best Method of Treating Accidents and Complaints." John B. Parsons, General Manager, West

Chicago Street R. R. Co., Chicago, Ill.

"Street-Car Wheels and Axles." D. S. Cook, Electrical Engineer, Trenton Passenger Railway Co., Trenton, N. J.

"Transfer and Commutation." Rodney Curtis, President Denver Tramway Co., Denver, Col.

"The T-Rail Construction of the Terre Haute Street Railway Co." M. F. Burke, Supt. Terre Haute Street Railway Co., Terre Haute, Ind.

"A Standard Form for Accounts for Street Railways." H. I. Bettis, Cons. Engineer Atlanta Construction Street Railway Co., Atlanta, Ga.

The officers of the American Street Railways Association are :

President, Henry C. Payne, Milwaukee, Wis. ; First Vice-President, W. J. Stevenson, Washington, D. C. ; Second Vice-President, James R. Chapman, Grand Rapids, Mich ; Third Vice-President, Lewis Perrine, Jr., Trenton, N. J. ; Secretary and Treasurer, Wm. J. Richardson, Brooklyn, N. Y. Executive Committee : The President, Vice-Presidents, and D. F. Longstreet, Denver, Col. ; Thos. H McLean, Indianapolis, Ind. ; Edward Whittaker, St. Louis, Mo. ; W. Y. Soper, Ottawa, Can., and E. S. Goodrich, Hartford, Conn. Official stenographer, T. E. Crossman.

NEW YORK STATE STREET RAILWAY ASSOCIATION.

CONVENTION IN SYRACUSE, SEPTEMBER 18.

The twelfth annual convention of the New York State Street Railway Association will be held in the Yates House, Syracuse, N. Y., on September 18. The indications are that an unusually well-attended and interesting meeting will be had. Major G. W. NcNulty, of the Metropolitan Traction Company, of New York city, will read a paper entitled "Recent Improvements in Cable Traction." J. B. Craven, electrical engineer of the Buffalo Railway Company, will read a paper on "Economy in Electric Power Stations."

A number of supply men will be present and will show many new things of interest to street railway men and improved old things.

The New York Association is one of the most progressive of the State associations, and at its meetings are always seen the faces of men who are stars and giants in the street railway business.

The officers during the present term are : President, Daniel B. Hasbrouck, New York city ; First Vice-President, G. Tracy Rogers, Binghamton, N. Y.; Second Vice-President, James H. Moffitt, Syracuse, N. Y.; Secretary and Treasurer, William J. Richardson, Brooklyn, N. Y.; Executive Committee, John N. Beckley, Rochester; Daniel F. Lewis, Brooklyn; Charles Cleminshaw, Troy.

MAINE STREET RAILWAY ASSOCIATION.

The Maine Street Railway Association held its midsummer meeting at Rockland, Me., August 16 last. Matters of interest to the members were discussed, after which the delegates were taken to Bay Point Hotel, where an elegant dinner was served.

PENNSYLVANIA STREET RAILWAY ASSOCIATION.

The third annual meeting of this association was held at the Neversink Hotel, Reading, Pa., on September 5 and 6. Several interesting and valuable papers were read and discussed, and after the business of the convention was concluded excursions were made over the Reading Traction Company's lines and the gravity roads on Penn and Neversink Mountains.

POWER STATION FIGURES.

Some interesting figures regarding the construction and equipment of a modern power station are given in a recent lecture by Prof. H. J. Ryan, of Cornell University. The lecture is summarized in the *Engineering Magazine* as follows :

The amount of floor space required per horse-power varies from 9.5 square feet for plants of 2,000 horse-power and upwards, to 22 square feet for plants of 100 horse-power and under. A fireproof building of brick and iron may be estimated to cost about $40 per horse-power for 100 horse-power plants, which, for plants of 2,000 horse-power and over, falls to $17 per horse-power. The best type of engine for railway-power stations is the compound condensing engine, and the engine capacity should be from 20 to 25 horse-power per car operated. The actual amount required varies from 15 to 18 horse-power per car, sometimes rising to 20 on steep grades. The estimated cost of steam plant is from $45 to $55 per horse-power for high-speed, and $65 to $75 per horse-power for slow-speed engines of the Corliss type. A power-station generator must be absolutely automatic, in practice as well as theory. Machines that do not give an increase of pressure proportionate to load work badly when coupled together. The cost of the electric generating system, including switchboards, should be from $35 to $40 per horse-power. The switchboard must be mounted on an incombustible base, and a rheostat, voltmeter and dead-beat ammeter provided for each generator. A trustworthy form of lightning arrester and a safety circuit breaker which will act promptly at the point at which it is set, are absolutely essential. Fuses are less reliable than magnetic devices for this work. An essential feature of the switchboard should be an equalizing bar which places the series coils of all the machines in parallel with each other, and thereby prevents the possibility of any generator acting as a motor in case its potential accidentally falls too low, a circumstance liable to result in serious injury to the machine.

NEW YORK NOTES.

Office of the Electrical Age,
World Building, New York,
September 10, 1894.

The Metropolitan Traction Company has applied for permission to extend the lines of the Columbus and Ninth Avenue Railroad Co., through West 109th street to Manhattan avenue, thence to West 116th street. In the application it is stated that the underground trolley system will be used. Later on the Metropolitan Traction Company will apply for permission to extend its lines up Manhattan and St. Nicholas avenues as far as Kingsbridge road. As the Third Avenue Company is after a similar franchise, it is likely that a lively time will ensue.

The Edison Electric Illuminating Co., of Brooklyn, reports gross earnings for August of $29,351, an increase of $11,680 as compared with the same month of last year, and net $9,341, an increase of $4,639.

W. T. H.

NEW CORPORATIONS.

United Telegraph, Telephone and Electric Co , Chicago, Ill., operating telegraph and telephone lines, etc. Capital stock, $1,000,000.

Jacksonville Electric and Power Co., Jacksonville, Ill., furnishing electric light and power, dealing in electrical machinery, etc. Capital stock, $100,000.

The Hartford Electric Street Railway Co., Hartford City, Ind. Capital stock, $100,000.

Mutual Telephone Co., Fort Scott, Kansas. Capital stock, $1,000.

The Lenox Electric Co., Lenox, Mass., furnishing electric light, heat and power. Capital stock, $20,000.

The Ohio Storage Battery Co., Cleveland, Ohio, manufacturing electrical devices. Capital stock, $1,000.

The Citizens' Electric Co., Middletown, Ohio, furnishing light, heat and power. Capital stock, $20,000.

The Canton Light, Heat and Power Co., Canton, Ohio, supplying electricity. Capital stock, $50,000.

Tramway Power Storage Co., New York, N. Y., utilizing super-heated waters as motive power for street cars. Capital stock, $1,5co,000.

The Morse Electric Economy Co., New York, N. Y., manufacturing storage batteries. Capital stock, $5,000,-000.

The Electro-Magnetic Traction Co., Washington, D. C. Capital stock, $5,000,000.

The Block Lighting and Power Company, No. 1, to manufacture electricity for public and private uses in New York city. Capital, $50,000. Directors, Robert Stafford, Albert M. Palmer, Edward Lauterbach, and Thomas B. Robertson, of New York city.

POSSIBLE CONTRACTS.

T. Suddoth, Mt. Vernon, Ill., can give information concerning a contract to be awarded for furnishing the city with electric arc lights.

A contract is to be awarded in Vancouver, B. C., for an electric plant of 200 arc lights and 2,000 incandescent lights capacity. T. F. Guigan can give further particulars.

A contract is to be awarded in Portland, Ore., for arc and incandescent lamps for next year. For further particulars regarding the same, address W. H. Merrick.

An electric light plant is to be installed in the shoe actory of Johnson Bros., Hallowell, Me.

The Cherry Cotton Mills, Florence, Ala., are about to install an incandescent plant.

The Gaffney Manufacturing Co., Gaffney, S. C., contemplates adding new dynamos to supply the city with electric lights.

BUSINESS NOTES.

The Westinghouse Electric and Manufacturing Co., Pittsburgh, Pa., has closed a contract for 4,500 H. P. in generators and 300 motors, the latter for the 150 cars.

The Niagara Falls Power Company, Niagara Falls, N. Y., has increased its capital stock from $2,600,000 to $3,000,000.

TRADE NOTES.

A contract for the completed work for the West End Street Railway Co.'s subway system, Boston, has been awarded the National Conduit Manufacturing Company, of New York. This contract will amount to about $60,000. The National Conduit Manufacturing Company feel very much elated over this, as they were brought in direct competition with every style of conduit system that is in use today.

The Colburn Electric Manufacturing Co., Fitchburg, Mass., has just issued a neat catalogue of its electric generators and motors, for electric lighting, power and metallurgy. The catalogue is very generously illustrated.

THAT MAKES A DIFFERENCE.

"It seems as though the railroads were using smaller rails now than formerly," said a gentleman while travelling in the West. "Oh, no,'' said his companion, "you are entirely mistaken. All of the great trunk lines are laying heavier rails wherever changes are made. Your error is easily explained: You have been accustomed to travelling over the New York Central, which is equipped with 100 pound steel rails of the most durable quality, and of the most accurate size and shape: the alignment is perfect—and the rails are laid upon the sleepers with the greatest precision. This condition of the roadbed of the New York Central is necessary in order to operate the procession of great trains at a very high rate of speed, of which the most conspicuous are: the Empire State Express, the eight-hour train between New York and Buffalo; the Exposition Flyer and New York and Chicago Limited of the Lake Shore road, the North Shore Limited of the Michigan Central, and the Southwestern Limited of the 'Big Four,' all of which run to and from New York, Boston, Buffalo, Niagara Falls, Chicago, Cleveland, Cincinnati, Indianapolis and St. Louis, over the Four Track Route. The excellent equipment of this road has enabled it to operate all of these great trains without an accident or mishap of any kind."—*Medford (Mass.) Mercury.*

Electrical and Street Railway Patents.

Issued September 4, 1894.

525,332. Electric Switch. George F. Card, Covington, Ky., assignor to the Card Electric Company, Mansfield, Ohio. Filed Apr. 14, 1894.

525,336. Controlling Device for Electric-Railway Cars. Wm. H. Conrad, Lebanon, Pa., assignor of two-thirds to Jacob M. Shenk and William P. Coldren, same place. Filed Jan. 8, 1894.

525,353. Dynamo-Electric Machine. Jas. F. McElroy, Albany, N. Y., assignor to the Consolidated Car Heating Company, Wheeling, W. Va. Filed Jan. 10, 1891.

525,354. Electrical-Current Director. Jas. F. McElroy, Albany, N. Y., assignor to the Consolidated Car Heating Company, Wheeling, W. Va Filed July 1, 1891.

525,369. Electric-Lighting System and Apparatus. Elihu Thomson, Lynn, Mass., assignor to the Thomson-Houston Electric Company, of Connecticut. Filed Feb. 21, 1887.

525,390. Steam-Turbine Dynamo. Jas. F. McElroy, Albany, N. Y., assignor to the Consolidated Car Heating Company, Wheeling, W. Va. Filed Dec. 19, 1893.

525,394. Controller for Electric or other Motors. Elmer A. Sperry, Cleveland, Ohio, assignor to the Sperry Electric Railway Company, of Ohio. Filed July 21, 1894.

525,395. System and Apparatus for Control of Electric Machines. Elmer A. Sperry, Cleveland, Ohio, assignor to the Sperry Electric Railway Company, of Ohio. Filed July 24, 1894.

525,400. Electric Lock. Frederick Apitz, Lockport, Ill. Filed May 31, 1894.

525,437. Electric Cigar-Lighter. Albert C. Albertsen, Chicago, Ill., assignor to Charles E. Patrick, same place. Filed Nov. 29, 1893.

525,445. System of Electrical Distribution. Thomas C. Coykendall, Rondout, N. Y. Filed Jan. 4, 1894.

525,447. Alternating-Current Motor. Olof Dahl, Paterson, N. J. Filed Dec. 8, 1892.

525,480. Electric-Railway System. Francis B. Badt, Chicago, Ill. Filed Oct. 22, 1892.

525,491. Electric Battery. Luis Drescher, New York, N Y. Filed Mar. 23, 1894.

525,505 Electromagnetic Car-Brake. Robert T. Murray and Charles M. Allen, San Francisco, Cal. Filed Oct. 24, 1892.

525,516. Car-Fender. Thomas Ross, Westerly, R. I. Filed Mar. 8, 1894.

525,523. Electromagnetic Tractile Device. Charles M. Allen, San Francisco, Cal., assignor of one-half to Robert T. Murray, same place. Filed Aug. 22, 1893.

525,533. Car-Brake. Edward Cliff, Newark, N. J. Filed Apr. 2, 1894.

525,537. Concealed Battery. Louis C. Demain, Fairfax, Vt. Filed Apr. 12, 1894.

525,539. Conduit Electric-Railway System. Oscar A. Enholm, New York, N. Y., assignor to W. Dean Smith, same place. Filed Apr. 17, 1894.

525,555. Apparatus for Electrolytical Decomposition. Alf Sinding Larsen, Christiania, Norway. Filed Aug. 31, 1893.

525,563. Electrical Cut-Out. August Rockoff, New York, N. Y. Filed May 10, 1894.

525,564. Handpiece for Portable Electric Lamps. August Rockoff, New York, N. Y. Filed May 10, 1894.

525,590. Street-Car Truck. Ferdinand E. Canda, New York, N. Y. Filed Feb. 1, 1894.

525,592. Car-Fender. Henry W. Eaton, New York, N. Y. Filed Feb. 24, 1894.

525,623. Automatic Toll-Box for Telephone Pay Stations. Howard C. Root, Brooklyn, N. Y Filed Mar. 22, 1894.

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CONTENTS.

THE ELECTRIC LIGHT ASSOCIATION TO MEET IN CLEVELAND.

The next convention of the National Electric Light Association is to be held in Cleveland, Ohio, on February 19, 20 and 21, 1895. No city in the country offers better advantages for the holding of a large convention than the "Forest City." It is readily accessible by railroad from all sections of the country and, in the summer season, by steamers as well, from Buffalo, Chicago and the great Northwest. The water routes, however, will not be available in February owing to the suspension of navigation on the lakes on account of ice. Cleveland is centrally located geographically, and for this reason alone there will likely be a large attendance of delegates and supplymen in February. Hotel accommodations in Cleveland are excellent, and in the city there is much of interest to the electrical man.

HORSE RACING BY ELECTRIC LIGHT.

Horse racing at night by electric light is now being experimentally tried at a race track on Long Island, near this city, and we learn that it is being quite successfully accomplished. Efforts have been made in this direction many times before, but for one reason or another success does not seem to have resulted. The electrical difficulties, however, have been entirely overcome, and there seems to be no mechanical or electrical reason why racing cannot be conducted satisfactorily after dark. The main question is to get the crowd. If the public does not give its support to the enterprise, then no amount of mechanical success will make up the deficiency. We do not think, however, that horse racing at night will ever take a permanent hold on the sporting public, even among the bookmakers themselves. It may succeed for a short time, but when the novelty wears off, the nocturnal sport will, we opine, be abandoned as premature.

THE EDISON FEEDER AND MAIN PATENT.

Elsewhere in this issue we give quite fully the decision of Judge Acheson of the United States Circuit Court of Appeals in the appeal of Westinghouse, Church, Kerr & Co. from the decision of the Circuit Court of the United States for the district of New Jersey, in the case of the Edison Electric Light Co. against the above-named firm. The original suit was for the alleged infringement of patent No. 264,642, granted to Thomas A. Edison for an "electric distribution and translation system," and was decided in favor of the Edison interests. This decision, however, was reversed in the Court of Appeals on the ground that the patent was void for lack of invention. Judge Acheson holds that the system in question is not the "creative work of that inventive faculty which it was the purpose of the constitution and patent laws to encourage and reward," and that to sustain the Edison Company's claims "would be to sanction a monopoly in that which belongs to the public." The question at issue was a most important one, inasmuch as it was claimed by the Edison Company that it covered the method of distributing currents by means of feeders to centres of distribution, which included the method of supplying current to trolley wires by means of feeders, as well as in electric lighting. Had the decision been in favor of the Edison Company, a great many electric railroads as well as electric lighting plants installed by concerns antagonistic to the Edison interests would have been involved, and there is no telling when the legal snarl would have been straightened out. The decision on the appeal will undoubtedly be hailed with satisfaction in the trade in general and freer breathing can now be indulged in. The ground taken by Judge Acheson for his action is a broad and fundamental one, and would seem to be incontrovertible.

SIGNALLING THROUGH SPACE.*

BY W. H. PREECE.

Whenever an electric current rises or falls in a circuit another current is simultaneously induced in every neighboring conductor, if it form part of a circuit and be separated from the former by some insulating medium or dielectric, such as air. The secondary current flows only during the period of rise or of fall of the primary current.

Hence, if the primary current rises, falls, or changes its direction regularly and repeatedly a given number of times per second, the induced secondary currents will alternate with the same regularity and frequency. The intensity of these secondary or induced currents, among other things, will depend upon the character, form, and direction of the circuits, and upon the distance which separates them from each other. That such secondary currents, or electro-magnetic disturbances, as they are called, existed, has of course been known since the days of Faraday; but that they could be observed, measured, and utilized at a distance of some miles from the primary circuit, was not suspected before the introduction of that marvellously sensitive instrument, the telephone.

When these disturbances are rhythmic, musical sounds are produced in telephones fixed in the secondary cir-

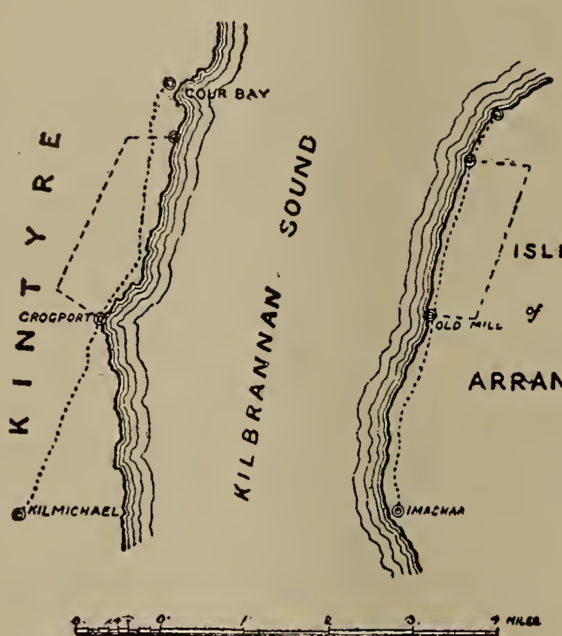


FIG. 1.

cuits, but when they are irregular, unpleasant noises alone are heard. If the sounds are preconcerted and directed, like the dots and dashes of the Morse code, then telegraphy is possible, and we have a means of signalling through space without wires. The distance to which we can signal is limited only by the distance to which these electro-magnetic disturbances, in their transit through space, retain sufficient energy to actuate our apparatus. The ether is supposed to be the real medium of transmission, and not the air. The disturbances through the ether take the form of undulations or waves, and in character they are similar to those radiations which at other frequencies give us heat, light, and photography. They move with the same velocity; they are subject to the same operations of reflection and refraction; and they differ only in the number excited per second.

Thus, to deal with the subject of signalling through space, we must have a primary conductor in which vibratory or alternating electric currents can be excited at will. They must alternate with a frequency that will pleasantly affect the ear—say about 600 per second. They must be manipulated so as to produce preconcerted signals. The primary circuit must be freely exposed in the ether; and the secondary circuit, which it is desired to excite, must not be screened from the primary by means of magnetic or conducting matter. The object of this lengthened inquiry has been to determine the best form of primary and secondary circuit, the function performed by the earth as a part of the circuit, and the distance to which communication is possible with the ordinary practical means at our disposal.

The telephone as an instrument of precision is scarcely sufficiently appreciated The car can be trained by its aid to measure graduations of sound as accurately as

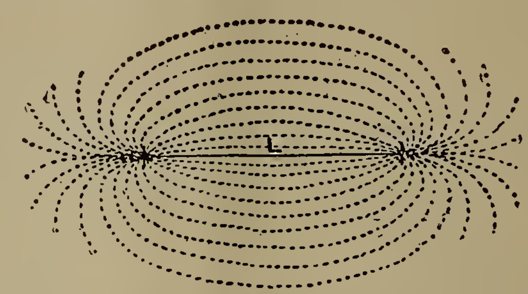


Fig. 2.

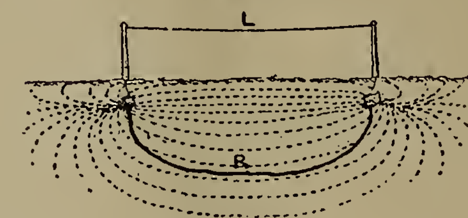


Fig. 3.

the eye determines the calibrations of engraved scales. In Hughes's induction balance we have a well-determined absolute zero of silence, and there are many well-defined nodes of sound which may be taken as fiducial points in a telephonic scale. The limit of speech where articulate sounds cease to be comprehensible is one, the limit of Morse signals where telegraphic reading becomes impossible is another. It is quite easy to determine the similar intensity of two sounds, as in photometry the eye determines the similar intensity of two illuminations. The ear, however, requires to be educated, and it is subject to fatigue; but when properly trained, and when assisted by the telephone, it can be used to observe effects with as much reliability as the eye.

My attention was first directed to the subject in 1884. In 1886 I brought it before this Association at Birmingham, and again at Manchester in 1887. In August, 1893, I reviewed, before the Electrical Congress at Chicago, the whole of my previous nine years' work. Much experimental work has been done during the past 12 months. In 1884 electro-magnetic disturbances were detected between telegraph circuits and telephone circuits 80 feet apart, the former in the streets underground in London, and the latter on the housetops; but in 1885 these effects were perceptible between parallel lines of telegraph 10¼ miles apart. The permeability of stone walls and buildings to electric waves was shown by Henry in 1842, when the discharges of a Leyden jar in the top floor of his house induced sparks in a circuit in the cellar. Sonorous vibrations were reproduced in a telephone circuit in the basement of the G.P.O. in 1886 by the induction of a primary circuit, excited by the voice in the upper corridor, 80 feet away. Speech was found possible between insulated coils of wire a quarter of a mile apart. Telegrams in 1893 were transmitted across a distance of 3.1 miles on the Bristol Channel. Regular communication was held last winter across Loch Ness, a distance of 1¼ miles, and recently at a much greater distance, between Arran and Kintyre, across Kilbrannan Sound. Across Loch Ness speech was maintained.

But this is not all. There is every reason to believe that we have detected distinct disturbances in our tele-

* Read before Section G., British Association, August 13, 1894.

graphic circuits, due to great electrical storms in the sun's photosphere, 92,000,000 miles away.

The fact that these signals across space are effects of induction, transmitted through the air or the ether as the dielectric, is beyond the region of doubt, for they were produced between isolated and insulated coils, each forming a complete metallic circuit; but the part played by the earth at short distances, when the earth was used to complete the circuit, was not so clear. Very exhaustive experiments were made on the sands in the Conway estuary in 1893, and again at Frodsham, on the estuary of the Dee, in 1894. These experiments were conducted for me by Mr. Gavey and Mr. H. R. Kempe. Further experiments were made by Mr. Gavey and Mr. Cooper on opposite sides of Loch Ness, a distance of 1¼ miles, and between the Island of Arran and Kintyre, where parallel wires, four or five miles apart, were available for use.

In the Conway estuary and at Frodsham, squares and rectangles were formed of insulated wires, and numerous measurements were made, both with reflecting galvanometers and with telephones, of the effects due to varying currents in the primaries, and at varying distances between these and the secondaries.

At Loch Ness two parallel wires on opposite sides of the Loch were taken. Between Arran and Kintyre (fig. 1) two parallel lines on opposite sides of the Sound, and four miles apart, were taken; and, in addition, two gutta-percha wires were laid along each coast at a height of 500 feet above the sea level, and five miles apart horizontally.

The general results and the conclusions arrived at may be briefly summed up as follows:—

The earth acts simply as a conductor, and *per se* it is a very poor conductor, deriving its conducting property principally, and often solely, from the moisture it contains. On the other hand the resistance of the "earth" between the two earth plates of a good circuit is practically nothing. Hence it follows that the mass of earth which forms the return portion of a circuit must be very great, for we know by Ohm's law that the resistance of a circuit increases with its specific resistance

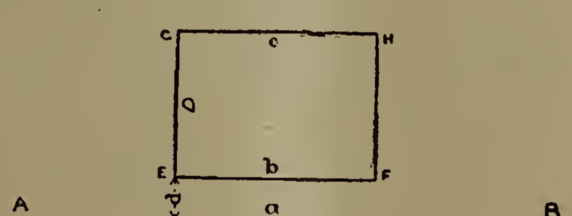


FIG. 4.

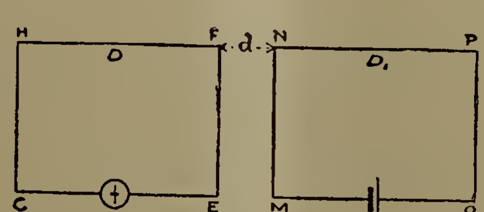


FIG. 5.

and length, and diminishes with its sectional area. Now, if the material forming the "earth" portion of the circuit were, like the sea, homogeneous, the current flow below the earth plates would follow innumerable but definite stream lines, which, if traced and plotted out, would form a hemispheroid. These lines of current have been traced and measured. A horizontal plan on the surface of the earth is of the form illustrated in fig. 2, while a vertical section through the earth is of the form shown in fig. 3.

With earth plates 1,200 yards apart these currents have been found on the surface at a distance of half a mile behind each plate; and, in a line joining the two transversely, they are evident at a similar distance at right angles to this line.

Now, this hemispheroidal mass could be replaced electrically by a resultant conductor (R, fig. 3) of a definite form and position, and, in considering the inductive action between two circuits having earth returns, it is necessary to estimate the position of this imaginary conductor. This was the object of the experiments at Frodsham.

If the material of the earth be variable and dry the hemispheroid must become very much deformed and the section very irregular, the lines of flow must spread out further, but the principle is the same, and there must be a resultant return. The general result of the experiments at Frodsham indicate that the depth of the resultant earth was 300 feet, while those at Conway are comparable with a depth of 350 feet.* In the case of Frodsham the primary coil had a length of 300 feet, while at Conway the length was 1,320 feet. At Loch Ness, and between Arran and Kintyre, where the parallel lines varied from two to four miles, the calculated depth

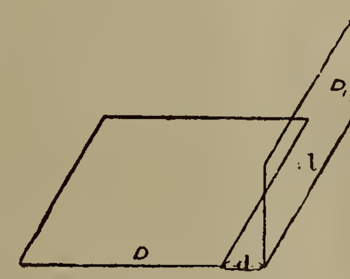


Fig. 6.

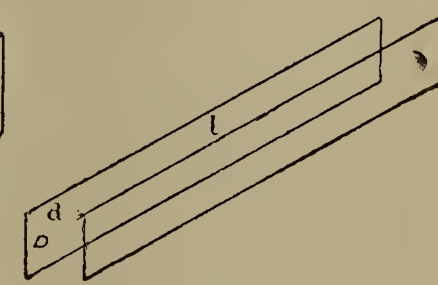


Fig. 7.

was found to be about 900 feet. The depth of this resultant must, therefore, increase with the distance separating the earth plates, and this renders it possible to communicate by induction from parallel wires over much longer distances than would otherwise be possible.

The first and obvious mode of communicating across space is by means of coils of wire opposed to each other in the way familiar to us through the researches of Henry and Faraday. All my illustrations of the principles involved in effecting this object have consisted in opposing two similar coils of wire having many turns, the one coil forming the primary circuit and the other coil the secondary circuit.

Vibratory or alternating currents of considerable frequency were sent through the primary circuit, and the induced secondary currents were detected by the sound or note they made on a telephone fixed in the secondary circuit.

The distance to which the effective field formed by a coil extends increases with the diameter of the coil more than with the number of turns of wire upon it. A single wire stretched across the surface of the earth, forming part of a circuit completed by the earth, is a single coil, of which the lower part is formed by the resultant earth return, and the distance to which its influence extends depends upon the height of the wire above the ground, and the depth of this resultant earth.

In establishing communication by means of induction there are three dispositions of circuit available, viz.: (*a*) single parallel wires to earth at each extremity; (*b*) parallel coils of one or more turns; (*c*) coils of one or more turns placed horizontally and in the same plane.

The best practical results are obtained with the first arrangement, more especially if the conformation of the

* These figures are obtained from the use of the formula:

$$Q = K\left\{ \log \left(\frac{D^2}{d^2} + l \right) \right\},$$

which is given in Appendix I.

earth admits of the wires being carried to a considerable height above the sea, whilst the earth plates are at the sea level. By adopting this course the size of the coil is practically enlarged, and even if it be necessary to increase the distance between the parallel wires to effect this object the result is still more beneficial. In a single wire circuit we have the full effect of electrostatic and electro-magnetic induction, as well as the benefit of any earth conduction, but in closed coils we have only the electro-magnetic effects to utilize.

In one experiment, two wires of a definite length were first made up into two coils forming metallic circuits, then uncoiled and joined up as straight lines opposed to each other, with the circuit completed by earth. The inductive effects, and the distance between which they were observable, was very many times greater with the latter than with the former arrangement.

Incidentally some extremely interesting effects of electro-magnetic resonance were observed during the experiments in Arran. A metallic circuit was formed partly of the insulated wire 500 feet above the sea level, and partly of an ordinary line wire, the rectangle being two miles long and 500 feet high. Wires on neighboring poles, at right angles to the shorter side of the rectangle, *although disconnected at both ends*, took up the vibrations, and it was possible to read all that was signalled on a telephone placed midway in the disconnected circuit.

I have not succeeded in determining satisfactorily the general law which regulates the distance to which one can speak, and I scarcely hope to do so. There are so many disturbing elements introduced, geological as well as electrical. In practice we have to deal with two complete circuits of unknown shape and in different planes. We have obtained some remarkable concordant and accurate results in one locality, but we have met with equally discordant results in another locality. I fear we are beyond the reach of the mathematician. In the appendix I have shown the formulæ that gave the most reliable results.

The mechanism of the mode of signalling across space is not difficult to follow. Its analogue is a flash of light seen at a distance. Energy is expended, say, in a lighthouse on some dangerous rock, or in a gun firing some warning signal, or in a bonfire on some mountain top. The energy assumes the luminous form exciting the ether to undulate with a frequency of many millions per second, which, acting upon the retina of the eye, produce the sensation called light. The burning of the oil lamp of the lighthouse is the primary source of energy; the rapid undulations of the ether propagated in straight lines at a velocity of 186,000 miles per second are the radiations, transmitting this energy in a wave form to the distant ship; the eye is the apparatus which transforms the energy of the light waves into a form which excites consciousness in the brain.

In our electrical experiments the primary energy is in the current form, the comparatively few hundred alternations per second excite waves in the ether of a few hundreds per second only. But these oscillations of the ether or electric waves are of the same character as those of light, they move with the same velocity, and when they fall on a sympathetic secondary conductor, they excite in that conductor currents of electricity of the same frequency; and if a telephone be inserted in that circuit and applied to the ear, sounds and musical notes are distinctly heard, which, by preconcerted measures, such as the use of the Morse code, can be utilized for the transmission of messages. Thus messages were sent across the Bristol Channel between Penarth and Flat Holm Island, 3.1 miles away. Speech was maintained in the Highlands across Loch Ness, 1¼ mile broad, and telegrams were transmitted from Kintyre to Arran, across distances of four and five miles, and thus we could readily communicate between England and France, or between outlying islands and the shore, when the conditions admit of the erection of the necessary circuits.

A somewhat fascinating branch of this subject is the possibility of signalling across planetary space. Signalling between one planet and another is merely a question of degree. Magnetic storms and earth currents have some intimate connection with the sun, although Lord Kelvin has questioned the reality of the fact. The great storms and sun spots of March 30 and 31, 1894, were accompanied by very marked and peculiar sounds in telephones inserted in our long telegraph circuits (*vide* Appendix II). The storm of July 20 was not so distinguished. Strange, mysterious, weirdlike sounds are frequently heard on long lines of telegraph in the calm stillness of the night, but whether due to terrestrial or to cosmic causes remains to be discovered. The sun's photosphere when disturbed by spots may be subject to violent electrical storms and those vast clouds of incandescent hydrogen that flame up with terrible velocity may excite electrical oscillations through ethereal space of such a frequency as to influence our terrestrial circuits. We may thus hear on earth the electric storms of the sun. But this is mere speculation, and the evidence before us at present is not sufficient to justify positive deduction. We shall continue to watch and record, and it is hoped that observers in other parts of the world will assist by making use of the telephones and telegraph lines at their disposal.

The practicability of this method of effecting communication is now solved, but the subject possesses great scientific interest from the views it imparts of the mechanical character of electrical waves, of the molecular theory of electricity, and of the great distances at which electromagnetic disturbances are perceptible.

APPENDIX I.

The following are the formulæ on which the foregoing calculations are based:

Let A B (a), Fig. 4, be an infinitely long wire, and b and c be two wires forming parallel sides of a rectangular circuit, E F G H; then, if a current be set up in A B, the lines of force cutting E F and G H will cause a momentary current to be set up in the rectangle, so that

$$Q = K \left\{ \log (D + d) - \log d \right\} = K \log \frac{D + d}{d},$$

where Q is the quantity induced.

K is a constant depending on the length of the sides G H, E F of the rectangle in centimetres, the current strength in amperes in the wire A B, and the total resistance in ohms of the rectangle.

Within certain limits this formula is approximately correct, even if the wire A B is not infinitely long, but makes one face of a second rectangle similar in form to the induced rectangle E F G H, and set either in the same plane with, or at right angles to, the first rectangle; but in such cases the formula has to be corrected to allow for the influence of the second face of the inducing rectangle as follows.

With two rectangles in the same plane, Fig. 5, the total effect produced by the two faces, M N, O P, of the inducing rectangle is

$$Q_1 = K \left\{ \log \frac{D + d}{d} - \log \frac{D_1 + d + D}{D_1 + d} \right\}.$$

If the two rectangles are at right angles to each other, Fig. 6, and l is large compared with D, then the formula becomes

$$Q_2 = K \left\{ \log \frac{D+d}{d} - \frac{1}{2} \log \frac{D_1^2+(D+d)^2}{D_1^2+d^2} \right\}.$$

Again, if the two rectangles are parallel and equal, Fig. 7, and l is large compared with D, then

$$Q_3 = K \left\{ \log \left(\frac{D^2}{d^2} + l \right) \right\}.$$

These formulæ take into account the effects on the wires in the secondaries which are parallel to the primaries, but not the effects of those at right angles to them. The latter oppose the main induced current, so that in practice this current diminishes more rapidly with the distance than the log law indicates. The problem is very intricate, but Mr. Kempe, to whom I am indebted for the formulæ, still hopes to obtain a final and accurate solution.

APPENDIX II.

The following letter appeared in *Nature*, April 12, 1894:

Earth Currents.

The Astronomer Royal was kind enough to show me the permanent photographic records of earth currents during the great magnetic storm on February 20–21, and they indicate so unmistakably such rapid and violent alternations that I supplied our principal relay stations with telephones, and with instructions to insert them in circuit whenever they observed indications of disturbances. This happened on March 30–31, during the display of the aurora borealis. Mr. Donnithorne, in Llanfair P.O., Anglesea, reports: "At 2 A. M. (Saturday) the telephone receiver was again tried, and then 'twangs' were heard as if stretched wire had been struck, and a whistling sound. The strength of the earth current was 17.7 milliamperes." Mr. Miles, in Lowestoft, reports: "Noise on 408 (Liverpool-Hamburg) wire seemed like that heard when a fly-wheel is rapidly revolving," and "sounds in telephone appear like heavy carts rumbling in the distance." Mr. Scaife, in Haverfordwest, reports: "March 31, 2.5 A. M. Earth currents on all wires; wires completely stopped. . . . Peculiar and weird sounds distinctly perceived, some highly-pitched, musical notes, others resembling murmur of waves on a distant beach. . . . The musical sounds would very much resemble those emitted by a number of sirens driven at first slowly, then increased until a 'screech' is produced, then again dying away. Duration of each averaged about 20 seconds." These experienced observers, situated at three distant points, and perfectly acquainted with the ordinary inductive disturbances on telephone circuits, simultaneously observed and independently recorded their own impressions of peculiar sounds exerted in telephones by very rapid alternations or pulsations of currents which accompanied or were consequent on sun spots, earth currents, and the aurora borealis.

G.P.O., April 9. W. H. PREECE.

PLATINUM.

The Ural platinum deposits in Russia occur in the Ural Government of Perm, where it is found on various private properties and State lands. In the district of Goroblagodat there are 70 allotments for the exploitation of platinum under different private individuals. At present all the platinum extracted in the Urals is forwarded in the crude state to St. Petersburg, whence it is sent abroad. Although there are two laboratories in the Russian capital for refining platinum ore, the greater quantity is sent abroad in the crude state. The largest quantity of platinum is now extracted at the deposits of Nizhni-Tagilsk, belonging to Prince Demidoff San Donato, and at the Krestovosdvigensk deposits of Count Schouvaloff. In 1890 there were 6,000 workmen employed in the exploitation of platinum.

LIGHTNING.

BY G. EMIL HESSE.

Many articles have appeared about the capacity of the lightning flash, and most of the experimenters, who have either measured it with some specially designed instrument or calculated it, have come to the conclusion that the amount of force stored in it is insignificant. The amperage is no doubt very small, but the voltage is extraordinarily high, and that makes the kilowatt higher than most scientists will agree to. To measure the flash with an instrument is a very unsatisfactory and unreliable way of ascertaining its real capacity, but how to make the measurement with greater certainty is a problem not easily solved. I shall, however, in this article endeavor to show how it can be done, and as a basis for the theory I shall assume that force and kilowatt are equivalent.

We sometimes read in the newspapers that a tree so many centimeters in diameter was cut down by the lightning, or a stone weighing so many tons thrown a certain distance. I do not remember any dimensions as far as the trees were concerned, but was particularly impressed some years ago after reading the facts that a piece of a wall weighing about 3 tons and 2 meters high was torn out and thrown on a sandbank. Without considering the power required to tear the section of wall from its position this action represents a force of

$$3{,}000 \times 2 = 6{,}000 \text{ kilogram-meters.}$$

Reducing this to kilowatts we get

$$\frac{746 \times 6{,}000}{1{,}000 \times 75} = 59 \text{ kilowatts,}$$

which is equal to about one horse-power for one minute.

The duration of the flash is shorter than it appears, and the reason is, that a strong light makes an impression on the eye that disappears very gradually. Assuming that the thunder-cloud is 500 meters from the earth, and, knowing the velocity of electricity to be 400,000 kilometers, we find that the duration of a flash of lightning is only

$$\frac{500}{400{,}000{,}000} = 0.00000125 \text{ seconds.}$$

Knowing that the work of nature is practically perfect, it is safe to say that the 59 kilowatts appear as light, but as soon as it meets a resistance it is changed into force.

Experiments with the incandescent lamp show, that only about 1 per cent. of the force expended appears as light, the other 99 per cent. being wasted as heat.

We get 260 candle-power per kilowatt with such lamps, and, taking these facts as a basis, we find that the approximate candle-power of the lightning-flash is

$$\frac{260 \times 100 \times 59}{0.00000125} = 1{,}280{,}000{,}000{,}000 \text{ c. p.}$$

This figure can be depended on as being reasonably correct and does not appear large, when we remember that the entire vicinity is lighted up almost as if by the sun.

The above example does not, of course, hold good in every instance, for the reason that there is as much difference in the capacity of a flash as there is in everything else, one of the reasons being the variable distance of the clouds from the earth, or between the clouds themselves.

NATIONAL ELECTRIC CO.'S DIRECT-CURRENT DYNAMO.

The accompanying illustration shows the new 50 K. W. direct-current, constant potential dynamo just brought out by the National Electric Company, of Eau Claire, Wis. As will be seen, this machine is of the overtype, bipolar pattern, which has been adopted as the standard at the National Company's factory. The company asserts that several years' experience with this type of machine has confirmed the opinion that for all capacities up to as high as 60 K. W. it is unrivalled, and for this reason has adhered to this type in bringing out the latest lines of machines.

This dynamo is constructed on substantial lines and is compact in design. It is mounted upon a heavy cast iron base, and for the purpose of tightening the driving belt easily operated shifting screws are provided. The bearings of the machine are of the ring, self-oiling type, and are also self-aligning. The armature shaft is turned from a high grade of forged steel, which insures excellent wearing qualities. The armature is perfectly balanced, both as to its rotating action and magnetically. It is held in proper position by the action of the field without the use of collars on the shaft.

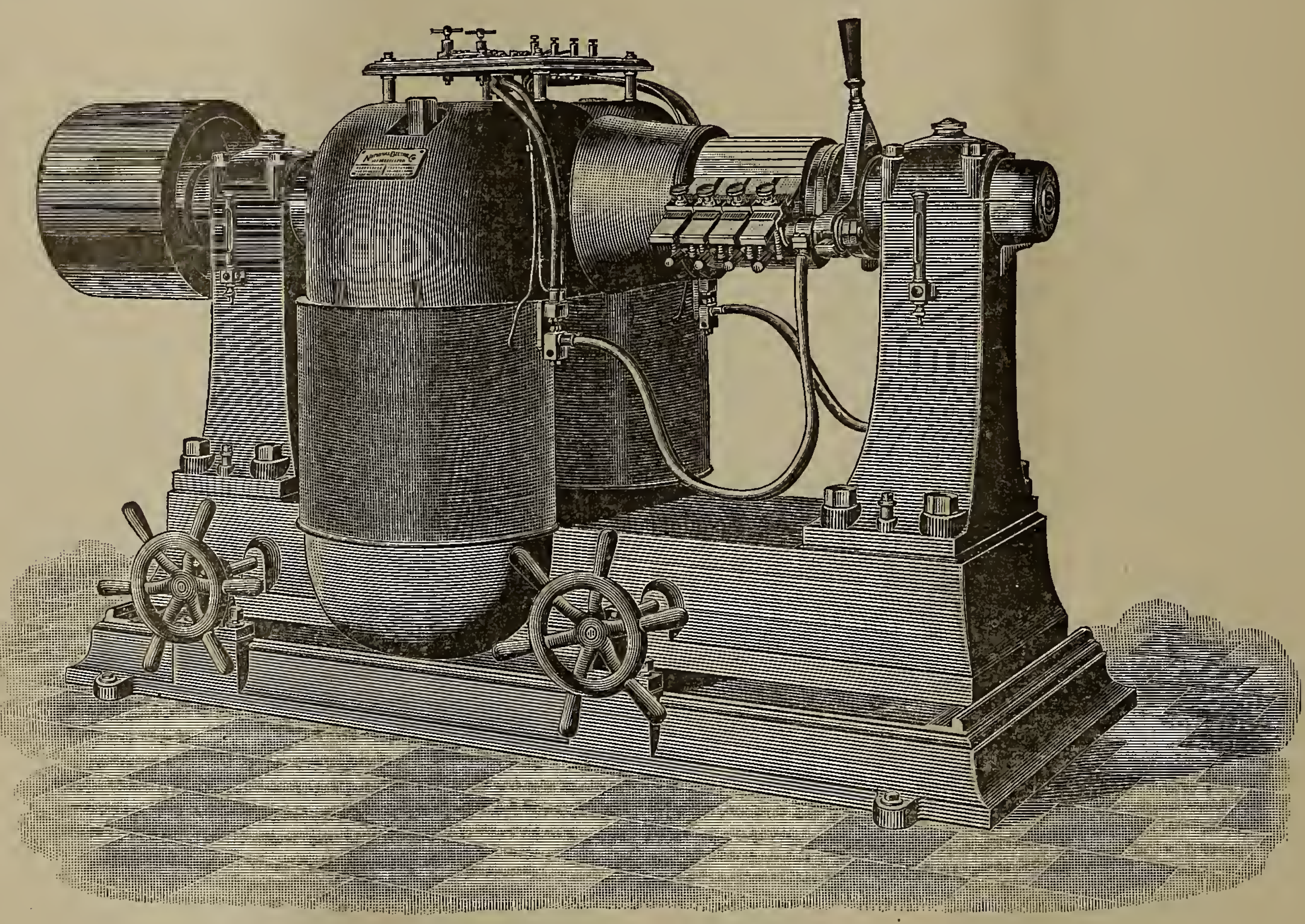
The field magnets are comparatively massive with easy, rounded lines, which design gives a powerful field, and the armature is small and runs smoothly and sparkless.

In every way this machine is claimed to be most efficient. There is the proper amount of metal in its construction to produce the best results, and the armature core and windings further promote its efficiency by being arranged with a view to reducing armature losses. The armature is of the standard drum type, the cores being built up of thin steel disks, insulated, keyed to the shaft and rigidly clamped in position. It is most carefully insulated, there being no less than five layers of selected insulated materials, such as oil paper, linen ducking, mica, etc., between the core and conductors.

All parts of the machine are made to standard gauges and templates, and the workmanship is of the very best character throughout.

The constant potential dynamos and motors of this type are wound for E. M. F. of 100, 110 to 125, 220 and 500 volts.

The company has one of the largest and best equipped factories in the United States, and manufactures its own switchboards and instruments.



NATIONAL ELECTRIC CO.'S DIRECT-CURRENT DYNAMO.

FINANCIAL.

The Edison Electric Illuminating Company of New York reports gross earnings for August of $91,956, an increase of $17,397 as compared with the same month of last year, and net $38,985, an increase of $14,110. For the eight months ending August 31 the gross earnings were $866,358, an increase of $101,069, as compared with the corresponding period of last year, and net $454,357, an increase of $113,683.

The Executive Committee of the Western Union Telegraph Company has recommended the declaration of a quarterly dividend of 1¼ per cent., payable October 15.

Dynamo Design.—Owing to the press of other matter we have been compelled to omit in this issue the next portion of Mr. Harrison's article on "Dynamo Design." It will appear in our next issue.

AGAINST THE EDISON COMPANY.

DECISION ON THE APPEAL IN THE DISTRIBUTION SUIT.

On September 12 Judge Acheson filed an opinion in the United States Circuit Court of Appeals, in Philadelphia, in the case of Westinghouse, Church, Kerr & Co., appellants, *vs.* Edison Electric Light Company, appellees, which was an appeal from the decision of the Circuit Court of the United States for the District of New Jersey.

The main points of the decision are given below.

This suit was for the alleged infringement by the defendant of Letters-Patent of the United States to Thomas A. Edison, No. 264,642, dated September 19, 1882, granted upon the application filed August 9, 1880, for an "electric distribution and translation system." After stating that the "invention relates to a method of equalizing the tension or 'pressure' of the current through an entire system of electric lighting, or other translation of electric force, preventing what is ordinarily known as a 'drop' in those portions of the system the more remote from the central station," the specification proceeds thus:

"As is well known from patents already granted me, and prior applications pending, I use in my system an electric light formed of a continuous incandescing conductor, large numbers of which are grouped into one system, supplied and regulated from a central station, main conductors leading from and to the central station, each lamp or translating device being in a derived circuit to the main conductors, the entire system being what is known as a 'multiple-arc' system. From a central station the main conductors may proceed, and it is intended that they should, to a great distance, and supply a large number of translating devices. In such cases there is inevitably a difference in tension between various parts of the circuit, due to the resistance of the main conductors. This may be partially remedied by making the conductors very large near or at the station, gradually decreasing their size or conducting capacity; but such plan only lessens slightly the ratio of fall. To obviate the difficulty I provide feeding conductors, which extend from the generator or generators to the main conductors of the lamp or consumption circuit or circuits, such feeding conductors not having any translating devices connected therewith, and being connected with the main conductors of the consumption circuit or circuits at the centre, ends or other points on such main conductors. From a central station several sets of such feeding conductors may run, each set feeding into its own lamp or consumption circuit, or all the sets feeding into a connected system of lamp or consumption circuits It will be seen that the drop upon the feeding conductors has no effect upon the regular candle-power of the lamps of the system, the relative candle-power of the lamps being affected only by the drop upon the main conductors of the consumption circuit or circuits between the end of a set of feeding conductors and points most distant from any feeding conductors. In order to maintain practically the same candle-power throughout the system, the main conductors of the consumption circuit or circuits should be so proportioned that the drop in tension upon them shall not exceed a definite small limit; for example, five per cent. This drop will make a difference of less than a candle-power in all the sixteen candle-power lamps of the system, which difference is not perceptible to the eye. Upon the feeding conductors, however, any loss can be made. This loss will be varied according to localities, and the relative cost of copper for conducting purposes, and horse-power for generation. This loss upon the feeding conductors, in large and extended systems, will generally be greater than upon the main conductors of the consumption circuit or circuits. It may be, for example, about fifteen per cent.; but circumstances might make it desirable to diminish the loss upon the feeding conductors down even as low as that upon the main conductors of the consumption circuit or circuits, or to increase the loss upon the feeders to more than fifteen per cent. * * * When it is desired to use a few lamps near the central station, they may be placed upon a direct circuit therefrom, with resistance at the commencement or home end of the circuit sufficient to then reduce the tension of the current in such circuit so that it shall only be equal to that in the more distant circuits, and one or more such circuits may be combined with the circuits before described. When large buildings or blocks of buildings using many lamps are to be supplied, it may be desirable to lay therefor separate feeders insulated from each other. Where several central stations are used in a city, each having feeding conductors leading to lamp-circuit conductors of the description before noted, it may be advisable to connect the feeding circuits of all the stations, equalizing the tension or pressure throughout the entire system of the place where the central stations are located."

The illustrative drawings show different applications of the general form of circuit described in the specification. The patent has six claims, but the defendant was charged only with the infringement of the first, second and third claims, which are as follows:

"1. A consumption circuit, in the main conductors of which the drop in tension is not sufficient to vary practically the candle-power of the lamps connected therewith, in combination with feeding conductors connecting the consumption circuit with the source of electrical energy, and having no translating devices connected therewith, the drop in tension upon such feeding conductors not affecting the relative candle-power of the lamps of the consumption circuit, substantially as set forth.

"2. A consumption circuit, in the main conductors of which there is a definite small drop in tension, not sufficient to vary practically the candle-power of the lamps connected therewith, in combination with feeding conductors connecting the consumption circuit with the source of electrical energy, and having no translating devices connected therewith, the loss upon such feeding conductors being greater than upon the main conductors of the consumption circuit, substantially as set forth.

"3. The combination of a consumption circuit, in the main conductors of which the drop in tension is not sufficient to vary practically the candle-power of the lamps connected therewith, with a feeding-circuit having no translating devices, and extending from the source of electrical energy to the centre of the consumption circuit, substantially as set forth."

For the proper determination of this case it is essential that the subject matter of these claims should be clearly understood. The patent is for a specific arrangement and proportioning of the two sets of conductors which together constitute the complete circuit.

The gist of the alleged invention is in the combination and proportioning of the two parts of the circuit, and not in the scale of use.

Contrary to these views, the Circuit Court was of the opinion that certain unexpressed qualifications are to be incorporated into each of the claims by virtue of the concluding words "substantially as set forth." After discussing the specified limitations, the Court said: "But this statement of the claims would be highly inaccurate if permitted to stand alone. Other limitations must be regarded. Not only are the circuits, feeding and consumption, unique in their special characteristics, but, as well, are jointly applicable to the lighting by incandescent lamps, in multiple arc, of large areas, of which portions or parcels are very distant or remote from a central station, from which, however, emanates complete control. It is true that these latter limitations are not expressed in terms in the claims under consideration, or in either of them. But, in draughting the claims, Mr. Edison, by the words used, clearly referred to the descriptive phraseology of the specifications of his invention preceding them."

Accordingly, the Court construed these several claims as involving the lighting of a "large territory" by the use of "large numbers" of incandescent lamps, and as implying central-station regulation whereby variable drop in tension in remote parts of the system may be controlled. But, in our judgment, these limitations are inadmissible. The fact is, pending the application for this patent, it was sought to amend the specification and insert a new claim by the introduction of the matter of central-station regulation, but the Patent Office rejected the proposed amendment for the assigned reason that "it describes and claims an invention not even hinted at in the original specification nor shown in any of the drawings."

While central station regulation is incidentally referred to in the introductory part of the specification, it is not described at all, and clearly is no part of this alleged invention. The only described means to secure equality of pressure between the lamps of a circuit near the central station and the lamps of a circuit more remote therefrom are resistance coils put in the supply conductors of the near circuit. This device is covered by the fifth claim, infringement of which is not charged.

The claims in question are unambiguous and exact. Upon well settled principles, then, limitations other than those expressed are to be excluded (*Railroad Company vs. Mellen*, 104 U. S. 112; *Yale Lock Company vs. Greenleaf*, 117, U. S. 554; *White vs. Dunbar*, 119 U. S., 47, 52). As was said in the last cited case, "the claim is a statutory requirement, prescribed for the very purpose of making the patentee define precisely what his invention is; and it is unjust to the public, as well as an evasion of the law, to construe it in a manner different from the plain import of its terms." The claims here, we think, were purposely framed broadly, so as to cover the simplest form of the alleged invention.

The claims with which we are concerned, as we have seen, are each for a combination of two elements, a consumption-circuit and feeding conductors having respectively the peculiar properties specified. The primary question for solution, then, is, whether it involved invention in a patentable sense to combine a circuit for feeding only with a consumption-circuit the main conductors of which are so proportioned as to maintain such uniformity of pressure upon them that there is practically no variance in the candle-power of the lamps connected therewith.

Now a claim for a combination carries with it an implication that the separate elements are old. * * * Most certainly the patent in suit discloses no new means either for transmitting a current of electricity or for equalizing pressure upon the consumption-circuit. * * *

Of a truth, the feeding conductors of the patent are nothing more than the ordinary supply wires running from the source of the electrical energy. The proper function of such conductors being to transmit the electric current to the point where it is to be utilized, as a matter of course they have no "translating devices connected therewith." The statement in the specification —"It will be seen that the drop upon the feeding-conductors has no effect upon the relative candle-power of the lamps, being affected only by the drop upon the main conductors of the consumption circuit or circuits between the end of a set of feeding conductors and points most distant from any feeding conductors"—is the mention of an obvious fact. Indeed, it is put as a self-evident proposition. That no loss upon the supply part of the circuit can affect the relative candle-power of the lamps upon the consumption part of the circuit is a quality inhering in the circuit by the very nature of things. It is a necessary incident of any circuit part of which supplies the current and part of which distributes it.

The specification states, that "in order to maintain practically the same candle-power throughout the system, the main conductors of the consumption circuit or circuits should be so proportioned that the drop in tension upon them shall not exceed a definite small limit—for example, five per cent.," but gives no information whatever how that is done. This silence is highly significant. The specification assumes that to secure uniformity of electrical pressure, and thus uniformity of effect, is a matter of common knowledge among those skilled in the electrical art, as indeed it was. The drop or fall in tension or pressure in an electrical current in its passage through a conductor was an observed and well-understood phenomenon long prior to the year 1880. * * *

In the art of electroplating as practiced long before 1880, we find an arrangement of circuits substantially the same as that of the patent in suit. * * *

Turning now to the Khotinsky French Patent of 1875, which relates to the art of electric lighting, we discover that it shows and describes a circuit of feeding and consumption parts in combination, identical in form with that of the patent in suit * * * Undeniably, Khotinsky's combined arrangement of feeding conductors and distributing conductors is precisely the arrangement of the patent in suit. Nothing indeed is said by Khotinsky about proportioning the main conductors of the consumption circuit so as to prevent injurious drop in tension. It was, however, wholly unnecessary for him to say anything upon that subject. All that was needful to overcome the difficulty due to drop in tension was to make the main conductors of the consumption circuit of proper thickness. * * *

How can it be affirmed that it would require invention simply to proportion Khotinsky's circuit in the manner contemplated by the patent in suit—to make his transmitting wires and distributing conductors, respectively, of suitable size to perform their intended functions? * * *

Under the proofs, we cannot assent to the suggestion that the alleged invention here in question supplied a long-felt want, or met a difficulty generally recognized in the art as a serious hindrance to the distribution of the electric current. In fact, prior to the application for this patent, no incandescent electric lighting plant had been built. There had been no occasion to erect such plants, for no pratically successful incandescent lamp had yet been furnished to the public. Hence, electrical engineers had not been called upon to deal practically with the problem of drop in tension in the construction of such plants. In truth, the feeder and main system of distribution came naturally, in the ordinary progress of the art of incandescent electric lighting, as and when needed. * * *

It is a great mistake, as the proofs demonstrate, to attribute to the patent in suit the merit of having solved the problem of economically supplying the requisite current for extensive use to circuits covering large areas, portions of which are at great distances from the source of electrical energy. Whatever of economy in copper may result from the plan of the patent is confined altogether to the transmitting conductors, and the cost of copper restricts the use of this system to comparatively narrow limits. The extension of incandescent electric lighting over large areas is really due to subsequent inventions. Conspicuous among the more recent discoveries and improvements which have brought incandescent lighting into extensive and common use is the converter or alternating current system, whereby the electric current is transmitted from the generating station to a very great distance at an extremely high pressure, and is converted at the points of distribution with the low-pressure currents required by the incandescent lamps.

The multiple-arc or derived-circuit system of distribution being confessedly old, and the high resistance incandescent lamp having been devised to provide "feeding conductors which extend from the generator or generators to the main conductors of the lamp of consumption current," was, it seems to us, an obvious engineering expedient. Then, as already shown, the proper proportioning of the two parts of the combined circuit involved only the exercise of the common knowledge and skill of the electrician. * * * The plan of electric distribution covered by the claims in question is not "the creative work of that inventive faculty which it was the purpose of the Constitution and patent laws to encourage and reward." To sustain these claims would be to sanction a monopoly in that which belongs to the public. * * *

The appellant maintains that under the ruling of the Supreme Court in the case of *Miller vs. Eagle Manufacturing Company*, 151 U. S., 186. the first, second and third claims of the patent in suit are void, because of the grant of an earlier patent to Mr. Edison, No. 239,-147, dated March 22, 1881, which dealt with the evil of drop in tension, and provided a remedy by feeding conductors, having no lamps thereon, connected with the mains around the central generating station and so proportioned as to secure equal electrical pressure throughout the entire system. It is contended that the invention described and claimed in the earlier patent is for one form of the alleged invention described in the latter patent and covered by the first three claims thereof, and that no one could use the invention of the earlier patent without infringing these latter claims. The question thus raised is a serious one, but we do not deem it to be necessary to consider it, inasmuch as the views we have expressed upon the other branch of the case are decisive.

The decree of the Court below is reversed, and the cause is remanded, with directions to enter a decree dismissing the bill of complaint, with costs.

THE PATHOLOGY AND TREATMENT OF ELECTRIC ACCIDENTS.*

BY W. S. HEDLEY, M. D.

If the living body become the path of an electrical current of dangerous magnitude, what are the nature and sequence of the lesions that ensue; and how may death occur? Not on account of its connection with lightning stroke, nor because of a ghastly interest it may derive from the process of "electrocution," but because of those accidents that occasionally occur in connection with electric light circuits it is that this question becomes chiefly interesting. It has an obvious practical bearing on the proper treatment to be pursued in attempting the resuscitation of persons injured by such accidents—if, indeed, it be permissible to speak of electrocution as an accident—and to hint at the possibility of reanimation. One of the most useful contributions to a knowledge of this subject is a communication made by M. d'Arsonval in 1877 to the Société de Biologie; and this has recently been followed up by interesting confirmatory evidence. It is considered that the alternating currents of commerce may cause death in either of two ways: (1) by actual lesion or destruction of tissue; and (2) by arrest of respiration, producing asphyxia. In the former class death is actual, and nothing can restore animation; in the latter (including electrocution) death may be, and at first often is, only apparent, recovery still being possible, and even probable, by a timely resort to artificial respiration. The following practical rule is therefore formulated: "Un foudroyé doit être traité comme un noyé." There is a limit, however, to this possibility of recovery. If the elevation of temperature produced by the passage of such currents exceed 45 deg. death ensues, "as Claude Bernard has shown, by coagulation of the muscular fibres of the heart." Should this point have been reached such cases pass into the first category of "mechanical destruction," and are not recoverable; but in accidents of the kind under consideration the contact is generally of short duration, and the tetanic muscular contractions have not generally lasted long enough to induce the fatal elevation of temperature.†

It is thus considered that in cases of accidental contact with electric light wires the condition is generally one of suspended animation—of only apparent death—and that by the timely use of artificial respiration real and actual death can often be averted. In attempting the restoration of persons thus injured those repeated rhythmical tractions on the tongue known as the "Laborde" method for the treatment of asphyxia are advocated. It is the procedure which its originator, in his communication to the Academy of Medicine, called "the physiological treatment of death," and its technique is thus described: "With the thumb and index finger, either bare or covered by a handkerchief, the tongue is seized by its anterior third, and powerful repeated rhythmical tractions and relaxations are carried out with a frequency of about 15 to 20 times a minute. In making these tractions it is important to feel that the dragging action affects the root of the tongue. If, in attempting to seize the tongue, it is found that the jaws are closed and the teeth clenched, open them by the finger, if possible, or use as a wedge a piece of wood or the handle of a pocket knife, or anything of the kind that may be at hand"

In illustration of the foregoing points an interesting case of recent occurrence is cited. Its details, as given by two electrical engineers who were eye-witnesses of the occurrence, and who assisted in the efforts of restoration, are as follows: It appears that with the voltmeter registering 4,500 volts and an ampere-meter marking 750 milliamperes an alternating current was accidentally short-circuited through the body of a man. The point of entrance was the hand, and that of emergence the buttock. The duration of contact was "certainly many minutes." More than half an hour elapsed before artificial respiration was commenced, and during that time the man showed no sign of life. Arm movements were then carried out, without apparent effect; on practising the Laborde procedure, however, respiratory movements soon appeared, and in about two hours the man could speak. In the course of a few days he had quite recovered, excepting from the burns at the points of entry and exit. In such accidents the line of treatment to be pursued is sufficiently obvious. It is imperative that artificial respiration be promptly and patiently carried out. The pathology of the accident, however, seems by no means so simple. It is nearly a century and a half since Priestley, experimenting with Leyden jar discharges, showed that death

*The *Lancet*.

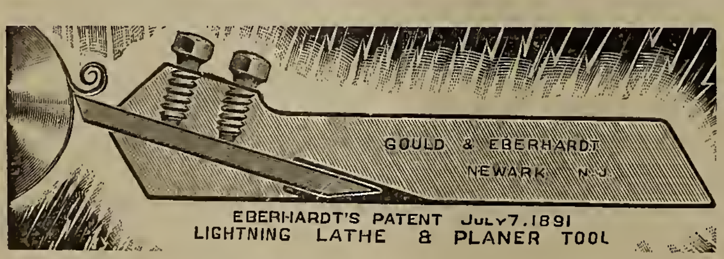
†M. d'Arsonval points out that the elevation of the central temperature produced by the passage of these strong currents is not due to the "resistance of the body to the passing current, in conformity with the laws of Joule, but to the violent contractions throughout the whole of the muscular system, and also to the condition of asphyxia, as Dr. Brown-Séquard has shown."

might result from "electric shock" without structural lesion. Recent experiments, especially in electrocution, have abundantly demonstrated this. Such cases might perhaps come under d'Arsonval's second class, and it is allowable to speculate how far the result might have been averted by a timely resort to artificial respiration. How, then, in the absence of actual destruction to vital structures, may such accidents injure or kill? What part do the lungs, heart and nervous system respectively play in the morbid process? How far is the process direct, or reflex, or inhibitory? Stimuli applied through the vagus or "almost any afferent nerve" will, by reflex effects through the bulb, influence respiration, and it may probably be accepted that, if the stimulation be very strong, respiratory action may be arrested by inspiratory tetanus. So far as the heart is concerned, the inhibitory action of the vagus will come into play. Ziemssen showed in his "classic" experiments that tentanizing induction currents applied to the heart of the dog produced those irregular, arhythmic, fibrillar contractions spoken of as "delirium cordis," caused by some change in the muscular fibres themselves. Is this change a coagulation by the heat resulting from the tetanic muscular contractions? The further experiments of Ziemssen with currents applied directly to the human heart with only pericardiam intervening, as well as the experiments of Ludwig and Hoffa, of Biedermann, MacWilliam, Herbert, and Dixon Mann, are familiar through the text-books of physiology. Such experiments may possibly serve as a guide to ordinary therapeutic work or as a starting-point in the controversy as to the risk of vagus stimulation in such conditions as chloroform narcosis or other intoxications; but they will not tell us how a modern industrial current may injure or kill. Further direct experimentation ought to be taken up from the point where the above-named investigators have left it. Cardiographic and respiratory tracings are wanted to show in sequence of time the nature and extent of the influence on circulation, respiration, and innervation of modern currents under various conditions of contact, strength, direction, and duration.

TOOL HOLDER.

All machinists will be interested in the device described and illustrated herewith.

This tool holder is for use on lathes, planers and shapers, and possesses many advantages over other holders. It saves time, labor, annoyance and money, for the reason that it never requires forging or tempering. Any form or shape of cutting edge can be ground in a few seconds, and no more time is consumed in



GOULD & EBERHARDT'S TOOL HOLDER.

handling or changing this tool than with the ordinary. In practice it is said to be more convenient.

These tool holders are furnished with best tool steel set screws, and with each holder are supplied fine pieces of special self-hardening steel, each end ground to a different shape, together with a suitable wrench.

This device is manufactured by Gould & Eberhardt, New Jersey R. R. ave., Green and Bruen streets, Newark, N. J. It is said to save about 75 per cent. over forged tools. A glance at the illustration will show at once the method of construction and use in practice.

HOW TO MANAGE DYNAMOS AND MOTORS.

Everyone having charge of a dynamo or motor should know how to manage these machines properly. Trouble is liable to occur at any time, and to be able to determine the cause by the symptoms and how to apply the remedy is a knowledge that every operator should possess. The book entitled "Practical Management of Dynamos and Motors," and written by the well-known electrical authorities, Prof. F. B. Crocker and Dr. S. S. Wheeler, gives plain directions for the management of these machines. It costs but $1.00 a copy, and can be purchased at the office of The Electrical Age, New York.

ELECTRICAL TABLES.

"Electrical Tables and Memoranda," is the title of a valuable little reference book for engineers, electricians and others interested in the electrical science. It contains a great deal of valuable information and a number of illustrations and diagrams. It is only 1⅞ by 2⅝ inches in size, and can easily be carried in the vest pocket. The author of this convenient little work is Prof. S. P. Thompson, and the price is only 50 cents per copy. For sale by the Electrical Age Publishing Co., World Building, New York.

NEW CORPORATIONS.

A company has been organized in Brookhaven, Miss., with F. F. Becker as president, L. H. Baggett, vice-president and Henry Meyer secretary, to construct and operate a telephone system.

The Phœnix Electric Light Co., McKee's Rocks, Pa., with a capital stock of $5,000.

The Arkansas Valley Electric Co., Florence, Col., Capital stock $50,000. J. W. Stearns is interested.

The Eldridge Electrical Mfg. Co., Eldridge, N. Y. Capital stock $10,000.

The Electro-Magnetic Traction Co., Washington, D. C., by Senator William B. Stewart, Phillip B. Thompson, Jr., of New York City, and B. E. Shear, Denver, Col., to construct electric motors and furnish gears and equipments for street cars. Capital stock $1,000,000.

Baltimore, Middle River and Sparrow's Point Electric Railway Co., Baltimore, Md. Incorporators, James Young and others. Capital stock, $400,000.

Pottsville and Reading Railway Co., Wayne, Pa. Capital stock, $250,000, to construct an electric railway. Incorporators, C. H. Barritt and others.

The Mayfield and Stanford, Jr., University Street Railway Co., Mayfield, Cal. Capital stock, $10,000. Incorporators, J. P. Ponce, Bernard Meyer, Gordon Wigle and B. L. Ryder.

The Albany, Newton and Camilla Telephone Co., Albany, Ga. T. M. Carter, president; J. M. Sloane, manager; and T. M. Tichenor, secretary and treasurer; to construct a telephone line between the places named in the title.

The National Telephone Construction Co., Gainesville, Texas, by J. M. Dubois, Geo. J. Funkhouser, J. M. Lindsey, J. B. Lindsey and C. R. Smith, to build and open telephone lines. Capital stock, $25,000.

The United States Equipment Co., Kansas City, Mo., by J. L. Brown and C. B. Hoffman, to equip, manu-

(*Continued on page 166.*)

CAPO-FARAD BLASTING BATTERY.

The little battery shown in the accompanying illustration is truly a little electrical giant. It is made up of four cells of the well-known Capo-Farad battery fitted with a light wooden case, suitable for carrying in the pocket.

This battery is designed for blasting purposes, and on account of its compactness and power it is claimed to be the most perfect ever devised for this class of work. In size it is only $3\frac{1}{2}$ inches wide by $3\frac{1}{4}$ inches high by 1 inch thick. Each cell has an E. M. F. of slightly exceeding 1.10 volts; the four cells giving a total E. M. F. of 4.50 volts, and a current of two amperes.

For the prospector or mining engineer this battery has no superior, and its convenient size certainly commends it for such use. It is equally as valuable and useful to the electrician for testing, and to the surgeon for cautery work.

The Capo-Farad cell is said to be the smallest and most powerful made. Its elements are chloride of silver and zinc, and its strength remains constant up to the moment of exhaustion. It is hermetically sealed and never polarizes, and it makes no difference what

SMALLEST BLASTING BATTERY MADE.

position it is in, it works just as well. Each cell weighs one ounce and is $\frac{11}{16}$ of an inch in diameter and $2\frac{3}{4}$ inches long.

This superior little cell is manufactured by the Nassau Electrical Co., 106 Liberty Street, New York, Mr. James J. Pearson, the manager of the company, being the inventor. It is well made and calculated to give the most satisfactory service.

THE NATIONAL ELECTRIC LIGHT ASSOCIATION.

NEXT CONVENTION IN CLEVELAND.

At a meeting of the executive committee of the National Electric Light Association held at the Hotel Brunswick, New York city, Tuesday, September 11, 1894, it was voted that the next convention of this association be held in Cleveland, O., February 19, 20 and 21, 1895.

The officers of the association during the present year are: M. J. Francisco, president, Rutland, Vt.; C. H. Wilmerding, first vice-president, Chicago, Ill.; Frederic Nicholls, second vice-president, Toronto, Ont.; Geo. F. Porter, secretary and treasurer; C. O. Baker, Jr., master of transportation.

Executive Committee: H. H. Fairbanks, H. J. Smith, G. H. Blaxter, John A. Seely, E. F. Peck, A. J. De Camp, Charles R. Huntley, A. Markle and W. W. Carnes.

THE ARCHITECTS' DIRECTORY FOR 1894

This valuable reference book to the architectural profession has just appeared from the press of Wm. T. Comstock. It is put up in convenient shape and bound in red boards with gilt stamp, making quite a striking appearance. The work bears marks of very careful preparation and aims to give, classified by States and towns, all the architects in practice in the United States and Canada.

A selected list of the principal dealers in building materials and appliances is also given, which will be found useful to architects. To manufacturers and dealers the list of architects will be found of great value in addressing circulars and sending samples.

The work is well got up, clearly printed and of convenient size, and will be found of great value to architects, the building trades and electrical contractors. The price is $1.00.

ANOTHER STORAGE BATTERY CASE.

The Accumulator Company has brought suit against the Edison Electric Illuminating Company of New York, to restrain it from purchasing or using the chloride batteries manufactured by the Electric Storage Battery Company, of Philadelphia, for the reason that they are an infringement of what is now well known as the Swan-Reissue patent, which covers a perforated plate with the active matter confined within the perforations only. It will be remembered that Judge Coxe sustained this patent in the suit of the Accumulator Company against the Consolidated Electric Storage Company. The case came up before Judge Lacombe on the 11th inst., but the defendants were not ready to go on; and as a condition of adjournment the judge, after hearing the general features of the case, granted a restraining order preventing the Edison Company from making a contract with the Chloride Company for buying or using its batteries. The method of manufacture pursued by the Electric Storage Battery Co. is said to be of such a character that the active matter *must be* confined within the perforations only, for the reason that they cast their support plate around the tablets, which at the time are hard and can in no way overlap the surface of the plate.

AVERAGE CANDLE-POWER OF INCANDESCENT LAMPS.

The only practical method of keeping the average candle-power of lamps on a station at a point which will be satisfactory to customers or on a competitive basis with other methods of lighting, says A. D. Page, in a recent paper on Incandescent Lamps, is to keep records of the average life on the entire station where free renewals are furnished, and then to take out of the sockets and break up all lamps which are dim, by this means keeping down the average life to whatever constant is decided as the best under local conditions. Where the lamps are sold to customers, to keep the candle-power of lamps in use on the circuit of a central station at a point which will insure satisfaction or tend to keep the electric light popular, is a difficult problem. Whether the customer is on a meter or on a contract basis, it is poor economy for him to keep lamps in his sockets which are giving only 50 per cent. of their initial candle-power, but for the corporation which sold him the lamps and supply him with current, to call his attention to the fact that lamps in his sockets are giving only about 8 candles, and attempt to sell him lamps at 50 or 60 cents each, is not likely to bring about the desired result. To meet the above difficulties a number of central stations in different parts of the country are now selling lamps at retail to their customers at cost, and a few stations even below cost, at the same time doing all in their power to prove to them that only by a liberal use of lamps can they obtain the greatest amount of light for a given expenditure of money.

(*Continued from Page 164.*)

facture and lease and operate cars, engines and other appliances. Capital stock, $62,500.

Charleroi, California and Brownsville Street Railway Co., Charleroi, Pa., by Jas. S. and A. C. McKeen, Wm. J. Berryman, C. F. Thompson and John W. Crawford. The company will construct a 15-mile railway. Capital stock, $70,000.

The Port Huron and Lexington Railway Co., Port Huron, Mich., to build a street railway. Capital stock, $8,000.

POSSIBLE CONTRACTS.

The City and Suburban Electric Railway Co., Catonsville, Md., contemplates the extension of its line along the Frederick Turnpike.

The Lampasas Water, Electric Light and Ice Co., Lampasas, Texas, has been granted a franchise, and will commence operations at once.

The Sturgeon Bay Water Works and Electric Light Co., Sturgeon Bay, Wis., is securing stock subscriptions.

A movement is on foot in Boise City, Idaho, to organize a company for the purpose of constructing and operating an electric railway between Boise City and Lewiston, a distance of 300 miles.

An electric railway is to be built from South Bend, Ind., to Mishawaka, to be ready for operation next spring.

It is reported that the Citizen's Railroad Co., of St. Louis, Mo., intends to substitute electricity for the cable system. The company is in the market for equipment. Robert McCullough is the general manager.

An electric light plant is to be put in at Stevenville, Texas. The Mayor of that place can give further information.

The Peoples' Telephone Construction Co., of Wheeling, W. Va., has applied for a franchise for the construction and operation of a telephone system. Mr. W. D. Johnson is secretary.

The People's Telephone & Construction Co., Wheeling, West Va., W. J. Johnson, secretary, is in the market for equipment for a telephone line.

The Somerset Electric Light & Street Railway Co., Crisfield, Md., is in the market for electrical equipment. Thos. D. Hodson, 6 East Lexington St., Baltimore, can give further information.

J. O. Adams and others, of Greenville, Tex., have secured the right of way for an electric railway.

The Citizens' Electric Light & Power Co., of Pensacola, Fla., will erect a new plant at once.

The Pelzer Manufacturing Co., Pelzer, S. C., has decided to build a new mill which will be operated by electricity, generated by water power at a point two miles from the site of the mill.

NEW YORK NOTES.

Office of the Electrical Age,
First Floor, World Building,
New York, September 17, 1894.

James Hervey Bates, M. E., formerly with the Moore Electrical Mfg. Co., has opened an office at 126 Liberty Street.

Ned Fox, the Chicago manager for the Phœnix Glass Co., of Pittsburgh, Pa., was in town last week. He speaks favorably of the business outlook. He secured some good orders at a stop-off station enroute to New York. Business in Chicago, he says, looks more hopeful.

W. H. Gordon, the well-known electrical supply dealer of this city, has been seriously ill for several weeks at his home, 73 West 5th Street, Bergen Point, N. J. He is still in a serious condition, the result of an operation for appendicitis. His many friends hope he will soon be around again.

Mr. Charles Blizard, of the New York office of the Electric Storage Battery Co., of Philadelphia, gave the Electrical Age a call one day last week.

A course of twenty-five lectures on Electrical Engineering will be given by Max Osterberg, E. E., graduate of Columbia College, on Saturday evenings, beginning October 6, 1894, in the Young Men's Christian Association Building, corner 23d street and 4th avenue, New York city. For further information apply to Educational Secretary, Waldo H. Sherman, 52 East 23d street, or to Mr. Osterberg, 232 East 62d street, on or before October 1, 1894.

Messrs. F. Schmerber and J. S. Du Vall, of the Parker Engineering Co., 30 Cortlandt street, New York city, have just finished the installation of a lighting plant which is said to have been the quickest work ever accomplished in this line. They took the contract to install a 200-H. P. plant, including two boilers and two engines, all the foundations, piping, etc., and seven days afterwards had the plant in complete operation. It worked so satisfactorily that it was at once accepted. The installation was at the Maspeth Race Track, Maspeth, L. I., for the purpose of illuminating the track for night racing. The lamps used for this purpose are of the Electric Construction & Supply Company's well-known make of arc lamps for incandescent circuits. The track is illuminated besides with groups of four incandescent lamps, placed fifteen feet apart, and three search lamps of the Electric Construction Company's make are used, with which to follow the horses around the track. The lights show the colors of the riders as plain as by day. In connection with this installation, Messrs. Schmerber and Du Vall also put in a pumping plant, carrying water fifteen hundred feet from its source. W. T. H.

THE ATLANTA CONVENTION.

The Lewis & Fowler Mfg. Co., of Brooklyn, are, we understand, arranging to run a special train to Altanta, to convey a party of their friends to the convention of the American Street Railway Association, on October 17, 18 and 19 next. The plan is to live aboard the sleeping cars while in Atlanta, and the total cost of fare, sleeper there and back, meals, etc., is $50 per head. We hear that quite a large party will go this way.

TRADE NOTES.

A contract for the completed work for the West Chicago Street Railroad has been awarded the National Conduit Manufacturing Company. This contract will amount to about $75,000. The National Conduit Manufacturing Company were brought in direct competition with every style of conduit that is in use today and feel very much elated over their success.

The Adams & Bailey Electric Co., Elkhart, Ind., is doing an excellent business in the Adams Improved Transformer. This Company has built up quite a reputation in repairing burned out transformers A guarantee for one year for a repaired transformer is of value, and that is what the Adams & Bailey Co. gives. The company also does a general electrical repairing business in the best manner possible Write them and see what they can do for you.

Coho & Co., 203 Broadway, have secured an order for eight dynamos for an installation in Philadelphia.

J. A. Machado of the Waddell-Entz Co., 203 Broadway, reports that his company is doing an excellent business now, having sold a number of dynamos recently.

The Alsite Aluminum Co, manufacturers of silver-plated aluminum ware, etc., have moved their quarters from 106 Liberty St. to the Ross Building, corner Bank and Hudson Streets, City. The company's plant has been largely increased.

Chas. J. Bogue, manufacturing electrician, 206 Centre Street, New York, is making a specialty of commutator refilling with Billings & Spencer's drop forged bars. These bars are an improvement over cast bars, being free from blow-holes and uneven surfaces. Mr. Bogue is also doing a large business in rewinding armatures, and for the past two weeks he has been working night and day on American dynamo armatures. He is thoroughly familiar with the construction and winding of all styles and makes of armatures.

BUSINESS NOTE.

It is reported that the Jenney Electric Co. of Indianapolis, Ind., will move its factory to Springfield, Ohio.

In another column will be found an advertisement of the Southern Railway Co., "The Greatest Southern System," the line which has been selected by a large number of prominent street railway officials, representatives of railway supply houses to make their trip to Atlanta during the street railway convention in October next This line operates solid Pullman vestibule trains from New York to Atlanta and, for the occasion of the Street Railway Convention, have arranged optional routes via this line operating a system of 4,396 miles south of Washington City all under one management, touching every important city south of the Potomac River. It has been arranged to carry members and friends via Washington, Danville, Salisbury, Asheville and Chattanooga to Atlanta, or via direct route from Washington Danville and Charlotte to Atlanta. There are a large number booked by this line and indications are that there will be a very large movement from New York to Atlanta, and it is very important that those desiring space in sleeping cars should advise the Eastern Passenger Agent, 271 Broadway, at once.

ELECTRIC LIGHT BONDS FOR SALE.

Sealed proposals will be received by me until 4 o'clock, P. M., Thursday, September 20, 1894, for the purchase of $40,000 of the bonds of the city of Kalamazoo. Each bond is for $500, dated Sept. 10, 1894, payable five years from date, with interest at the rate of 4 per cent. per annum, payable semi-annually, principal and interest payable at the office of the treasurer of the city.

The bonds will not be sold for less than their face value, or par and accrued interest, and the city reserves the right to award not more than $2,500 to any one bidder, and to reject any and all bids.

Aside from these bonds the total indebtedness of the city at this date is only $26,019.40.

Chauncey Strong,
City Clerk.

Kalamazoo, Mich., Sept. 12, 1894.

Electrical and Street Railway Patents.

Issued September 11, 1894.

525,689. Electric Transformer. Charles S. Bradley, Avon, N. Y. Filed Aug. 22, 1891.

525,690. Electric-Railway System. Charles S. Bradley, Avon, N. Y. Filed Jan. 2, 1894.

525,697. Winding for Drum-Armatures in Dynamo-Machines. Rudolf Eickemeyer, Yonkers, N. Y. Filed Mar. 9, 1892.

525,698. Armature for Dynamo-Electric Machines. Rudolf Eickemeyer, Yonkers, N.Y. Filed Apr. 3, 1894.

525,702. Telephone-Call System. Ezra T. Gilliland, Pelham Manor, N. Y., assignor to the American Bell Telephone Company, Boston, Mass. Filed Nov. 27, 1893.

525,703. Telephone-Call System. Ezra T. Gilliland, Pelham Manor, N. Y., assignor to the American Bell Telephone Company, Boston, Mass. Filed Jan. 11, 1894.

525,704. Electric Clock. Fred L. Gregory, Chicago, Ill. Filed Jan. 30, 1894.

525,708. Bus-Bar Insulating-Support. Albert D. Herrick, Schenectady, N. Y., assignor to the General Electric Company, of New York. Filed Apr. 11, 1894.

525,721. Carpet-Sweeper. Hiram W. Ru Ton, Goshen, Ind., assignor to the Goshen Sweeper Company, Grand Rapids, Mich. Filed Apr. 8, 1892.

525,730. Electric Fan. Charles Wachtel, Newark, N. J. Filed Jan. 17, 1893. Renewed Feb. 23, 1894.

525,732. Electrolytic Apparatus. Emile Andreoli, London, England. Filed Aug. 4, 1893.

525,735. Electric-Arc Lamp. Stewart L. Campbell, Kalamazoo, Mich., assignor of one-half to Henry W. Rood, same place. Filed Jan. 23, 1894.

525,743. Electric-Arc Lamp. Alexander B. Roney, Chicago, Ill., assignor to John E. Jacobs, same place. Filed Mar. 7, 1894.

525,769. System of Electrical Distribution. James F. McElroy, Lansing, Mich. Filed Oct. 5, 1887.

525,779. Synchronizing Mechanism for Electric Clocks. Edgar Ayres, Sydney, New South Wales. Filed Oct. 7, 1893.

525,782. Combined Brake and Electric Switch for Street-Railway Cars. George Brown, Long Island City, N. Y. Filed Jan. 29, 1894.

525,789. Trolley-Pole Connection. Maurice R. Mahon and John M. Crane, Newark, N. J. Filed Nov. 10, 1893.

525,828. Electrical Igniter for Gas or Hydrocarbon Engines. Paul A. N. Winand, Philadelphia, Pa., assignor to Messrs. Schleicher, Schumm & Co., same place. Filed July 26, 1893.

525,836. Self-Adjusting Brush for Dynamo-Electric Machines. William L. Bliss, Brooklyn, N. Y. Filed Apr. 13, 1894.

525,840. Lightning-Arrester. Archibald L. Courtright, Keokuk, Iowa. Filed Feb. 1, 1894.

525,864. Electric Railway. Herbert E. Rider, New York, N. Y., assignor to Adolph Falck, same place. Filed Feb. 26, 1894.

525,866. Electrical Signaling Apparatus for Railways. Paul Schwenke, Zerbst, Germany. Filed Apr. 8, 1892. Patented in Germany June 27, 1890, No. 59,-375; in Belgium July 16, 1891, No. 95,657; in France July 18, 1891, No. 214,949, and in England Feb. 12, 1892, No. 2,762.

525,874. Electric Annunciator. Henry C. Thomson, Boston, Mass., assignor to the Electric Gas Lighting Company, of Maine. Filed July 2, 1894.

525,886. Trolley for Electric Railroads. Edward Dawson, Terre Haute, Ind. Filed Dec. 26, 1893.

525,891. Fastener for Electric Wires. Harry C. Fricke, Pittsburgh, Pa. Filed June 14, 1894.

525,902. Fender for Street-Railway Cars. Alfred J. Hollingsworth, West New Brighton, and Joseph A. Weaver, New York, N. Y. Filed Mar. 10, 1894.

525,929. Spark-Shield or Protector for Electric Arc Lamps. William M. Tompkins, Philadelphia, Pa., assignor of one-half to Albert H. Manwaren, same place. Filed June 22, 1893.

525,936. Electric Switch. George Baehr, Jersey City, N. J., assignor to Samuel O'Connor, Brooklyn, N. Y. Filed Jan. 9, 1894.

525,943. Electric-Arc Lamp. Harold E. Bradley, New Bedford, Mass. Filed Feb. 28, 1894.

525,945. Conduit System for Electric Railways. William G. Creighton, Chicago, Ill. Filed Feb. 28, 1894.

525,993. Means for Equalizing Electromotive Force of Dynamos. Morris Moskowitz, Newark, N. J., assignor by direct and mesne assignments to the National Electric Car Lighting Company. Filed June 15, 1894.

526,016. Electric Motor. John S. Losch, Summit Station, Pa. Filed Mar. 6, 1894.

ELECTRICAL AGE

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NEW YORK, SEPTEMBER 29, 1894.

CONTENTS.

ECONOMICAL ELECTRIC LIGHTING.

The economy of the gas engine as a generator of power is well established, and it seemed to be an ideal machine for driving electric light dynamos, on account of the absence of heat, ashes and all the other disagreeable features of a steam plant. When the gas engine was first harnessed to the dynamo it at once became apparent that it was too unsteady in its motion for electric lighting—the variable motion producing corresponding unsteadiness in the light. However, it needed only to go through the refining process that the steam engine had gone through, to adapt it to electric lighting. An engine of this class has been recently brought to public attention in this city, which is said to give a perfectly steady light at a remarkably low cost for power. If this engine proves by actual work what is claimed for it, the lighting by electricity of the homes of people of moderate means is a possibility that has long been wished for.

EXHIBITS AT THE ATLANTA CONVENTION.

We print elsewhere in this issue some information of value to those intending to make an exhibition of their goods at the Atlanta convention of the American Street Railway Association next month. It seems that it is not generally known that exhibitors are, under prescribed conditions, entitled to reduced freight rates on goods shipped for exhibition, and that these concessions can be had for the asking. If intending exhibitors wish to avail of these special privileges they should at once take the necessary steps, in the manner indicated in the article referred to.

SEVEN THOUSAND AMPERES.

No more positive and convincing example of the wonderful development made in the use of electric current can be imagined than a glance at the monster switch described and illustrated on page 174, of this issue. Two years ago, aye, one year ago, if a man had ventured the opinion that a 7,000 ampere switch would soon be demanded in practice, he would have been adjudged a proper person to be restrained of his freedom. The 7,000 ampere switch is, however, an actual and practical thing, and in view of its appearance it may now be considered safe to make any sort of prediction with respect to the possibilities of electrical practice, without being considered visionary.

ELECTRIC BRAKES.

The paper of Elmer A. Sperry. on "the Electric Brake in Practice," which was read at the American Institute of Electrical Engineers last week, was one of the most interesting and practical that has been presented before that body in a long time. Mr. Sperry refers to the fact that comparatively little attention has been paid to the mechanism for retarding and quickly, but smoothly, bringing cars to a stop. It is the failure or impossibility to stop quickly that is the cause of so many accidents in our city streets, and the ordinary brake is utterly inadequate for the purpose. The electric brake, however, as developed by Mr. Sperry, appears to meet every requirement in electric railway practice. The current employed to operate the brake is developed by automatically turning the motors into generators, the current thus produced being at the expense of the mechanical energy stored up in the moving car. The brake, therefore, is not dependent upon the current that moves the car, the trolley current having nothing whatever to do with its operation. The current generated by the motors for braking is controlled as to intensity by the starting rheostat. The electric brake is a very ingenious device, and prominent among its many advantages is certainty of action. It is, moreover, very simple in its construction and application, and effects a great economy in wheels, brake shoes, etc. We print an abstract of Mr. Sperry's paper on another page of this issue, to which we refer our readers.

THE ELECTRIC BRAKE IN PRACTICE.*

BY ELMER A. SPERRY.

At the mention of electric brakes the engineer at once admits that they should be entirely feasible, and usually adds that there is plenty of electrical energy at hand from the central station to retard and control as well as to propel the car. This, however, is not the method undertaken by the writer. To employ the central station current for operating the brakes would be to limit very materially their usefulness and certainty of operation. The braking current, although used at comparatively infrequent intervals, and then only for a short period, should for this reason be absolutely certain and unfailing in its action, and not subject to any "heart failure" of the central station, or sudden cessation caused by the opening of the circuit breakers, the interruption of the line, the flying off of the trolley, failure of the fuse, or failure at other more or less vulnerable points. The electric brake under discussion has been operated over a year on equipment upon different roads, from electricity generated independently of the trolley connection, the braking current not being derived from the central station but produced by the power of the moving car, which power it is decided to get rid of, or destroy. The brake thus operates equally well with the trolley off, and, as will be understood from the following description, the trolley current has nothing at all to do with the car while the brake is being operated, except possibly to maintain the light circuit. The electric brake at the same time is entirely independent of the hand brakes, which may or may not be present upon the equipment. The braking action being altogether independent of the ordinary brake shoes, it is not found necessary to employ them in connection with the electric brake, although in the earlier forms they were used, and in the case of trail cars, especially in heavy service and on grades, some engineers prefer to use them at the present time, in connection with apparatus such as shown in Fig. 1. The current employed by the writer for operating the brakes is developed by automatically turning the motor or motors into generators. As these are driven forward by the moving car they develop current which is controlled as to intensity by the starting rheostat of the car. The braking current is thus produced at the expense of the mechanical energy stored up in the moving car, which being consumed causes a retardation and final stopping of the mass as a whole. The current so generated may be furthermore led through a brake magnet as above seen, to apply the brake shoes; it may arrest the motion of the car direct by magnetic adhesion, or develop heavy retarding currents in the moving metallic mass by magneto-induction. When an active local circuit is used, the latter method is usually employed for reasons which will be made more apparent.

In developing this system, the point which seemed fraught with the most difficulty, and which has finally received the simplest solution of any in connection with the problem, was that of obtaining always and with absolute certainty sufficient current at the lowest speeds without the aid of the trolley current. Teaser coils were at intervals resorted to, maintaining connection with the trolley circuit. "Artificial teasers" were also used, being a device by means of which the trolley circuit was entirely done away with, and which worked well. Observations made from time to time in connection with these experiments led to an exhaustive investigation of residual magnetism, in consequence of which structural means were adopted to utilize to the full the residual magnetism of the motor. This supply is constantly being renewed with every energizing of the car. This method was found to be the simplest as well as the most effective. The connections, and in fact the whole arrangement of the electric brake upon the car, are extremely simple. This is shown by the fact that only one small extra wire needs to be run to the controller in addition to the ordinary wiring of the standard equipment without the electric brake. The certainty of operation is evinced by the fact that at present writing over 150 of the equipments have been placed, which are making upwards of 10,000 miles daily in regular service. Early in the experimentation a phenomenon was observed in reference to the persistence of the current even after the motor had stopped. This is due to the slow action of the decreasing magnetization, taken together with the reaction or self-induction effect of the fields and any brake coil or coils that may be in the circuit. The movement of the magnetic lines, which persist after, and in fact long after the motion of the motor has ceased, generates potential. In many instances it is possible to draw an arc from the rupture of the brake circuit one second after the motion has ceased, showing the presence of current in the local circuit.

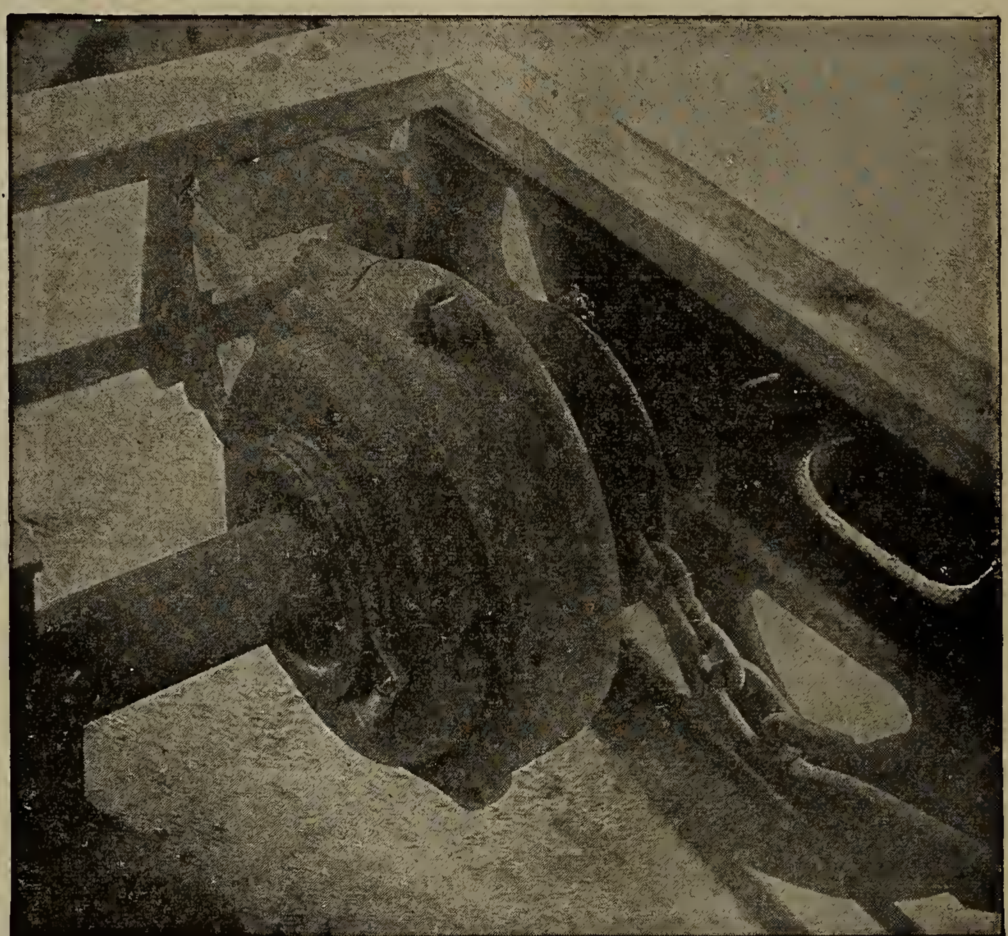


FIG. 1.

The current flowing after motion ceases, though small, is found exceedingly useful in holding the car from starting itself, even on quite a heavy grade, as only a small quantity of energy added to the already great friction of quiescence will prevent the car from starting. This persistency of current is also found useful to kill or destroy the magnetism of the brake magnet, in case it is desired to suddenly move the car forward again. The tendency on the part of the windings at the moment of rupture to generate an opposing E. M. F., tends to suddenly free the magnet from its face, a

* Abstract of a paper presented at the 89th Meeting of the American Institute of Electrical Engineers, New York and Chicago, September 19, 1894.

purely accidental feature, which is of great value and utility in this connection.

The current required to be developed to stop a car when no other braking apparatus is used, is found to be only a fraction of that required to accelerate the car in the same interval.

With this style of brake, the life of the wheels is increased from two to three-fold, thus affording a saving in the item next in cost to the electric maintenance itself, to say nothing of the entire saving in brake shoes. We little realize the great number of brake applications necessary in a day's run. Careful record has been kept of this point, giving in three days an average of 1377 brake applications per day for a run of about 164 miles.

Another interesting feature in this connection is that a flat wheel from skidding is an impossibility.

The braking action is two-fold and is especially efficient. The rotating armature of the motor, instead of tugging ahead by its momentum, is itself pulling

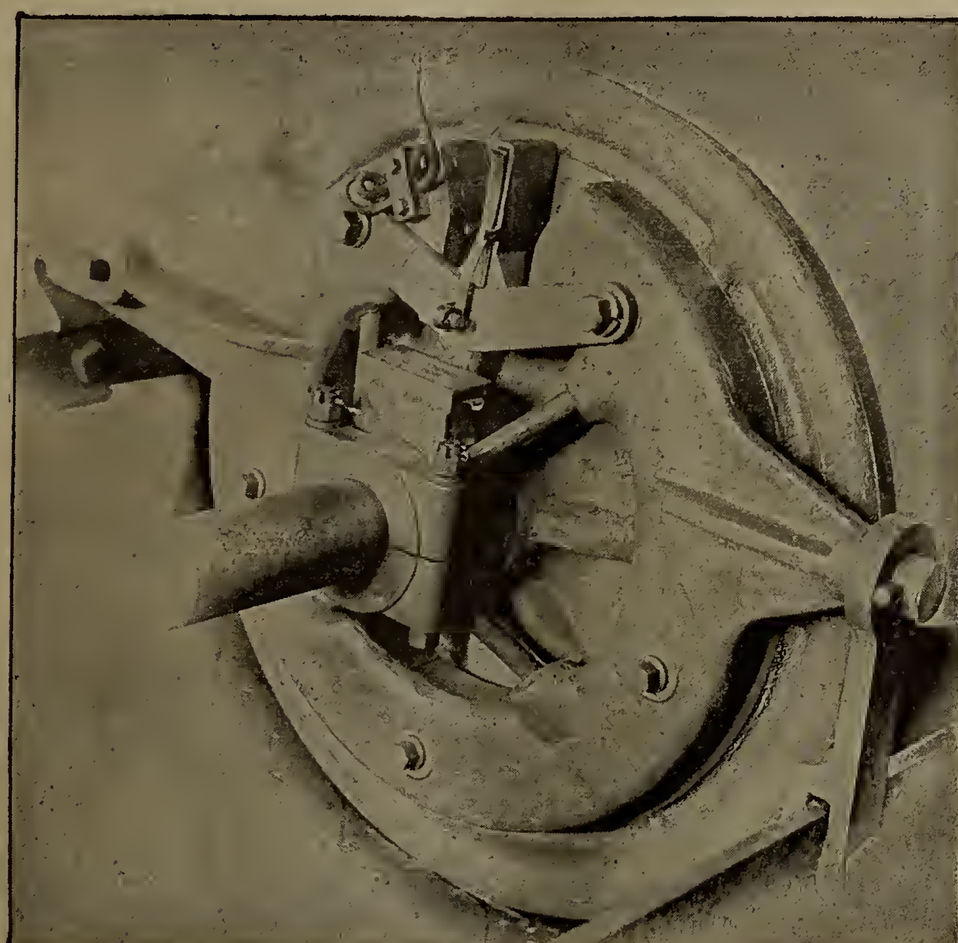


FIG. 2.

back and more or less powerfully braking the car through the gears by the retarding effort of the magnetism of its field while generating the braking current. The power required, therefore, to perform this work is taken from energy of the moving car which it is desired to destroy; not only is the car thus retarded, but the electric brakes arrest the motion of the wheels direct, with a force that is remarkably powerful and under perfect control of the motorman.

Two forms of braking magnets are used, one for winding up a brake chain usually employed in connection with the trailer, shown in Fig. 1, and another for directly arresting the motion of the axles, one magnet only being used in connection with each axle, as shown in Fig. 2. These magnets are truck-mounted, not an ounce of their weight being directly on the axle, and are so supported that their gravity acts to automatically retract them from the brake face. The brake is noiseless in its operation. Inasmuch as it does not revolve, no commutating or contact device is necessary. Its crescent form accomplishes important technical functions and also eliminates the necessity of pulling off a wheel for its attachment, removal or inspection. Its face is *solid unbroken metal* with no grooves or interstices for catching grit or sand, which in part explains the absence of wear above referred to. The brake magnet is practically indestructible, a few turns of stout wire constituting its one coil entirely enclosed and sealed in metal. No harm nor moisture can reach it. As to moisture it is immaterial, as the E. M. F. at which it works is extremely small, seldom reaching six volts. No mechanical pressures whatever are employed to arrest the car, and hence no strain or shoulder-wear comes upon the journals. In constructing the brake magnets their proportions and the arrangement of the magnetic circuits received considerable study. It was during some preliminary experiments that an unexpected phenomenon was noticed; namely, that the retarding effect, when speed is an element, is very much more than would have been expected from the coefficient of friction due to magnetic attraction or adhesion, this latter being a known and definite quantity. Farther experiment, made to ascertain the cause, showed it to be due to Foucault or eddy currents set up in the masses. The conditions and structure of the brake magnet were therefore varied in a number of particulars, especially such as would be expected to give the greatest result in Foucault currents produced. The result was immediately successful. It was found that the retarding effect of the brake magnet is due very much more to the generation of these currents than to the direct effect of the coefficient of friction resulting from direct magnetic adhesion, the amount of which I find can be relied on accurately when employed by itself.

By reference to the following table the result in retardation gained through the eddy or other currents may be plainly seen, column A indicating the retarding effect which should be expected from a friction coefficient of 10 per cent. between the lubricated surfaces due to magnetic attraction of the lines actually circulating; and column B indicating the values of retardation actually obtained on the dynamometer.

The advantages found to result from the practical use of the electric brake as compared with former brake systems; its qualities as an accident preventer, as well as its general commercial value, may be recapitulated as follows:

1. The certainty of its operation.

Amperes.	Volts.	"A" Pull due to magnetic adhesion or traction. Friction coefficient 10 per cent.	"B" Pull on brake chain obtained. Graphite lubrication.
5	1.	7.6 lbs.	125 lbs.
9	1.8	18.3	300
9.5	1.9	36.4	608
15	3.	121.	1976
16	3.2	149.	2432
20	4.	158.4	2584
23	4.6	167.	2736
25	5.	186.	3040
31	6.2	207.	3385
35	7.	213.	3490
35.5	7.3	214.	3500
41	8.5	223.	3650

The assumed values are based on a traction of 28.26 lbs. per square inch for 45,000 lines per square inch, being the assumed values at the knee of the curve easily recognized as occurring between 16 and 20 amperes in the table.

2. The enermous power at instant command and under perfect control.
3. The absence of all power absorption at moneyed cost from the central station.
4. Its high efficiency, being far superior to compressed air; amply proven in numberless instances where electricity has replaced air. (The air requires a direct application of energy, amounting to an immense aggregate power-absorption during the day from the central station; the working parts of the air machinery are attached to the car axles and require a large quantity of energy, not only while compressing, but at other times as well.)
5. Its extreme simplicity.
6. Observed saving in wheels, two to three-fold.
7. Entire saving in brake shoes.
8. Lubrication of brake face; very little wear of either wheel or magnet.
9. Absolute silence of operation and release. (No hissing to frighten horses on streets.)
10. The low E. M. F. at which it operates.
11. The ease of its application and control.
12. Conserving strength, and prolonging the usefulness and life of the motormen.
13. The smoothness of its operation.
14. The fact that its use cannot cause flat wheels.

PRINCIPLES OF DYNAMO DESIGN.

BY NEWTON HARRISON, E. E.

(*Continued from Page 146.*)

The Magnetic Circuit.

CHAPTER II.

Hopkinson's Formula.

The point of vital interest in the design of a magnetic circuit is the exact number of ampere-turns required for a working magnetic field.

Hopkinson's formula is more rigorously true, and, in general, more logically apparent as an exact means of calculation for iron circuits than any other existing method. The different qualities of iron of which a circuit is apt to be composed offer no obstacles to its application. Cast iron pole-pieces, wrought iron magnet cores, and a cast iron keeper of which many dynamos have been and are being constructed are cases only successfully treated by an analytical method.

First Approximation. Hopkinson bases his calculations upon certain premises that are necessary and strictly admissable in this case.

(1) He assumes that the distribution of magnetism in the cores is equal and regular, also in the armature and air gap.

(2) The lines of force of the pole-pieces pass into the armature.

(3) The reactory effect of the armature is neglected and therefore the total magnetic force acts integrally.

If I = total induction through the armature,
A_1 = the area of a section through the armature,
l_1 = mean length of the lines of force in the armature,
A_2 = the area of the air gap,
l_2 = the length of the air gap,
A_3 = the area of the core of magnet,
l_3 = total length of the magnets,

then the specific induction of each part could be represented as follows;

$\frac{I}{A_1}$ = The induction per sq. cm. of the armature core.

$\frac{I}{A_2}$ = The induction per sq. cm. of the non-magnetic spaces.

$\frac{I}{A_3}$ = The induction per sq cm. of the magnet cores.

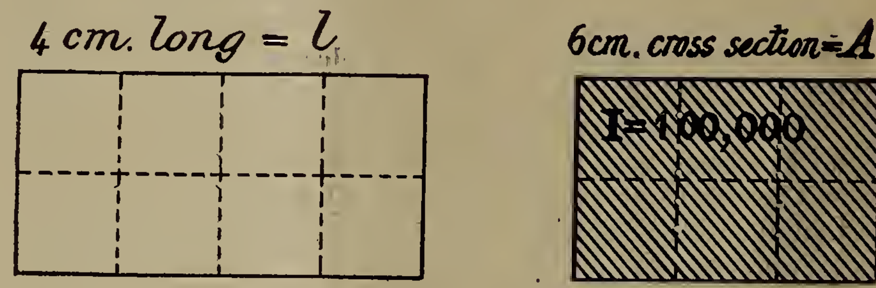


FIG. 11.

From the above the corresponding magnetic forces *per centimeter of length* must be

$$f\left(\frac{I}{A_1}\right),\ \frac{I}{A_2} \text{ and } f\left(\frac{I}{A_3}\right)$$

The expression $f\left(\frac{I}{A}\right)$ etc., reads function of $\frac{I}{A}$ and refers to a curve which would give the indicated value of $\frac{I}{A}$ in magnetizing force.

As an illustration supposing I = 100,000
and A_1 = 6 sq. cms.

then $f\left(\frac{I}{A_1}\right) = f\left(16667\right)$

= 70 ampere turns per centimeter of length for a bar of wrought iron subject to the above induction and of the cross section specified.

Therefore by multiplying the $f\left(\frac{I}{A}\right)$ etc., by their respective lengths in centimeters, we will obtain for each the integral of magnetic force required.

As the above indicates, the magnetizing force is given for each cubic centimeter of the iron because $\frac{I}{A}$ represents the specific induction for each sq. cm. of cross section and l_1 the length in cms, as above described, therefore the expression $l\,f\left(\frac{I}{A}\right)$ pertains more exactly to the cubic cm. of iron under examination.

The total or line integral of magnetic force round a closed curve must be

$$l_1 f\left(\frac{I}{A_1}\right) + 2\,l_2\,\frac{I}{A_2} + l_3 f\left(\frac{I}{A_3}\right)$$

in which $2\,l_2\,\frac{I}{A_2}$ represents the magnetizing force necessary for the air gap.

In this approximation we neglect the force required to magnetize pole-pieces and other parts not within the magnetic coils to avoid complication.

(*To be Continued.*)

GAS ENGINES FOR ELECTRIC LIGHT.

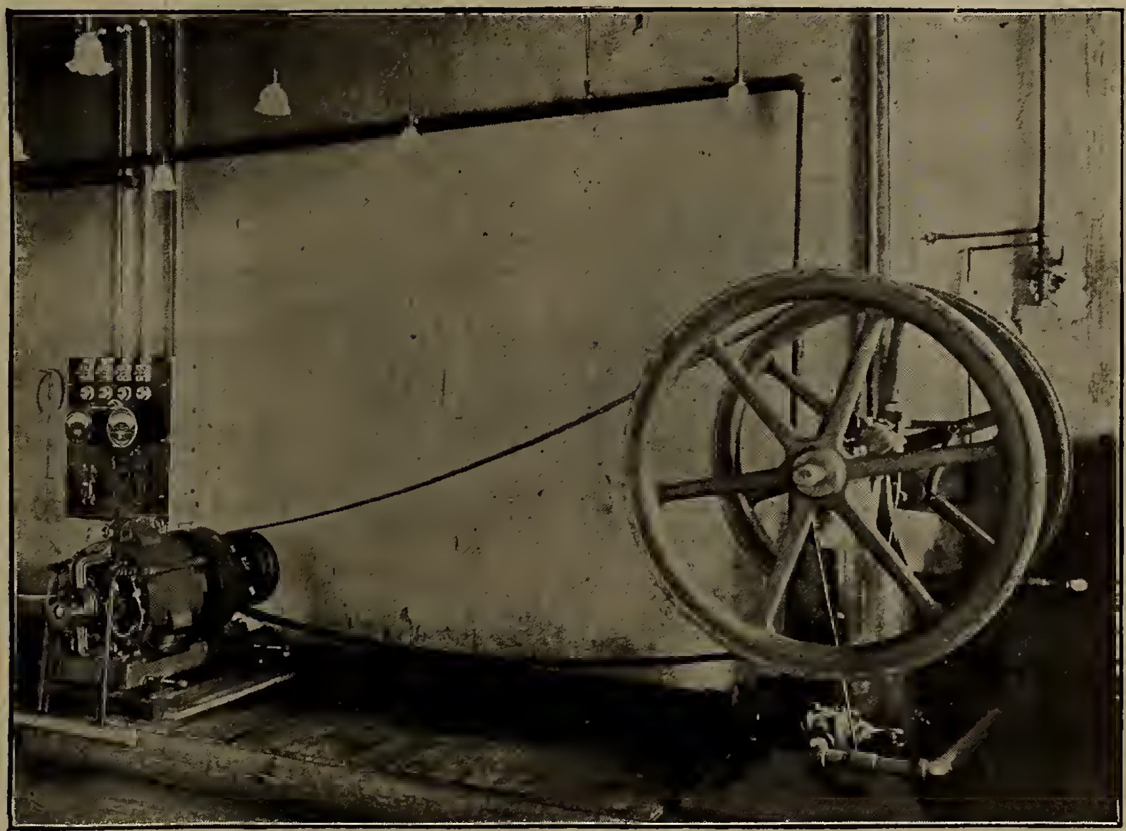
The highest grade multiple expansion steam engine in the market to-day, with condensers, feed water heaters, etc., etc., converts into work only about ten per cent. of the energy of the fuel, while the average gas engine converts from twelve to fifteen per cent., and the larger ones about twenty-five per cent.

If we take a steam engine and a gas engine with cylinders of the same diameter, and the same stroke of piston, both running at the same speed, the latter will develop more power, because of the high pressure in the cylinder produced by the explosion of gas.

The most severe test to which a gas engine can be put is in an incandescent electric light plant, where a uniform motion of the engine is essential to the proper working of the system. Any irregularity of motion necessarily affects the intensity of the light to a corresponding degree, and in many gas engines it is this unevenness of motion that unfits them for electric light work. By constant study and experimentation, however, the gas engine is being brought rapidly to the front as a prime mover for electric lighting, and in some instances very successful results are being obtained. There is in daily operation in this country a 300 H. P. central station gas engine for the purpose of driving electric light dynamos, which we are informed is giving most excellent satisfaction.

Gas engines consume from 15 to 20 cubic feet of gas per horse-power per hour in the smaller; and less than 15 cubic feet in the larger sizes, and it is a well-known fact that a given amount of gas consumed in a gas engine running a dynamo supplying incandescent lights, will produce 300 per cent. more light, or illumination, than the same quantity of gas consumed in the usual way. It is not to be wondered at, therefore, that electrical and mechanical engineers have been applying themselves assiduously to the problem of adapting the gas engine to electric light work.

An interesting gas engine plant is now running in this city and is accessible for inspection by any one interested. It is stated that there is a complete absence of flickering in the lights, and with any number of lights in circuit—from one up to full load—the voltmeter does not fluctuate as much as one volt. This engine is the joint invention of two prominent inventors of New York City, who have devoted two entire years to its perfection. An illustration of this plant is given herewith.



NEW GAS ENGINE FOR ELECTRIC LIGHTING.

A steam engine of the same dimensions as the gas engine shown would be of six horse power, but the gas engine develops a much greater power. At normal full load it maintains sixty full sixteen-candle, 110 volt, one-half ampere incandescent lamps, although it will sustain sixty-seven lamps for any length of time. The engine is of the four-cycle type and the dynamo runs at 700 revolutions.

In this system ten full sixteen-candle-power incandescent electric lights are burned for one hour with a consumption of twenty cubic feet of gas, which is equivalent to that consumed in burning four ordinary gas burners for one hour. Gas is used in proportion to the number of electric lights burning.

With gas at $1.25 per thousand feet, 1,000 incandescent lights can be burned at the remarkably low rate of $2.50 per hour, and the use of gasoline reduces this cost to two-thirds.

As no licensed engineer is required to operate such a plant the aggregate economy, it will be seen, is very great.

This plant may be seen in practical operation at any time at the office of Edward Durant, electrical engineer, 39 Cortlandt street, New York city, where that gentleman will take pleasure in explaining its features and advantages to all interested.

We have received from Dr. Robert Newman a cordial invitation to attend a reception to be given by the resident members of the American Electro-thereapeutic Association, at the New York Academy of Medicine, 17 West 43d Street, on the evening of September 26.

We have received from Jacques Ullman, constructing electrician, 16 Boulevard, St. Denis, Paris, a copy of his illustrated catalogue of electrical apparatus and fixtures. M. Ullman carries a very large line of electrical supplies, and the catalogue looks much like the modern American publication of this character.

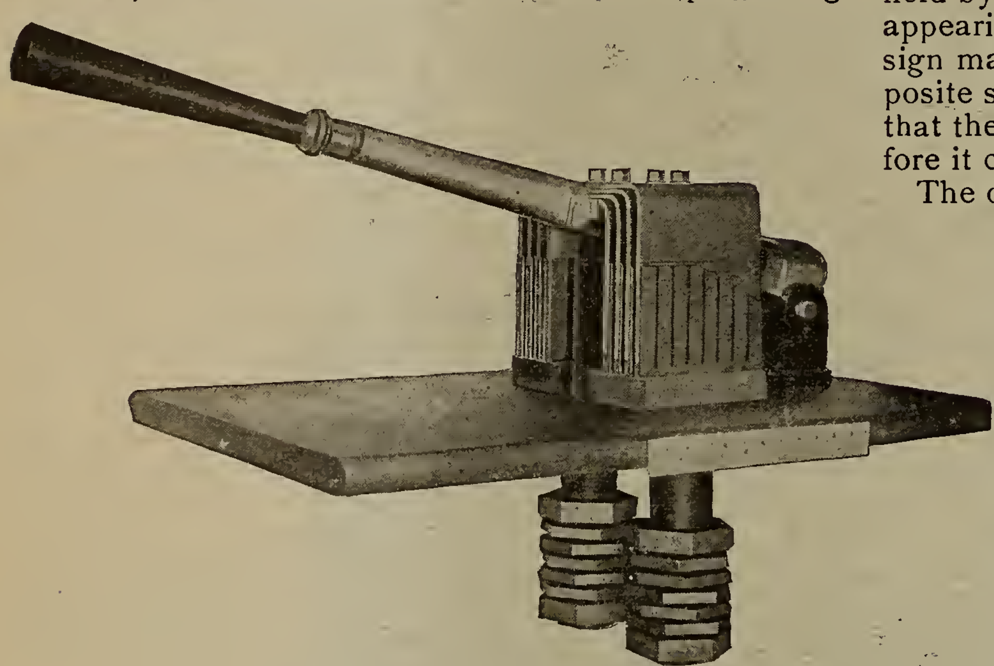
A GIANT AJAX SWITCH.

With the advance of electric traction and the consolidation of street railway interests, there has been a gradual tendency toward larger power stations with larger generating units, and, consequently, proportionately larger station apparatus.

As late as April, 1893, a switch that was guaranteed to successfully rupture a circuit carrying 3,000 amperes of current, at a potential of 500 volts, was considered a giant in breaking capacity; and it remained for the Ajax switch, described in the technical papers of that date, to demonstrate the utility of such large, quick-break switches, and the ability to open a circuit carrying 2,000 H. P. of electrical energy at 500 volts potential, without the slightest injury to either the operator or the apparatus.

During the interim, Ajax switches have been designed for 4,500 amperes (50 per cent. larger than any attempted before), and several such are in actual service on street railway circuits.

We now are enabled to illustrate another advance in switches, the switch in the illustration representing



VAN NUIS'S 7,000 AMPERE SWITCH.

a new "plunger type" Ajax switch of 7,000 amperes capacity. This switch, which was made by C. S. Van Nuis, of New York, is guaranteed to break its full rated capacity at 500 volts potential, or nearly 4,700 H. P. It was ordered by the Electric Traction Company of Philadelphia, through the General Electric Company, who is building the switchboard for the Traction Company's new Delaware Avenue power house.

Except the carrier and stand, which do not form any part of the circuit, the entire switch is made of commercially pure copper, and provision is made for clamping direct to a laminated "bus bar," consisting of six bars, each 5″ by ¼″, or a total of 7½″ sectional area; which is also the minimum of sectional area in any part of the switch.

The contact area, finish and action are of the well-known Ajax formula. The switch is compact in form and occupies a space only 14″ x 13″ on the switchboard.

A handle of unusual length is required to operate these large and close-fitting blades, which overhangs the switch proper several inches; the total length of the handle from the pivot is 41½″, and terminates in a highly polished piece of old mahogany.

As a continuous current circuit breaker, it is believed the subject of this sketch is the largest yet attempted. It is needless to say that it has not yet been tested to its limit.

A STUDY OF THE RESIDUAL CHARGES OF CONDENSERS AND THEIR DEPENDENCE UPON TEMPERATURE.*

BY FREDERICK BEDELL, PH.D. AND CARL KINSLEY, A.B., M.E

When a condenser is subjected to a difference of potential for some time, part of the charge received is absorbed by the dielectric and a part remains upon the surface of the condenser plates.[1] This latter part becomes discharged when the terminals of the condenser are connected together through a conducting circuit, and the condenser appears to be in a perfectly neutral condition. The absorbed charge, however, still remains in the condenser and will gradually come to the surface in the form of a residual charge of the same sign as before. If this be discharged and the condenser be allowed to stand insulated, a second residual charge will collect in the same way as the first. A series of residual charges with rapidly diminishing values may thus be formed. Therefore, the condition of a condenser is dependent upon its past charges, some of which may have been held by the dielectric for weeks or even months before appearing upon the surface; a former charge of one sign may entirely neutralize a subsequent charge of opposite sign and smaller value. It has been justly said that the past history of a condenser must be known before it can be trusted.

The object of the present investigation was to determine this soaking-in effect of dielectric. A study was made,[2] first of the successive residual discharges of a neutral condenser and then of the effects produced by previously charging the condenser in the opposite direction. The absorption of the dielectric was next studied by allowing a charged condenser to stand insulated and discharge through its own dielectric. The effect of a previous negative charge upon this absorption and upon the apparent resistance of the condenser was thus studied. An investigation was then made of the influence of initial potential upon the discharge curves, and the insulation resistance. An examination of temperature effects was then undertaken. The influence of temperature changes upon discharge curves through various commercial oils, and upon the resistance of the oils, was ascertained preliminary to similar experiments upon condensers. Finally, the influence of temperature upon the absorption by the dielectric of a condenser was obtained by a study of the successive residual discharges and by discharge curves at different temperatures.

THE EFFECT OF A PREVIOUS NEGATIVE CHARGE UPON SUCCESSIVE RESIDUAL DISCHARGES.

Previous to the final charge the condenser was subjected, for this series of experiments, to a charge of opposite sign. The final charge was in every case in the same direction (arbitrarily called positive) and for the same length of time, viz., 30 seconds. Experiments were made with previous negative discharges, *i. e.*,

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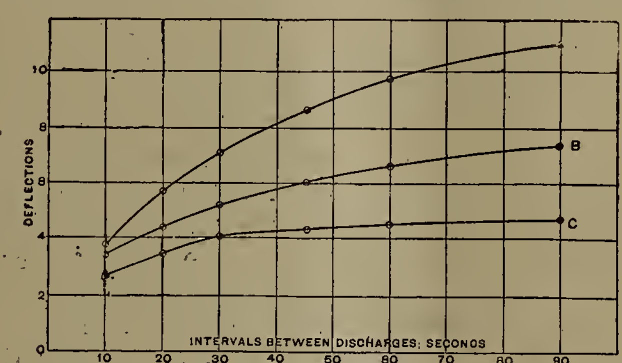
* Abstract of a paper presented at the 89th Meeting of the American Institute of Electrical Engineers, New York and Chicago, September 19, 1894.

1. The part absorbed depends directly upon the duration of the time of charge; the part remaining on the surface is practically independent of the length of charge, for the condensers used in the present investigation. This was shown in a preliminary investigation by Messrs. W. M. Craft and H. B. Henderson, who showed the first discharge, as measured by the throw of a ballistic galvanometer, to be independent of the length of charge.

2. The condensers used throughout these experiments were furnished by Mr. Stanley in the spring of 1893, and were used in the experiments upon "Hedgehog Transformer and Condensers," described in a paper before this INSTITUTE, Oct. 18, 1893. For their construction see TRANSACTIONS, vol. x, p. 514.

charges opposite in direction to the final charge, of different duration. The value of the positive or negative potential to which the condenser was charged was in all cases about 114 volts. After the final positive charge of 30 seconds, the condenser was allowed to stand insulated for five seconds, and was then short circuited for fifteen seconds. After this discharge by short-circuiting the condenser was allowed to stand insulated for definite intervals of time, during which the absorbed charges worked out to the surface. It was then discharged through a galvanometer, the throw of which furnished a comparative measure of the discharges. Successive residual discharges were thus obtained by allowing the condenser to stand after each discharge for an interval of time, during which the residual charges worked to the surface. The first, second, third and fourth residual discharges were obtained with equal intervals of time between the successive discharges. This was repeated, allowing different intervals of time between the discharges. In these figures curves A, B, C, D and E represent the residual discharges corresponding



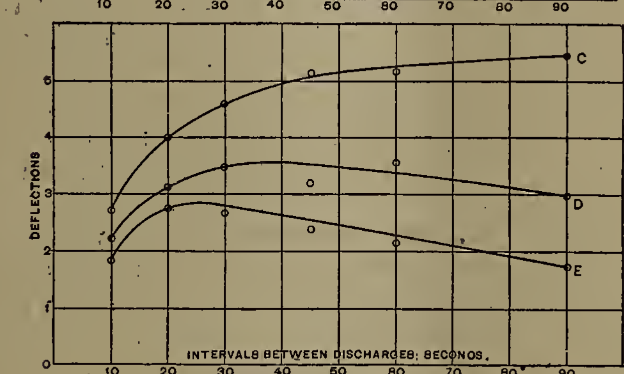


FIG. I.

First Residual Discharge. Curve A for no previous charge; curve B for a previous negative charge for 30 seconds; curve C for a previous negative charge for 60 seconds.

FIG. 2.

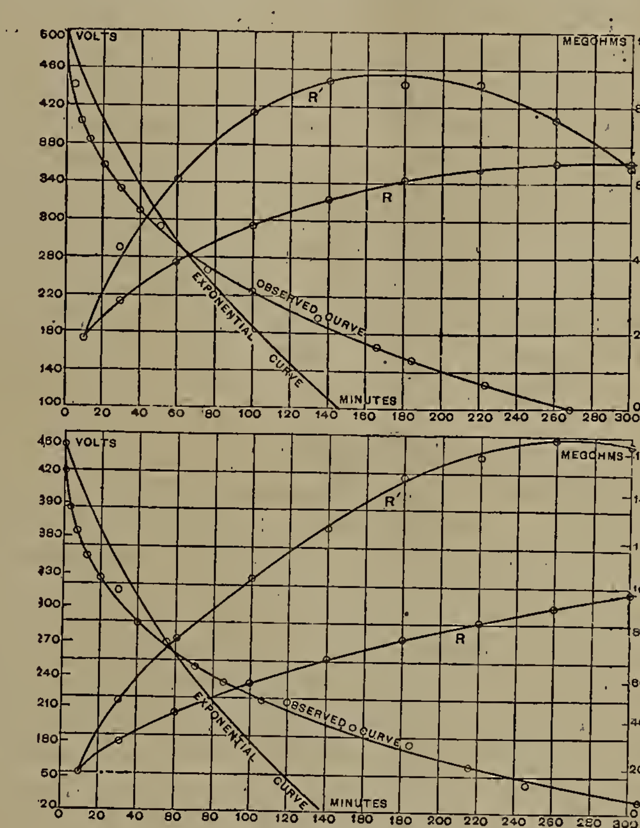
First Residual Discharge. Previous negative charge as follows: curve C 60 seconds; curve D 90 seconds; curve E 120 seconds.

to different lengths of previous negative charge. In the case of curve A, there was no previous charge of any kind, the condenser being as nearly neutral as possible when the final positive charge of 30 seconds was given. The measurements for curve B were made upon the same condenser, which was given a previous negative charge for 30 seconds, was then allowed to stand insulated for five seconds, and then short-circuited for 15 seconds previous to the final positive charge. For curve C, the condenser received a preliminary negative charge for 60 seconds, stood insulated for five seconds, and was then short-circuited for 15 seconds previous to the final positive charge. For curves D and E, the previous negative charges were 90 and 120 seconds respectively, all other operations being as before. The absorption, due to a positive charge, deflected the needle to the right, and such deflections are plotted above the X axis; deflections to the left, due to a negative charge, are plotted below the axis. In taking curves D and E, the sensitiveness of the galvanometer was changed, and curve C was, therefore, determined twice, in order to show the relation between curves A and B and curves D and E.

The effect of the previous negative charge in partially or wholly neutralizing the final positive charge is clearly seen by an inspection of the curves. This influence becomes more and more marked with each successive discharge, and still more apparent as the intervals between the discharges are made greater. This would naturally be so, since the previous residual charge has time to work out and neutralize the absorption due to the final charge.

In the first residual discharge curves, Figs. 1 and 2, the previous charge has evidently the most influence where the intervals between discharges are the longest, and although the discharges are all positive, it is not at all unlikely that curves D and E, at any rate, would be brought to zero, or even made negative by increasing the intervals between discharges.

In the curves for the second residual discharges, curve C is brought to zero, while curves D and E actually cross the X-axis, indicating a negative discharge; that is, one opposite in direction to the final charge. The evident turning again of the lower part of the curves



FIGS. 3 AND 4.

indicates that the previous negative charge is becoming weakened.

All these effects are more marked in the curves for the third residual discharges, where in the case of curves D and E, the 10-second interval is the only one giving a residual discharge in the direction of the final charge. These curves are very nearly of the form which they would have if the final positive charge had not been given to the condenser at all, and the residual discharges were due only to the previous negative charge as is more plainly seen by inverting the figure. As is usual, the fourth residual discharge curves are rather flat, but curves D and E, as they indicate the presence of merely a negative charge, resemble the usual second discharge curves and are considerably concaved toward the X-axis.

THE EFFECT OF ABSORPTION UPON THE DISCHARGE CURVES.

The curve for the discharge of a condenser through its own dielectric deviates widely from an exponential curve on account of the absorption of charge in the dielectric; for, as a condenser discharges, this residual charge works out to the surface and becomes effective. The form of the discharge curve depends likewise upon previous charges, whether of the same or of opposite sign. The resistance of a condenser is similarly dependent upon this absorption.

The discharge curves of the condenser were obtained by measuring the difference of potential at its terminals, by means of a multicellular voltmeter, as the condenser was allowed to discharge through its own dielectric. The leakage through the voltmeter was found to be negligible.

In Fig. 2 is given the observed discharge curve from a condenser, which, although used for some time, had always been charged in the same direction. An exponential curve is also plotted with the assumed constant resistance of 4,250 megohms.

This condenser was left short-circuited for 88 hours, and then charged in the opposite direction and the curve of discharge obtained as above. The results are shown in Fig. 3. The previous charge affects the shape of the discharge curves, but its influence is more clearly seen in the curves for the variation of resistance. The increase in apparent resistance, shown in Fig. 2, is due, as has already been explained, to the absorption in the dielectric. In Fig. 3 the resistance increases at first, due to the absorption of the final charge, and then decreases as the previous absorption of opposite sign begins to be effective. From this it is evident that the soaking-in effect, which is the cause of the usual rise of resistance, must have acted in the opposite direction, and so must have hastened instead of hindering the discharge. Where the curve for resistance R', calculated for short intervals of time from the discharge curve, is horizontal, the two absorbed charges neutralize each other, the resistance is constant and the discharge curve is truly exponential.

* * * * * *

CONCLUSION.

The action of a condenser is dependent, in a marked degree, upon its previous history; so much so, in fact, that its previous charges may be of more importance in determining its action under certain circumstances than charges received later. In that case the previous absorption, after neutralizing the absorption due to the final charge, may give rise to residual discharges which increase with time up to their previous initial value.

Absorption gives rise to the phenomena of residual charges and causes the condenser to depart from the exponential law in discharging through its own dielectric. The increase in apparent resistance in the condenser during discharge is associated with this effect of absorption. Previous charges modify these results, increasing or decreasing them according to whether the previous charges were in the same or opposite sense.

The resistance of pure oils is constant at any one temperature, but falls off rapidly with the temperature. There are, accordingly, no absorption or residual effects in pure oils.

In solid dielectrics the effects of absorption are diminished as the temperature is increased, as shown by the residual discharges and by the changes in the insulation resistance.

This investigation can in no wise be considered as comprehensive. Many of the results here described are already known, but they have not before been presented together so as to show the relation between them. The fact that the previous condition of the condenser has such an influence upon its action, causes considerable embarrassment in an investigation of this sort, inasmuch as a condenser used once under certain conditions may be practically useless in the same investigation for further experiments. One of the condensers experimented upon retained its past charges after being short-circuited for a month, and it was necessary to employ another condenser which was neutral for further experiments.

THE ANNUAL MEETING OF THE STREET RAILWAY ASSOCIATION OF THE STATE OF NEW YORK.

The Twelfth Annual Meeting of the Street Railway Association of the State of New York was held at The Yates, Syracuse, N. Y., Tuesday, September 18, 1894.

President D. B. Hasbrouck presided, and delivered his address, in the course of which he said:

"Though we have, in common with our fellow citizens, felt the pressure of the times during the past year, we have *not* had a blizzard to obstruct the roads for a week, nor have we had a "tie-up," to vex us and deprive us of revenue for a like period. We may follow the example of that good Dutchman, who, when he had broken his leg, thanked the Lord that it was not his neck. The continued growth of our cities and towns has increased the demand for street railways, and it is our business to supply the demand.

"The work of consolidation in many localities has gone on, by which many small companies have been merged into greater organizations, thus securing greater efficiency and economy in operation and a more satisfactory service to the public. That thousands of horses have been relieved by the tireless trolley, that thousands are given a rest by the substitution of the cable, is a matter of congratulation to every humanitarian.

"Measures have been taken to bring to the notice of the Constitutional Convention, now in session, the subject of taxation, in which we are all so deeply interested. We think we are entitled to even-handed justice. All taxes should be equal and uniform in their ratio to the value of the property taxed. Our present constitution is absolutely silent on this important matter, and the legislature might, if it chose, put the entire public burden on any class of either property or persons."

In conclusion, President Hasbrouck referred in feeling terms to the death of William Richardson, of the Atlantic Avenue Railroad of Brooklyn.

The report of the executive committee was then presented. It shows that the membership now consists of thirty companies, the highest number ever reached. A compliment is paid to Charles J. Bissell, of Rochester, N. Y., for his services to the association as special counsel before the legislature. "His work is faithfully and conscientiously performed," the report says, "and by the exercise of rare tact, has been able to protect our business from the enforcement of unreasonable demands, that have from time to time been attempted to be made through the medium of the legislature."

The report then refers, in an appropriate manner, to the death of William Richardson, Henry W. Slocum, and Edward F. Drayton, all of Brooklyn.

The report of the treasurer was then read; after which J. B. Craven read a paper entitled "Economy in Electric Power Stations," an abstract of which appears on another page in this issue.

An animated and interesting discussion followed the reading of the paper.

A paper on "Recent Improvements in Cable Traction" was then read by Mr. George W. McNulty, and was succeeded by a voluntary paper, by Mr. Allen R. Foote, entitled "Taxation." The latter paper was received and ordered printed.

The election of officers for the ensuing year was then proceeded with, and resulted as follows:

President, G. Tracy Rogers, Binghamton; First vice-president, John H. Moffitt, Syracuse; second vice-president, William W. Cole, Elmira; secretary and treasurer, William J. Richardson, Brooklyn.

Executive committee: D. B. Hasbrouck, New York City; John N. Beckley, Rochester; Daniel F. Lewis, Brooklyn. Place and time of next meeting, Albany, New York, third Tuesday in September, 1895.

The meeting then adjourned.

The following delegates of railroad companies were present:

Albany—John W. McNamara, Pres. Albany Railway.

Auburn—A. H. Underwood, Treas. Auburn City Railway Co.

Binghamton—J. Tracy Rogers, Pres., and J. P. E. Clark, Treas. Binghamton Street Railroad Co.

Brooklyn—W. J. Richardson, Director Atlantic Avenue Railroad Co.

Buffalo—J. B. Craven, Electrician Buffalo Railway Co.

Charlotte—C. A. Derr, Supt. Rochester Electric Railway.

Elmira—W. W. Cole, Gen. Mgr. West Side Street Railroad Co.

Long Island City—P. J. Gleason, Pres. L. I. City and Newtown R. R. Co.

New York City—D. B. Hasbrouck, Vice-Pres. Metropolitan Railroad Co.

Rochester—J. H. Stedman, Transfer Mgr. Rochester Railway Co.

Rome—John S. Wardwell, Pres. Rome City Street Railway Co.

Syracuse—W. R. Kimball, Pres.; John H. Moffitt, Gen. Mgr.; W. P. Gannon, Sec'y, and Paul T. Brady, Director Syracuse Street Railway Co.

There were also present:

Belden, A. J., Railroad Contractor, New York City.
Blake, Henry W., *Street Railway Journal*, New York.
Brady, Paul T., Agent Westinghouse Electric and Manufacturing Co., Syracuse, N. Y.
Cicott, Frank H., Railway Dept. Pettingell-Andrews Co., Boston.
Coles, Stephen L., *Electrical Review*, New York City.
Crossman, T. E., Official Stenographer, Brooklyn.
Crowell, Howard H., General Electric Co., Syracuse.
Evans, H. C., Johnson Co., New York City.
Foote, Allen R., Washington, D. C.
Forby, William F., Okonite Co., New York City.
Foster, H. H., Dreher Mfg. Co., New York City.
Fuller, Charles M., Davis Car Shade Co., Portland, Me.
Granger, John A., New York Car Wheel Works, New York City.
Harrington, W. E., Cutter Electrical Mfg. Co., Philadelphia.
Hooker, Thomas, Syracuse Storage Battery Co., Syracuse.
Issertel, Henry G., H. W. Johns Co., New York City.
Lawless, E. J., American Car Co., St. Louis.
Le Van, Jr., W. B., Brooklyn Car Works, Brooklyn.
Magee, Frank A., The E. S. Greeley & Co., New York City.
Mercur, R. J., New York Car Wheel Works, Buffalo.
Peckham, Edgar, Pres. Peckham Motor Truck and Wheel Co., New York.
Porter, H. C., Syracuse Storage Battery Co., Syracuse.
Ransom,—, Consolidated Car Heating Co., Albany.
Russell, F. D., Rochester Car Wheel Works, Rochester.
Seely, John A., Electrical Railroad Contractor, New York City.
Taylor, John, Taylor Electric Truck Co., Troy.
Sharp, Edward P., Webster & Beach, Boston.
Stump, C. E., *Street Railway Gazette*, New York City.
Vosburgh, A. C., New Process Raw Hide Co., Syracuse.
Wiley, F. W., Standard Underground Cable Co., Boston.
Wyman, Edward B., Central Electric Heating Co., New York City.
Young, Jefferson, Stilwell-Pierce Co., Syracuse.

Exhibits were made by the following named concerns:

H. W. Johns Co., Consolidated Car Heating Co., Taylor Electric Truck Co., Cutter Electrical Mfg. Co., Davis Automatic Car Shade Co., Peckham Motor Truck and Wheel Co.

In the afternoon the visitors were driven around the city and shown the various points of interest, and an inspection was made of the new track being laid by the Syracuse Street Railway Company.

In the evening a complimentary banquet was tendered to all in attendance, and was a pleasant affair, breaking up just in time to enable those living out of the city to catch their trains.

THE OLD-TIME AND MILITARY TELEGRAPHERS.

The Old-Time Telegraphers' Association and the United States Military Telegraph Corps held their annual meetings at the Carrollton Hotel, Baltimore, Md., on September 12 and 13.

At the Old-Timers' meeting, at 10 A. M., September 12, Mayor Latrobe of Baltimore delivered an address of welcome, which was followed by a few remarks from President Charles Selden. Several members gave interesting reminiscences of the old telegraph days.

It was voted that all telegraphers who have been in service twenty years prior to their application shall be eligible to membership in this association. The initiation fee was fixed at $1.00, and the dues $1.00 a year. It was also voted that the members of the United States Military Telegraph Corps be exempt from payment of dues to the Old-Time Telegraphers' Association.

Mr. E. C. Cockey, of New York city, was elected president for the ensuing year; R. J. Hutchinson, of New York, vice-president; and George C. Maynard, of Washington, secretary, treasurer and historian.

The name of the association was changed to "Old-Time Telegraphers' and Historical Association."

The meeting of the United States Military Telegraph Corps was called to order at 2 P. M., September 12, President Plum in the chair. After Mr. Plum's address, and the transaction of other routine business, the following named officers were elected for the ensuing year: W. R. Plum, of Chicago, president (re-elected); Wm. B. Wilson, Philadelphia, vice-president; J. E. Pettit, Chicago, secretary and treasurer.

The two associations will meet jointly in New York next year.

There was no end to entertainment, and Mr. Selden, with his usual hospitality, gave his entire time and attention to making the stay of the visitors enjoyable. There was quite a number of ladies in the party, who were entertained by Mrs. Selden and other ladies of the Ladies' Committee on Entertainment

On Thursday, the 13th, an excursion was given to the telegraphers over the Western Maryland Railroad to Pen-Mar, where a complimentary dinner was served at the Blue Mountain House. Ex-president Selden acted as toast-master, and several of the members responded to appropriate toasts.

President Cockey, of the Old-Timers' Association, is general storekeeper and superintendent of supplies of the Western Union Telegraph Company, New York, and he is well-known among telegraph people throughout the country. He is also president of the Magnetic Club, and there is not a more genial soul to be found anywhere in the United States than he.

The Metropolitan Telephone and Telegraph Company is now renting telephones to physicians, residences, private stables, etc., for from $100 to $150 per year, according to frequence of use. Long distance equipment is installed.

The annual meeting of the Telegraphers' Mutual Benefit Association will be held in New York city Nov. 21,

NATIONAL SOCIETY OF ELECTRO-THERAPEUTISTS.

The second annual meeting of the National Society of Electro-Therapeutists was held in the Berkeley Lyceum, 19-21 West 44th street, New York city, on September 20 and 21.

The address of the President, Dr. William Harvey King, was on the subject of "Electro-Therapeutic Teaching."

Papers were read during the meeting as follows :

"An Investigation of Interpolar Action in Galvanic Currents," by William L. Jackson, M.D., Boston, Mass.

"Investigations Regarding Use of Static Electricity," by Frank E. Caldwell, M.D., Brooklyn, N. Y.

"Some Observations on the Influence of Electricity on Muscular Development," by William H. King, M. D., New York city.

"Use of Electricity in Orificial Surgery," by C. A. Weirick, M.D., Chicago, Ill.

"Clinical Use of Electricity in Muscular Development," by William H. King, M.D., New York city.

"Radical Electrolysis," by F. M. Frazer, M.D., New York city.

"Hints on the Use of Electricity in Gynecology," by Flora A. Brewster, M.D., Baltimore, Md.

Paper, by M. Belle Brown, M.D., New York city.

"My Experience in Regard to the Susceptibility of the Electrical Current," by Jeannie W. Martin, M.D., New York city

"The Physical Properties of the Sinusoidal Current," by J. W. Gladstone, New York city.

"The Exhibition of an Apparatus for the Application of Heated Oxygen on Ozenized Oxygen by Electrical Propulsion," by Irving Townsend, M.D., New York city.

"Exhibition of an Electrical Endoscope, Laryngoscope and Stethoscope, by M. Milton Weill, M.D., New York city.

"Diphtheritic Paralysis Treated by Electricity," by William L Jackson, M.D., Boston, Mass.

"Brief Researches on the Action of Galvanic, Faradic and Franklinic Currents on Nervous Tissue," by Walter Y. Cowl, M.D., Berlin, Germany. Presented by J. T. O'Connor, M.D., New York city.

"Electrical Massage in the Treatment of Diseases of the Ear," by Thomas L. Shearer, M D., C.M., Baltimore, Md.

"The Galvanic Current of High Amperage in the Diseases of the Liver," by Lorenzo J. Kohnstamm, M. D., New York city.

"Details in the Instrumentation in Diseases of the Ear," by Henry C. Houghton, M.D., New York city.

"Report of Clinical Cases," by M. Bonner Flynn, M. D., Worcester, Mass.

Paper by W. Eustis Deuel, M.D., Chittenango, N. Y.

"A New Method of Treatment for Gouty Arthritis of the Fingers," by Frank A. Gardner, M.D., Washington, D. C.

"Electricity as a Therapeutic Means at River View Home," by W. S. Watson, M.D, Fishkill, N. Y.

"Inter-Uterine Cataphoresis," by William H. King, M.D., New York city.

"Cicatrix of the Cervix Uteri treated by the Negative Pole of the Galvanic Battery," by Alice B. Condict, M. D., Orange, N. J.

"The Electrical Treatment of Appendicitis," by W. N. Williams, M.D, San Jose, Cal.

"New Painless Method of Removing Facial Blemishes by Electrolysis," by H. E. Waite, M.D., New York city.

"An Electric Potpourri," by A. S. Baily, M.D., Atlantic City, N. J.

"Electric Induction Cabinet and some of its Uses," by J. H. Woodward, M.D., Seward, Neb.

"How to Measure the Faradic Current," by Henry F. Waite, New York city.

"Clinical Reports of Electricity in Gynecology," by Bessie P. Haines, M.D., St. Paul, Minn.

"Important Points in Selecting Electro-Therapeutic Apparatus," by Dr. T. F. Livingston, New York city.

The election of officers for the ensuing year resulted as follows :

President, Dr. W. L. Jackson, Boston; First Vice-President, Dr. E. S. Bailey, Chicago; Second Vice-President, Dr. F. A. Gardner, Washington, D. C ; Secretary, Dr. Clara Gary, Boston ; Treasurer, Dr. J. B. Garrison, New York.

The Executive Board consists of all the officers and the following named members: Dr. W. H. King, New York, and Dr. M. D. Youngman, Atlantic, N. J.

The next meeting will be held in Boston, the time to be fixed by the Executive Board.

FREIGHT RATES ON EXHIBITS FOR THE ATLANTA CONVENTION.

A representative of the Electrical Age called on the agents of the various railroads that are bidding for Atlanta business in connection with next month's convention, for the purpose of ascertaining what concessions had been made in freight rates for the benefit of exhibitors of electrical apparatus. The fact was developed that none had, as yet, been granted, for the reason that no application with this object in view had been made, and that in order to obtain them it would be necessary for some intending exhibitor or exhibitors to make an application to Mr. E. B. Stahlman, Commissioner Southern Railway and Steamship Association, Atlanta, Ga.

Our representative was informed that the rule on such occasions was, first to make application for special rates to the commissioner, who would authorize the railroads in the Association to grant the same. Under such an arrangement exhibitors would be required to pay the full usual freight rates on their goods to Atlanta, but upon presentation of a cer ificate duly signed by the proper official of the Street Railway Association, certifying that the goods named had been on exhibition, the exhibits would be returned free. Practically this is a half rate, but in order to secure this concession the certificate must be presented just before the return of the goods from Atlanta.

Mr. W. J. Richardson, secretary of the American Street Railway Association, was seen in regard to the matter. He stated that he had taken no action respecting freight rates. When informed, however, of the advantages to be gained by proceeding in the manner above indicated, he at once became deeply interested, and said that he would give the matter his immediate attention.

No reduction of rates can be authorized except by the commissioner, and he, of course, will not take the initiative ; the action must begin with the exhibitors themselves. Unless application is made to him for concessions none can be granted, and exhibitors will be compelled to pay full rates on their goods both ways.

The regular schedule rates from New York to Atlanta, via the Virginia, Tennessee and Georgia Air Line, are as follows : first-class, $1.14 per 100 lbs.; second class, 98 cents ; third class, 86 cents ; fourth class, 73 cents ; fifth class, 60 cents ; sixth class, 49 cents ; class A, 36 cents.

Mr. George H. Van Etten, president of the Little Rock Edison Light & Power Company, Little Rock, Ark., died a few days ago.

ECONOMY OF POWER HOUSE OPERATION.*

BY J. B. CRAVEN.

Starting from the boiler room, we come at once to the place where in most cases the greatest waste will be found. It has been said that the waste due to improper firing is often of greater consequence than any other loss which is produced in the operating of a steam plant. There are two causes for this: First, poor construction of the boiler. Secondly, poor firing and lack of care of the boilers. Most of us think that any man can fire a boiler, and whilst looking with awe and wonder at the engine and generator, forget that all the power comes from the coal pile and pay little attention as to the economy in transmitting that power from the coal to the engine. No greater mistake is made than to place the care of boilers in incompetent hands, for they require the highest degree of care, conscientiousness and constant attention.

The fireman must be ever on the watch to see that the water is kept at the proper level, to keep an even steam pressure, and to show by his steam, coal and water records that be is getting just as good cards as the engineer can show by the manipulation of the steam he uses in his engine. He must see that the fires are spread evenly over the grates and are of an even thickness; that the proper amount of air is admitted into the furnace to obtain good combustion.

If you could realize how easily from 1 to 20 per cent. of coal can be shoveled into the furnace and up the chimney without generating any more power, you would see how essential it is to have something more than mere machines shoveling coal into a furnace. Another point of importance is to see that boilers are kept clean and free from scale, which is simply the result of improper attention. I have used quite a number of boiler compounds for the prevention of scale, but have found the best to be plain coal oil. We have used it in Buffalo for the past two years with success, putting about one pint a day into each boiler and letting it enter with the feedwater by means of a sight feed lubricator. However, no one remedy will fill all cases, and each must be the subject of some experiment.

Another source of loss comes from insufficiently covered boilers and pipes; see that all exposed parts, that possibly can be, are covered with some good non-conducting material, and prevent as much as possible radiation and condensation. The steam pipes should be kept tight and all leaks followed up at once and stopped, and in this way have as little loss as possible between the boilers and engines. See that the piping is well drained, so that water will not carry over to the cylinder of the engine. This is accomplished by separators placed as near to the engine as possible, and the water thus separated is returned to the boilers. In a good many cases this water is allowed to go to waste; if this is found to be the case it should be remedied, as this water is separated at a very high temperature, and requires very little heat to turn it again into steam. Before entering the engine room I would like to say something on the subject of feedwater heaters. If your engines are running non-condensing, the question is very easily settled; as, however, the majority of steam plants are run condensing other factors are brought in. In the power house of the Buffalo Railway Company, one-seventh of the engine capacity is run high pressure. In this way, taking the feedwater from the hot well, at an initial temperature of 110 degrees, and passing it through two heaters in the exhaust line of the high pressure system, we get a final temperature of 194 degrees before the water enters the boilers. It is claimed by some that this method of taking the water from the hot well is not right, on account of the oil to be found in this water. But so small a portion of the hot well water is used that the amount of oil in it is small, and by this method we do away with secondary heaters in the exhaust line, between the engine and condenser, and not only save in the first cost, but I think obtain slightly better results. However, one thing is important, whatever means are used to heat the feedwater, it should be done, for not only will there be a great saving in fuel, but the straining of the boilers due to putting cold water in will be done away with.

Passing from the boiler room we come to the engines and generators, and the types seen here will be many and varied, from the high speed, belt-driven machine to the slow speed, direct-connected machine of large units; as you all know, the tendency of late has inclined to the use of the latter type. In my mind there is no doubt of the efficiency of the direct-connected unit over the belted one: It is evident to all that where space is valuable it has the advantage of taking up less room. They can be thrown in and out of service with as much rapidity as the belt-driven machine; there is a saving of from 1½ to 3 per cent. due to the slipping of belts, very little in itself, but when figured up at the end of a year in a plant of any size will amount to considerable. What I said in reference to the man in charge of the boiler room applies with equal force here. Put a thoroughly competent man in charge and you will find it a paying investment. Intelligence and experience are the best safeguards and the real insurance against accidents. Here I will say a little on the subject of oil, as I think quite a saving may be made at this point; in fact, I have had one engineer use $640 worth more of oil in six months than another engineer used in the same time, and the engine capacity was increased during the time the last man was in charge. The lowest priced oil is not always the cheapest; some oils will go much farther than others, and the question of what to use should be settled only by careful examination. After being used once it can be filtered and used again on the lighter parts of the machinery. Coming to the generator, we find a machine that is usually well made and efficient. Keep them dry and thoroughly clean and have the commutator kept as smooth as possible. The principal trouble will be found in the sparking of the brushes and the heating of the armature and the field coils. The causes for these troubles are too many to enter into here; but on the appearance of trouble the machine should be stopped as soon as possible, for the old maxim "A stitch in time saves nine," can be applied here. Keep the minor electrical apparatus in a station, everything such as switches, connections, and all instruments should be kept clean and in working order, especially in the case of lightning arresters, as they may be the means of saving an armature.

In conclusion I would call your attention to the necessity of having ample copper in the outside lines, and the rails well bonded, and where the system is large enough put in return wires. What is the use of expensive and economical machinery in the power house if you allow 20 per cent. of the power to be expended heating up poor connections in the return circuit?

* Abstract of paper read at the twelfth annual meeting of the New York State Association, Syracuse, N. Y., September 18, 1894.

Railway Telegraph Superintendents.—We have received copies of the proceedings of the annual meeting of the Association of Railway Telegraph Superintendents, held at Detroit, Mich., June 13 and 14 last

Died.—George D. Johnson, superintendent of the Hartford (Conn.) Electric Light Company, died of typhoid fever on September 19, at his home in that city.

NEW CORPORATIONS.

The Chateaugay Electric Light and Power Co., Chateaugay, N. Y. Capital Stock, $6,000. A. S. Douglas is interested.

Bluff City Electric Railway Co., Waukegan, Ill. Capital stock, $200,000, to construct an electric railway to South Waukegan. Incorporators: S. D. Talcott, D. L. Jones, and others.

Terre Haute and Brazil Electric Railway Co., Brazil, Ind. Capital stock, $100,000, to construct a new line twelve and one-half miles in length. Incorporators: W. H. White, J. G. Elder, and others.

The Southern Harrison Telephone Co., Alexandria, Va., with S. W. Tulloh, president; W. H. B. Stout, vice-president; S. H. Merrill, secretary and treasurer, to do a general telephone business in Virginia and Southern States. Capital stock, $100,000.

The Interstate Telephone Co., Louisville, Ky., by T. C. H. Vance, J. M. Hogan and F. A. Vance.

The Citizens' Telephone Co., Raleigh, N. C., by A. R. D. Johnson and others, to install and operate a new telephone system.

Newtown Railway Company, Steinway, L. I., to construct a street railway between Long Island City and Flushing, L. I. Capital stock, $150,000. Directors: Rudolph T. McCabe, Eugene L. Bushe, Stephen Peabody, John L. Lamson, Walter A. Pease, New York City; Cord Meyer, Christian M. Meyer, Maspeth, N.Y.; George Chambers, Long Island City, and Robert C. Pruyn, Albany.

POSSIBLE CONTRACTS.

An electric light plant to cost $15,000 is to be established in Cuthbert, Ga.

The town clerk of Hempstead, N.Y., can give information regarding contract for electric lights in that place.

C. Mamer, Chicago, Ill, can give information regarding the electric light fixtures for the new Criminal Court Building in that city.

Bids for the lighting of Stillwater, Minn., will be considered. For further information address J. F. Burke, city clerk.

The Polytechnic Street Railway, Fort Worth, Texas, has been purchased by R. Vickery, S. S. Ashe and others, and the company will be reorganized and the lines extended.

Samuel C. Lancaster, city engineer of Jackson, Tenn., can give information regarding the electric light contract for a term of five years. It is said that the city will grant exclusive franchise for electric lighting for both commercial and domestic use for the same length of time.

An electric light plant is to be established in Stephenville, Texas. For further information address the city clerk.

The Washington and Great Falls Railway Co. contemplates equipping its lines with electric power. J. P. Clark, 1420 F Street, Washington, D. C., can give further particulars.

Steps are being taken in Alexandria, Va., looking to the organization of a company to construct and operate an electric railway between Alexandria and new towns northwest of the city.

The Oxford Lake Line Street Railway Company, Anniston, Ala., has asked for permission to extend its lines.

The Greenville Mills & Ice Factory, Greenville, Ala., is in the market for a complete electric light plant.

Estimates are invited for the construction of an electric light plant for the city of Richmond, Va. The Superintendent of the City Gas Works can give further particulars.

The North Chattanooga road, Chattanooga, Tenn., will be extended to the foot of Walden's Ridge, an inclined cable road to be built to the summit of the same.

The Mayor of the City of Bartow, Fla., can give particulars regarding an electric light plant for that town.

J. G. Anderson, and others, Rock Hill, S. C., have organized a telephone company and are now in the market for equipment.

The Mayor of Covington, Ky., should be addressed for particulars regarding the contract for lighting the city with electricity. A franchise will be granted for ten, fifteen or twenty years.

The Interstate Telephone & Telegraph Co., Frederick, Md., is going to construct a telephone system in Brunswick, that state.

The Virginia Mfg. Co., manufacturer of woodenware, at Suffolk, Va., has been granted a franchise. Geo. B. Walton, of Suffolk, is secretary and treasurer, and Davis S. Walton, of New York, is president.

A charter has been granted the Norfolk Brewing Co., Norfolk, Va., to erect a six-story fire-proof building, as a brewing plant. Mr. H. Crueger, of Roanoke, Va., is vice-president and general manager. Further information can be had from the Southern Immigration Land and Title Co., Baltimore, Md.

The plans of B L. Gilbert, architect, of New York City, for the various buildings for the Atlanta, Ga., Exposition, have been adopted. There will be five buildings as follows: Manufacturer's, Administration, Mineral and Forestry, Electricity and Agriculture. Mr. Gilbert will receive bids on or about October 1st. His address is 50 Broadway, New York City.

Plans have been accepted for a new city college in Baltimore, Md. The building is to cost $150,000, and Baldwin & Pennington, 44 South Street, Baltimore, are the architects.

A contract has been awarded to C. A. Black, for the erection of the Atherton Lyceum Building, Charlotte, N. C.

The Pickwick Hotel, Fort Worth, Tex., is to be overhauled to the extent of $40,000. Hurley & Roche are the proprietors.

C. H. McMaster, secretary of the Chamber of Commerce of Galveston, Tex., can give particulars regarding the proposed public library building in that city.

A Women's Home, to cost $30,000, is to be erected in Galveston, Tex.

A new school building and a new fire engine house are to be erected in Washington, D. C.

NEW YORK NOTES.

Office of the Electrical Age,
World Building, New York,
September 24, 1894.

The Pittsburgh Reduction Company, manufacturers of aluminum, have opened an office in the Havemeyer Building, corner of Church and Dey streets. A large stock of aluminum goods is carried. Mr. James C. McGuire is the New York agent and consulting engineer.

On September 18, the Board of Aldermen granted the joint application of the Columbus and Ninth Avenue Railroad Company and the Metropolitan Traction Company for permission to extend their lines along certain streets in the upper part of the city. It is reported that the Metropolitan Traction Company will use an underground trolley system along its new line.

Michael Lewis, a motorman on the South Orange and Newark trolley road, was convicted of manslaughter last week for the killing of a four year child last August, by running over it with his car. The evidence at the trial showed gross carelessness on Lewis' part. Lewis was sentenced to one year s imprisonment.

The Edison Electric Illuminating Company of New York has declared a quarterly dividend of 1½ per cent., payable Nov. 1.

A young man named Daniel Mullane, Jr., aged 17, was killed by a charge of electricity, at 203 Chrystie St., on the evening of September 19. The iron hand rail of the steps leading to the first story of the premises became heavily charged with current from a leaky transformer box, and as soon as Mullane placed his hands on the rail he received the fatal shock.

The Commercial Cable Company announces that the cable landing at Pier A, North River, is now completed and in perfect working order. This company enjoys the distinction of being the only one that operates a complete submarine telegraph line between New York and the continent of Europe. It operates three cables between the United States and Europe.

Mr. Francis Jehl, an electrical engineer who has been connected with the old Edison Co. in Europe for the past fourteen years, arrived on the "Paris" last Saturday. He will shortly locate in this city, where he will represent the firm of F. Hardmuth Co., the well-known pencil and electric light carbon manufacturers, of Vienna, Austria.

On Saturday, September 8, the works of the Bishop Gutta Percha Co. were closed to enable the employés to hold their annual outing, an old-time custom introduced over twenty-five years ago by Mr. Bishop. The workmen on this occasion accepted the invitation of their Superintendent, Captain W. Wolcott Marks, and attended the annual encampment of his command, Co. "F," 9th Regiment, National Guard, at Gifford's, Staten Island, where they witnessed many intricate military movements, listened to the martial strains of national airs as furnished by the celebrated fife and drum corps of the regiment, and participated in the games of baseball, foot-ball, potato racing and other athletic exhibitions.

The educational department of the Young Men's Institute, 222 Bowery, New York City, will be formally opened on Tuesday, October 2. An excellent educational work is done by the Institute each year Among the subjects of instruction are, steam engineering, practical electricity, mechanical drawing, etc. The classes are open to all young men between the ages of 17 and 35. The distinctive feature of the educational work is that the theory is taught to those who get the practical parts of the subjects in their daily work. The instructor in electricity is R. H. Mansfield. In the electrical branch, the first part of the time will be devoted to a study of the units of potential, current, resistance, and energy, followed by a description of the methods of their measurement and of the measuring instruments; primary and storage batteries, electrotyping and electroplating; the principles of the dynamo and motor (both direct and alternating currents), incandescent and arc lighting, electric railroads aad transmission of power, telegraph, telephone, testing of apparatus and wiring, measurement, and standardizing of lights.

W. T. H.

TRADE NOTES.

The Manufacturers' Advertising Bureau and Press Agency, 111 Liberty Street, this city, has just issued a neat little pamphlet entitled, "Advertising for Profit." It gives some good points to advertisers, also some testimonials from the company's clients, regarding the excellence of the service rendered by it Benjamin R. Western is the proprietor, and Jos. H. Williamson manager.

J. Jones & Son, 67 Cortlandt Street, have taken the agency for the Metropolitan district of the Iona Mfg. Co., of Boston, Mass. They will carry a large stock of Iona electric light goods. A new catalogue of the Iona electrical specialties has just been issued, and a copy of it will be mailed, on application, to any address. J. Jones & Son have still on hand bargains left over from the defunct Alexander, Barney & Chapin Co. It will pay all buyers to get a list of these goods.

CHARACTERISTICS OF A POPULAR RAILROAD.

Travellers find unexcelled accommodations and supreme comfort on the cars of the New York Central Railroad. American railways are noted for the advantages which they afford the travelling public, and there are none that surpass this splendidly equipped road.—*Paper Trade Journal.*

ELECTRICAL TABLES.

"Electrical Tables and Memoranda," is the title of a valuable little reference book for engineers, electricians and others interested in the electrical science. It contains a great deal of valuable information and a number of illustrations and diagrams. It is only 1⅞ by 2⅝ inches in size, and can easily be carried in the vest pocket. The author of this convenient little work is Prof. S. P. Thompson, and the price is only 50 cents per copy. For sale by the Electrical Age Publishing Co., World Building, New York.

Electrical and Street Railway Patents.

Issued September 18, 1894.

526,063. Multiphase Converter. Hermann O. C. E. Wagemann, St. Louis, Mo., assignor of three-fourths to Charles F. Orthwein, same place. Filed July 5, 1892.

526,064. Electric Generator. Hermann O. C. E. Wagemann, St. Louis, Mo., assignor of three-fourths to Charles F. Orthwein, same place. Filed July 5, 1892.

526,083. Electric Motor. Alexander W. Meston, St. Louis, Mo., assignor to the Emerson Electric Manufacturing Company, same place. Filed Aug. 1, 1892.

526,139. Telephone-Transmitter. Henry L Baldwin, Chicago, Ill. Filed Jan. 30, 1892.

526,140. Electrically-Operated Register for Barrels, &c. Henry J. Bang, New York, N. Y. Filed April 4, 1894.

526,142. Bond for Electric Railways. Dwight D. Book, Brooklyn, N. Y. Filed July 14, 1894.

526,145. Incandescent Electric Lamp. David J. Cartwright, Boston, Mass. Filed Jan. 27, 1894.

526,152. Street-Railway Switch. John C. Jacobs, Alexander Keil and John H. Roemer, Buffalo, N. Y. Filed Jan. 26, 1894.

526,169. Electric Motor. Elihu Thomson, Lynn, Mass., assignor to the Thomson-Houston Electric Company of Connecticut. Filed Aug. 30, 1894.

526,170. Dynamo-Electric Machine. David H. Wilson, Chicago, Ill. Filed Aug. 17, 1893.

526,172. Electric Switch. Louis Winterhalder, Milford, Conn., assignor to the National Electrical Manufacturing Company, same place, and Jersey City, N. N. J. Filed Feb. 17, 1894.

526,183. Trolley-Wire Finder. Edward Gale, Peoria, Ill. Original application filed Nov. 21, 1892. Divided and this application filed Jan. 15, 1894.

526,220. Electric Indicator. Clyde J. Coleman, Chicago, Ill., assignor to himself and Louisa M. Goodrich, same place. Filed Dec. 8, 1893.

526,227. Electric Cut-Out. Elmer E. Hersh, Denver, Colo., assignor of two-thirds to John B. Torbert and Clinton A. Scott, same place. Filed Mar. 7, 1894.

526,356. Dial Transmitter. Frederick Pearce, New York, and Joseph Broich, Brooklyn, N. Y., assignors to said Pearce. Filed June 11, 1894.

REISSUES.

11,442. Secondary Electric Battery. Charles Theryc and Alfred Oblasser, Paris, France. Filed Mar. 15, 1894. Original No. 500,978, dated July 4, 1893. Patented in France, Nov. 14, 1892. No. 225,644; in Belgium Nov. 14, 1892, No. 102,141; in Switzerland, Dec. 3, 1892, No. 6,240; in Austria-Hungary, Dec. 6, 1892, No. 62,939 and No. 90,635, and in Italy, May 12, 1893, No. 38,088.

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Copy for advertisements or changes therein should be in our hands before the Saturday preceding publication day.

NEW YORK, OCTOBER 6, 1894.

CONTENTS.

THE ATLANTA CONVENTION.

We publish in this issue the official programme of the Street Railway convention in Atlanta this month, and other facts of interest in connection with the meeting. The manifesto is official and, therefore, reliable, and those who contemplate to visit Atlanta on this occasion should carefully read the information thus imparted. There is every indication that the convention will be a successful one, both in point of attendance and exhibits. The live supply man sees an opportunity now, for the first time in months, of paving the way, at least, for future business, and, no doubt in many cases, a direct benefit will result from representation at the exhibition. We trust that all expectations in this direction will be realized. In order to realize a hope, however, it must be worked for. Business is not what it used to be. It does not seek the man; the man has to seek the business.

NO BUGS ON THESE BELLS.

The man who says that "there is nothing new under the sun" does not know what he is talking about. A "bug-proof" electric bell is the newest thing out. If it has been tested in New Jersey and found intact as to its bug-proof qualities, then it must be a good thing.

ELECTRICITY ON THE BROOKLYN BRIDGE.

The trustees of the Brooklyn Bridge have taken the first step in the matter of utilizing electricity in the operation of the cars on that structure. Last week they voted to light the cars by electricity, and gave the superintendent of the bridge instructions to place the contract for that purpose. Two prominent electrical companies and one gas company bid for the contract. Compared with the figures of the gas company's bid one of the electrical companies' bid was lower and the other's higher. As to the cost of maintenance the gas system is put at a higher figure than both of the electric companies' estimates. The logical result of the use of electricity as a means of lighting the cars will be the use of the same force to propel them. Eminent electrical engineers have given their opinion regarding the practicability of electric propulsion of the bridge cars and their estimates were favorable to the system. We believe, therefore, in view of what has been said in the past and what is now about to be done, that it will not be long before the cars on the bridge will be moved by the power that is conquering the world.

ELECTRO-THERAPEUTICS.

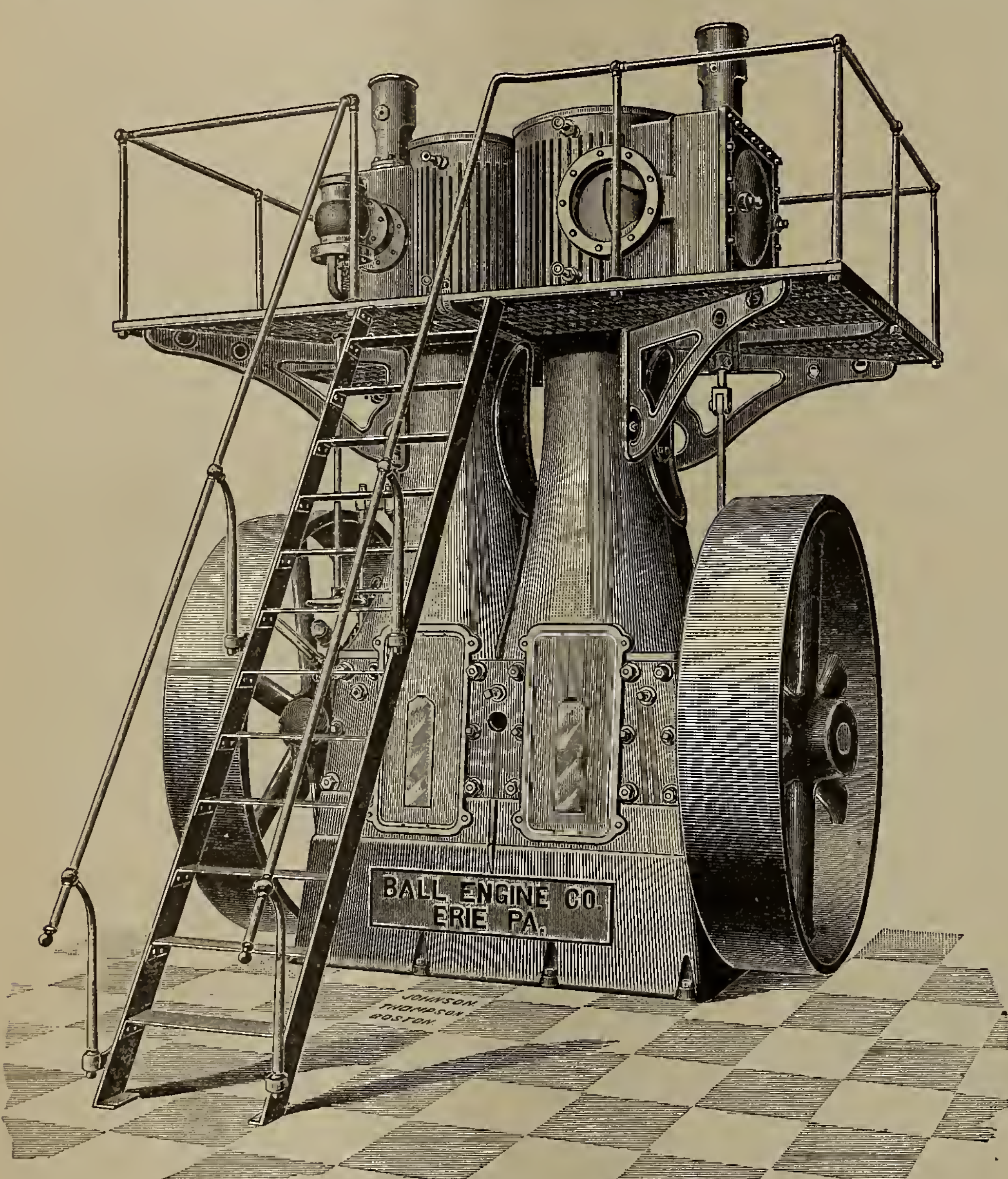
If a stranger had dropped in casually at the meeting of the American Electro-Therapeutic Association last week he would have concluded that he had got among a body of electricians, on account of the continual use of electrical terms during the proceedings. The air was thick with volts, amperes, galvanism, faradism and the like, and, moreover, those who used the terms were as familiar with them as the most skilled electrician. As the observer contemplated he could not fail to be impressed with the wonders of electricity—which, in the hands of skilled medical practitioners produces marvellously beneficial results in the treatment of sickness and disease. There is nothing that a professional man loves more than to be conscious of advancement in knowledge in the things pertaining to his profession. He is always ready to grapple with any problem that comes under his observation, and never gives up a task he has undertaken until he is complete master of it, as far as it lies within human power to be. It is therefore inspiring to see a body of the most skilled physicians in the land meet together to discuss the advancement in knowledge and practice in the use of electricity as a remedial and curative agent. Such organized effort will surely lessen the sum of sickness and disease among the human family.

NEW VERTICAL ENGINE.

In the design of this engine, the makers—taking advantage of their large experience of engine driving in electric stations—have tried to place themselves in the position of station owners and operators.

It was desired to arrange an engine whose structure should be of such a form that the main pieces should be absolutely rigid and indestructible, and, while having this feature, allow ease of access for adjustment or removal of any part that is subject to wear; and, while covering these points, to produce an engine whose steam distribution is symmetrical on both sides of all the pistons, whether one, two, three or four are used; in other words, an independent valve motion for each and every cylinder employed, and each of these being a perfect engine in itself.

By reference to the illustration, it will be seen that the main proposition as to strength and indestructibility is fully covered in the symmetrical form of the upright housings.



BALL NEW VERTICAL ENGINE.

The introduction of the shaft into this engine is accomplished by arranging the shaft boxings in a large jaw cutting into one side of the housing deep enough to bring the centre of the shaft in a plane with the centre of the housing, finish spots being provided to meet correspondingly finished surfaces upon the cast-iron boxes.

These boxes consist of one lower, two quarter and one top box for each journal, and these are provided with removable babbitt-metal shells, upon which the journals bear.

Above the openings for the shaft the housing becomes a round taper column, having on two sides of its inner surface the crosshead guide surfaces which are cast in place and bored out coincident with the boring and facing of the upper end for the reception of the cylinders and the lower end for its seat upon the base. The other two sides of each housing are pierced by elliptical openings making easy access to the crosshead and upper end of connecting rod.

The shaft is of one piece of forged steel from end to end, the crank pins being 180 degrees apart.

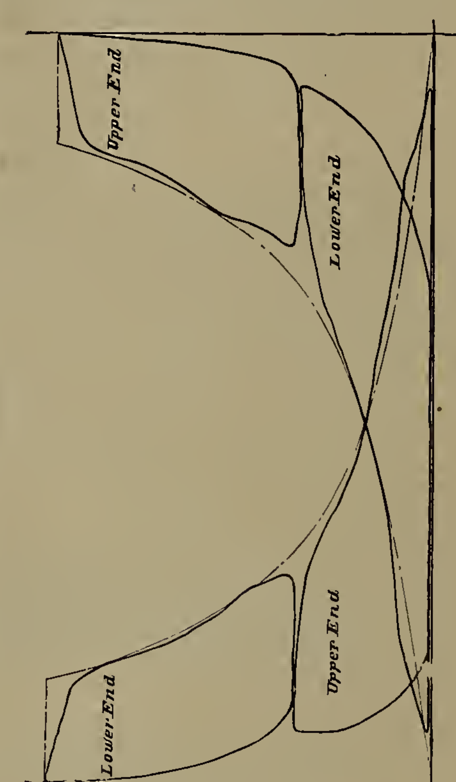
Covering each pair of crank bells is a pair of disks carrying a sufficient amount of counterweight to give a perfect running balance to the cranks and the reciprocating parts, so that there is practically no vibration to be communicated to the housings and hence to the upper works of the engine.

The connecting rods are of forged steel, the upper end being solid and cut out for the reception of the brass crosshead box and the removable crosshead pin.

The piston rods are of crucible steel, screwed into the crosshead. The stuffing-boxes are adapted for the use of fibrous packing, unless otherwise ordered.

The cylinders are made of charcoal iron mixed in such proportion of hard and soft as to produce a very strong, close-grained iron, which enables the surfaces to take a mirror polish. They are provided with single valves, each of which is practically one piece so far as the motion and wear are concerned.

The high-pressure valve is of the double-faced telescopic-relief type, and the low-pressure valve is of the common letter D type with improved proportion and construction.



INDICATOR CARD.

In substantiation of the main proposition contained in the production of this engine, there is presented an indicator diagram showing that where single valves of proper design are used the steam distribution can be made perfect.

A recent test demonstrated that the governor was in absolutely isochronous adjustment, that the valves were absolutely steam-tight, and that this degree of control over an engine of this magnitude using such a pressure and discharging into a vacuum was exceptional.

This engine, which is made by the Ball Engine Co., Erie, Pa., is guaranteed not to vary in speed from full load to no load, and *vice versa*, more than one per cent., hence, as the test showed, but (.0086) eighty-six one hundredths of one per cent., it was conceded that the guarantee was fulfilled in very good form.

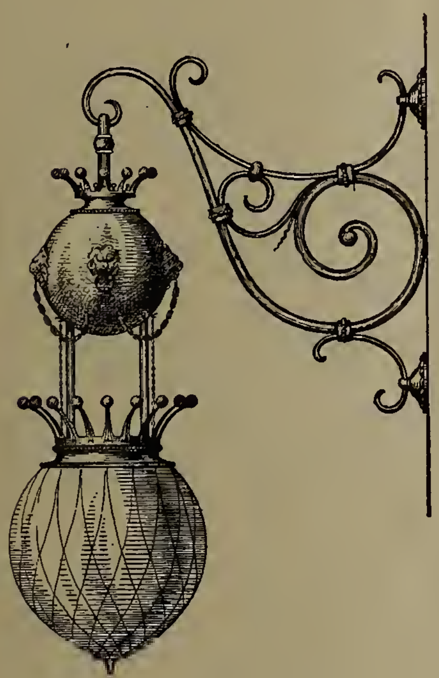
The governor is made of the best materials, the points of severe contact being provided with hardened pins and renewable soft bushings, thus throwing the wear into those parts that are easily and cheaply replaced.

The outward appearance of the engine is neat, symmetrical, and at once demonstrates that in this arrangement has been accomplished a great reduction of floor space required for this amount of power.

THE SOLAR ARC LAMP.

The artistically designed lamp shown in the accompanying illustration is one of the many produced by the Solar Arc Lamp Company, 351 and 353 Jay street, Brooklyn, N. Y., which company was recently organized. This lamp is finished in oxidized silver and is suspended from a handsome wall-bracket. It has a single carbon and takes eight amperes at 44 volts. The globe surrounding the mechanism is of the above-named metal and is richly ornamented. The compactness and simplicity of this lamp is one of its most notable features, and its elegant design renders it peculiarly appropriate for use amid artistic surroundings.

The Solar Arc Lamp Company has recently received from one of the most prominent technical institutions in Europe an order for some of its new ribbon lamps.



SOLAR ARC LAMP.

A representative of the institute who visited this country saw the lamp and on his return home spoke so highly of it that the order above referred to was the result.

In addition to this flattering order, the company is expecting another from a foreign dry goods house, for 300 of its standard lamps. From the well-known fact that foreigners will have none but the best lamps, the selection of the Solar arc lamp is an acknowledgment of its superior qualities, and is a flattering compliment to American products of this class.

A few words regarding the superintendent of the Solar Arc Lamp Company will not be out of place here. Mr. George Kirkegaard is a Dane by birth, being born in Copenhagen, the capital of Denmark. He was graduated as a mechanical and electrical engineer with high honors from the Technical Institution in his native city, and came to New York in 1886. He was connected with the Edison Company in various capacities for two years, when he visited his native country to attend the exhibition then being held. On his return to America he was successively employed by the Excelsior Electric Company and the Universal Arc Lamp Company. He is the patentee of the arc lamp manufactured by the General Incandescent Arc Light Company, and has taken out several patents on arc lamps. He is highly esteemed in the electrical trade and among his fellow countrymen. He is a member of the American Institute of Electrical Engineers, and in the new company occupies the position of superintendent, having full charge of the manufacture of the Solar arc lamps, which have a great promise for popular favor.

KINSMAN PORTABLE DESK LIGHTS.

The question of distribution of artifical light on the desk or table is one that is not so easy to compass as it looks. The Kinsman portable desk light, however, seems to have solved the problem, and these devices are rapidly coming into use all over the country. In New York city they are very popular among the daily newspaper editors, and giving the best of satisfaction. Mr. Corrigan, of the *World*, has one on his desk and he says that it is worth a fortune to him through his eyes. Fifteen of these lights have been put into the office of the New York *Press*, and the *Herald* has placed a large order for them.

The accompanying illustrations show styles No. 1 and No. 2 of the Kinsman portable light. These are designed for flat-top desks or tables, and are a slight

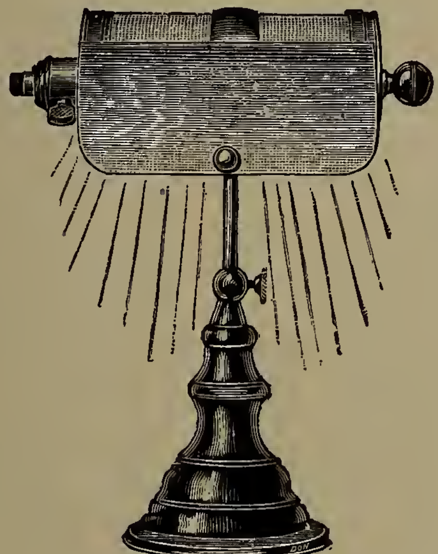


FIG. 1.

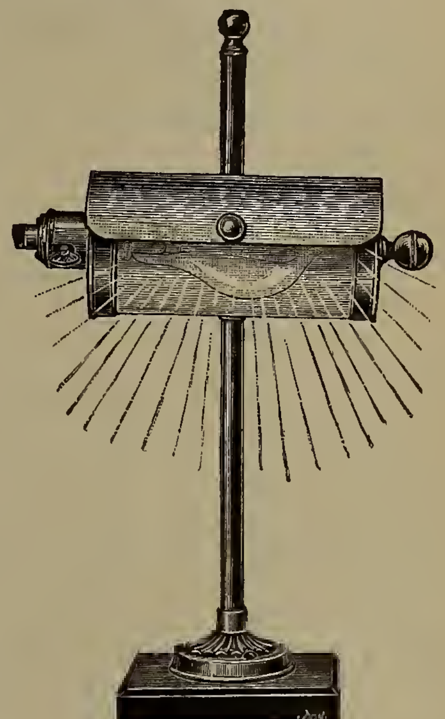


FIG. 2.

modification of the light made for roll-top desks. The latter style permits of opening and closing the desk without having to remove the light.

The portables are neat in appearance and handsomely finished in nickel. The shades can be easily raised or lowered. In the No. 1 style (Fig. 1), the shade is down, which throws the rays of light directly underneath and completely shading the eye, while in Fig. 2 the shade is shown up, which allows the rays to project both horizontally and perpendicularly.

In addition to the shade, other means are provided to modify the light. Two-thirds of the surface of the glass cylinder is ground and the other third left clear. The ground glass, as is well known, softens the light and effects a more even distribution, which is preferable to many eyes; but those who like a strong light can have it by using the clear glass.

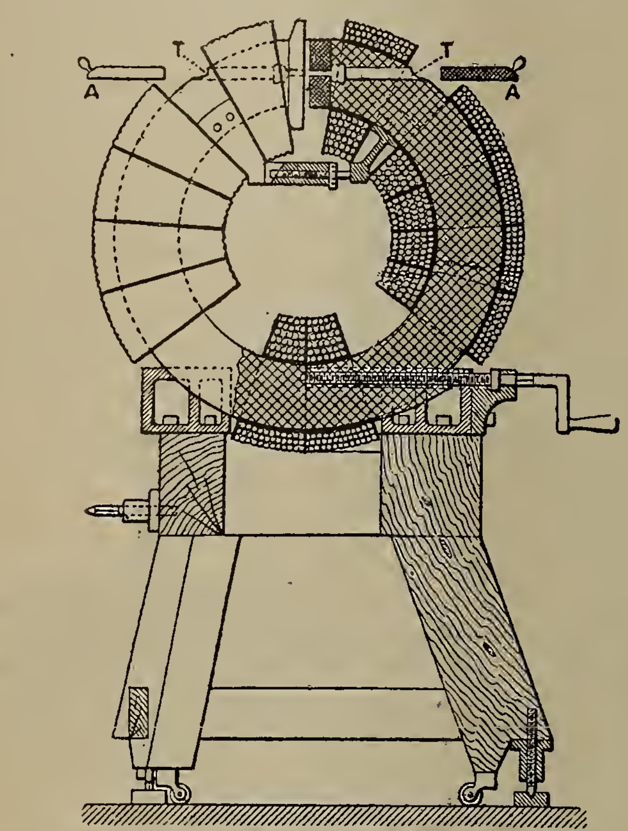
The glass cylinders are removable and are turned by simply taking the knob (shown at the right hand) in the finger and thumb and turning to the desired point.

These excellent lamps are made and handled by McLeod, Ward & Co , 91 Liberty street, New York, and are meeting with a large and increasing demand.

ELECTRO-MAGNET FOR PRODUCING INTENSE FIELDS.

The following description of a new ring-shaped electro-magnet for producing intense magnetic fields is taken from *Wiedemann's Annalen* by the *Electrical Review* of London.

The apparatus consists of a ring of annealed soft iron of a mean diameter of 50 cm. There are 12 coils, each of 200 turns and embracing each a sector of 20°. They have a total resistance in series of 2.4 ohms, and are capable of carrying a current of 45 ampères, 108 volts.



DEVICE FOR PRODUCING INTENSE MAGNETIC FIELDS.

The magneto-motive force is thus 108,000 ampere turns, and the mean intensity of the field 860 C.G.S. units. Three hundred and eighty C.G.S. units go to produce the induction, and the remainder is used in resisting the demagnetizing action; the intensity of magnetization is 1,600 C.G.S. The maximum value of the coefficient of self-induction is 180 henrys, and the current takes an appreciable time to attain its definite value; for example, a current of 1 ampère only arrives at $\frac{9}{10}$ths of this value in about 17 seconds. Hence it is necessary to make and break current very gradually. A general view of the apparatus is shown in the figure.

The measurement of the magnetic field between the poles (which can attain 38,000 C.G S. units) is effected by means of the method of the rotation of the plane of polarization in water which can be placed in this space. A canal, T, perpendicular to the pole-piece permits of these measurements being made very easily. In most experiments, however, this canal would be stopped up by the rods A, A. The dispersion of the lines of force increases with the intensity of the current, passes its maximum at about 3 ampères, and then diminishes.

Very intense fields can be obtained, as everyone knows, by concentrating the lines of force by means of conical pole-pieces, for which theory indicates as the most favorable summit-angle 109°, but in reality the best results are got with a summit-angle of about 120°, as Ewing and Low have already proved. This is the angle selected by Du Bois for his pole-piece summits.

So far the apparatus has only been used for measuring the "Verdet constant" for a certain number of samples of glass of which the indices of refraction were known.

This apparatus was devised by H. Du Bois, and is adapted to the study of the "Hall" and of magneto-optic phenomena, etc.

THE ATLANTA CONVENTION.

The following is a copy of the general programme of the Thirteenth Annual Meeting of the American Street Railway Association, which will be held in Machinery Hall, Piedmont Park, Atlanta, Ga., on October 17, 18 and 19, as supplied us by Secretary Wm. J. Richardson:

First.—*Reports of Special Committees.* Special committees will report on the following subjects: "A Standard Form for Street-Railway Accounts;" "Can the T Rail be Satisfactorily Used in Paved Streets?" "City and Suburban Electric Railways;" "Mail, Express and Freight Service on Street-Railway Cars;" "Standards for Electric Street-Railways;" "Street Car Wheels and Axles;" "The Best Method of Treating Accidents and Complaints;" "The T Rail Construction of the Terre Haute Street Railway Company," and "Transfers and Commutation." Notice has been received by the secretary that special papers will be read on the following subjects: "A Practical System of Long Distance Electric Railway Work;" "Brake Shoes;" and "Destructive Arcing of 500 Volt Fuses."

Second.—*Exposition of Street-Railway Supplies.* The executive committee has secured Machinery Hall, at Piedmont Park, Atlanta, for the exhibition of supplies of every nature used in the street-railway business. The building has been engaged for two entire weeks, beginning October 10 and ending October 24, thereby giving ample time for the setting up and removal of the largest exhibits. The room for the meeting is also in the same building on the main floor, and delegates will therefore be enabled to examine the exhibits to the best advantage, and with the least possible loss of time. The exposition will be in charge of the secretary, assisted by Mr. N. W. L. Brown, of the Atlanta Consolidated Street Railway Company. Applications for space, if not already made, should be sent without delay direct to Mr. Brown, at Atlanta.

Third.—*Local Entertainment.* The Atlanta Consolidated Street Railway Company proposes to entertain all who attend the meeting with an excursion. In connection therewith, a typical "Georgia Barbecue" will be a prominent feature of the occasion.

Fourth.—*Reduced Rates of Fare.* All the Traffic Associations, except the Western Passenger Association, have authorized the sale of tickets at reduced rates—namely, a fare and one-third for the round trip. This concession applies to all attending the meeting—delegates, supply dealers and accompanying friends. The Traffic Associations that have extended this courtesy are the Trunk Line Association, the Southern Passenger Association, the Central Traffic Association, the New York and Boston Lines Passenger Committee, the Boston Passenger Committee and the Railway Association of Michigan.

Those in the East who desire to go to Atlanta via the Pennsylvania Railroad from New York to Washington, and over the Southern Railway from Washington to Atlanta, returning via Chattanooga, Paint Rock, Asheville and Salisbury, through the finest scenery in the Blue Ridge Mountains, will make application to R. D. Carpenter, general agent, No. 271 Broadway, New York.

N. B.—The rules governing reduced rates, *strict conformity with which is required*, are given as follows:

First.—Each person must purchase (not more than *three* days prior to the date of the meeting), a first-class ticket (either unlimited or limited), to Atlanta, for which he must pay the regular tariff fare, and upon request, the ticket agent will issue a certificate of such purchase, properly filled up and signed by the said ticket agent.

Second.—Where the journey is made over more than one line it may be necessary for the passenger to purchase separate local tickets, and procure certificates thereof for each of the lines over which he travels in going to Atlanta, as some lines do not honor the certificates of any other line. The passenger should ascertain from the ticket agent what portion (if not all) of his journey can be covered by the certificate procurable of him, and purchase his ticket and secure a certificate filled in accordingly. In case a ticket on the certificate plan cannot be procured at the starting-point, the person should purchase to the nearest point where such a ticket can be obtained, and there repurchase through to Atlanta, requesting a certificate properly filled out by the agent at the point where the repurchase is made.

Third.—Tickets for the return journey will be sold by the ticket agent at Atlanta at one-third the highest limited fare, to those *only* who hold certificates signed by the ticket agent at the point where through tickets to Atlanta were purchased, and contersigned by the Clerk of the convention, certifying that the holder has been attending the convention. Mr. N. W. L. Brown, of the Atlanta Consolidated Street Railway Company, has kindly consented to serve as clerk of the meeting for this exclusive purpose.

Fourth.—It is absolutely necessary that a certificate be procured, as it indicates that full fare has been paid for the going journey, and that the person is therefore entitled to the excursion fare returning. It will also determine the route by which the ticket for the return journey should be sold, and without it *no reduction will be made*, as the rule of the association is: "No refund of fare will be held because of the failure of the person to obtain a certificate."

Fifth.—Tickets for the return journey will be furnished only on certificates procured not more than *three days* before the meeting assembles, nor later than *two days* after the commencement of the meeting, and will be available for continuous passage only; no stop-over privileges being allowed on tickets sold at less than full fare. Certificates will not be honored unless presented within *one day* after the date of the adjournment of the convention. The certificates are *not transferable*, and the signature affixed at the starting-point compared with the signature to the receipt, will enable the ticket agent to detect any attempted transfer. In order to guard against the misuse or transfer of either a certificate, or ticket procured through it, the association has been obliged to guarantee the redemption at full fare of any return ticket afterwards found to have been transferred or misused.

N. B.—Please read *carefully* the above instructions, and be particular to have the certificates properly filled out and certified by the railroad agent from whom you purchase your going ticket or tickets. *Tickets and certificates shall be obtained at least THIRTY MINUTES before the departure of trains.*

A certificate is void if altered; if not presented within prescribed dates; if not signed by the clerk of the meeting, and viséd by the agent of the Southern Passenger Association in attendance at the meeting at Atlanta; or if blank spaces on the *going* side are not filled out, signed and stamped by the agent of the line, at the point from which the passenger started.

The secretary suggests to all who will attend the meeting, who desire to transact business at any other city, *en route*, to arrange to do so on the trip TO Atlanta, as the going ticket will, of course, carry with it, in most cases, stop-over privileges, while the return ticket will not.

Fifth.—*Attendance of Ladies*. The attendance of the wives and daughters of gentlemen attending the convention has become an established custom, and grows more and more popular every year. The society of ladies adds largely to the pleasure of the meeting, and their participation in the excusion and banquet will be fully arranged for as heretofore. The ladies will be entertained Wednesday evening at the Capital City Club.

Sixth.—*The Banquet.* The annual dinner will take place on Thursday evening, October 18. Each company that is a member is entitled to the free admission to the banquet of two of its officers. Each additional officer, or any other gentleman in attendance at the meeting not an officer of a member-company, will be charged ten dollars; ladies' tickets, five dollars each. In order to facilitate the executive committee, will you please inform the secretary immediately upon the receipt of this notice of the number that will be present from your company, enclosing the additional amount covering the number in excess of the two to which the company is entitled, so that definite arrangements as to the number that will attend the banquet will be promptly made?

Seventh.—*Hotel Accommodations.* There will be ample hotel accommodations for all who attend the meeting. The headquarters of the association will be at the Hotel Aragon. The rates at the hotels are as follows: Hotel Aragon, American plan, $3.00 to $5.00 per day; European plan, $1.50 to $3.00 per day. Kimball House, $2.50 to $5.00 per day. Markham House, $2.00 to $4.00 per day. Hotel Marion, $2.00 to $4.00 per day. National Hotel, $2.00 to $3.00 per day.

Rooms will be assigned in the order of the applications received; and, as far as possible, in accordance with the expressed wishes of the applicants. Those who expect to be present are urged to communicate with Mr. W. W. Kingston, Equitable Building, Atlanta, Ga., AT ONCE, stating whether they will be accompanied by members of their families, and if so, how many, in order that due provision may be made for the accommodation of all who attend. As orders for rooms will be taken subject to cancellation on or before October 13, it will be readily seen that no risk is taken by anyone, who, expecting to be present, engages a room at once. It is certain that immediate action in this respect can only be to the advantage of the applicant; for the hotel proprietors can readily dispose of any rooms that may have been engaged prior to October 13, should engagements for any reason be cancelled. In case a preference for rooms at any other hotel be expressed, Mr. Kingston will undertake to secure such quarters as are desired, it notified in due time.

AN IMPORTANT TELEGRAPH DECISION.

A despatch from Los Angeles, Cal., stated that a decision was handed down on September 26 by Judge Ross in the application of the Postal Telegraph Company asking permission to build a telegraph line along the line of the Atlantic and Pacific Railroad. The Judge held that the Postal Company could build the line, notwithstanding the fact that the Western Union Company had an exclusive contract with the Atlantic and Pacific Railroad. The decision will permit the Postal Company to come in to California and complete its through lines from the East to Mojave.

PRINCIPLES OF DYNAMO DESIGN.

BY NEWTON HARRISON, E. E.

(*Continued from Page 172.*)

Figure 12, to which reference has already been made, fully illustrates the internal action going on in a

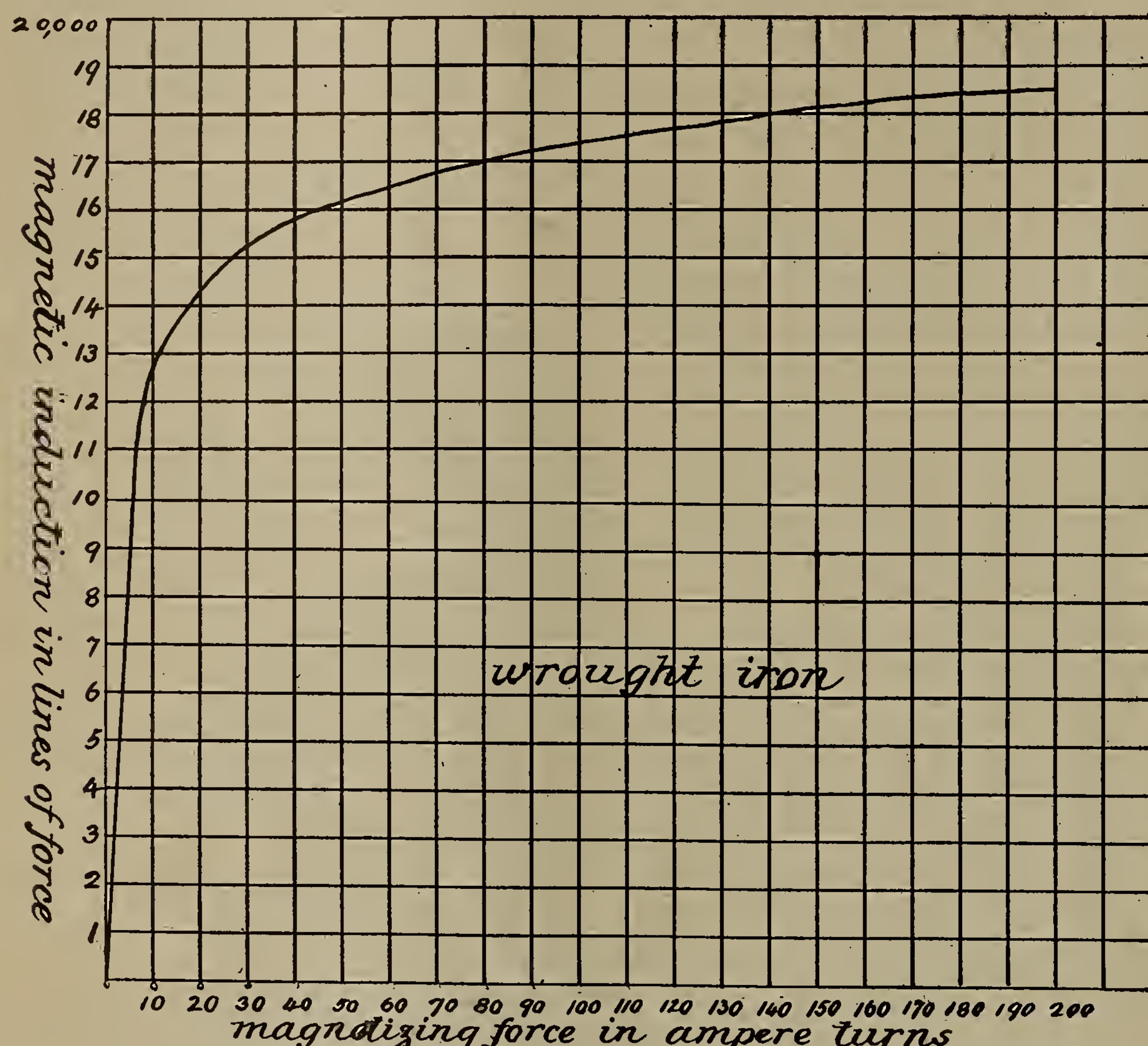


FIG. 12.

sample of wrought iron. Aside from this fact it serves as an excellent reference when a portion of the magnetic circuit composed of wrought iron is to be considered. Grades of good wrought iron do not differ so greatly in permeability as to force us to disregard data concerning other samples. On the contrary, they serve as the best

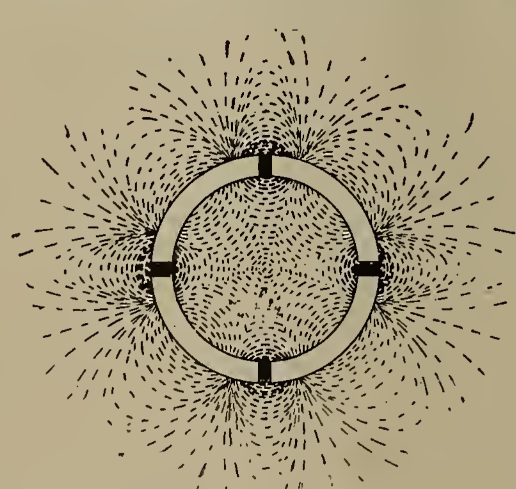


FIG. 13.

possible assistance and enable the engineer to arrive at certain fixed conclusions which otherwise would be perfectly indefinite without their use. Any piece of wrought iron of fairly good quality can have its magnetic output very appoximately predetermined by the above. As an illustration: A wrought iron ring of one centimeter cross section (see Figure 13), and 35 centimeters length is divided into four parts, how many ampere turns will be required to produce afield of 15,000 lines of force? There are four air gaps of equal length and cross section and a similar number of segments of wrought iron to be considered.

By referring to the curve $f\left(\frac{B}{A}\right) = f\,(15{,}000)$.

$= 27$ ampere turns.

Therefore each cm. of iron requires 27 ampere turnsor a sum total of $35 \times 27 = 945$ *A. T.* for the reluctance of the iron.

As regards the air gaps, each gap is 1 sq. cm. by ½ cm. long. Referring to the formula already given

$$\text{Ampere turns} = .8\,B\,\frac{l}{q}$$

$$= .8 \times 15{,}000 \times \frac{2}{1} = 24{,}000.$$

This last number of ampere turns must be added to those required to overcome the magnetic reluctance of the iron, thus giving a sum total of 24,945 ampere turns.

The magnetic circuit of a dynamo differs in no respect from the example cited. We have a circuit composed of parts of different permeabilities; wrought iron, air, and possibly cast iron or steel. The system to be followed is identical in both cases, certain allowances being necessarily made which will be treated of later.

The table below, the result of Hopkinson's investigations, clearly shows the magnetic properties of cast and wrought iron.

HOPKINSON'S OBSERVATIONS.

Annealed Wrought Iron.			Grey Cast Iron.		
B	H	μ	B	H	μ
5,000	1.66	3,000	4 000	5.	800
9,000	4.	2,250	5,000	10.	500
10,000	5	2,000	6,000	21.5	279
11,000	6.5	1,692	7,000	42.	133
12,000	8.5	1,412	8,000	80.	100
13,000	12.	1,083	9,000	127.	71
14,000	17.	823	10,000	188.	53
15,000	28.5	526	11,000	292.	37
16,000	52.	308			
17 000	105.	161			
18,000	200.	90			
19,000	350.	54			
20,000	666	30			

(*To be Continued.*)

W. H. Gordon, the well-known electrical engineer and supply dealer, 115 Broadway, city, died at his home in Bergen Point, N. J., on October 1st, after an illness of several weeks.

AMERICAN ELECTRO-THERAPEUTIC ASSOCIATION.

The annual meeting of the American Electro-Therapeutic Association was held at the New York Academy of Medicine, 17 West 43d street, on September 25, 26 and 27.

The address of Dr. W. J. Herdman, of Ann Arbor, Mich , president of the association, was on the Function of the American Electro-Therapeutic Association.

Committees on Scientific Questions reported as follows ; at the first session :

On Standard Coils—Dr Wm. Jas. Morton, New York.
On Standard Meters—Dr. Margaret A. Cleaves, New York.
On Standard Electro-Static or Influence Machines—Dr. Wm. Jas. Morton, New York.
Exhibit of Stand and Electrode for Static Electricity —Dr. Lucy Hall-Brown, Brooklyn, N. Y.
Exhibit of a Rheostat for Controlling the Static Induced—Dr. Margaret A. Cleaves, New York.
On Constant Current Generators and Controllers—Dr. W. J. Herdman, Ann Arbor, Mich.
On Standard Electrodes—Dr. A. Lapthorn Smith, Montreal.
On Electric Light as a Therapeutic and Diagnostic Agent—Dr. Margaret A. Cleaves, New York.
Exhibit of a Portable Battery for Electric Illumination—Dr. Robert Newman, New York.
On the Sinusoidal Current Method of Regulation—the E. M. F. and Resultant Current — Dr. Lucy Hall-Brown, Brooklyn, N. Y.

AFTERNOON SESSION.

The Constant Current

Physics, Current Distribution—Mr. W. J. Jenks, New York.
Physiological Effects—Professor A. E. Dolbear, Tuft's College, Boston, Mass.
Therapeutic Uses :
General—Dr. A. D. Rockwell, New York.
Gynecological—The Galvanic Current in Catarrhal Affections of the Uterus—Dr. G. Betton Massey, Philadelphia.
Ultimate Results of Conservative Electrical Treatment in Gynecology—Consecutive Pregnancies —Dr. Georges Apostoli, Paris.
Treatment of Urethral Stricture, Report to date—Dr. Robert Newman, New York.
Behavior of Cancer Under Mild Galvanic Currents—Dr. R. J. Nunn, Savannah, Ga.

SECOND DAY.

MORNING SESSION.

The Constant Current—continued.

The Action of Electricity on the Sympathetic—Dr. A. D. Rockwell, New York.
Metallic Electrolysis—M. le Docteur Georges Gautier, Paris ; Dr. Wm. Jas. Morton, New York ; Dr. Margaret A. Cleaves, New York ; Dr. A. H. Goelet, New York.
Diseases of the Eye, Electro-Therapeutics of—Dr. L. A. W. Alleman, Brooklyn, N. Y.
Notes on Goitre and Improvements in Apparatus for Treatment of same—Dr. Chas. H. Dickson, Toronto.

AFTERNOON SESSION.

Hydro-Electric Methods, Physics and Appliances—Mr. Newman Lawrence, M. I. E. E., London.
Special Hydro-Electric Applications—Dr. Margaret A. Cleaves, New York.
The Hydro-Electric Therapeutics of the Constant Current—Dr. W. S. Hedley, Brighton, England.
Effects of High Frequency Discharges—Professor Elihu Thomson, Lynn, Mass.
Some Landmarks in Electro-Therapeutics—Dr. O. S. Phelps, New York.

THIRD DAY.

MORNING SESSION.

Induction Currents.

Interrupted Currents:
Physics—
Therapeutic Uses.
General Faradixation — Dr. A. D. Rockwell, New York.
Gynecological—Dr. A. H. Goelet, New York ; Dr. H. E. Hayd, Buffalo ; Dr. A. Lapthorn Smith, Montreal.

Sinusoidal Current.

Physics—Mr. A. E. Kennelly, F. R. A. S., Philadelphia.
Physiological Effects—Dr. W. J. Herdman, Ann Arbor, Mich.; Dr. J. H. Kellogg, Battle Creek, Mich.
Therapeutic Uses—Dr. Margaret A. Cleaves, New York ; Dr. Wm. Jas. Morton, New York ; Dr. J. H. Kellogg, Battle Creek, Mich.; Dr. Holford Walker, Toronto ; Dr. A. H. Goelet, New York.
Les Courants Alternatifs ; leur Transformation ; leur mesure et leurs applications therapeutiques—M. le Docteurs Gautier et Larat, Paris.

AFTERNOON SESSION.

Static and Static Induced.

Physics—Prof. Edwin Houston, Ph. D., Philadelphia.
Physiological Effects—Dr. Wm. Jas. Morton, New York.
Therapeutic Uses :
General Therapeutic Uses—Dr. Wm. Jas. Morton, New York.
The Treatment of Chorea—Dr. D. R. Brower, Chicago.
Static Induced—Dr. Margaret A. Cleaves, New York.
High Frequency Currents derived from Static Machines as per Method d'Arsonval—Dr. J. H. Kellogg, Battle Creek, Mich.

On the evening of the first day, the 25th, the members, by invitation, visited the laboratory of Mr. Nikola Tesla, where that gentleman performed some interesting experiments with high tension currents.

A reception was given at the Academy of Medicine between 9 and 11 o'clock Wednesday evening, which was largely attended by the medical profession and others, and on Friday morning, at 10.25, the members took a train to Llewellyn Park, on invitation of Mr. Edison to visit his laboratory. A bountiful lunch was provided for the visitors, who were deeply interested with what they saw.

EXHIBITS.

There were quite a number of exhibits of electro-medical apparatus.

The Galvano-Faradic Manufacturing Company, 300 Fourth Avenue, New York, had two large static machines in air-tight cases ; one of the machines had eight 30-inch plates, and gave a 15-inch spark. The exhibit included a full line of medical batteries and cabinets, nasal and cautery electrodes, etc., and was in charge of Mr. T. R. Ten Brock, a member of the firm.

The Jerome Kidder Mfg. Co., of 820 Broadway, New York, had a very complete display of its well-known electro-medical outfits and apparatus. Mr. T. F. Livingston looked after the company's interests.

The Edison Manufacturing Company, of 110 East 23d Street, New York City, had a large exhibit in charge of H. H. Shrope. Mr. J. W. Gladstone, the general manager of the company, was around, too, renewing old acquaintances and making new ones, and at the same time speaking a good word for the Edison electro-medical and other apparatus. The exhibit included various types of Edison-Lalande cells, two Kennelly therapeutic alternators, family and physicians' outfits, including a Faradic battery of entirely new design, operated by four cells of battery. There were also a Delevan condenser; a dental reversible motor run by Edison-Lalande battery, the motor being suspended from Simonson's extension motor bracket; a battery fan motor; a surgical motor, operated by battery current and controlled by a rheostat; a Kennelly milli-ammeter and a Kennelly adapter.

The Nassau Electrical Company, of 108 Liberty Street, New York, had a large exhibit of its celebrated Capo-Farad batteries and outfits. Among the most noticeable things were diagnosis batteries, said to be the smallest made. They were contained in a vulcanite case, 3½" long by 2" wide. Also a combination set for electrolysis or incandescence. Mr. James J. Pearson, the manager of the company, also showed a battery outfit having twenty-four of the celebrated Capo-Farad cells, which were so connected that any number of the cells within the range of the outfit could be placed in series or parallel, or both combined, by simply turning a switch. The "Little Major" battery is used for massage and diagnosing, and is a little giant. It is contained in a case measuring 3¾" long, by 2¼" wide by 1⅜" deep. Other apparatus seen in this exhibit was a probe which, when in contact with an encysted bullet or other metallic substance within the body, closed the circuit and sounded a buzzer. The buzzer and battery were in a case that could be conveniently carried in the pocket Another application of the Capo-Farad cell was to a differential thermometer, for the purpose of controlling the temperature and keeping it within a certain limit. On the table stood a pyramid of Capo-Farad cells. They looked innocent enough, but their combined power would make things lively if let loose.

J. G. Vetter & Co., 104 East 23d Street, New York, exhibited the well-know Vetter dry battery, Vetter's portable dry cell galvanic and Faradic batteries, Vetter's direct-reading milli-ammeter, the Vetter current controller, a handsome cabinet complete, and a medical outfit on a panel supported on a standard. The display was very attractive, and the fine workmanship and finish of the instruments were noticeable. J. C. Vetter & Co. continue to maintian their reputation as manufacturers of electro-medical apparatus, and a glance at the display was convincing proof that their goods are first-class and reliable.

Queen & Co., of Philadelphia, had an exhibit of milli-ammeters, an Acme voltmeter, microscopes, galvanic-meters, etc., in charge of O. T. Louis, of the New York office.

Waite & Bartlett Mfg. Company, 222 East 24th Street, New York, was represented by Mr. Harry Waite, and a large display of the company's goods. This included a Ranney static machine, a combined galvanic and Faradic cabinet, a Ranney transformer in connection with the static machine, which so controls a current of 2,000,000 volts as to render it useful for ear, throat and vaginal diseases. The exhibit also included a line of probes and electrodes, also Bleyer electrodes for nasal troubles.

The McIntosh Battery and Optical Company, Chicago, showed a McIntosh jewel ammeter and voltmeter and a McIntosh current controller for 110 volt direct or alternating currents. The company was represented by C. D. Neiswanger.

Large & Twining, Philadelphia, Pa., have succeeded to the business of Large & Son, manufacturers of electrical supplies.

SOME EXPERIMENTS ON DEATH BY THE ALTERNATING CURRENT.*

BY PROF. EDWIN J HOUSTON AND A. E. KENNELLY.

After referring to D'Arsonval's recent communication† respecting a case of apparent death produced by accidental contact with an alternating current circuit, the writers say: While we do not for a moment doubt the correctness of the general observations in this case * * we desire most emphatically to call in question the correctness of the general conclusion reached by Dr. D'Arsonval, that because in this particular case resuscitation was possible, all cases in which no marked lesions or evident destruction of the tissues are effected, death is only apparent and resuscitation possible.

The authors then recite the facts as described by D'Arsonval, and refer to the method of "electrocution" as practiced in New York State. Continuing they say: "In view of these facts we submit that in our opinion Dr. D'Arsonval is entirely unwarranted in drawing the general conclusion already alluded to. Unwilling, however, to base our opinions on mere surmises we arranged for a series of experiments on dogs in our laboratory under conditions in which actual facts only were admitted. In these experiments we had the co-operation of eminent members of the medical profession in Philadelphia."

The experiments are then described in considerable detail, four animals being used for the purpose, and the conclusions reached are described as follows: "It was the unanimous opinion of the medical gentlemen present that death was absolute and resuscitation consequently impossible in the first three cases. In the third case, however, reflex movements exhibited themselves and although the heart had ceased to beat when the first examination was made, death was not reached until about one minute from the time of closing the circuit; Also that in the fourth case where a much stronger current under 700-volts pressure passed through the head during five seconds the loss of consciousness was instantaneous and complete, but the animal revived without the aid of artificial respiration.

* * * * * *

We believe that the following conclusions may fairly be drawn as the result of these experiments:

(1) That the passage of a sufficiently powerful alternating current through the body of an animal is followed by instantaneous, painless and absolute death.

(2) That, consequently, where electrocution is properly carried out, there is not even a remote possibility of subsequent resuscitation of the criminal.

(3) That in cases of accidental contact, where the current passing is not excessive, it is quite possible that death may be apparent only, and that the method of artificial respiration suggested by D'Arsonval should invariably be followed.

It is a remarkable fact that in the last experiment, where the strength of current was much greater than in the previous instances and passed directly through the head, the effect of this current was much less upon the vitality than in the preceding cases."

New York Electrical Society.—The attenton of our readers is called to the article on another page under the heading "Addresses Wanted." Secretary Guy, of the New York Electrical Society, is desirous of obtaining the present addresses of the persons named in the list, and any one who can aid him in securing them will confer a favor by letting him know.

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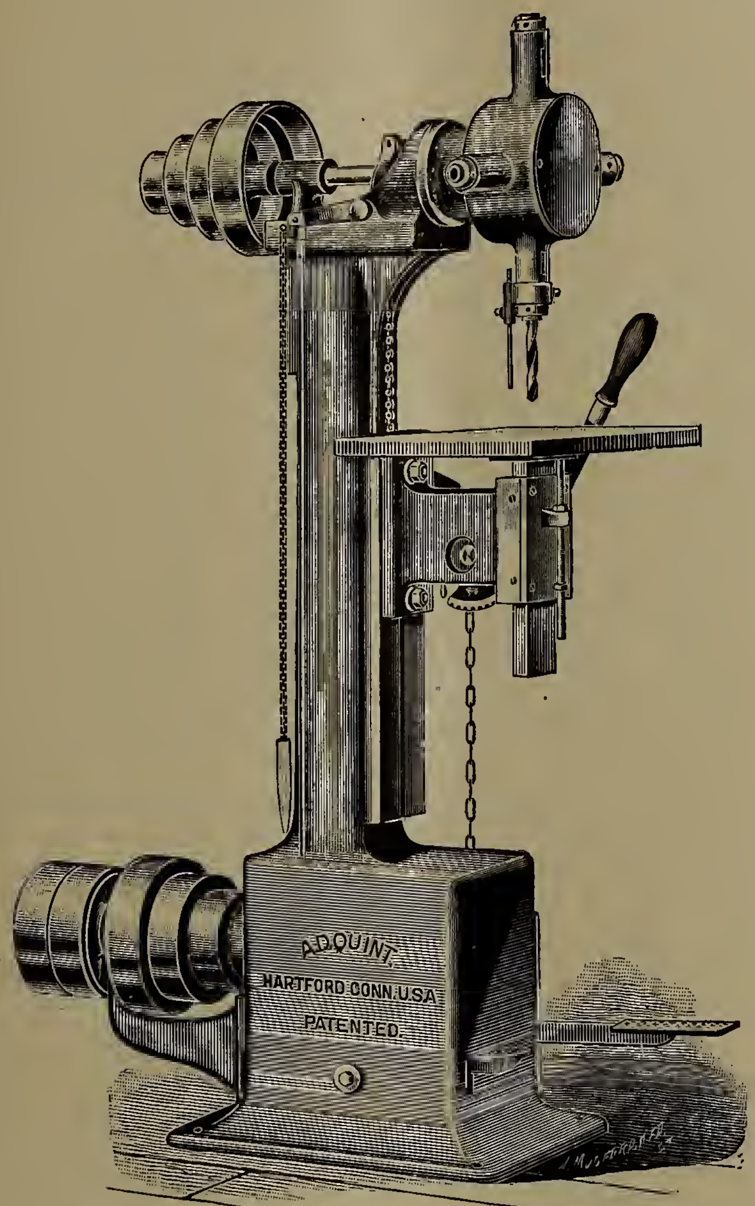
* Abs ract of paper read at the Fourth Annual Meeting of the American Electro-Therapeutic Association, held in New York, September 25, 26, and 27, 1894.

† See pp. 15 and 18 Electrical Age, July 14, 1894.

QUINT'S NEW TURRET DRILL, No. 2 PATTERN.

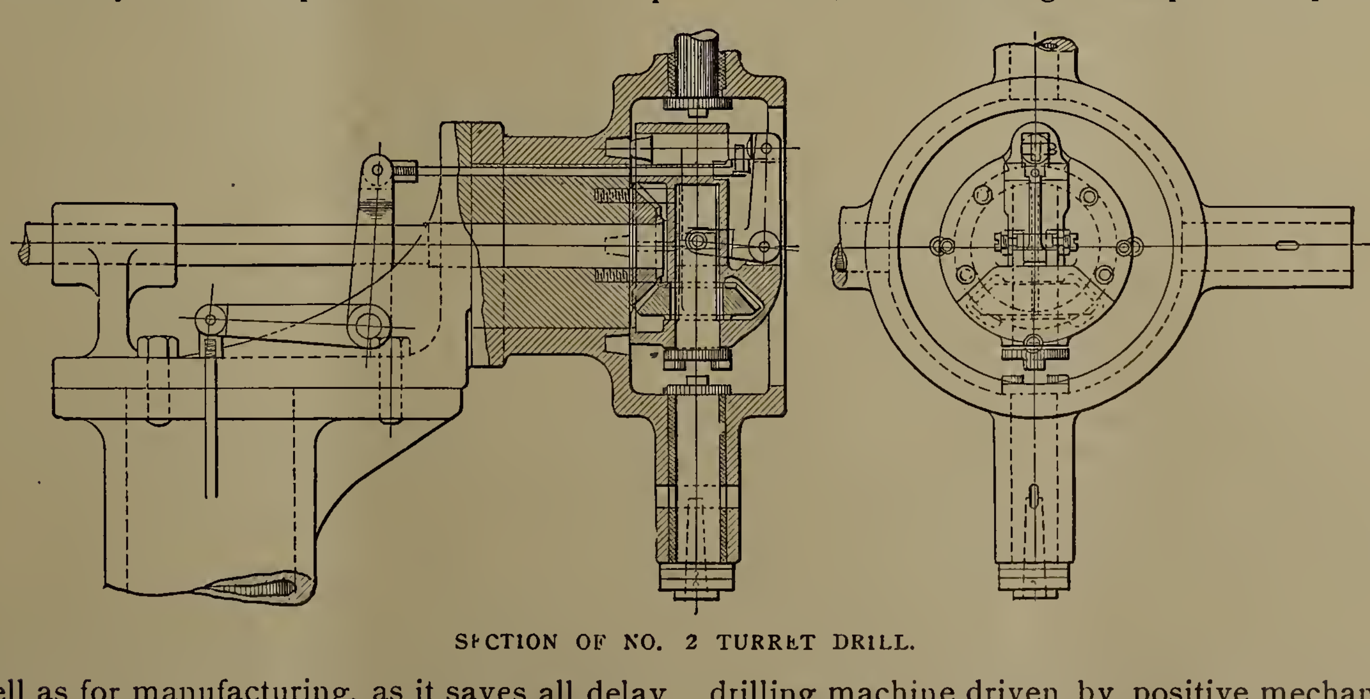
We illustrate herewith a new turret drilling machine, built by A. D. Quint, of Hartford, Conn. While it is of the same general design in outward appearance as the



QUINT'S NO. 2. TURRET DRILL.

Quint friction turret drill brought out over two years ago, the present machine is for heavier or medium drilling, being positively driven by bevel gears.

It is particularly well adapted for machine shop



SECTION OF NO. 2 TURRET DRILL.

work as well as for manufacturing, as it saves all delay and loss of time in changing tools or moving the piece operated on, as is the case with ordinary drill press. The construction is such that the user may have any number of drill spindles desired, from two to twelve, without enlarging the machine, or, in fact, any change with the single exception of the revolving head. A few of its advantages are its light, compact form and conveniency for handling. All tools are up out of the way, and idle when not in use, and all may be brought to the same centre and starting, when in position, stopping when thrown out of position.

On the column is secured the frame with a circular hub or trunnion projecting forward, and on this trunnion is mounted the turret head with any number, from two to twelve (cut shows four), of hubs or bearings, which support and guide the drill spindles. Through the frame passes the driving shaft, on the end of which, inside of turret, is fastened a bevel gear in mesh with the bevel gear loosely splined by means of feather key to driving spindle, that runs continually in its bearing inside turret head. On the lower end of driving spindle is a clutch that engages, when in operation, with a corresponding clutch on the inner end of drill spindle. Pivoted on the front of gear case in the interior of turret head is a bell crank lever, one end of which is forked and loosely connected to the driving spindle; the other end of this lever is fastened to the locking bolt that locks the turret head when in position.

Connected to the locking bolt is a rod that is fastened to the foot treadle, shown on left hand side of base; when the foot lever is pressed downward it causes the locking bolt to move outward, at the same time the driving spindle moves upwards and is disengaged from drill spindle before the locking bolt leaves its socket, thus making it impossible for the turret head to be moved while the spindles are engaged. When the turret head is revolved to the tools wanted, the locking bolt will, by means of a spring attached to treadle rod in base, automatically drop in its socket, locking the head in position; at the same time the driving spindle moves downward and engages the drill spindle, thus making a positive connection between the driving mechanism and the tool that is in position for work, all other tools remaining idle. It is immaterial whether the d iving mechanism is revolving at a high speed or idle, for when the spindles engage, there can be no resistance on the drill spindle other than the friction in its bearing, as it is impossible for the operative tool to be cutting until the spindles are engaged. Several different sizes of tools for drilling, reaming, or boring may be placed in spindles, and either tool wanted can instantly be brought into position without stopping the machine, thus making a simple, cheap, and durable drilling machine driven by positive mechanism, which insures accurate rotation.

All driving parts are located in the interior of the head and out of the way of damage. The feed is by hand

and foot lever; the table is 12" x 20", balanced, and has a vertical feed motion of 7 inches.

The knee that supports table is fastened to face of column and balanced by weight inside column, which allows a quick adjustment of table and supporting knee. The drill is driven by a 2¼" belt on a four-step cone, with countershaft fastened to base of machine. The drill spindles are of steel, hardened and ground, and reamed for the No. 2 Morse taper, and the workmanship and material are of the best.

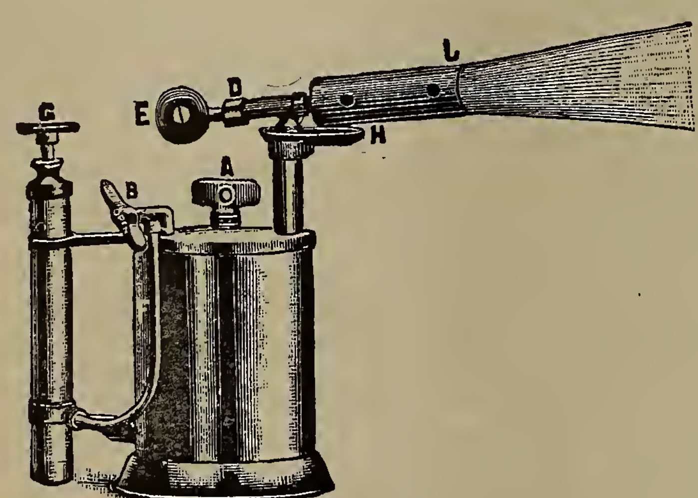
The manufacturer is now prepared to fill all orders for the drill with from two to twelve spindles

UNIVERSAL BLOW-PIPE.

The blow-pipe has become an indispensable article to electrical contractors and wiremen, for brazing, soldering joints, etc., and naturally they want the best.

The Universal blow-pipe, which is illustrated herewith, is said to be the best and most convenient made. Each one is tested before it leaves the factory and is guaranteed. The parts being machine made, and of standard size, are interchangeable. The torch is absolutely safe and reliable and is always ready for use.

The chamber is filled to within an inch of the top with 74° gasoline, then air is pumped in with about six



UNIVERSAL TORCH.

strokes of the handle C. To light the torch the valve E is opened, which allows the cup N to fill with gasoline. The gasoline is then lighted with a match and when it is nearly burned out E is again opened and the flame regulated thereby. More pressure can be obtained by opening B and then pumping as before. In order to extinguish the flame the valve E is closed.

This blow-pipe, or torch, can be used in any weather and in any position, and is made by the Knapp Manufacturing Co., 24 Frankfort St., New York City.

ADDRESSES WANTED.

The following members of the New York Electrical Society, who have made a change of residence, will oblige by sending their new address forthwith to the secretary, 534 Temple Court, New York city: M. W. Grovesteen, J. D. Bishop, C. A. G. Groenbeck, C. G. Curtis, Albert C. Barrett, W. L Tamblyn, C. H. Wright, A. G. Holcombe, W. S. Dix, R. A. Mitchell, A. B. Bennett, W. H. Ripley, M. B. Meddler, Alex. Mackinnon, Herman Wetzler, A. S. Miskin, S. V. Hoffman, Jas. Callopy, W. B. Heron, D. H. Washburn, Jas. Stewart, C. D. U. Hobbie, T. A. Sherman, C. C. Sibley, E. S. Reid, J. McMahon, Chas. Herman, J. A. Cabot, Thos. Bennett, E. C. Bischoff, J. T. Palmer, E. C. Miller, J. H. Longstreet, C. P. Gott, Francis E Donohue, W. Schwein, H. T. Salmons.

The members of the society are informed that the photograph, taken by flash light, of the visitors to the Wild West Show, is now ready and can be had on application to the photographer, Stacy, 450 Fifth avenue, Brooklyn; price 50 cents.

NEW YORK NOTES.

OFFICE OF THE ELECTRICAL AGE,
FIRST FLOOR, WORLD BUILDING,
NEW YORK, OCTOBER 1, 1894.

The New York and Brooklyn Bridge Trustees have decided to light the bridge cars by some electric system. The bids which had been received were opened. That from the General Electric Company engaged to furnish the apparatus to light sixty cars, each with ten lamps of 16 candle-power, for $14,200, the cost of running the same to be $4,905.60 a year. The bid of the Electrical and Mechanical Trading Company was $17,634 for the apparatus and $3,409 annual cost of running. The Pintsch Gas Company's bid was $14,707 for the apparatus and $5,764 running expense. Superintendent Martin will decide who shall receive the contract.

The Scott Electric Lamp Co. is the name of the organized Scott Electrical Company, of 126 Liberty street, New York city. The new company will continue to manufacture arc lamps, making specialties of the Huntington search light, focussing lamps, electro-calcium lights, etc.

Mr. W. J. Morrison, the Syracuse representative of the Fort Wayne Electric Corporation, of Fort Wayne, Ind., is in town. He is deluging the State with Fort Wayne apparatus.

The case of the Accumulator Company against the Edison Electric Illuminating Company, of New York, was argued before Judge Lacombe on Wednesday last. A decision is looked for in about 10 days.

H. C. Willis, of the insulating department of the Washburn & Moen Mfg. Co., 16 Cliff Street, New York, reports a good and improving business in his line.

Julius Bock, manager of the Himmer & Anderson Dry Battery Co., 123 Chambers Street, New York, has had an extensive experience in the dry battery business. He understands it in every detail, and the Himmer & Anderson interests are in good hands. W. T. H.

POSSIBLE CONTRACTS.

It is reported that the Baltimore Passenger Street Railway Co., Baltimore, Md., has decided to substitute electricity for the cable on its Charles street division, better known as the Blue Line.

The Owl Cigar Co., Quincy, Fla., will establish a cigar box factory, and put in an electric light plant.

Brock Brothers, Mecca, Ga., are making preparations to rebuild their cotton gin which was burned.

The Arminius Chemical Co., 18 Wall street, New York city, contemplates the erection of a large acid and metallurgical plant in Baltimore, Md. W. H. Adams, Mineral City, Va., is the general manager. Bids for material for the plant will soon be invited.

The Great Southern Telephone and Telegraph Co., Natchez, Miss., is going to build a telephone line from Natchez to Vidalia, which will include a cable across the Mississippi River.

(*Continued on Page 194.*)

AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS.

At the meeting of Council held September 19, the following associate members were elected :

Baker, Geo. O., local superintendent, General Electric Co., 44 Broad street; residence, 450 West 23rd street, New York city.

Berg, Ernst Julius, engineer, General Electric Co.; residence, 540 Liberty street, Schenectady, N. Y.

Blanchard, Charles M., 714 Girard Building, Philadelphia, Pa.; residence, 4565 Pulaski avenue, Germantown, Pa.

Boileau, Willard E., superintendent and electrician, Brush Electric Light and Power Co., Columbus, Ga.

Brady, E. D. H., consulting and constructing engineer; Lock P. O. Box 132, Waterbury, Conn.

Brown, Edward D., district inspector, American Telephone and Telegraph Co., 18 Cortlandt street, New York city; residence, 75 Hicks street, Brooklyn, N. Y.

Chase, Harvey Stuart, agent, H. Ward Leonard & Co., 12 West 31st street, New York city.

Compagnie, George Boune, chief engineer, Antwerp Hydro Electric Supply Co., Antwerp, Belgium.

Crews, J. W., manager, Southern Bell Telephone and Telegraph Co., Telephone Exchange, Norfolk, Va.

Cushing, Harry Cooke, Jr., electrical inspector, Boston Board of Fire Underwriters, 55 Kilby street; residence, 259 Beacon street, Boston, Mass.

Darlington, Frederic W., consulting electrical and mechanical engineer, 503 Girard Building, Philadelphia, Pa.

DeLancey, Darragh, manager of works, Eastman Kodak Co., Rochester, N. Y.

Drysdoll, William A., consulting electrical engineer, Hall Building, Philadelphia, Pa.; residence, Overbrook, Pa.

Dyer, Francis Marion, associate engineer, with Chas. L. Eidlitz, 10 West 23rd street; residence, 160 West 129th street, New York city.

Eden, Morton Edward, electrical inspector, the Underwriters' Association of the Middle Department, Philadelphia, Pa.; residence, 83 Fourth avenue, Pittsburgh, Pa.

Elgin, Wm. C. L., chief of electrical department, Edison Electric Light Co., 909 Walnut street; residence, 4230 Chester avenue, Philadelphia, Pa.

Eidlitz, Chas. L., 10 West 23rd street; residence, 1142 Madison avenue, New York city.

Ellicott, Edward B., superintendent of construction, Western Electric Co., 4438 Ellis avenue, Chicago, Ill.

Erickson, F. Wm., electrical engineer, with C. L. Livingston, 713 Penn avenue; residence, 5812 Parker street, Pittsburgh, Pa.

Fuller, Frank G., salesman, with W. R. Brixey, Meriden, Conn.

Gerson, Louis Jay, partner and manager, The Gerson Electrical Co , 4303 Walnut street, Philadelphia, Pa.

Grissinger, Elwood Aristides, electrical engineer, Mechanicsburg, Pa.

Hollerith, Herman, Washington, D. C.

Hubley, G. Wilbur, electrical engineer, Louisville Electric Light Co., Louisville, Ky.

Hunt, Arthur L., electrician, Utica State Hospital, Utica, N. Y.

Kammeyer, Carl E., western manager the *Electrical Engineer*, 1439 Monadnock Block, Chicago, Ill.

La Roche, Fred. A., president and manager, La Roche Electric Works, American and Diamond streets; residence, 2235 North 16th street, Philadelphia, Pa.

Lyman, Chester Wolcott, manager, Herkimer Paper Co., Herkimer, N. Y.

Lyman, James, student in electrical engineering at Cornell University, 39 Eddy street, Ithaca, N. Y.; residence, Middlefield, Conn

Medina, Frank P., electrician, Pacific Postal Telegraph Co., 534 Market street, San Francisco, Cal.

Myers, L E., secretary and treasurer, Electrical Installation Co., Monadnock Building, Chicago, Ill.

Potter, Henry Noel, electrician, Laboratory of Westinghouse Electric and Mfg. Co., Pittsburgh, Pa.

Price, Chas. W., editor, the *Electrical Review*, 13 Park Row, New York city; residence, 223 Garfield Place, Brooklyn, N. Y.

Reed, Harry D., electrician, Bishop Gutta Percha Co., 420 East 25th street, New York city; residence, 88 North 9th street, Newark, N. J.

Richardson, Robert E., electrical engineer, Pierce & Richardson, 3827 Forest avenue, Chicago, Ill.

Roberts, Wm. H., assistant engineer, South Covington and Cincinnati Street Railway Co., 15 Harrison street, Cincinnati, O.

Roller, John E., Lieut. U. S. N., in charge of inspection and installation, U. S. Navy Yard, New York; residence, 515 Clinton avenue, Brooklyn, N. Y.

Rowland, Arthur John, professor of electrical engineering, Drexel Institute; residence, 4007 Powelton avenue, Philadelphia, Pa.

Shields, W. J., professor of electrical engineering, University of Vermont, Burlington, Vt.

Slade, Arthur J., student electrical engineering, Columbia College; residence, 62 East 66th street, New York city.

Smith, Frank E., chief electrician, Edison Light and Power Co., 229 Stevenson street, San Francisco, Cal.

Stevens, J Franklin, secretary and treasurer, La Roche Electric Works, American and Diamond streets; residence, 1419 Walnut street, Philadelphia, Pa.

Tait, Frank M., superintendent, Catasauqua Electric Light and Power Co., 731 3rd street, Catasauqua, Pa.

Varley, Thomas W., electrician, The Okonite Co., Ltd., Passaic, N. J.

Total 44.

In accordance with the preference expressed by a plurality of members in Chicago and vicinity, the council appointed Mr. Bion J. Arnold local honorary secretary for that city, to succeed Mr. Edward Caldwell, resigned, on account of his removal to New York.

NOTES ON THE EFFECTS OF HIGH FREQUENCY ELECTRICAL DISCHARGES PASSED THROUGH THE BODY.*

BY ELIHU THOMSON.

"Much absurd talk has been made in the newspapers," said the author, "over the ability of persons to withstand currents of hundreds of thousands or millions of volts. * * Now it so happens that if an insulated person be subjected to charge and discharge at a high frequency, say over 10,000 per second, and with a voltage of 100,000 or 200,000, there is comparative absence of sensation during the reception and reversal of charges. * * * The writer has from time to time conducted experiments that prove beyond question the conduction through the body of currents or discharges the heating effect of which in a carbon filament, whether the same be enclosed in a vacuum or not, is equal to that which is given by continuous currents of from .3 to 1.5 amperes."

Prof. Thomson then describes the apparatus used to conduct his experiments, and in conclusion explains

* Abstract of paper read at the fourth annual meeting of the American Electro-Therapeutic Association, held in New York, September 25, 26 and 27, 1894.

that he has endeavored to condense the results of those of his experiments which have had especial reference to the passage of high frequency currents through the body, which experiments have tended to show the true nature of the phenomena in their physical aspect, and has not attempted to discover or confirm the existence of varieties of physiological effect or their absence, except incidentally to the other work. What will be the limit to the increase of current which may be sustained without injury is not yet known.

POSSIBLE CONTRACTS.

(*Continued from Page 192.*)

W. F. Elliott and others, Moberly, Mo., have organized a company to build an electric light plant in that place.

Wm. C. Cloyd can give particulars regarding the construction of an electric light plant in New Birmingham, Texas.

Plans for the United States Government Building to be erected at the Atlanta Exposition will be prepared in the office of the Supervising Architect, Washington, D. C. Fifty thousand dollars has been appropriated for this building.

The City of Charleston, W. Va., intends to build a hospital. For particulars regarding the same, address the Mayor of that place.

A business building is to be erected by J. A. Wardlan, Chattanooga, Tenn.

The Southern Finishing and Warehouse Co., Greensboro, N. C., is building a large warehouse.

A hotel is to be built at West End, New Orleans, La., by the New Orleans City and Lake Railroad Co. It is to cost $17,000.

A. H. Lindsay & Co., Norfolk, Va., will build a brick warehouse.

A hotel is to be erected on the property of J. T. Drummond, St. Louis, Mo., to cost $400,000.

Address the County Clerk, Waco, Texas, for information regarding the building of a new court house.

C. E. Anderson, Washington, D. C, has prepared plans for various buildings in that city, which call for electric light fixtures, etc.

The Baltimore Traction Co., Baltimore, Md., has been asked to extend its lines to Mount Winans and Westport, a distance of three miles.

The South Covington and Cincinnati Street Railway Co., Covington, Ky., J. J. Shepherd, president, it is reported will introduce the electric system of propulsion on its lines. Electrical equipment for three miles of track will be needed.

Address J. B. Stetson regarding a proposed electric railroad in De Land, Fla.

The Houston Suburban Railroad Co., Houston, Texas, has been granted a franchise to extend its lines along several streets.

Wareham & Hughes, Beaver Falls, Pa., are interested in the proposed construction of an electric railway at Moundsville, W. Va.

It is reported that the New Orleans Street Railway Co., New Orleans, La., has decided to introduce the trolley system on its lines. The company will lay nineteen miles of track.

An effort is being made to have the Richmond Railway and Electric Co., Richmond, Va., adopt the electric system on its Broad street line. Mr. Geo. E. Fisher is general manager of this company.

Jas. C. Fuller, Calvert, Texas, invites quotations on an arc light plant of thirty lights.

Second hand electric light outfits are wanted by the Waterman Machine Tool Co., Oakland, Me., and the Big Run Mfg. Co., Big Run, Pa.

There is talk of establishing an electric light plant in Plano, Texas.

J W. Bell, Springfield, Tenn., can give information regarding a proposition to light the city by electricity.

S. M. Rubush, Meridian, Miss., has been awarded a contract to rebuild the electric light station of the Meridian Gas Light Company, which was recently burned.

A new telephone exchange is to be established in Gainesville, Fla., by the Bell Telephone Company.

J. W. Maxwell and others, of Hillsboro, Tex., are interested in a project to build an electric railway from that city to Rose Hill.

C. L. Goodman and W. B. Willeford, of Atlanta, Ga., are arranging to establish a telephone system in Florence, S. C.

The Mayor of Palatka, Fla, can give information regarding a proposition to light that place by electricity.

A movement is on foot in St. Charles, Mo., to establish a municipal electric light plant in that place.

D. L. McPherson, Abbeyville, Fla., and others, will establish a telephone exchange in that place, and is in the market for the necessary equipment.

The Indianapolis, Alexandria & Marion Electric Railway, Indianapolis, Ind., will be constructed shortly.

Address Jas. T. Fuller, Calvert, Tex., for particulars regarding electric machinery and telephone exchange apparatus which he intends to install.

The Raleigh Street Railway Co., Raleigh, N. C., intends to introduce a system of electric lighting.

The Baltimore Traction Co., Baltimore, Md., will put in an additional 500 H. P. engine in their Retreat street power house, also an engine in the South Charles street power house. Frank Hambleton is chief engineer of the company.

Chas. S. Powell and others, of Richmond, Ky., have been granted a franchise to construct a telephone exchange.

It is reported that the Southern Electrical Supply Co., of New Orleans, La, has been awarded a contract for the construction of the electric lighting and water-works in Alexandria, La.

The Brown Electric and Machinery Co., of Little Rock, Ark., has been awarded a contract for the installation of two electric light plants in sugar refineries in Jeanerette, La.

J. E. Duval, Charlotte, N. C., has secured a contract for the installation of electric light plants in the Long Shoals cotton mills and the Chowder Mountain mill.

The Hopkinsville Water, Light and Power Co., Hopkinsville, Ky., has submitted a proposition to light the city by electricity.

NEW CORPORATIONS.

The Phœnix Carbon Mfg. Co., St Louis, Mo., by Albert Blair, E. L. Adron, Henry S. Page and others. Capital stock, $100,000.

New London Electric Light Co., New London, O., with a capital stock of $4,000.

A company is to be organized in Ashland, Ky., to establish an electric light plant. The proposed capital stock is $8,000.

The Interstate Telephone Co., Louisville, Ky., by T. C. H. Vance, president; G. L. Hogan, vice-president, and F. A. Vance, secretary and treasurer. Telephone lines and exchanges will be constructed.

The Chicago Passenger Traction Co., Chicago, Ill., by P. H. Hoynes, William Riley and J. W. C. Jones, with a capital stock of $1,000,000.

American Electric Exercising Machine Company, Chicago, Ill., by J. W. Williams, H. L. Weld and others. Capital stock, $50,000.

The Portchester, Rye & Mamaroneck Electric Railway Co., Rye, N. Y. Capital stock, $150,000. Bernard Bruch is an incorporator.

The Ohio Storage Battery Company, Cleveland, O. Capital stock of $1,000. G. S. Kain is an incorporator.

Brown's Electric Supply Co., Minneapolis, Minn., by C. D. Brown, P. W. McAllister and others.

HOW TO MANAGE DYNAMOS AND MOTORS.

Everyone having charge of a dynamo or motor should know how to manage these machines properly. Trouble is liable to occur at any time, and to be able to determine the cause by the symptoms and how to apply the remedy is a knowledge that every operator should possess. The book entitled "Practical Management of Dynamos and Motors," and written by the well-known electrical authorities, Prof. F. B. Crocker and Dr. S. S. Wheeler, gives plain directions for the management of these machines. It costs but $1.00 a copy, and can be purchased at the office of The Electrical Age, New York.

TRADE NOTES.

The Metropolitan Electric Company, Chicago has taken the agency for the Commercial Electric Company's dynamos and motors, and carries a large stock from which to fill orders promptly.

P. Claus, 333 and 335 E. 107th street, New York, manufacturer of Claus dynamos, generators and motors, during the past month closed orders for several electric plants and apparatus, among them being one for the "Scheffal Germania Beer Hall," 17th street and Third avenue, for one 70-H. P. boiler, one 50-H. P. engine, one 500-light Claus dynamo, including the installation of 650 incandescent lamps; also two 36-inch fans and two 2-H. P. motors. This is to be the largest and finest beer garden in the U. S, and will be fitted up in the old German style. P. Claus has enlarged his factory by taking the building next door to enable him to fulfil orders quickly.

Warren & Lozier is the name of a new firm which has just opened for business at 465 Greenwich street, New York city. The firm succeeds the New York Electrical Repair Company, and will undertake construction and repair work and furnish supplies of all kinds. Mr. Lozier is well known in the electrical trade, and is familiar with every detail of the business in which he is now engaged, Mr. Warren has had large experience, and the two gentlemen will undoubtedly make a strong team in their line.

The Okonite Company, Ltd., New York, has established a branch at Pittsburgh, Pa. This will prove a convenience to many users of Okonite specialties and should largely increase the business of the company in that territory.

W. M. Stine, director of the Department of Electricity of the Armour Institute, Chicago, has submitted an elaborate report of tests of various samples of carbon furnished by Edward Wertheim, 207 and 209 Lake street, Chicago. The carbons were all $\frac{7}{16}$" in diameter and were burned in the same lamp, and under as uniform conditions as possible. Of the brands submitted the "Union" proved to have the longest life. This carbon was not only the longest lived, but yielded the quietest and steadiest arc. It was the only make that gave a really satisfactory arc in an alternating current lamp. These carbons are made solid and with soft cores, and are manufactured by the Union Carbon Works, Kronach, Germany, of which Mr. Wertheim is the sole agent.

OURSELVES AS OTHERS SEE US.

The *Herald*, of Glasgow, Scotland, speaking of the "Four-Track Series,"—the New York Central's guide book—says:

"No effort is made in this country to produce railway guide books that can compete with this series. The scope of the books gives every opportunity for the display of the varied charms of American scenery, there being views on the Hudson River, in the Adirondack Mountains and Catskills, on the St. Lawrence, Niagara Falls, etc. The great feature of the guides is the admirable pictures."

A copy of the illustrated catalogue containing a thorough review of the "Four-Track Series"—books, maps and etchings—will be sent free by mail, postpaid, to any address in the world, by George H. Daniels, General Passenger Agent, New York Central & Hudson River Railroad, Grand Central Station, New York.

The White-Crosby Company, Baltimore, Md., has been awarded a contract for constructing the electrical subways in that city.

The Western Telephone Construction Co., Chicago, Ill., has secured a contract to establish a telephone exchange at Waxahachie, Tex.

Electrical and Street Railway Patents.

Issued September 25, 1894.

526,388. Coin-Controlled Electrical Apparatus. Henry F. Galligan, Lebanon, Mo. Filed Apr. 16, 1894.

526,392. Conduit for Electric Railways. David F. Graham, Springfield, Ohio, and William P. Allen, Chicago, Ill., assignors of one-third to Oliver S. Kelly, Springfield, Ohio. Filed Oct. 25, 1893.

526,408. Bracket for Trolley-Wires. Leroy S. Pfouts, Canton, Ohio. Filed Dec. 30, 1893.

526,409. Trolley and Feed Wire Bracket. Leroy S. Pfouts, Canton, Ohio. Filed Jan. 11, 1894.

526,414. Electric Signal Apparatus. Wilmer W. Salmon, Chicago, Ill., assignor to the Hall Signal Company, of Maine. Filed Feb. 1, 1894.

526,415. Electric Signal Apparatus. Wilmer W. Salmon, Chicago, Ill., assignor to the Hall Signal Company, of Maine. Filed Feb. 1, 1894.

526,422. Trolley-Wire Hanger. Irvin B. Walker, Sioux City, Iowa. Filed Feb. 26, 1894.

526,432. Means for Driving Dynamos from Car-Axles. William Biddle, Brooklyn, assignor to the American Railway Electric Light Company, New York, N. Y. Filed Oct. 20, 1893.

526,438. Trolley-Support for Ladders. Martin Croissant, Albany, N. Y.; Philoppina Croissant, executrix of said Martin Croissant, deceased. Filed May 4, 1892.

526,453. Cable-Car-Grip Slot-Brake. James T. Marlin, Kansas City, Mo., assignor of one-third to Alfred Blaker, Kansas City, Kan. Filed Jan. 22, 1894.

526,468. Closed Conduit for Electric Railways. Charles D. Tisdale, Boston, Mass., assignor to himself and John D. Gould, New York, N. Y. Filed Sept. 4, 1893.

526,472. Insulator for Electric Conductors. George Webster, Philadelphia, Pa., assignor of one-half to Arthur J. Ingraham, same place, and Samuel H. Brown, Bala, Pa. Filed July 26, 1894.

526,481. Switching-Device for Street-Railway Cars. Joseph Brautigam, Brooklyn, N. Y. Filed Oct. 19, 1893.

526,487. Electrical Measuring-Instrument. Hermann Herberts, Schenectady, N. Y. Filed Mar. 5, 1894.

526,498. Conductor-Support and Insulator. David N. Osyor, Columbus, Ohio, assignor to Joseph A. Jeffrey, same place. Filed Nov. 29, 1893.

526,502 Electrical Safety-Fuse. Otto M. Rau, Milwaukee, Wis. Filed Oct. 31, 1893.

526,567. Register for Street-Cars. William D. Forbes, Hoboken, assignor by mesne assignments to Horace B. Miller, trustee, Montclair, N. J. Filed Nov. 4, 1893.

526,580. Trolley for Electrical Conductors. David N. Osyor, Columbus, Ohio, assignor to Joseph A. Jeffrey, same place. Filed Dec. 6, 1893.

526,583. Voltage-Regulator for Dynamos. Malcolm P. Ryder, New York, N. Y. Filed May 12, 1894.

526,598. Electric Cab-Signal for Railways. Edgar C. Wiley, Bristol, Tenn. Filed Jan. 31, 1894.

526,605. Rheostat. Burton E. Baker, New Britain, Conn. Filed June 4, 1894.

ELECTRICAL AGE

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Copy for advertisements or changes therein should be in our hands before the Saturday preceding publication day.

NEW YORK, OCTOBER 13, 1894.

CONTENTS.

THE NEW YORK ELECTRICAL SOCIETY.

The New York Electrical Society will, on Thursday afternoon of this week, inspect the new permanent electro-disinfecting plant at Riker's Island. A special steamboat will convey the members from the foot of 33d street, East River, to the island, leaving the pier at 2:30 o'clock sharp. This will be an extraordinary opportunity to examine this interesting system and, no doubt, if the weather is favorable a large party will avail of it. Electricity plays an important part in the disinfecting plant at Riker's Island. The vast amount of refuse from New York city is treated by the disinfecting process and rendered harmless as a disease-producing agency. Every facility will be afforded the members to study the system, even to microscopic investigations.

INDUCTION MOTORS.

We reproduce elsewhere in this issue an article by Rankin Kennedy, the well-known English electrical engineer, in which he explains the actions of the induction alternating motor in extremely plain language. He sticks to pure English all the way through, and avoids mathematics entirely. There is yet prevalent among practical men in the electrical field considerable ignorance regarding this important type of machine, and we think that this article will be greatly appreciated by those who are familiar with the induction motor by name only. The underlying theory is so clearly explained that any novice can gain a better understanding of this apparently complicated machine by carefully reading the article. It would be well if more articles of this nature were written for the benefit of those who have not had the opportunity to make a special study of the subjects so considered.

A FRENCH YARN.

We doubt if this country has ever produced so palpable a humbug as the one recorded in the following note taken from an English contemporary. The story emanated from Paris, and is as follows:

"A series of very wonderful experiments, which have just been concluded by Dr. Luys, whose observations and discoveries in connection with magnetism and electricity made a profound impression upon the scientific world some time ago, has led to a remarkable result. The latest discovery establishes the fact that cerebral activity can be transferred to a crown of magnetized iron, in which the activity can be retained and subsequently passed on to a second person. Incredible as this may seem, Dr. Luys has proved its possibility by the experiments just referred to. He placed the crown, which in reality is only a circular band of magnetized iron, on the head of a female patient suffering from melancholia, with a mania for self-destruction, and with such success was the experiment attended that within a fortnight the patient could be allowed to go free without danger, the crown having absorbed all her marked tendencies. About two weeks afterwards he put the same crown, which meanwhile had been carefully kept free from contact with anything else, on the head of a male patient suffering from hysteria, complicated by frequent recurrent lethargy. The patient was then hypnotized, and immediately comported himself after the manner of the woman who had previously worn the crown. Indeed, he practically assumed her personality and spoke of himself as a woman, and uttered exactly the same complaints as she had done. Similar phenomena, it is reported, have been observed in the case of every patient experimented upon. Another experiment showed that the crown retained the impression acquired until it was made red-hot."

This story has a peculiar ring about it, and suggests the probability of the reporter getting hold of the crown of the melancholic woman and putting it on his own head.

PRINCIPLES OF DYNAMO DESIGN.

BY NEWTON HARRISON, E. E.

(*Continued from Page 188.*)

Silvanus Thompson gives a very useful formula, verified by this table, for wrought iron as follows : If the flux be between 7,000 and 16,000 lines of force per sq. cm. μ can be calculated by the formula.

$$\mu = \frac{17{,}000 - B}{3.5}$$

This is only true for annealed wrought iron. As an example, if the permeability at 10,000 lines of force be desired, then,

$$\mu = \frac{17{,}000 - 10{,}000}{3\ 5}$$

$= 2{,}000$, which, by comparison with the table is found to be correct.

A table of more immediate benefit has been drawn up, showing the ampere turns per cm. and inch length of wrought iron at different specific inductions.

WROUGHT IRON.

Per Centimeter Length.		Per Inch Length.	
A. T.	B.	A. T	B.
200	18,500	500	115 625
190	450	475	115.313
180	300	450	114,375
170	250	425	114,063
160	200	400	113.750
150	150	375	113,438
140	100	350	113 125
130	17,800	325	111,250
120	600	300	110,000
110	500	275	109.375
100	300	250	108 125
90	200	225	107,500
80	17,000	200	106.250
70	16,700	175	104.375
60	550	150	103,438
50	200	125	101.250
40	15,800	100	98.750
30	200	75	95,000
20	14,300	50	89,375
10	12,600	25	78,750

Diameter of Wire. Calculations for the right size of wire on a coil have been given in different formulæ with the stipulation that certain conditions be preserved.

(1st.) The iron core is far from saturation, which is imperative in the construction of dynamos. In such a case the strength of field may be expressed in ampere turns and, given a certain required strength in ampere turns and a given difference of potential between the ends of the coil, the diameter of the wire may be calculated as follows :

Let T = ampere turns required.
E = difference of potential in volts between the ends of the coil.
n = number of turns on magnet.
r = resistance of coil in ohms.
C = current in amperes.
x = the length of a mean convolution in inches.
d = diameter of wire in mils.

(Note.) A mil is equal to .001 of an inch.

We may take as a standard that a wire 1 mil in diameter, and of 96% pure copper, 1.106 inches measures 1 ohm. Then the resistance of any wire will be

$$\frac{\text{Length in inches}}{1.106\ d^2} \qquad (1)$$

from the conditions we have

$$T = \frac{E\,n}{r} = C\,n \qquad \frac{n}{r} = \frac{T}{E}\ \text{constant} \qquad (2)$$

$$r = \frac{x\,n}{1.106\ d^2} \qquad d = \sqrt{\frac{x\,n}{1.106\ r}}$$

by equation (2) $\dfrac{n}{r} = \dfrac{T}{E}$ $\therefore\ d = \sqrt{\dfrac{x\,T}{1.106\ E}}$ (3)

Having found the diameter, it is obvious that if E is constant, as we are assuming it to be, T will also be constant, whatever n may be, for r varies with n, and C varies inversely as r by Ohm's law. It is, however, necessary to make n sufficiently large so as to avoid overheating. This is readily calculated from the formula $d = 31\sqrt{C}$, whence $C = \left(\dfrac{d}{32}\right)^2$ being the maximum current which should be used on the stationary coils of dynamos to avoid wasteful heating. The wire should be coiled on until $r = \dfrac{E}{\left(\dfrac{d}{32}\right)^2}$

As an illustration, let us suppose it to be necessary to find the diameter of the wire on a coil of 10,000 *A. T.* and 110 volts difference of potential between ends, and the mean length of each turn 10″ :

T = 10,000.

E = 110. $\quad d = \sqrt{\dfrac{10 \times 10{,}000}{1.106 \times 110}} = 29$ mils.

x = 10 inches.

We can now apply the limiting formula for the value of the current in terms of the diameter. If this seems incompatible with the size of the wire another adjustment of parts will be necessary in order to obtain the proper relationship.

Applying the formula $C = \left(\dfrac{d}{32}\right)^2$ to the data on hand

we find $\quad C = \left(\dfrac{29}{32}\right)^2 = .9$ amperes.

A wire having a diameter of .029 of an inch has a cross section of about 850 circular mils, and this sized wire according to the results of actual practice is proper for the current it is supposed to carry.

Under ordinary conditions, the coil not being wound too deeply, a warmth of about blood heat is obtained if a figure of 1,000 circular mils per ampere be allowed. If a minimum of 700 cm. be employed, the safety limit, though small, will be sufficient to prevent the overheating of coils of small depth, though it is best and strictly desirable to allow a figure of 800 to 1,000 C. M. per ampere in the generality of cases.

The determination of the correct number of circular mils to allow in different specific cases is almost arbitrarily settled. So much depends upon the depth of the coil, that it may almost be said that the current density in all cases is strictly proportional to the radiating power or ventilation of the coil. Armature windings are different in this respect from field coils. Their rapid rotation and almost constant circulation of air, naturally allows the safety factor to be considerably lower than in field coils. But even here there are factors that tend to modify the expected results. Stranded wire on armatures possesses a much higher radiating power than would be at first supposed, and this combined with other fortuitous conditions might lower the circular mils for large armatures to a point never to be thought of for magnet coils; but this will be more fully treated in another department of this subject.

ELEMENTARY THEORY OF THE INDUCTION ALTERNATING MOTOR.*

BY RANKIN KENNEDY.

The present papers are attempts to give an explanation of the actions of the induction alternating motor without any mathematical illustrations. The explanation is based on a theory which is borne out by the actual facts ascertained by experiments with simple motors such as can be constructed for demonstration purposes.

Induction motors are of three kinds: single-phase, multiphase, and transformer motors. The transformer motor is a special form of multiphase motor at present not embraced in this theory; we shall therefore refer only to the single-phase and multiphase induction motors.

It is a remarkable fact now quite apparent to those who have followed the rise and progress of alternating

FIG. 1.

FIG. 2.

motors, that if electricians had followed up the results of Arago's experiments with a rotating copper disk and a pivoted magnet, they would have discovered and developed the alternating motor, and two-phase and three-phase motors, years ago; but instead of following Arago's disk and elucidating the induction effects therein, we have followed Faraday's disk experiments, and so the continuous current motor and dynamo first arrived at comparative perfection.

Let us take a copper disk, C, mounted on a spindle, and free to rotate in front of a laminated horseshoe electro-magnet, M. As in fig. 1, which is merely a diagram, in practice the disk should be mounted between two such magnets, for if mounted in front of one magnet excited by an alternating current, the disk would be violently repelled in a line parallel to the shaft; with two magnets it is balanced between them.

Imagine our magnet excited by an alternating current, then in the disk secondary currents are induced, circulating in front of the poles in lines concentric with the poles as seen in C, the front view of the disk in fig. 1. Owing to the various lags between primary current and secondary current, these induced currents are really in the same direction as the current which induced them, but by the time they have reached full power, the succeeding reversed current in the magnet coils has also reached full power, so that the magnetism actually repels these induced currents, but the repulsion is equally strong one way as the other tangentially, so that no rotative motion is set up. The induced current is quite as strong on one side of the pole as on the other, but give the disk a smart twirl and at once off it starts and runs up to a considerable speed and exhibits power if a load is put on. How is this? Why does it run on after starting? The explanation is simple. Fig. 1, C, shows the induced currents circulating in the stationary disk, concentric with the poles, having no more tendency to move one way or the other.

In fig. 2 the disk has just been started in the direction of the arrows. Now the induced currents set up by the induction have been carried round by the motion during the interval of time between the induction and the formation of the induced current, so that when the next magnetic wave which repels the induced currents comes on, these currents are flowing eccentric to the poles, as seen in fig. 2, and hence they are pushed much more

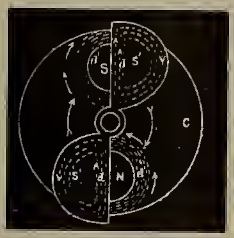


FIG. 3.

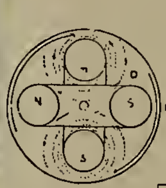


FIG. 4.

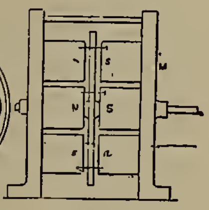


FIG. 5.

forcibly one way than the other, and that in the direction of the motion given to the disk. It is this carrying round of the induced currents during the interval between the one + and the next — wave of magnetic flux, and *vice versa*, which causes the disk to go on rotating after once being set in motion; first we have a flow of + magnetism, then after a short time a flow of current in the copper disk. but by this time the disk has moved round and a — flow of magnetism begins just in time to give the induced current its full impulse forward, then another flow of current after another short time appears in the disk to be acted on by the following + magnetic flow, and so on, the currents keeping an eccentric position to the poles owing to the disk moving round while the currents are forming, and being eccentric, they are propelled more one way than the other.

It matters not which direction the turning impulse is given, the action is the same.

On this principle, the single-phase induction alternating motors of C. E. L. Brown and Elihu Thomson are built. They require to be started by some extraneous means; small motors may be spun round by hand, or by a string like a spinning top. Large motors are started as two-phase motors by splitting the current for a few moments.

A method of starting may be very instructively illustrated by the model here described, shown in fig. 3. If between the disk, C, and the poles a piece of copper, shaped like that shown at S, S, be inserted, so as to half screen the poles, the disk will start off itself, because currents will now also be induced in the fixed copper blades which flow in the same direction and at the same time as those in the disk, so that the circular currents in the disk will cause the disk to turn in the endeavor to move under the fixed blades. It will be seen that the currents at *d*, *d*, and *d'*, *d'*, flow in the same direction and are therefore attractive.

The copper blades are made movable so that they are only used at the start up of the motor.

I now come to a class of motors in which we have two sets of poles and two currents, purposely made the one to lag behind the other by a quarter of a period, so that when the one is at its maximum strength, the other is at its minimum or zero value.

By the use of two currents in this way, we are able

* London *Electrical Review*.

to make an induction motor start off from a state of rest with great torque. The induced current set up by the one set of poles is attracted and repelled by the magnetic flow of the other set, which being energized by a current coming a quarter of a period behind their magnetic flow, coincides with the current flow induced by the first set, so that the disk is propelled round to bring the current concentric with the second set.

In figs. 4 and 5 this class of motor is illustrated diagrammatically. Imagine a copper disk mounted on a spindle and between two sets of field magnets, N, S, energized by one current, *n*, *s*, energized by the other; referring to fig. 5, *n*, *s*, have just been energized by a wave of current which set up the induced currents in the disk, represented by the concentric dotted lines, the magnetic flow from *n*, *s*, is falling to zero; but the magnetic flow in N, S, is now rising to a maximum, and a time arrives at which the currents in the disk are a maximum, and the magnetic flow from N, S, is a maximum, while the flow in *n*, *s*, is zero, hence the disk is pulled round to bring the current flow concentric with N, S. Then N, S, set up an induced currrent in the disk, which in turn coincides with the next maximum magnetic flow from *n*, *s*, this propels the disc again to bring the current and magnets concentric.

Thus we see that the currents set up by the one set of poles are acted upon motively by the other set, because the one set of poles are at a maximum flow when the other set are at zero, and the currents induced by one set are at a maximum at the same instant that the magnetic flow of the other set is at a maximum, and thus the motor starts with considerable torque from a state of rest if we have two sets of poles energized by two currents having a difference of phase of one-quarter of a period.

Now, if after this motor has been started one of the two currents is entirely cut off, the disk will still run on, and, what is more surprising, it will exert as much power as it did with the two currents, or rather, to speak more accurately, it will run at a higher speed when at its maximum torque. This fact leads to a most important conclusion, namely, that the two currents are of no advantage except as an aid to starting; and if we could start the single-phase motor with full torque by any means, it would have the advantage in simplicity and direct applicability to present circuits.

Mr. C. E. L Brown has devised several methods of starting the single-phase motors described in our first paper, but what the actual torque obtained by the best of his methods is I cannot say, as actual independent tests are not available.

The shielded pole method described above is due to Prof. Elihu Thomson, and does not give more torque than that necessary for a start

The two-phase motor has still the paramount advantage of starting without any extraordinary devices, and that, too, against considerable torque. And when it is taken into consideration that motors are only used to any extent in isolated plants, where the generator, the mains, and everything else can be erected for two-phase working, the two-phase motor is likely to hold the field in cases where absolutely no commutation is desirable.

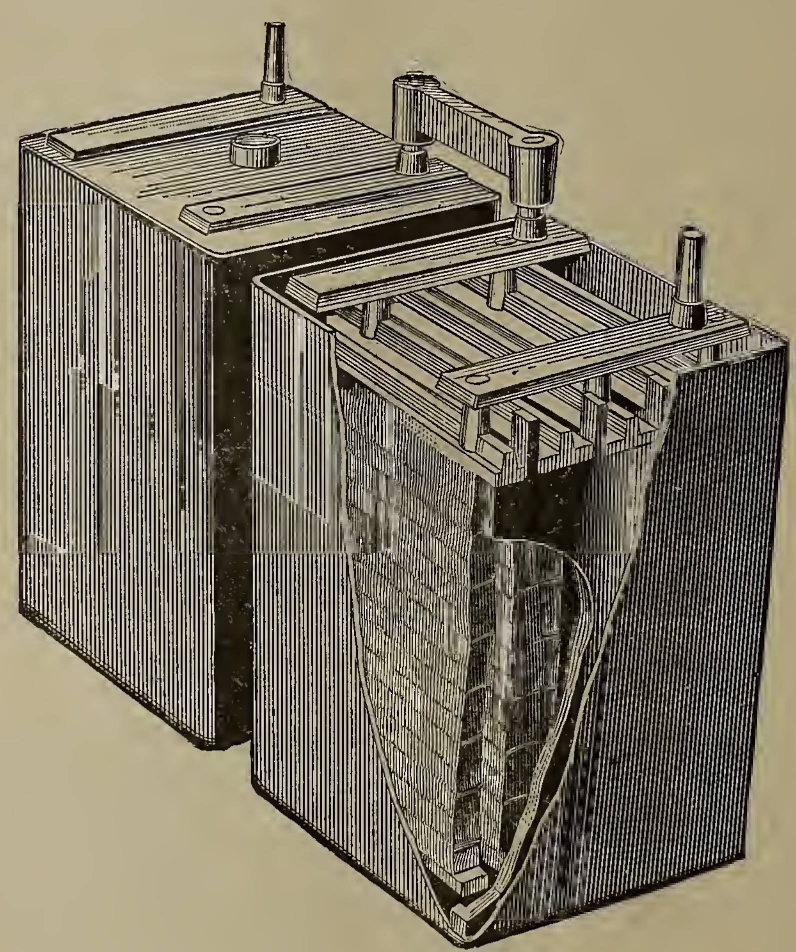
Immediately we introduce the commutator, even if only for starting purposes, then the motor is on a level with the ordinary continuous current motor; it is the entire absence of the commutator which is the sole recommendation for the alternating motor. Accept a commutator and the ordinary motor is ready to do the work.

It will be quite easy to apply this elementary theory to a three-phase motor, and at a future time we hope to describe actual disk motors of the types shown in these diagrams, which are to be taken merely as aids to understanding the principles and not as the best designs for construction.

ELECTRIC POWER STORAGE COMPANY'S ACCUMULATOR.

A few months ago the Electric Power Storage Company, of New York City, put upon the market its storage battery of the pure Planté type, which has been meeting with merited favor. The fact that it is free from all legal entanglements is an important one, which naturally is greatly appreciated by those contemplating the purchase of accumulators.

This battery is said to be thirty per cent. lighter than other batteries of corresponding capacity, and the construction of the electrodes is such as to give them great strength and solidity, which renders them suitable for hard usage. The electrodes are constructed in a special manner, the lead plates being assembled in such a way as to expose a very large amount of active surface to the action of the electrolyte. The battery embodies



ELECTRIC POWER STORAGE CO.'S ACCUMULATOR.

certain features which permit of rapid, economical and efficient charging. The plates cannot buckle nor sulphate, and will not disintegrate, and the internal resistance of the cell is less than .0001 of an ohm, which is remarkably low. The battery may be overcharged, and discharged rapidly, without detriment to the plates. It will discharge a current that would ruin other batteries of similar rated capacity.

This make of battery, on account of the many valuable properties above named, is especially adapted for traction work, running electric launches, lighting or performing service where an extensive discharge rate may be occasionally demanded. As an instance of the power of this battery to withstand rapid discharges, it may be mentioned that a plant of these cells has been discharged repeatedly, for a period of sixteen months past, at rates of from one and one-half to four amperes per pound of plate, and that not a single plate of the batteries submitted to these severe tests is buckled, bent or warped, or shows the least sign of disintegration.

An illustration of this cell is given herewith, which shows to some extent the construction of the plates and their arrangement in the cell.

This battery is the result of an extended period of experimental work and investigation, and is offered to the public as one that can be entirely depended upon as being highly efficient. Every cell sent out is thoroughly tested before leaving the factory and is fully guaranteed in every particular.

The office of the Electric Power Storage Company is in the Havemeyer Building, New York City.

LIGHTNING AND LIGHTNING CONDUCTORS.

BY OLIVER J. LODGE, F. R. S.

The *Engineering Magazine* for October, 1894, contains an interesting article on the title-subject, written by Prof. Lodge. Not until quite recently, he says, have the real conditions of the problem of protection against lightning been grasped. Franklin and his followers did not know of the possibility of electric oscillations. They aimed at making an easy path to ground for the lightning discharge, thinking that the path of least resistance would be chosen and that others would be spared. Failure to properly protect was always laid to the lightning rod as having been badly erected or imperfectly tested.

He then points out the analogy between the phenomena of a lightning discharge and a straight steel spring held in a vise at one end, the other end being bent aside and released. The spring recoils and vibrates with a rapidly decreasing amplitude of vibration before finally settling down to rest. An electrified body is a store of energy similar to the bent spring. The discharge of the body corresponds to the release of the spring. * * Experimentally, it can be shown that when a discharge takes place down a rod, sparks may fly from it to all conductors near, even to quite insulated conductors which lead nowhere. * * When the discharge has reached the earth the danger is not over. A region of earth is for the moment overcharged, and the charge rushes away as best it may, splashing and surging up in many unexpected places.

What then is the remedy? For important buildings, gunpowder magazines and the like, there is no hesitation in the answer of modern science. They should be encased completely in metal and no pipe or wire or anything metallic should be allowed to come through the walls, or floor, or roof without being itself metallically united to the metal sheathing at the place of perforation. That being done, and the sheathing being stout enough not to melt even at the place where a flash may happen to strike, everything inside is absolutely secure. No spark can be caused inside a closed metal cavity by anything that happens without. But inasmuch as the fierceness of a flash at its place of striking is very great, and such as few metal sheathings can with safety stand, it will be better to provide a projecting rod or two so as to tempt the flash to strike them; for then the melting of the first foot or so will be of no consequence.

But science goes a little further in the direction of ease and practicality than the above counsel of perfection. It asserts that an open metal netting is quite sufficiently safe, except as regards regions inside, but so near the boundary that their distance from the net is comparable to the width of its mesh. * * Any metal serves equally well for the conductor; the cheapest and most infusible is best. * Conductivity is ridiculously unimportant; durability is a much more serious matter. Points or projections to the sky are useful for the reason stated, namely, to take the violence of the direct flash at its point of incidence in a cheap and conspicuous manner. Earth connections are desirable to save the foundation, the soil, and the pipes therein from being knocked about. Sometimes one is inclined to recommend plenty of sky points, in the hope that a flash may be averted by their continual steady discharge. But I have lost faith in the discharging power of points where any large quantity of electricity has to be dealt with. * *

The only significance of conductivity is to avoid destruction by heat, and even in this matter, oddly enough, a bad conductor has certain advantages. A good conductor allows less time for the heat to escape, it may even get more heated than a bad one, because it can convey a stronger current. A non-conductor for instance, whatever else might happen to it, would certainly never get *melted* by an electric current. As regards the easy conveyance of a violent flash, conductivity has nothing to say. The obstruction which an alternating or rapidly varying current meets with is not the reciprocal of conductivity known as ordinary electrical resistance. It is not a bit like any resistance or anything analogous to friction; it is an obstruction of a totally different kind, closely allied to inertia.

A well greased railway truck may be pushed along by a boy when it is once in motion on a level line, but try to get it in motion or stop it by a sudden blow, and, though you may knock the truck to pieces, you will not make much other impression on it. Electricity in this respect behaves like a substance with a great deal of inertia. Speaking popularly, to set all the electricity in a stout copper conductor into motion by a sudden force is a thing not to be done without violence. The force of lightning is indeed sufficient, but the violence of it is excessive, and, from every part of the rod subjected to lightning, electricity spurts as if a column of water were struck with a steam hammer. This immense inertia obstruction, quite different from frictional resistance, and non-existent to steady and long-continued forces, has lately received the name "impedance;" and it is desirable that the cultivated world should get accustomed to the thing, whether by this name or by some other.

I spoke, a little way back, of inertia as being the cause of the prolongation of a discharge into oscillation. It is also the cause of the extraordinary obstruction which even a perfect conductor offers to sudden electromotive forces—an obstruction not many times less than that offered by a corresponding air-space, especially if the air be hot, so that when a discharge has begun to strike down a stream of hot air, for instance, the current rising vertically from a factory chimney, it is not easily diverted to a lightning conductor projecting from the side of the chimney only a few feet away, but may prefer to continue its path down the air column unless it is intercepted by some metal hoop or branch conductor thrown right across the mouth of the chimney.

In the light of such facts as these it is obviously absurd to speak of "areas of protection," or to think that one easy path protects all others in its vicinity. The fact is that to make an easy path is impossible; all paths offer a great obstruction to sudden currents, and many paths are therefore liable to be called on to convey a portion of the rush. Elaborate testing of the minute resistance which lightning conductors offer to feeble voltaic currents is quite useless. It is worse than useless, because it is misleading. It is like trying to predict the course of an avalanche by trickling a pail of water down a hillside.

Such is the outcome of some recent electrical investigations, and the result may be said to constitute the first distinct advance in this particular branch of applied electrical science since the time of Franklin.

MUNICIPAL ELECTRIC LIGHTING.*

BY E. CARL BREITHAUPT.

It is the purpose of this paper to consider the question of government ownership of natural monopolies only in so far as it concerns works for the supply of artificial light, and particularly such as is wholly for the public use, viz., the lighting of streets and public buildings.

It is proposed that these works be owned and operated by the municipal corporation, and many cities and towns have been considering the advisability of the plan. The question has been hotly argued on both sides, and it is to be regretted that these discussions are not always conducted in a fair-minded, liberal manner. Arguments advanced by men interested in private lighting companies are denounced by their opponents as prejudiced opinions; the cry of "monopolist" is raised to enlist public favor on the side of municipal ownership, and the same offence is thus committed as is charged. It is but natural that persons having capital invested in any particular enterprise should strive to protect their investments, especially in a case of so serious a nature where the threatened danger means inevitable destruction. On the other hand there is much to show that the arguments put forth by the advocates of municipal ownership are not always inspired by pure and unselfish motives. If these discussions are to accomplish any good the opinions advanced by either side must be honest and unbiassed, and above all the facts and figures cited must be truthful, for the outcome of the case really hinges thereon.

The burden of proof lies with the advocates of municipal ownership, and the arguments in favor of their claim are identical with those of the complete scheme of government ownership.

Can a municipal corporation perform its own lighting service cheaper than a private company can supply it? Figures are given showing the cost of the service where the plant is owned and operated by the municipality, and estimates are made on the cost of building and operating proposed plants, nearly all of which are so surprisingly low that they must at once arouse suspicion in the minds of thoughtful men. According to these reports the cost of public lighting, where it is done by the municipality, averages about one-half of the price usually paid to private companies. One town in Illinois having 120 electric lamps on its streets, even reports that these cost nothing, that the expenses of operating are all paid by the profit received from commercial lighting. It is a significant fact, however, that these figures rarely represent the actual total cost. There is a tendency on the part of the advocates of municipal ownership to underestimate or entirely ignore any items which are not cash actually paid out, such as depreciation in value of plant due to wear and tear, and to the fact that new and improved apparatus and methods are constantly coming into use, interest on capital invested, insurance, taxes, and in some cases water supply. The town treasurer's statement of expenditures incurred in operation is often the only outlay considered, and even this may be incomplete, since municipal authorities do not always analyze accounts so as to show a full statement for each department. Insurance and similar expenses may be debited to separate ledger accounts and not appear at all in the statement of a particular department. Other items are charged to the department where they belong, but under the wrong heading. As a case in point, we may cite the financial statement of Toronto Junction for 1893. Under receipts and disbursements authorized by by-laws for issuing debentures on account of electric light construction, we find an item for rebuilding engine bed of $162.93. This was a repair and properly belongs to maintenance.

Now, it is plainly unfair to compare such figures with those paid to private companies and say that a municipality operating its own plant saves the difference. To compare results intelligently we must agree on a basis of comparison. If the price paid a private company is remunerative to them, it includes depreciation, interest, insurance and taxes, and we must therefore debit a municipal plant therewith. The municipality may for a number of years persuade itself to believe that these expenses are imaginary, but it must meet them in the end, and no matter to which account they are charged they are incurred by the lighting plant.

Many cities and towns have been persuaded by incomplete reports and alluring estimates to undertake the experiment, but it still remains to be proven that a municipal plant can supply a cheaper light than a private company. In towns which are not large enough to make the business remunerative the installation of a plant by the corporation may be justified, because street lighting is a public necessity, but where private plants already exist that are able and willing to supply the municipality at a fair price, the outlay cannot be regarded otherwise than as an unnecessary expenditure and a waste of public money.

* Abstract of paper read at the meeting of the Canadian Electrical Association, Montreal, September 19, 20 and 21.

DECISION IN THE STORAGE BATTERY CASE.

Judge Lacombe, on October 8, rendered a decision in the case of the Accumulator Co. vs. the Edison Electric Illuminating Co., New York,* granting the preliminary injunction asked for. In the decision the Judge says, "Defendants also insist that the material which they use is not active when the process of packing antimonious lead around it is complete, and that it does not become active the moment it is placed in the battery fluid, but requires further electrolytic treatment before it becomes active. But the patent is not confined to active material, it includes 'material to become active,' and whether it becomes active by one process or another is apparently immaterial. The gist of Swan's invention as found by Judge Coxe was the *confining of the material which was to do the work within perforations which extended completely through the plate.* There is nothing in the patent or in Judge Coxe's opinion which supports the contention that the claim is other than what it appears to be—a claim for a completed article, not for a process of manufacture. Infringement is clear."

Softening Lamp Filaments.—It is possible to soften the filament of an incandescent lamp to such an extent, with an excessive current, that it will not sustain its own weight. It is recorded, in one instance, where the filament wilted and the parallel legs crossed each other. As soon as the current is stopped the filament at once assumes its rigid condition.

Electro-Therapeutics.—*The New York Polyclinic* of September 15 contains a valuable and interesting article written by Prof. E. J. Houston and A. E. Kennelly, entitled "Modern Views of the Physics of Electricity as applied to Electro-Therapeutics." It is illustrated by diagrams showing the characteristic curves of the various classes of currents.

* See page 165, Electrical Age, September 22, 1894.

THE ATLANTA CONVENTION.

RAILROAD TRANSPORTATION.

The Royal Blue Line and Shenandoah Valley Route will run a special train to the Atlanta convention of the American Street Railway Association, leaving New York, October 15, 1894, at 3 P. M., and reaching Atlanta at 6 P. M. the next day.

This train will carry the representative men in the street railway and supply business. Among those who have already declared their intention of going on this special train are the following named gentlemen:

Benj. Norton, president Atlantic Avenue Railroad Company, Brooklyn; Jas. H. McGraw, *Street Railway Journal*, New York; E. Peckham, Peckham Motor, Truck and Wheel Company, New York; Henry C. Payne, president American Street Railway Association; P. C. Ackerman, American Electrical Works, New York; E. Martin, vice-president Hamilton Street Railway Company; C. O. Baker, Jr., Complete Electric Construction Company, New York; Wm. J. Richardson, secretary American Street Railway Association; E. J. Wessels, Genett Air-Brake Company, New York; Geo. F. Porter, secretary National Electric Light Association, New York; J. B. Griffith, manager Hamilton Street Railway Company; W. J. Clark, General Electric Company, New York; T. E. Crossman, assistant to secretary American Street Railway Association; Wm. W. Cole, superintendent West Side Railroad Company, Elmira, N. Y.; H. C. Evans, The Johnson Company, New York; Lewis J. Perine, Jr., president Trenton Passenger Railway, Trenton, N. J.; J. H. Woodward, Benedict & Burnham Manufacturing Co., New York, and a number of others.

A special car will be reserved for gentlemen accompanied by ladies.

The railroad rates will be one and one-third fare for the round trip on the certificate plan, one fare going and one-third of regular rate returning.

The sleeping car fare will be the regular fare in each direction, or $6.00 a berth, New York to Atlanta; $5.50, Philadelphia to Atlanta; $4.50, Baltimore to Atlanta; $4.00, Washington to Atlanta; and double these figures for sections. Remittance for the going trip from New York, including sleeping car accommodations, one berth and meals is $34.00; from Philadelphia, $31.00; from Baltimore, $26.20; from Washington, $24.50.

L. J. Ellis, 317A Broadway, New York, is the eastern passenger agent, to whom all correspondence relating to the trip and remittances should be addressed.

The Southern Railway Co., Piedmont Air Line, has perfected arrangements for a most elegant Pullman vestibule train, composed of dining and sleeping cars, to leave New York 4:30 P. M., on Monday, October 15, via the Pennsylvania Railroad and Southern Railway, Piedmont Air Line, arriving in Atlanta at 3:55 P. M. the following day, making the trip within twenty-three hours and a half. The Southern Railway owns and operates the entire direct line from Washington to Atlanta, also the line via Ashville, Knoxville and Chattanooga, and is prepared to handle passengers with absolute comfort and despatch via either route.

Already five Pullman sleeping cars are filled and the attendance from the East will be larger than at any other meeting heretofore held.

Many of the New England and Eastern representatives are going via the Southern Railway, Piedmont Air Line, as it is 14 hours quicker than via Chattanooga to Atlanta. This gives the choice of going and returning by different routes.

Among the number who go via this line are representatives from the large manufacturing establishments of Lewis Fowler Company H. W. Johns Co, Portland Shade Manufacturing Co., Okonite Co., Mr. C. W. Price, of the *Electrical Review*, and a large number of other representatives of leading supply houses.

From Boston two special sleepers will carry the delegates, including Mr. J. H. Cunningham, of Massachusetts Street Railway Association.

Sleeping car accommodations can be secured at 271 Broadway, New York.

THE PHYSICS OF SINUSOIDAL ELECTRIC CURRENTS.*

BY A. E. KENNELLY.

The author first explains the sinusoidal current and describes the three ways in which sinusoidal curves may be graphically traced. He then continues:

"Of all possible types of alternating currents, the sinusoidal current is the one which has the least mean rate of change and, therefore, of all possible alternating currents which can be applied to the human body, it is the one which possesses, for the frequency considered, the least mean irregularity. For example, a current of the zig-zag type whose semi-period is, say one-hundredth of a second, so that its frequency is 50, and whose maximum value is one ampere, is increasing and diminishing at any moment at the rate of 200 amperes per second, since it rises to one ampere from zero in one two-hundredth of a second, but at the apex at its curve it suddenly changes rate at what is, geometrically speaking, an infinite rate for the instant of change. The curve representing a sinusoidal current having the same maximum and frequency, and the same maximum rate of change, current strength is now no longer at the apex, where the change is very gradual, but just at the point where the curve crosses the zero line or where the current strength is zero. In this case the maximum rate of change would be 314.16 amperes per second, thus only about 50 per cent. more than the change in the zig-zag curve without taking into account the sudden discontinuities of the latter at the apex."

Mr. Kennelly then refers to the complex and irregular form of a periodic alternating current curve as produced by a combination and superposition of a number of different sinusoidal currents of different amplitudes and frequency. Such combinations are sometimes called complex harmonics. In such cases the wave of greatest length is called the fundamental wave or sinusoid, and the shorter waves superposed are called the harmonics, and the harmonics have a frequency which is always some multiple of the fundamental frequency.

Then follows a description of the four methods of producing alternating currents and the apparatus and character of current in each case.

"Alternators," Mr. Kennelly says in conclusion, "have been constructed to produce as many as 10,000 periods per second. All frequencies higher than these have to be obtained by the discharges of Leyden jars through air gaps."

LIGHT IN BRAID MILLS.—Mr. Darius L. Goff, of the Goff Braid Mill, Pawtucket, R. I., is making experiments with a view to the better distribution of the electric light in his mill. He reverses the arc light current, which throws the light up to the ceiling whence it is reflected downward. It is stated that a better light is thus obtained, and the operatives are enabled to work with better advantage.

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*Abstract of a paper read at the fourth annual meeting of the American Electro-Therapeutic Association, held in New York, September 25, 26 and 27, 1894.

TEST OF A STORAGE BATTERY PLANT WITH MARVELLOUS RESULTS.

A gentleman representing one of the large electrical construction companies in this state recently called upon the Electric Power Storage Company, Havemeyer Building, New York city, to investigate this company's storage batteries.

Mr. George W. Harris, the manager, took him to the company's works and laboratory, No. 166 Elm street, in this city, where many of the cells are always kept set up for test and exhibition. On this occasion twenty-six 140-ampere-hour cells were used in series to light 50-volt 16-candle-power lamps. The normal output for cells of this capacity would be fourteen 16-candle-power 50-volt lamps. In order to satisfy the curiosity of the caller, who doubted the ability of the cells to receive an overcharge and stand excessive discharge without the buckling, sulphating, or disintegrating of the plates, one hundred 16-candle-power 50 volt lamps were connected with the cells, taking in all 111 amperes of current. In addition to this a 1-H. P. motor, taking 15 amperes, was connected in circuit. The action of the motor did not affect the brilliancy of the lamps. The caller, however, yet entertained some doubts regarding the cells, believing that the plates must surely sulphate, buckle, or become disintegrated by these extraordinary strains put upon them. So in order to satisfy the investigator on this point, Mr. Harris took one of their 70-ampere-hour cells and overcharged it with a current nine times its normal rate and discharged it on short circuit, to test the power of the cell to withstand severe work and prove its value for commercial use, but without showing the least signs of damage to a single plate.

As is well-known, storage batteries are frequently ruined by overcharging, through the carelessness of those having them in charge, but no danger of this sort ever threatens the Electric Power Storage cells. Being of the Planté type, they will stand any amount of overcharge and rapid discharge.

The gentleman referred to was satisfied with the test made and reported favorably on the battery to his company, who is now trying to secure the sole right to sell and install these cells in the western part of New York State.

Mr. Harris, the manager of the Electric Power Storage Company, is very enthusiastic over the success of the work of his company. He knows exactly what is required in the way of storage batteries, and is familiar with all the defects of storage cells of other makes, all the way from the time of Planté to the present. He takes great pleasure in showing interested parties the storage cells of his company, and never tires of expatiating on their merits.

Dr. Leonard Paget, the inventor of this battery, and the electrician of the Electric Power Storage Company, recently returned from an extended trip in Europe, where he did much valuable work in the interests of his company. Dr. Paget, who has an European reputation as an electro-chemist of rare distinction, has had many years' practical experience in storage battery work, having been connected with Gaston Planté in 1883 and subsequently. Since the death of Gaston Planté, Dr. Paget is the oldest in the art, in point of investigation, experience, practice and success.

Rope Driving.—We have received a copy of a pamphlet entitled "Practical Notes on Rope Driving," by M. E. This pamphlet is issued by the Street Railway Publishing Co., of New York, and its contents are reprinted from the *Street Railway Journal*. The price is 50 cents per copy.

LONG DISTANCE TELEPHONE.

The American Telephone and Telegraph Company (the Long Distance Telephone Co.), on October 3, formally opened its long distance lines connecting Terre Haute, Ind., with the principal eastern and western cities. The company was represented by W. A. Vail, of the New York office, George C. Brooks, of the Chicago office, John H. Cross, of the Cincinnati office and H. J. Curl, of the Pittsburgh office.

The Vacuum of Lamp Bulbs.—It has been noticed by those who exhaust the air from incandescent lamp bulbs that it is not advisable to continue the exhaustion too far, for the reason that the lamps do not last so long. The reason of this is thought to be that when the vacuum is too complete a point is reached where the mercury of the pump vaporizes and surrounds the filament.

RELATION OF CORPORATIONS TO THE PUBLIC.

BY ALLEN R. FOOTE.

The following is a copy of a communication to the *Journal of Commerce and Commercial Bulletin*, of New York, in a recent issue, from Mr. Allen R. Foote, containing suggestions to the Constitutional Convention now being held in Albany, touching the subject of the title :

Editor *Journal of Commerce and Commercial Bulletin*.

No question of governmental policy occupies at this time a more prominent place in the minds of corporate people than that of how properly to control, without unnecessarily checking, the growth of corporate power.

As urban citizens are closely in touch with corporations operating under municipal franchises, and as the legislation of municipal councils and of State legislatures readily responds to clearly defined demands, public service corporations naturally receive much attention from these bodies. For this reason the generally accepted policy of municipalities and of States for controlling municipal public-service, corporations will become the sure foundation of a national policy for the control of national public-service corporations. This fact gives a double significance to whatever the Constitutional Convention may adopt touching this question. Having in view the national, as well as the local bearings of the subject, I have suggested to several members of the Convention the adoption of an article as follows :

An article defining public-service corporations; providing for their relations with and controlled by public authorities ; for their incorporation under a general law ; and for the public ownership of public-service corporations.

A new article. Section 1. A public-service corporation is a corporation legally incorporated under the laws of this State for the purpose of supplying throughout the State, or in one or more political subdivisions of the State, a public service for the satisfaction of a public need, which requires for its economic production, operation or distribution a special use of municipal, country or State thoroughfares or the exercise of the power of eminent domain to secure a right of way, over, upon, or under the same, the investment of capital in lands, buildings, mechanical apparatus, and appliances ; laying, constructing, erecting and maintaining of lines of poles, wires, pipes, conduits, rails, tracks or cables; the organization and expert direction of labor, and the organization and continued maintenance of systematic operations, in order that the service rendered may be supplied at the lowest practical cost to the users of the service. Such services may be specified as the transportation of persons and commodities; the electrical transmission of intelligence; the generation and distribution of gases, steam, electricity or other agents for the purpose of distributing the means of producing light, heat or mechanical power; the collection, storage, sanitary treatment and distribution of water for all purposes. the collection, removal and final disposal of sewage, garbage, street sweepings and dead animals.

Sec. 2. The State shall not, nor shall any political subdivision of the State, create a debt or invest funds for the purpose of supplying a public need, if it can obtain a service for supplying the needs by a contract with a public-service corporation at a cost to the users of the service no greater than the cost would be if the State, or one or more political subdivisions of the State, should own and operate on public account the means of supplying the same service and charge to users thereof the full cost of its production.

Sec. 3. In consideration of the investment of capital by a public-service corporation, in lands, buildings, mechanical apparatus and appliances, the organization and expert direction of labor, and the organization and continued maintenance of systematic operations for the purpose of supplying a public need for the people of the State, or of one or more of the political subdivisions of the State, the State authorities, or the authorities of the political subdivisions in which the service is rendered are hereby authorized to secure to such public-service corporation by contract, the full enjoyment of all economic advantages and privileges that would be enjoyed by the State if it, or by the political subdivisions of the State, if they, owned and operated on public account the means of supplying the same service.

Sec. 4. To safeguard the welfare of the public and of public-service corporations all contracts made under authority of this article shall stipulate :—

First. That the contracting public-service corporation shall so erect and extend the necessary plants as to supply the service required in the best known manner and at the lowest practical cost to the users of the service, whenever and wherever the public authorities may direct. That the extension of the plant, methods of distribution, or system of management, designed to render the production, distribution or final use of the service better, safer or more economical for the users of the service may be required by the public authorities at any time, but that no such changes shall be required unless the rate of charges for the service to be rendered and the prospective income from the same is sufficient to fully pay all items specified in this section. The contracting corporation may consent to make extensions or changes of any kind whenever requested so to do by the public authorities without reference to the effect such changes may have upon the relation of investment to income.

Second. That charges to users of the service shall be the same to all users under like conditions, that no free service shall be rendered and that charges shall be fixed by the contracting corporation at such rates as shall produce an income only sufficient to fully pay interest upon all its outstanding shares of stock and bonds legally issued, at the same rate paid by the public authorities on public bonds ; a reasonable allowance for the depreciation of the value of the plant from use ; the cost of all accidents, contingencies, taxes, insurance, rents, salaries and operating expenses ; the cost of all materials consumed in the processes of operation and ordinary repairs, and a net profit for dividends of not to exceed ten per cent. per annum, and that in case a surplus remains as the result of the operations for any year, such surplus shall be divided equally between the contracting parties.

Third. That the books of account of the contracting corporation shall be audited annually by the State Auditor and that the charges for the services rendered shall be subject to revision by the contracting public authorities at the termination of regular periods of five years each.

Fourth. That in case of a disagreement of any kind between the contracting parties, such disagreement shall be settled by a board of arbitration having three members, selected for the special purpose, each contracting party to select one member, and the two members so selected to select the third member. The findings of the board of arbitration so selected are to be subject to appeal by either party to a court of proper jurisdiction.

Sec. 5. Whenever two or more plants are operated within the jurisdiction of the State, if for a State service, or within the jurisdiction of one or more political subdivisions of the State, for supplying one or more classes of public service, are owned by different owners, such owners may consolidate their interests and reincorporate as a single public-service corporation under the general law for the incorporation of public-service corporations, for the purpose of securing greater economy in operation, and therefore to cheapen such services to the users thereof, but such consolidation shall be effected only upon condition that the new public-service corporation so organized shall at once contract, under the provisions of this article, with the State, or with the political subdivisions in which the service plants are located. In case the State, or the political subdivisions of the State, shall fail to secure contracts with owners of existing plants in accordance with the provisions of this article, within two years after this Constitution goes into effect, then, and only then, shall the State and the political subdivisions thereof have authority to contract with other public-service corporations organized to supply the same service.

Sec. 6. The Legislature shall enact a general law for the incorporation and control of public-service corporations in which the provisions of this article shall be carried into full effect.

Sec. 7. Whenever the public authorities of the State or of the political subdivisions of the State can demonstrate beyond a reasonable doubt, by judicial investigation, that an economic gain for the public welfare can be secured, sufficient in amount to justify a change in public policy, and only then, authority is hereby given to the State, or to any political subdivision of the State, to acquire the complete ownership of any plant owned by a public-service corporation and operated by it for supplying a public service, within the jurisdiction of such authorities, to purchase such plant by paying the full value of the same when judicially determined.

The economic principles involved in this suggested article must be complied with before individual and public welfare can be served in the best and most economic manner by public-service corporations.

There is no subject that requires more time in State legislatures or municipal councils, and many think that causes more corruption than that of public-service corporations. The defects in present legislation are favorable to speculators, and they are decidedly subversive of the best interests of the users of public services, investors in the securities of such corporations and of good morals.

The vital importance of this subject and the lack of a thorough understanding of it in all of its economic bearings, by members of legislatures, of municipal councils, and of the public, justifies and makes necessary the placing of an article in the Constitution covering it somewhat more elaborate than is ordinarily permissible, in order to cause a well-considered system to supersede the diversity now existing in this class of legislation.

THE UNIVERSAL INTERNATIONAL EXHIBITION OF 1900 AT PARIS.

This exhibition will open on April 15, close on November 5. It will receive works of art, agricultural and industrial products. All nations are invited to participate. To the contemporary exhibition there will be appended a retrospective centennial exhibition showing the progress effected in the various branches of production since 1800.

The locality of the exhibition will comprise the Champ de Mars, the Trocadero and its approaches, the Quay d'Orsay, the Esplanade des Invalides, the Quay de la Conference, the Cours la Reine, the Palace of Industry, and the grounds adjoining this palace between its produced longitudinal axis, the Avenue d'Antin and the Cours la Reine.

Articles for exhibition will be admitted from December 1, 1899, to February 28, 1900. Exhibitors will be informed in sufficient time of the reductions in freights made by the railways, steamboat companies, &c.

Exhibitors will not be charged any rent for the space which they will occupy in the Palace and the pavilions constructed by the management of the exhibition.

Water, gas, steam and motive power necessary for actuating the machinery will be supplied free; but exhibitors will supply at their own cost the connections to the water mains, gas and steam pipes, and the transmissions required for obtaining motive power from the shafting.

For the contemporary exhibition the exhibitors must bear all the cost of packing, carriage, unpacking, the custody of chests, the installation, repacking and removal. At any time the general management may cause the removal of any articles which appear injurious or incompatible with the object of the exhibition.

Nothing may be removed before the close of the exhibition without a special authorization from the general management.

Articles for the exhibition will not be required to pay any duties, though they must be accompanied by a report from the sender indicating their nature, their weight and their origin.

The jury for deciding on the merits of exhibits consists of three grades, the class jury, the group jury, and the superior jury. The class jury may call in to its assistance one or more persons specially acquainted with the articles or processes in question.

The awards to exhibitors may be diplomas of the great prize, medals of gold, silver and bronze, and honorable mentions. If an exhibitor is associated with a jury as an expert he cannot compete in the class concerned.

Electrical appliances fall under the fifth group and comprise: Class 23d, the production and mechanical application of electricity; class 24th, electro-chemistry; class 25th, electric lighting; class 26th, telegraphy and telephony; and class 27th, promiscuous applications of electricity not included under the above classes.

THE OHIO TRAMWAY ASSOCIATION.

This association held its annual meeting at the Boody House, Toledo, Ohio, on September 26. There was a good attendance of delegates.

President Albion E. Lang delivered his annual address and welcomed the members to Toledo.

The committee on topics for discussion reported that the following named subjects would be considered: A desirable and satisfactory fender or life guard; the best qualifications for conductors and motormen; the treatment of low joints and how to prevent them; the best method of controlling employés and collecting fares.

These topics were quite fully discussed with considerable interest and profit to the delegates present.

The following named companies were admitted to membership: The Toledo Electric Street Railway Co., and the Toledo and Perrysburg Railroad Co.

Officers for the ensuing year were elected as follows: President, W. F. Kelly, Columbus; vice-president, Reid Carpenter, Mansfield; Secretary and Treasurer, J. B. Hanna, Cleveland; Chairman Executive Committee, Wm. A. Lynch, Mansfield.

After the session was ended, excursions were made about the city and in the evening a banquet was tendered at the Toledo Club by the local representatives of the association.

Among those present at the meeting were: Albion E. Lang, Consolidated Street Railroad Company, Toledo; James Robinson, Toledo Street Railroad Company, Toledo; J. K. Newcomer, Delaware Electric Railroad Company, Delaware, O.; R. Carpenter, Mansfield Street Railroad Company, Mansfield, O.; B. P. Foster, Toledo and Maumee Valley Railroad Company; W. F. Kelley, Columbus Street Railroad Company, Columbus, O.; W. S. Jewell, Consolidated Street Railroad Company, Toledo; J. B. Hanna, Cleveland City Railroad Company; W. G. Owens, Des Moines Street Railroad Company, Des Moines, Iowa; C. M. Fuller of the Davis Car Shade Company; H. H. Foster, the Dreher Manufacturing Company, New York; John Dale of the Dale Manufacturing Company; E. A. Smith, Consolidated Car Heating Company.

HOW TO USE STORAGE BATTERIES WITH SUCCESS.

The question is often asked why storage batteries are used to so limited an extent in this country and with such indifferent or poor success, while in England and on the European continent they are extensively and successfully used. The trouble here is that storage batteries are worked with too small a margin of safety. The whole situation was stated in few words by Mr. W. W. Griscom, in his paper read at the annual meeting of the American Institute of Electrical Engineers in Philadelphia, last May. He said: "A storage battery continually worked to its commercial rating is a commercial failure. A storage battery worked sufficiently within its capacity is invariably a commercial success." If this axiom were heeded more the storage battery would occupy a larger place in the estimation of the people than it does.

LEGAL.

THE DETROIT STREET RAILWAY CASE.

The United States Court of Appeals at Cincinnati has handed down a decision in the Detroit street railway case, unanimously reversing the opinion of Judge Taft, and deciding in favor of the company. The suit was brought by the city to oust the railway company from its streets. The principal point involved was the right of the company to operate under franchises that ran for a period longer than its corporate existence. The company's charter expired in 1893, and the franchise extended to 1909. The suit involved $1,000,000 in stock and $3,000,000 in bonds. The property has just passed into the hands of R. T. Wilson & Co., New York brokers.

The railroads to Atlanta report that large parties have engaged accommodations from the East. A large attendance at the convention is promised.

THE TAUSSIG ELECTRICAL SMELTING PROCESS.

Among the experimenters who have been engaged in electro-metallurgical work, says the *Manufacturers' Record*, none have achieved more important results than Edward Taussig, of Bahrenfeld, Germany. The process which he has been perfecting for some time past consists in first reducing and smelting the ore, and finally, in casting the metal thus produced Both processes are carried on in a vacuum, so that under the influence of rarefied air all bubbles of gas or air are removed, and the casting is thoroughly homogeneous.

The apparatus consists of a long, air-tight smelting chamber in which the hearth inclines towards a central opening, through which the metal passes into the mould. The chamber is filled with ore and flux or metal alone. The furnace is lined with glazed fire-bricks, which insulate it thoroughly and prevent any loss of current. Experiments have shown that within fifteen minutes sufficient heat can be developed to melt pig iron, and but little longer for Siemens-Martin steel.

As no carbon is present, the fused metals are almost pure, and the rarefied atmosphere existing in the furnace removes any gases produced, prevents oxidation or blistering and increases the fluidity of the metal, thus producing castings which are dense and homogeneous.

For smelting raw ores the most obvious advantage claimed for this process is that it can be worked wholly by water-power and without fuel in mountainous and remote districts which produce ores and have abundant water, but no coal. For fusing iron, steel or other metals for casting, the advantages claimed are rapidity of operation, improved quality in the castings, susceptibility of continuous working and—even where steam-power is used to generate the current—an economy in fuel which is estimated at from 30 to 50 per cent. It would appear that the practical limit of capacity will be a furnace or fusion channel from thirty-six to forty feet in length, and capable of containing at one charge about one and a half tons of metal. By working such a furnace with a current of 30,000 amperes and fifty volts—which would represent a force of about 2,000 horse-power, or somewhat less than the energy employed in the reduction of aluminum at Neuhausen—the entire charge of 3,000 pounds can be fused and run into castings within a quarter of an hour. By repeating the operation as rapidly as the charge can be replaced and smelted, a single furnace of this capacity can be made to turn out in a working day a large quantity of castings, and when motive power for generating the current is supplied by water, or even by steam made with a cheap quality of coal, the economy of the process over present methods would seem to be obvious.

Comparisons have been made with the well-known results of making iron and steel castings by smelting in a Siemens-Martin regenerative furnace, where from 1,000 to 1,400 pounds of coal are burned to smelt 2,000 pounds of iron. Assuming that water-power for the Taussig process is not available, and that the dynamo and air pumps must be worked by steam, it is claimed that the same result, the smelting of 2,000 pounds of iron or steel, can be effected by the consumption of from 720 to 800 pounds of steam coal, an economy of 50 per cent. in the use of fuel. This economy is still greater, if, instead of the foregoing comparison with smelting in a Siemens regenerator, the treatment of steel in crucibles is considered, where 1,200 pounds of the best coal is consumed for each 1,000 pounds of steel, and this proportion is increased to 1,500 or even 1,600 pounds when the coal used is of inferior quality and yields a large percentage of ash.

While the preliminary experiments, using a current of eighteen to twenty horse-power, have been successful in all particulars, the process has not yet been applied on a commercial scale. Works now almost completed at Copenhagen have a large Taussig furnace, and another similar plant is being erected in the south of France.

The experiments made with iron ore have resulted in the production of pig iron containing under three per cent. total carbon, and show that when desired it will be possible to reduce the carbon to the limit of that contained in steel. It has been estimated that a plant equipped with 500 to 600 horse-power, using a good quality 48 per cent. ore, can produce pig iron for $8.00 to $9.50 per ton, allowing $2.40 for the cost of ore. While this is not so low as iron is now produced at certain plants in the South, the cost can in all probability be brought below this figure where a water-power is available to generate the electrical current.

The most advantageous application of the process is in places where ores exist near to some available water-power, or where fuel is high-priced and such water-power exists near enough to permit transmission of the current without too great loss. It has been suggested that an electric generating plant might be erected near to coal mines and power generated by using slack coal in producers, the gas thus obtained heating boilers. From here the current would be transmitted to ore mines, where smelting furnaces would be erected. What success might be secured is, as yet, only a matter of conjecture, and until the plants in France and Copenhagen have placed the process on a commercial footing it is not safe to make calculations as to results.

Should success be attained, the South is an exceptional field for the process. The numerous water-powers in this section would permit the generation of electricity at very small cost, and where these water-courses have already been utilized in this way, dynamos giving the required voltage could readily be added to the plant.

Log Book—The 1895 Edition of Burgoyne's Log Book is now ready for delivery. There is a page for each day of the year, the size of the pages being 5½ inches wide by 9 inches long. A good quality of paper is used, and the book will be found very useful to business men. It is published by C. G. Burgoyne, 146 Centre street, New York city.

NEW BOOKS.

Following is a list of books just issued, copies of which we have received for review :

A Laboratory Manual of Physics and Applied Electricity. Vol. II., Arranged and Edited by Edward L. Nichols, Macmillan & Co., New York and London; price $3 25.

Electricity at the World's Columbian Exposition, including an account of the electrical exhibits, by J. P. Barrett; price $2,50.

Electricity, Electrometer Magnetism, and Electrolysis, by G. Chrystal, M. A., LLD., and W. N. Shaw, M. A., F. R. S. Reprinted from the Ninth Edition of the Encyclopedia Britannica, Macmillan & Co , New York; price $1.60.

The Telephone Hand Book, by Herbert Laws Webb, Electrician Publishing Co., Chicago; price $1.00.

Brooklyn Institute of Arts and Sciences. We have received a copy of the Sixth Year Book, of this Institute It contains the names of the officers and members ; copies of the constitution and by-laws ; a brief history of the Institute ; an account of the work of 1893–4 and a copy of the charter. It has 270 pages.

POSSIBLE CONTRACTS.

E A. Sweet, Pensacola, Fla., desires to purchase a 750-light alternating current dynamo with a switch-board complete.

Manufacturers of electric and gas fixtures will find it to their advantage to send their catalogues to J. E. Duval, Charlotte, N. C.

James Beech, Stephenville, Tex., can give information regarding a proposed electric light plant.

The Southern Electrical Mfg. & Supply Co., New Orleans, La., are in the market for two 80-h. p. boilers, one 100-h. p. automatic cut-off engine and one 100-h. p. heater.

D. L. McPherson, Abbeville, Pa., wants estimates on equipment for telephone exchange and lines.

The Interstate Telephone Co., Louisville, Ky., desires to purchase line equipment.

J. N. Du Bois, Sherman, Tex., representing the National Telephone Co., is endeavoring to establish a telephone exchange in that city.

Chas. S. Powell, of Richmond, Va., will establish a telephone system.

The Canal Street division of the Carrollton Railroad Co., New Orleans, La., is to be rebuilt and the trolley system introduced. Jas. Temes is the president, who should be addressed for further particulars.

John Barnett, of Hope Sound, Fla., is in the market for electroplating apparatus and wishes estimates.

It is reported that Grass Valley and Nevada City, Cal., are to be connected by electric railroad.

W. H. Rogers and W. Ware, of Gainesville, Tex., are interested in a project to establish an electric light plant in Ardmore, Indian Territory.

The City of Henderson, Minn., has decided to issue bonds for the purpose of installing an electric light plant.

An electric light plant is to be established in Lisbon, Ia., and bids for the same are invited. Address Mayor W. H. Runkle, for further particulars.

Address the Mayor of Kalamazoo, Mich., concerning $40,000 worth of bonds to be issued for the erection of an electrlc light plant in that city.

An electric street railway is to be built in Parkersburg, W. Va., by eastern capitalists, and work is to be commenced at once.

The proposition to issue bonds to the amount of $30,000 to build an electric light plant in Martin's Ferry, O., has been carried.

The City of Americus, Ga., is considering the advisability of erecting an electric light plant. For further particulars address the Mayor.

The Louisiana Electric Light Company, New Orleans, La , is considering a proposition to build an electric power station for street railway service.

The Southern Telephone Company, Bennettsville, S. C., has removed its business to Fayetteville, N. C.

An electric-light plant and water-works are to be established in Sulphur Springs, Tex. Address the Mayor for further particulars.

The Mayor of Fredericksburg, Va., can give information regarding the establishing of an electric light plant in that city.

The People's Telephone Construction Company, Wheeling, W. Va., has been granted a franchise to construct a telephone system. Address W. D. Johnson, secretary.

The Young Men's Christian Association, Hagerstown, Md., is contemplating the erection of a new building. For further particulars address the secretary.

Chas. J. Reynes has prepared plans for a sanitarium in New Orleans, La., to cost $15,000.

NEW CORPORATIONS.

Pennsylvania Automatic Telephone Co., Harrisburg, Pa., by Chas. L. Powers, Allegheny City, Pa.; Geo. W. Wilson, New Brighton, Pa.; and Chas. L. Addleman, Wilkinsburg, Pa. Capital stock, $5,000.

The Chillicothe Electric Railroad, Light and Power Co., Chillicothe, Ross County, Ohio, by Joseph P. Myers, Jno. A. Poland, Willard A. Story, Richard Enderlein and Jos. M. Klingesmith. Capital stock, $100,000.

The Wadsworth General Electric Co., Wadsworth, Medina County, Ohio, by W. B. Hansberger, Eli Overholt, Jno. A. Clark, A. M. Beck, F. G. McCauly, O. V. Bibble, J. P. Baldwin, and J. G. Grisimer.

The Syracuse and East Side Railway Co., Syracuse, N. Y. Capital stock, $20,000. J. L. Kyne can give information concerning the same.

Westlake Electrical Mfg. Co., East St. Louis, Mo., by C. T. Westlake, David Biggs, Edward and Chas. C. Collins. Capital stock, $100,000.

Magnetic Telephone Co., Oak Park, Ill., by Henry E. Pecimier, David J. Kenedy, and Geo. W. Wilson. Capital stock, $100,000.

The Great Kanawha Falls Water-Power, Electrical, Manufacturing and Land Company, Charleston, S. C., by A. O Patton, W. W Thompkins, W. F. Scott, T. F. Snyder and M. Levi, of Charleston ; Chas. M. Reed, of Baltimore, Md., and A. McClintock, of Philadelphia. Capital stock, $2 500,000.

NEW YORK NOTES.

Office of the Electrical Age,
World Building, New York,
October 8, 1894.

The Norwich Insulated Wire Co. have secured some valuable contracts from the leading electric railway companies of the country. Among them we mention the West Chicago Street Railway Co , of Chicago, Ill., and the West-End Street Railway Co. of Boston, Mass. The Norwich Company will furnish 300 miles of cable for each of the above roads of 500,000 circular mils capacity. The Norwich Company is to place these cables in the new underground system now being installed by the National Conduit Company of New York. Mr. Geo. Jackson, manager of the Norwich Company, has been hustling on these orders for several months past and has done himself proud in the work he has accomplished. He has several more large contracts to close for street railway underground systems.

Mr. Edward E. Winters, contracting, constructing, electrical and mechanical engineer, has lately opened offices at 203 Broadway.

Coho & Co., contracting and electrical engineers, of 203 Broadway, city, report an active business and many contracts under way.

Mr. Perkins, of the Mather Electric Co., was met in town lately and reports that his company is running its factories night and day to meet the many orders on hand for generators, etc.

Frank X. Cicott has recently opened offices at 39 Cortlandt street, for Pettingell, Andrews & Co., of Boston, Mass., and Dick, Kerr & Co., manufacturers of rails. Mr. Cicott is making a specialty of street railway supplies. He is very popular with street-railway people, and we wish him success in his new office.

Dr. J. B. De Lery, of 5 Dey street, has lately returned from an extended trip abroad and is looking as chipper as ever. It will be remembered that Dr. De Lery introduced into this country the Wenstrom system, and still holds an interest in the Wenstrom Company of Baltimore. He is also interested in other electrical enterprises.

W. A. H. Bogardus, general manager of the Brooklyn Heights Railroad Company, Brooklyn, N. Y., has resigned his position on account of ill health. Cyrus P. Smith, secretary and treasurer of the company, also resigned. Mr. Bogardus was elected to take Mr. Smith's place.

It is reported that the Brooklyn Heights Railway Company has reduced the salaries of all the employés, from the president down, with the exception of the motormen and conductors These retrenchments will, it is stated, effect an annual saving of about $200,000.

W. T. H.

TRADE NOTES.

The Metropolitan Electric Company, Chicago, has just arranged to take the product of a well-known glass factory for insulators. They will be able to furnish the market with standard grades of insulators at factory prices. A large stock will always be kept on hand and immediate shipments can be made.

The Kerite Co., 203 Broadway, New York, has unsurpassed facilities for quickly filling large orders for switchboard-feeder wire and cables, and underground cables and wire for electric railways. The company has lately closed several orders for these classes of wires and cables.

WHAT WILL THE NEW YORK CENTRAL DO NEXT?

After having his thirst whetted, like a tiger by the taste of blood, by the wonderful performances of Engine No. 999, the *genie* who presides over the transportation department of the New York Central Railroad is rampant again, and laboring persistently to find means of attaining the speed of lightning. He is at work in his cell, by stealth and at midnight, and before many moons have passed we expect to see a terrible apparition coming up the Hudson River like the war chariot of Jove.

We may expect a monster engine, with double boilers of enormous power and wheels as tall as a shot tower, which will trot up to Albany in an hour, skip over to Utica or Syracuse at half-an-hour schedules and cover the distance from New York to Buffalo in three hours. Then we shall need some means of artificial respiration. —*Medford* (*Mass*) *Mercury.*

Electrical and Street Railway Patents.

Issued October 2, 1894.

526,686. Electric Motor. John H. Clark, Boston, Mass., assignor to the General Electric Company, of New York. Filed Apr. 16, 1894.

526,704. Trolley-Wire Hanger. John J. Green, Boonton, N. J., assignor to the Loando Hard Rubber Company, same place. Filed June 4, 1894.

526,705. Trolley-Spring. Julius L. Hanson, U. S. Army. Filed May 14, 1892.

526,720. Electric Winding and Setting Clock. Henry Loriot, New York, N. Y., assignor to Henri F. Mouquin, trustee, same place. Filed Oct. 3, 1893.

526,721. Composition of Matter for Electric Conductors. Duncan Macfarlan, Philadelphia, Pa. Filed May 16, 1894.

526,722. Composition of Matter for Electric Conductors. Duncan Macfarlan, Philadelphia, Pa. Filed May 19, 1894.

526,723. Electric-Igniting Apparatus for Fire-Engines. William C. Matthias and Wilmer Hartman, Reading, Pa. Filed Oct. 2, 1893.

526,725. Electric Snap-Switch. Amandus Metzger, Schenectady, N. Y., assignor to the General Electric Company, of New York. Filed May 11, 1894.

526,743. Dynamo-Electric Machine. Edwin W. Rice, Jr., Swampscott, assignor to the General Electric Company, Boston, Mass. Filed Feb. 28, 1894.

526,756. Trolley-Guard. Henry J. Tanner, Lynn, assignor of one-half to Harry Fairfield Hamilton, Boston, Mass. Filed Apr. 2, 1894.

526,760. Electric-Alarm Operating Mechanism. Parker C. Thompson, Elmira. N. Y. Filed Dec. 19, 1893.

526,767. Electric-Railway Conduit. Robert B. Wilson, Cincinnati, Ohio, assignor of one-half to Jeremiah M. Wilson, Washington, D. C. Filed Jan. 2, 1894.

526,810. Apparatus for Putting Electric Motors into Circuit. Carl Hoffmann, Charlottenburg, assignor to Siemens & Halske, Berlin, Germany. Filed Oct. 29, 1892. Patented in Belgium Aug. 16, 1892, No. 100,765; in Italy Sept. 23, 1892, No. 32,443; in France Nov. 8, 1892, No. 223.298; in Austria-Hungary Nov. 18, 1892, No. 38,698 and No. 69,457; in Switzerland Nov. 30, 1892, No. 5,483; in Germany Jan. 7, 1893, No. 66,622; in Norway Feb. 3, 1893, No. 2,882; in Sweden June 20, 1893, No. 4,461, and in England July 10, 1893, No. 14,647.

526,813. Electrical Switch Setting, Indicating and Controlling Device. Karl Moderegger, Vienna, Austria-Hungary, assignor to Siemens & Halske, Berlin, Germany. Filed Nov. 15, 1893. Patented in Germany Sept. 6, 1891, No. 68,722; in Austria-Hungary Jan. 29, 1892, No. 42,613 and No. 76,773; in Belgium Nov. 11, 1892, No. 102,331; in France Nov. 22, 1892, No. 225,853; in Switzerland Nov. 24, 1892, No. 6,232; in Italy Dec. 1, 1892, No. 33,076, and in England Mar. 3, 1893, No 4,976.

526,825. Electric-Lamp Hanger. William S. Weston, Chicago, Ill. Filed Jan. 13, 1894.

526,835. Conduit Railway-Trolley. Robert J. Hewitt, St. Louis, Mo. Filed Feb. 9, 1894.

526 850. Conductor-Switch. George H. Benjamin, New York, N. Y., assignor to the firm of Siemens & Halske, Berlin, Germany. Filed Sept. 28, 1893.

526,851. Car-Fender. Ambrose J. B. Berger, Hingham, Mk., assignor to the Steel Cable Engineering Company, of Maine. Filed Nov. 15, 1893.

526,857. Pedestal and Axle-Box for Car-Trucks. Edward Cliff, Newark, N. J. Filed Apr. 4, 1894.

526,860. Elastic Wire Support for Beds or Seats. Gustav Dominick, Cologne, Germany. Filed Apr. 1, 1893. Patented in Germany, Sept. 13, 1892, No. 68,639; in England, Jan. 8, 1893, No. 1,480; in Switzerland, Jan. 24, 1893, No. 6,319; in Belgium, Feb. 1, 1894, No. 103,226; and in Austria-Hungary, June 17, 1894, No. 6,230 and No. 19,733.

526,865. Telephone. Hosea W. Libbey, Boston, Mass. Filed Aug. 1, 1892.

526,867. Rheostat. Duncan Macfarlan, Philadelphia, Pa. Filed May 18, 1894.

526,879. Dynamo Regulator. John Van Vleck, New York, N. Y. Filed May 31, 1894.

526,888. Transmitter for Telephones. Mark O. Anthony, Cincinnati, Ohio. Filed July 28, 1894.

526,893. Fire-Alarm-Telegraph System. William E. Decrow, Boston, Mass., assignor to The Gamewell Fire-Alarm Telegraph Company, New York, N. Y. Filed Mar. 13, 1893.

526,897. Electric-Railway Trolley. Robert A. Grant, Providence, R. I., assignor of three-fourths to August F. Borchardt, Clifton A. Hall and John Conrad Schott, same place Filed Jan. 22, 1894.

526,909. Electric Lock. Theodore P. Pratt, Boston, assignor to James Wilkinson, Everett, Mass. Filed May 7, 1894.

526,949. Car-Fender. William L. Shockley, Colorado Springs, Colo. Filed Dec. 20, 1893.

526,963. Conduit for Electric Railways. Michel-Angelo Cattori, Rome, Italy. Filed Apr. 3, 1894. Patented in Italy, May 13, 1893, LXVI, 373, May 24, 1893, LXVI, 419, and Aug. 22, 1893, LXVIII, 75.

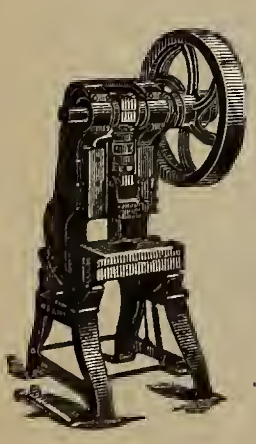
526,966. Electric Friction-Brake. Bergen Davis, Newark, N. J. Filed Mar. 28, 1894.

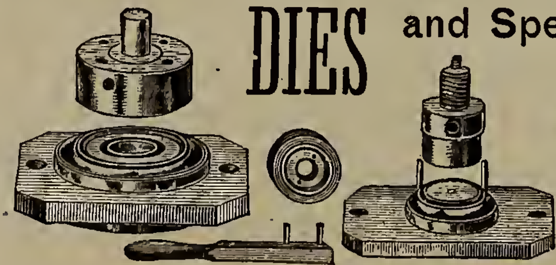
526,985. Automatic Switch for Electric Railways. Wilber S. Wright and John E. Venus, New Orleans, La. Filed Dec. 6, 1893.

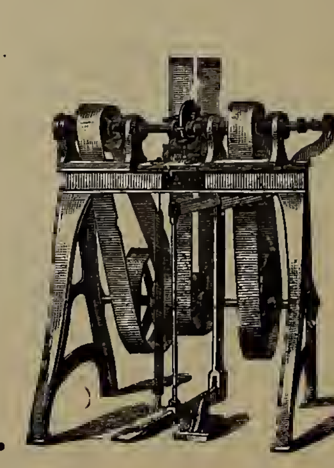
526,988. Electric Switch. Frank G. Beron, Waterbury, Conn, assignor of one-half to James F. Gaffney, same place. Filed June 21, 1894.

527,004. Car-Fender. Robert Raphael, Brooklyn, N. Y, assignor to William J. McKelvey, same place. Filed Oct 27, 1893.

527 037. Electric Mouth-Battery. Levi L. Funk, Chicago, Ill. Filed Nov. 27, 1893.







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CONTENTS.

THE ATLANTA CONVENTION.

During the present week Atlanta, Ga., will be the scene of unusual bustle and activity. When a crowd of street railway men get together the air of the place where they meet is full of life, and everybody feels their presence. Street railway men of today are progressive and enterprising. The railway men who meet in Atlanta this week come to hear of the latest developments in electric railroading, and they will hear an interesting story of progress and activity. The most brilliant scientific minds of the day are devoted to electrical development in all its forms, and the electric railway offers a greater field at the present time than all others for enterprise. Why should it not? It is bringing what were scattered communities into closer relations with one another, and enables the citizens' and their families to live in the suburban districts, where they can breathe pure air and get away from the noise and bustle of the business districts. The electric railway brings happiness and longer life wherever it goes, and the people who enjoy these blessings have such men as those who meet in Atlanta this week to thank.

THE AMERICAN STREET RAILWAY ASSOCIATION.

HISTORICAL SKETCH.

The Atlanta meeting is the thirteenth held by the association. The association was organized in Boston, Mass, in 1882.

The following table gives the names of the places of meeting of every convention since the organization of the association, and the name of the president during each year. The organization meeting is counted as the first.

MEETING.	YEAR.	PLACE OF MEETING.	PRESIDENT.
2.	1883.	Chicago.	H. H. Littell.
3.	1884.	New York.	Wm. H. Hazzard.
4.	1885.	St. Louis.	Calvin A. Richards.
5.	1886.	Cincinnati.	Julius S. Walsh.
6.	1887.	Philadelphia.	Thomas W. Ackley.
7.	1888.	Washington.	Charles B. Holmes.
8.	1889.	Minneapolis.	George B. Kerper.
9.	1890.	Buffalo.	Thomas Lowry.
10.	1891.	Pittsburgh.	Henry M. Watson.
11.	1882.	Cleveland.	John G. Holmes.
12.	1893.	Milwaukee.	D. F. Longstreet.
13.	1894.	Atlanta.	Henry C. Payne.

Mr. William J. Richardson has been secretary of the association since its organization.

JUDGE LACOMBE'S DECISION.

Our readers will find in this issue the full text of the decision rendered on the 8th inst. by Judge Lacombe, of the U S. Circuit Court for the Southern District of New York, in the case of the Accumulator Company *vs.* The Edison Electric Illuminating Co., of New York, enjoining the defendant from purchasing or using the chloride battery, manufactured by the Electric Storage Battery Co., of Philadelphia. The decision is far reaching in its scope, for it would seem that the plate of the chloride battery is not only an infringement after the tablets have been reduced, but that it is an infringement the moment the plate is cast around the original tablet of chloride of lead and chloride of zinc; for the reason that the chloride of lead and chloride of zinc tablet is matter to *become active*, and the Swan patent covers "active matter or matter to become active." But the most interesting feature of the decision is the doctrine of laches, or neglect to sue on the part of the complainants, as laid down by Judge Lacombe; and that is, that a patentee is not compelled to sue every infringer who comes to his notice, provided he can show that he is diligently prosecuting any one infringer for the purpose of establishing his rights under his patent. This doctrine would seem to be founded in reason and common-sense, for it is practically impossible for a patentee to prosecute every infringer that may appear. It would be a great hardship to be compelled to do so, and the cause of insupportable expense.

ATLANTA—THE CONVENTION CITY.

ATLANTA, GA., VIEWS.

1.—Union Depot.
2.—Post Office and Grady Monument.
3.—Aragon Hotel, Convention Headquarters.
4.—Power House Collin's Park and Belt Line R. R.
5.—Convention and Exhibition Halls, Piedmont Park.
6.—Entrance to Piedmont Park.
7.—Joel Hurt, President Atlanta Cons. Street Railway.
8.—H. N. Hurt, Superintendent Atlanta Cons. Street Railway.

INTRODUCTORY.

When a person visits a place for the first time it is quite natural to entertain a desire to know something about the locality—its history, its people, its characteristic features, its industries, etc. For the benefit of those in attendance at the convention in Atlanta of the American Street Railway Association, we have prepared a short description of the city in its many aspects and a brief historical sketch of the place, in the hope that it may aid the reader to better appreciate some of the things he sees and enjoys during his stay. This year's convention has special interest for the reason that it is the first time in the history of the association that a meeting has been held in a southern city. The selection of Atlanta was a wise one on account of its central location and accessibility from every direction. It is distant from New York 876 miles, and from Chicago 733, and is the focal point of nine trunk lines of railroad.

Atlanta is in one sense a new city. In 1843 its site was an unbroken forest, and it is difficult to imagine why the locality was selected for the site of a city—not that it is an unfavorable spot, but on account of the absence of any of the natural advantages that are usually considered indispensable to the prosperity of a community. However, we shall not consume any of our readers' time in speculation, but pass on to the more practical things.

HISTORICAL.

The first corporate name given to the place was "Marthasville," in honor of the daughter of ex Governor Lumpkin of Georgia. In 1847 a charter was granted for the municipal government of the new town under the new name of "the City of Atlanta." The name "Atlanta" was suggested by J. Edgar Thomson, then chief engineer of the Georgia Railroad and afterwards connected in a prominent capacity with the Pennsylvania Railroad. The idea of the name occurred to him, it is said, from the geographical position of the place. It is immediately on the dividing ridge separating the waters of the gulf from those of the South Atlantic slope, and has an elevation of 1100 feet above sea level. Its climate, therefore, is comparatively mild, and its atmosphere is dry, pure and healthy. No doubt these conditions have largely contributed to its growth, thrift and prosperity.

The city covers an area of 9.62 square miles, and has a population of 104,421. It is within easy reach of the coal and iron fields of the South and is the great wholesale distributiug point for the Southeast.

During the late war Atlanta was the theatre of many important events. This was the objective point of General Sherman in his famous campaign of 1864. After many sanguinary conflicts in his progress from Dalton (from the 7th of May to the last of August) he finally succeeded in reaching his goal and taking possession of the city on September 2. This he held until November 15, when he set out upon his grand "march to the sea." Before starting on this movement he compelled all the inhabitants to leave, and by general conflagration left the city in ruins. But after the war was over new life and energy animated the place, and as early as the fall of 1865, Atlanta, Phœnix-like, was "rising from her ashes." In 1868, by the new constitution, made in pursuance of the requirements of the reconstruction acts of Congress, Atlanta was established as the future capital of the State.

Atlanta has been the capital of Georgia since 1868. The State Capitol is one of the most imposing buildings in the city. It is built of limestone, granite and marble, and is 325 feet long on the east and west face, and 172 feet north and south. The highest point of the dome is 257 feet from the ground, and the building cost $1,000,000.

HOTELS.

There are several excellent hotels in Atlanta, among which may be named the Aragon (which is the association headquarters), the Kimball House, the Markham House, the Arlington, the Leland, the Marion, the Albemarle, and the Cooledge.

The Aragon Hotel is located on the corner of Peachtree and Ellis streets, and is about five blocks from the Union Station. This hotel is comparatively new, and has about 200 rooms. It is conducted on both the American and European plans.

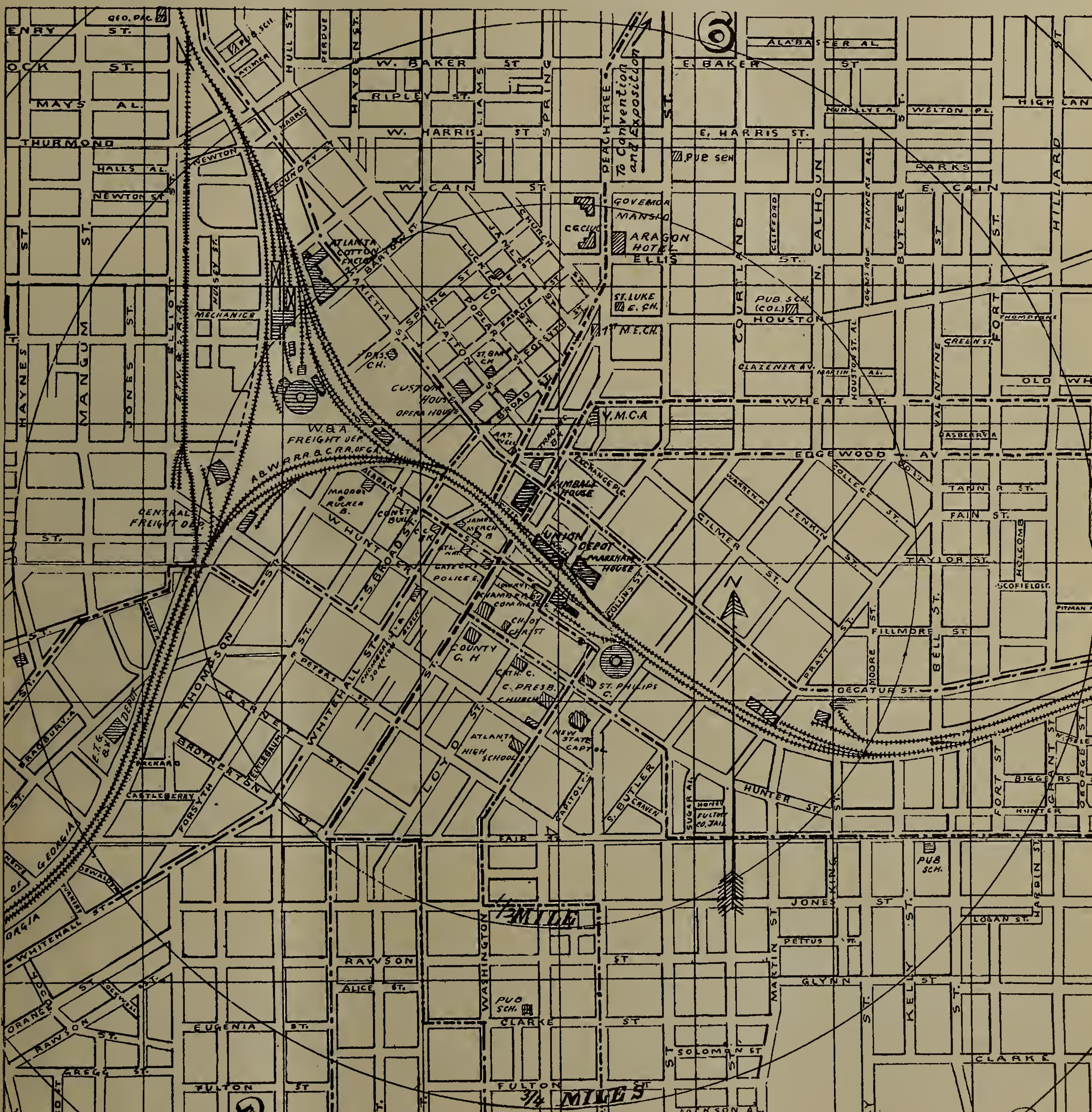
The Kimball House is on Pryor street, opposite the Union Station, and has 450 rooms for the accommodation of guests. It is conducted on the American plan. It is a fireproof building and has a central arcade 60 x 100 feet, which is open to the skylight, with wide balconies upon each floor.

STREET RAILWAYS.

In the matter of street railways Atlanta is ahead of all other Southern cities excepting New Orleans. The aggregate length of track in the city and suburbs is over 100 miles, which is operated by four companies, namely: the Atlanta Consolidated Street Railway Company, the Atlanta Traction Company, the Collins Park and Belt Railroad Company, and the Lithia Springs Railway Company.

THE ATLANTA CONSOLIDATED STREET RAILWAY COMPANY.

This company operates 70 miles of track, and was formed by the consolidation in 1891 of several lines.



GUIDE MAP OF ATLANTA, GA.

In 1889 the work of introducing the trolley system was begun and on August 24 of that year the first electric car on the line was run. Since that time all the lines in the city have been rebuilt and electric power substituted for animal power. The gauge is the standard —4 feet 8½ inches—rails of different sizes being used. These include 40, 45 and 56 lb. rails of the girder type, and T rail. The company has 104 cars in all, 94 motors and 10 trailers, and the lines are operated on the Thomson-Houston system. Almost every car manufacturing concern in the United States is represented in the rolling stock of this company—Stephenson, Brill, Pullman, Jones, and the Fiegel Car Company. Most of the cars are mounted on Bemis trucks, and the company makes its own car wheels.

The main power house is located about three miles from the centre of the city, and is near the Exposition building, where the meeting of the Street Railway Association will be held. The main buildings of the plant are of brick, and the power equipment consists of two Cooper engines of 300 H. P. and one of 500 H. P., driving two 300 K. W. T.-H. generators. The 500 H P. engine drives a 500 K. W. generator. The steam plant consists of three return tubular boilers of 125 H. P. each, made by the Bigelow Company, New Haven, Conn.

The company manufactures most of its own supplies, including car wheels, gears and trolley wheels. Thomas Elliott, the company's chief engineer, is the designer of all the appliances used in production of supplies, and she has exercised considerable ingenuity in devising the same.

The officers of the Atlantic Consolidated Street Railway Company are as follows: President, Joel Hurt; Vice-President, E. Woodruff; Secretary, T. K. Glenn; Treasurer, R. J. Lowry; General Superintendent, H. N. Hurt; Purchasing Agent, W. H. Glenn; Electrician, N. W. L. Brown; Chief Engineer of Power Station, T. Elliott. The company has a capital of $2,000,000.

THE ATLANTA TRACTION COMPANY.

This company was organized in 1891, consolidating the Atlanta McPherson Barracks and West End R'y Company and the Grant Park Railway Company, the lines extending from Alabama street, the business centre of the city, five miles to Fort McPherson, the U. S. army post, in the suburbs of the city, with a line three miles long connecting at Richardson street, and running thence to Grant Park, the largest park in the city.

Subsequently, in 1893, the company purchased the Atlanta City Street Railway Company, a line running from the Union Depot to Decatur, a distance of seven and one-half miles, with a branch two miles long to East Lake, one of the most popular of the pleasure resorts around the city. After purchasing this line, a mile of road was built on Forsyth and Ellis streets, connecting the two properties, and giving a continuous line through the business centre of the city, and one reaching all the prominent points of interest.

On account of the severe and unlooked-for depression of 1893, the company was unable to carry through the financial arrangements that it had planned, and the management considered it the best policy, in May, 1894, to temporarily put the property in the hands of the court. For this purpose the May interest was defaulted on the bonds, and a receiver applied for. W. C. Hale, the vice-president of the company, and Judge E. B. Rosser, one of the largest stockholders, were appointed receivers.

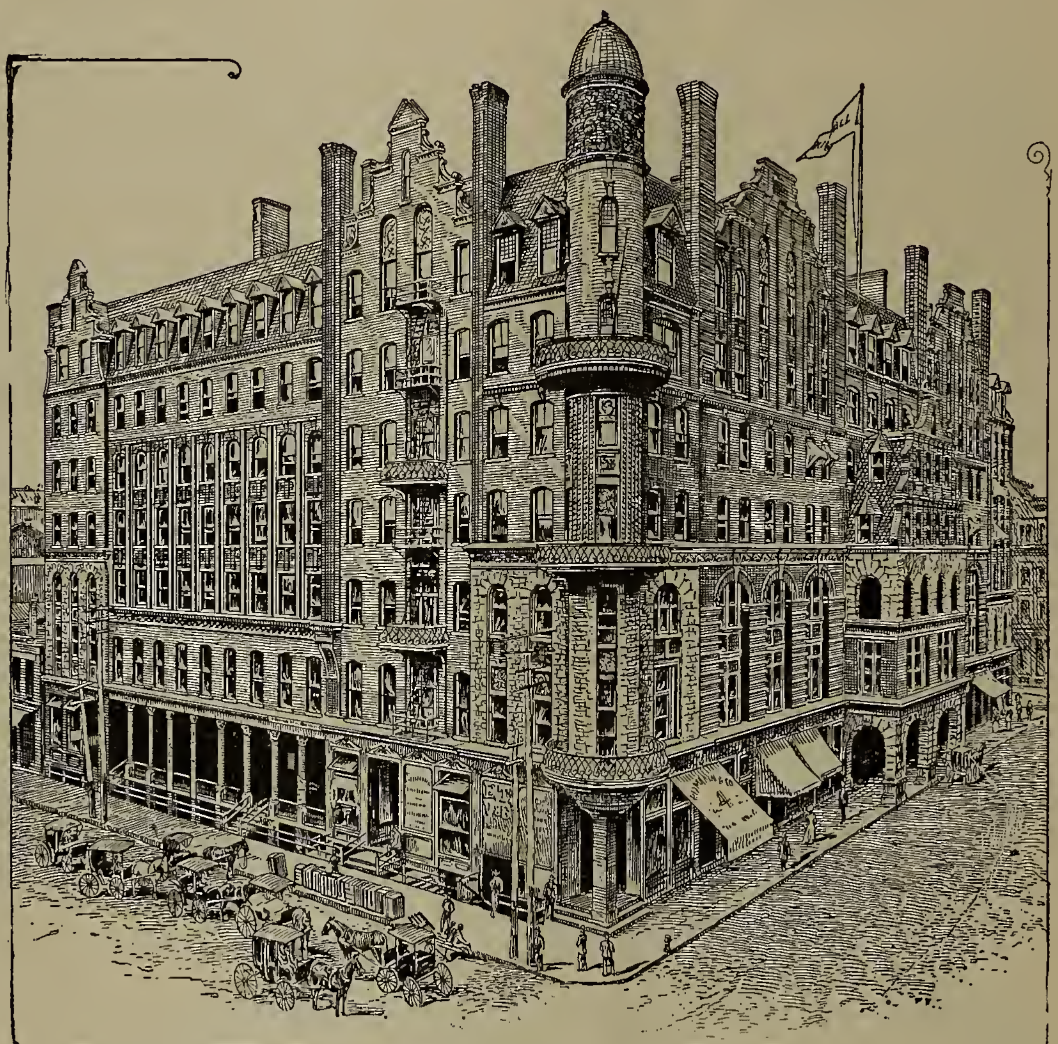
The management feels confident that, with so valuable a property, its temporary embarrassment will be adjusted, and its reorganization carried through.

The company operates twenty miles of track, and is a single track road with switchback turnouts. Two power houses supply the electric power, one being located in the southwestern part of the city, and the other on Irwin Street. The power in the first-named station is generated by one 100 K. W. Edison generator and two 100 K. W. multipolar Eddy generators.

The cars are of the Brill and American car companies' make and are mounted on Brill, McGuire and Robinson trucks. Westinghouse, Edison, and Detroit motors are used under the cars.

THE LITHIA SPRINGS RAILWAY.

When completed, this line will run from near the post-office, in Atlanta, to Lithia Springs, a popular resort twenty-two miles from the city. Information regarding this line we found difficult to obtain, but as far as we can learn at this writing about six miles of the road have been put into operation. The line is projected to develop suburban property, and to establish a park at the river, where popular amusements and all forms of recreation will be provided. T rails are mostly used in the track construction, the Johnson girder rail being laid down in the paved streets in the city.



KIMBALL HOUSE, ATLANTA.

THE COLLINS PARK AND BELT R. R.

The Collins Park and Belt R. R. was built during the spring of 1892 with the intention of developing the country north and west of the city, the promoters being C. J. Simmons and W. R. Baker, two prominent residents of Atlanta. The road-bed is of unusually substantial construction, consisting of fifty-six pound T rails, spiked direct to 6 x 8 sawed pine sleepers, the rail joints being bonded with O galvanized iron wire, supplemented by a continuous O iron wire, thus eliminating any possible open circuit in the return or ground current and greatly facilitating track repairs. The grading of this road was an expensive piece of work; many deep cuts, and high fills, and ten trestles (one three hundred feet long) being necessary on the nine miles of track at present being operated. The power-house, situated some five and a half miles from the city terminus, is a substantial stone structure, containing two Allis-Corliss engines, 18" x 44" cylinders, with fly-wheels 18 feet in diameter and 24" face, making ninety revolutions per minute. They are belted direct to two

LIGHT AND POWER STATION OF GEORGIA ELECTRIC LIGHT CO., ATLANTA, GA.

Short 36-inch, 300-ampere generators of the multipolar type, making 500 revolutions per minute. Steam is furnished by three 200 horse-power return tube boilers made by E. H. Jones & Co, of Cleveland, O. The feed pumps are of the Worthington pattern, with 8" steam and 6" water cylinders. As a rule one boiler suffices for the ordinary business of the road.

This company owns two Brill 16-foot box and seven eight-seat open cars, all mounted on Dorner & Dutton trucks. On each axle is mounted one Short 20 horse power single reduction motor. The controlling stands and rheostats (the latter having twelve ohms resistance) are of the Short type, as is also the overhead line construction. As before stated, the primary object in constructing this road was the development of idle land. Unfortunately the financial depression coming on about this time greatly upset the fond hopes of the builders. The day when the water-power of the Chattahoochee River will be utilized is not far off and the prospects are that the hopes of the originators will, ere long, be fulfilled.

A considerable freight business is done. The principal commodities hauled being sand, brick, cord wood, lumber, tobacco and garden truck. Small freight cars trailed behind the regular cars have proven the most convenient and profitable. A newly opened cemetery affords an opportunity for the use of special funeral cars, and the innovation has been received with much favor by the public.

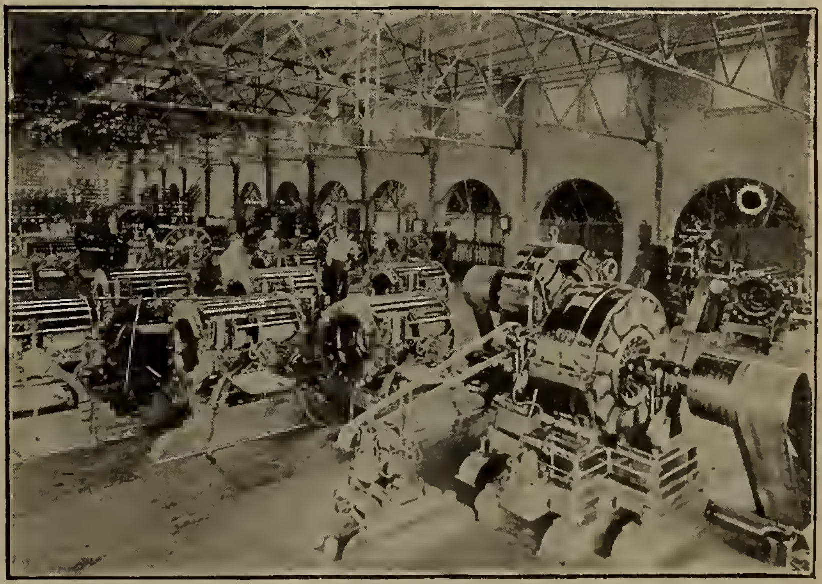
Four cars are in daily operation, from 5.15 A. M. until 9.15 P. M., and run on thirty minutes headway. Two fares are charged, but the five-cent limit extends over six miles from the city.

As originally organized, the company was officered by President J. K. P. Carleton, Treasurer Darwin G. Jones, and J. M. B. Carleton, general manager. Financial troubles, however, sent the property into the hands of a receiver, W. Darr, who was appointed by the court in March of last year, and who still continues in that capacity. The northern terminus is at the Chattahoochee River, and during the summer many thousands journey to its banks in search of recreation and pleasure.

At many places along the line earthworks and forts, still in a good state of preservation, can be seen. These were constructed to oppose the advance of Sherman's army during the late war.

ELECTRIC LIGHT.

The city is lighted by 400 arc lights, of 2,000 C. P. each, and 600 incandescent 75 C.P. lamps. They are burned all night every night in the year, and cover an area of ten square miles. The Georgia Electric Light Company is the principal one in the city, its plant being located on the outskirts of the city. It is one of the largest and most complete lighting plants in the entire South. Current is not only furnished for arc and incandescent lights, but also for power purposes, power being furnished to operate a part of the Atlanta Consolidated Street Railway Company's system, and to operate machinery in factories, printing offices and other establishments, also for the operation of elevators and electric fans in office buildings and residences. The building is fireproof, being constructed of brick and iron, and is built in three sections. The first section, shown on the right in the illustration, is the boiler room, while the engine room, which is open to the ceiling, occupies the middle section of the first floor,, and the left hand section is occupied by the counter-shaft, from which the generators, located on the floor above, are driven. Communication is had from the boiler room to the generator room by means of stairs and arched openings through the brick walls. Near the station is a small lake, from which the water for condensation is drawn, there being on the shore, to the left, a cooling tower with successive platforms covered with brush, through which the hot water descends, after being pumped to the top platform, whence it returns to the lake. The lake is about fifteen feet in depth, being an old quarry excavation, but which has filled from a subterranean stream, the water being pure and excellent for boiler purposes. Coal is delivered to the boiler room from the tracks of the railroad company about one-half mile



INTERIOR OF GEORGIA ELECTRIC LIGHT CO'S STATION.

from the station, by means of an electric locomotive and special coal cars run over an electric road, owned and operated by the company. To the right of the building is a coal shed, containing five hundred tons of coal, which is kept in stock in case of an emergency due to strikes.

The power equipment consists of nine return tubular boilers of the Bigelow type, in which soft coal is employed as fuel. These boilers are 250 horse-power each. The entire engine equipment aggregates 2825 horse-power, and consists of two pair of tandem compound 500 horse-power McIntosh & Seymour engines, each pair standing side by side and coupled to the same shaft, which carries a 14-foot fly-wheel, from which power is communicated, by means of a 40-inch belt, to one of the counter-shafts. There is also one Harris-Corliss tandem compound engine, of 800 horse-power, with a 20-foot fly-wheel and 48-inch belt, and one pair of tandem compound Greene engines, of 450 horse-power each, and an Armington & Sims engine of 125 horse-power, the latter being non-condensing. Both Deane, McIntosh & Harris jet condensers are employed.

The generator equipment consists of four multipolar 80 generators, of the T. H. type, which are owned by the Atlanta Consolidated Street Railway Company, and which supply power to their lines. There are also two multipolar 100 generators, of the General Electric type, which supply current for power purposes over special lines.

The lighting plant consists of nineteen M. P. T. H. arc dynamos, which supply current to 514 2,000 candle-power arc lamps and 556 75 candle-power incandescent lamps, for street lighting purposes. One hundred of these arc lamps are used for commercial purposes, and the other 414 for street lighting. There are five alternating dynamos, of the T. H. type, with a total capacity of 8,300 lights, which supply current for incandescent lighting, there being over 11,000 incandescent lights connected. The company is also making a specialty of alternating arc lamps, and on September 1 had about seventy of these lamps in use on the meter system. They have opened up an entirely new field of lighting and have not, with very few exceptions, replaced any incandescent lights. The officers of this company are H. M. Atkinson, president; and T. H. Edgar, general manager.

NOTES OF INTEREST.

Nine railroads centre in Atlanta, as follows: The Central; the Georgia; Richmond and Danville; Atlanta and West Point; Western Railway of Alabama; Georgia Pacific; Western and Atlantic; Nashville, Chattanooga and St. Louis; East Tennessee; Virginia and Georgia; Georgia, Carolina and Northern; and the Atlanta and Florida.

The principal public buildings are the State Capitol, the Court House, the United States Custom House, Fire Department Buildings, Police Headquarters, and Chamber of Commerce. There are also some unusually fine office and church buildings and college structures.

The business of the city amounts to $140,000,000 annually, exclusive of $30,000,000 produced by the various manufactories.

Total valuation of property returned for taxation, $78,000,000.

Atlanta has fifty miles of paved streets; 150 miles of paved sidewalks; fifty miles of sewers; and it has the finest school system in the South, there being nineteen grammar schools and two high schools, with an aggregate of 9,000 scholars.

The city has twenty-one banking establishments, with a total capital of $5,500,000, and the bank clearances average $4,000,000 weekly.

Atlanta enjoys the distinction of being the second largest horse and mule market in the world, last year's business amounting to $5,462,500, and the firm doing the largest cotton business in the world (S. M. Inman & Co.) is located here.

Atlanta is well provided with telegraph facilities. The Postal Telegraph main office is in the Gate City Bank Building, corner Alabama and Pryor streets, with branch offices at the Kimball House, Equitable Building, Old Capitol, and corner Broad and Alabama streets. The Western Union Telegraph Company's main office is in the Constitution Building, and there are branches in the Equitable Building, Markham House, Aragon Hotel, Alabama street and Marietta street. The Telephone Exchange is on the corner of Pryor and Mitchell streets.

The Union depot is the geographical centre of the city, the city limits being a circle whose radius is one and three-quarter miles from this point.

Piedmont Park, where the convention and exhibition halls are located, contains about 200 acres and lies just outside the northern limits of the city. About sixty acres of this space have been enclosed by a fence, and graded and arranged for exhibition purposes. The park is a little more than two miles from the Union passenger station and the hotels.

OUR ACKNOWLEDGMENTS.

The Electrical Age is indebted for favorsto Mr. T. A. Closs, manager of the Postal Telegraph Company, Atlanta, Ga.; Mr. T. H. Edgar, general manager of the Georgia Electric Light Company, Atlanta; Mr. Saunders, editor of the City Directory, Atlanta, and Mr. Litt Bloodworth, of the East Atlanta Land Company, Atlanta.

THE ATLANTA CONVENTION.

PROGRAMME OF THE MEETING.

Reports of Special Committees. Special committees will report on the following subjects: "A Standard Form for Street-Railway Accounts;" "Can the T Rail be Satisfactorily Used in Paved Streets?" "City and Suburban Electric Railways;" "Mail, Express and Freight Service on Street-Railway Cars;" "Standards for Electric Street-Railways;" "Street Car Wheels and Axles;" "The Best Method of Treating Accidents and Complaints;" "The T Rail Construction of the Terre Haute Street Railway Company," and "Transfers and Commutation." Notice has been received by the secretary that special papers will be read on the following subjects: "A Practical System of Long Distance Electric Railway Work;" "Brake Shoes;" and "Destructive Arcing of 500 Volt Fuses."

RAILROAD TRANSPORTATION.

All the Traffic Associations, except the Western Passenger Association, have authorized the sale of tickets at reduced rates—namely, a fare and one-third for the round trip. This concession applies to all attending the meeting—delegates, supply dealers and accompanying friends. The Traffic Associations that have extended this courtesy are the Trunk Line Association, the Southern Passenger Association, the Central Traffic Association, the New York and Boston Lines Passenger Committee, the Boston Passenger Committee and the Railway Association of Michigan.

Tickets for the return journey will be sold by the ticket agent at Atlanta at one-third the highest limited fare, to those *only* who hold certificates signed by the ticket agent at the point where through tickets to Atlanta were purchased, and countersigned by the Clerk of the convention, certifying that the holder has been attending the convention. Mr. N. W. L. Brown, of the Atlanta Consolidated Street Railway Company, has kindly consented to serve as clerk of the meeting for this exclusive purpose.

Tickets for the return journey will be furnished only on certificates procured not more than *three days* before the meeting assembles, nor later than *two days* after the commencement of the meeting, and will be available for continuous passage only; no stop over privileges being allowed on tickets sold at less than full fare. Certificates will not be honored unless presented within *one day* after the date of the adjournment of the convention. The certificates are *not transferable*, and the signature affixed at the starting-point compared with the signature to the receipt, will enable the ticket agent to detect any attempted transfer. In order to guard against the misuse or transfer of either a certificate or ticket procured through it, the association has been obliged to guarantee the redemption at full fare of any return ticket afterwards found to have been transferred or misused.

Tickets and certificates shall be obtained at least THIRTY MINUTES before the departure of trains.

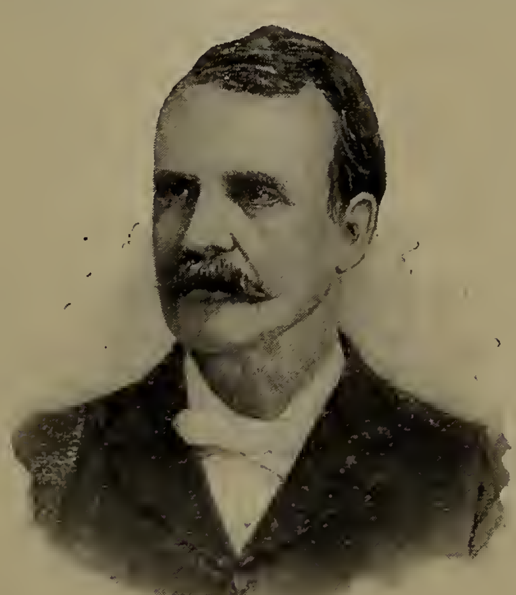
THE BANQUET.

The annual dinner will take place on Thursday evening, October 18. Each company that is a member is entitled to the free admission to the banquet of two of its officers. Each additional officer, or any other gentleman in attendance at the meeting not an officer of a member-company, will be charged ten dollars; ladies' tickets, five dollars each.

BIOGRAPHICAL.

HENRY C. PAYNE.

The subject of this sketch was born in Ashfield, Mass., on November 23, 1843. The early years of his life were spent in his native town, where he attended the country school. He afterwards went to the Shelburn Falls Academy, where he was graduated at the age of sixteen. After this he went into business in Northampton, Mass. At the breaking out of the civil war he enlisted in the 10th Massachusetts Volunteers, but owing to his youth he was not mustered in. In October, 1863, he moved to Milwaukee, and started life as a clerk in a dry goods



H. C. PAYNE, PRESIDENT AMERICAN STREET RAILWAY ASSOCIATION.

house, in which business he was engaged for four years. During this period he became interested in the Young Men's Library Association, and was elected its president. He afterwards became interested in politics and, in 1872, became leader in the organization of the Young Men's Republican Club. Under his guidance, the Association became a power, and is now known as the Republican Central Committee of Milwaukee County. In 1876 he was appointed postmaster of Milwaukee by President Grant, which office he held for ten years.

Mr. Payne is a man of extended business interests, and, in 1885, became president of the Wisconsin Telephone Company, which office he still holds. He is also a director of the First National Bank, and holds official positions in various railroads and other concerns in that section of the country.

He became interested in street railway work, and was president of the Milwaukee and Cream City Street Railway Company until this line became a part of the Villard system. He has since occupied the position of vice-president and general manager of the Milwaukee Street Railway Company, and under his management the change of the system to electricity was made. Mr. Payne is very popular and universally liked by street railway men and others who are acquainted with him, and under his guidance the American Street Railway Association has maintained its reputation as one of the most influential industrial organizations in the country.

WILLIAM JAMES RICHARDSON.

Mr. Richardson was born in Albany, N. Y., October 22, 1849, and is consequently now 45 years of age. His early education was obtained in the Experimental Department of the State Normal School at Albany, and afterwards he attended Bryant & Stratton's business school, until the election of his father, Mr. William Richardson, in 1864, to the presidency of the Dry Dock, East Broadway & Battery Railroad Company, New

WILLIAM JAMES RICHARDSON, SECRETARY AMERICAN STREET RAILWAY ASSOCIATION.

York. At that time he came to New York city with his parents, where he finished his business-school education. At the age of sixteen he was engaged in the importing hardware business, in which he remained until 1867, when he accepted a position as assistant to his father in the railroad business in Brooklyn, where Mr. Richardson, sr., had become largely interested in the lines controlled by the Brooklyn and Jamaica Railway Company. At the end of two years he gave up his business relations with the railroad company to complete his studies, and for this purpose entered the Collegiate Department of the Brooklyn Polytechnic and

Collegiate Institute, where he remained three years. In 1872 he was elected secretary of the Atlantic Avenue Railroad Company of Brooklyn, which position he held continually until July 1 of this year.

In 1873 Mr. Richardson married Mary Carrington Raymond, second daughter of John H. Raymond, L.L.D., president of Vassar College. Mr. Richardson is an active member of the Hanson Place Baptist Church, Brooklyn.

When the American Street Railway Association was organized in 1882, Mr. Richardson was elected secretary and treasurer, and has continued in this office ever since, being re-elected annually.

Mr. Richardson has visited Europe several times, on each occasion taking special interest in city passenger transportation in the cities visited on the Continent.

No other member of the American Street Railway Association is better known and liked than Mr. Richardson. He goes about in a quiet and unassuming way, but he manages to dispose of an enormous amount of business, and he receives everyone with the kindliest attention.

It gives us pleasure to be able to present to our readers an illustration of the features of Mr. Richardson.

THE GENERAL ELECTRIC COMPANY AT THE CONVENTION.

The exhibit of the General Electric Company at the Atlanta Convention will be of the elaborate nature which befits its position. It will comprise motors, controllers, other car equipment parts, station switchboard panels, line material, wattmeters, etc.

The motors will be shown not only in the exhibit proper, but mounted on cars will be operated on the lines of the Atlanta Street Railway Company. Ample opportunity will be afforded for a close and critical examination of these motors and of the component parts which enter into their construction. The motors shown in operation will act in conjunction with the "K" controller, and those interested will be enabled to investigate the merits of the combination. The principle of the magnetic blow-out device will also be shown and explained and its action demonstrated. This principle is embodied in all other devices in which electric arcs may occur, such as switches, fuses, lightning arresters, etc.

Several sizes of generator and feeder panels for station switchboards, all of black marbleized slate, with the necessary instruments mounted thereon, will also be shown. These panel boards are made in various capacities to suit the requirements of the plant, and have been devised so that the switchboards may be increased in size as the station grows, merely by the addition of other panels.

The line material exhibited will embody several improvements of an important character, which have become necessary by the increased demands of railroad service.

The Thomson Recording Wattmeter in its portable form for testing on moving cars will also form an imimportant item of the exhibit, which will be illuminated by means of Thomson '93 arc lamps for railway circuits, connected in series and operating on the railway lines. They have been especially designed for use in power houses, car barns and elsewhere where light is desired, from a 500-volt circuit.

The exhibit will also comprise samples of underground feeder-tubing, with models of junction boxes and taps, and amongst the literature which will be distributed will be found a special pamphlet dealing with the application of the three-wire system to street railway work.

The interests of the General Electric Company will be in charge of Mr. W. J. Clark, General Manager of the Railway Department. He will be ably assisted by Messrs. W. H Knight, Chief Engineer of the Railway Department, Theo. P. Bailey, H. H. Corson, H. J. Crowley, W. B. Potter, H. C. Wirt and A. K. Baylor.

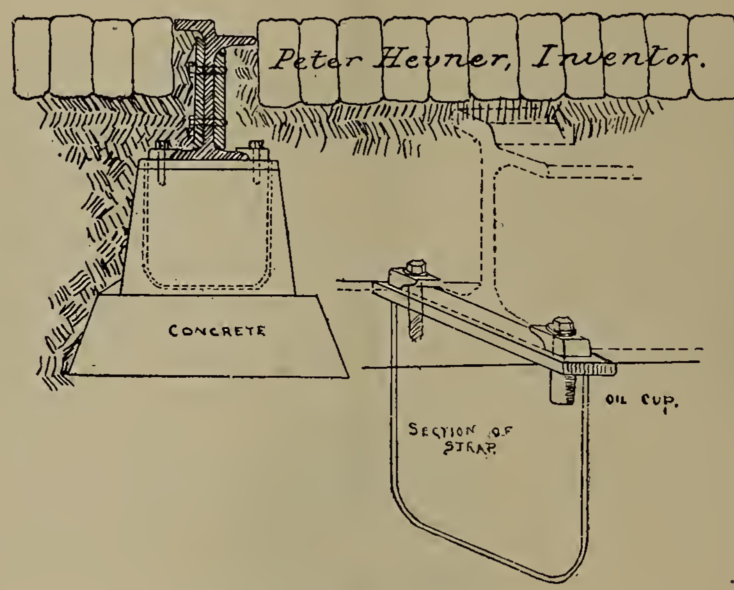
Visitors to the Convention will find a warm welcome at the Atlanta office of the company, and, indeed, anywhere the General Electric Company's representatives may be found.

THE HEVNER RAILWAY CONSTRUCTION SYSTEM.

A new system of railroad construction has recently been brought out and is now in the market.

The main features of the system consist of the method of supporting the rails, ties being dispensed with entirely. The rail supports are in the form of piers, made of Portland cement, 18 inches square at the base and 18 inches in height. These piers are made in two horizontal sections, the upper section being a little smaller in its base area than the upper surface of the lower section. Both parts taper slightly.

In the construction of the upper section of the pier an iron U-shaped strap is moulded, the upper ends of



HEVNER RAILWAY CONSTRUCTION.

which provide a fastening for an iron plate. Two iron lugs are screwed to this plate and hold the base of the rail with a firm grip. The screw bolt of each lug passes down into an oil cup embedded in the concrete pier, the object of this arrangement being to keep the bolt from rusting and to render its removal a matter of facility in case of necessity.

In building a road on this system the piers are placed five feet apart between centres. Besides doing away with the use of ties it is practicable to lay smaller rails, thus saving thirty or more per cent. in iron and cost of rails. All of the unavoidable expense in the construction and maintenance of road beds of the ordinary type, such as renewals of ties, tamping, handling, etc., are also done away with.

It is claimed by the inventor of this system, Mr. Peter Hevner, that a saving of $500 a mile is effected in construction alone, by its use, not to speak of the saving in renewals, etc. On Western roads the cost of tie renewals is an enormous amount each year. While the saving to the railroad company is great, the citizens of the community come in for a share of benefits, in the absence of torn up streets for the purpose of effecting repairs.

The piers are constructed to stand a crushing pressure of more than 300 lbs. to the square inch, and they are as hard as adamant.

In Montreal practically the same system of construction is in use, and it has successfully withstood the severe frosts of that climate, showing no signs whatever of deterioration. Negotiations are now pending for the building of 60 miles of road on this system in one of the large Western cities, and 27 miles of single-track line are to be built between Germantown to and through Frankford, Pa.

A model of the Hevner system can be seen at the office of Bloomer, Bros. & Co., the general agents, 111 Havemeyer Building, New York city.

PRINCIPLES OF DYNAMO DESIGN.

BY NEWTON HARRISON, E. E.

(*Continued from Page 199.*)

The external surface of a coil has much to do with the determination of its depth and the cross section of wire used. A coil whose external surface is small with respect to the number of turns used, or in other words, a very deeply wound coil would be so limited in its power of radiation that necessarily an accumulation of heat would occur and greatly raise the temperature of the coil above the surrounding air.

There must therefore be some relation existing—such that the proportion of energy wasted in a coil and supplying heat to the surfaces of radiation—that rises of temperature can be predetermined and controlled to limits within our ordinary compass.

Therefore it is at once seen that, as the size of wire used will be dependent upon the radiating surface, the depth of coil winding, the energy wasted in heat and the number of turns, such limits may be determined.

It therefore necessarily follows that if a coil be so proportioned that for every unit of heat developed there be an allowance made of a certain number of units of surface to radiate heat, and this ratio be strictly adhered to throughout, the rise in temperature above a certain limit can never occur.

All heating due to an electric current is measured by $C^2 R$, and the number of units of heat developed in a conductor is proportional to the resistance, the square of the current and to the time the current lasts, or

$$H = C^2 R t \times .24 = \text{Calories.}$$

H = units of heat (heat that will raise 1 gram of water 1° Cent.)
C = current.
R = resistance.
t = time.

$$C^2 R = \text{watts} = \frac{E^2}{R}$$

It can be easily shown that in the case of a body heating by an electric current the product of $C^2 R$ = watts. The material of which a body is composed and its geometrical dimensions determines the rise of temperature. A heavy wire of great length will generate the same amount of heat as a short, thin wire; but having a greater volume of metal to heat does not act to such a perceptible degree.

The finer wire may become hot or incandescent before the heavier wire becomes uncomfortable to the touch.

If W = weight in grammes,
S = specific capacity for heat,
θ = rise in temperature Centigrade,

then

$$\theta = .24 \frac{C^2 R t}{S W}$$

applying the formula in its fullest sense and calling the specific heat of copper .094, we have then if No. 10 B. and S. be considered with a heat waste of 10 watts for 1 minute.

if W = 100 grammes.
S = .094
θ = degrees Centig.
$C^2 R$ = 10.

$$\theta = .24 \times \frac{10 \times 60}{.094 \times 100}$$
$$= 15.32° \text{ Cent. or } 27.6° \text{ Fahr.}$$

It is of course understood that certain modifications would have to be effected in order to more extensively apply this formula for general use; for instance, the rise in temperature for different depths of winding of various gauges would be a matter of necessary investigation also as a factor in determining the current density at which the current would flow. All these conditions in total would help increase or decrease the number of circular mils per ampere in a wire to a point surprisingly above and at times as equally below common practice. The limiting conditions in all cases are a function of the coil surface, or extent and rapidity of radiation, also the amount of metal per unit of energy to be raised in temperature.

A body would rise in temperature if the supply of heat be uniform until it is dissipating as much into the atmosphere and surrounding objects as it is receiving; then its temperature becomes constant.

In general, an allowance of from one square inch to an inch and a half is allowed per watt in a coil to radiate heat.

A square inch of surface heated 1° Fahr. above the surrounding temperature will dissipate the heat of $\frac{1}{225}$ of a watt.

As there are 746 watts to a horse-power, each square inch will radiate

$$\frac{1}{225 \times 746} = \frac{1}{167850} \text{ H. P. at } 1° \text{ Fahr.}$$

As a general rule, all coil windings are in cross sections of copper more than the current requires for its flow. The capacity of the wire is very great for but a small current at times. The E. M. F. is a factor which greatly affects this state of affairs also; because the current dependent upon the voltage for its very existence, and the size of wire dependent upon the square of the current, the E. M. F. and size of wire express a relationship which effects an influence upon the length of the wire used if an imposed limit of temperature be resolved upon.

The Atlantic cable, for the passage of but a few amperes at a *low voltage*, would require a cross section perhaps greater than at present, in order to be of a required ampere length or more exact equivalent of ampere turns.

Should a larger safety factor be used—namely, 1½ square inches per degree Fahr. for radiation—then the horse-power emitted as heat energy becomes less, or, $\frac{1}{338}$ of a watt per square inch per degree Fahr.

At this rate the proper proportioning of the winding to prevent any but a definite rise of temperature becomes a matter of absolute surety.

With a certain calculated number of ampere turns and size of wire, which will incidently necessitate a certain depth of winding, a radiating area follows, which by this rule may be tested as to its rise of temperature. If it be insufficient for the proper and rapid dissipation of heat it must either be increased by the use of more wire or by the reduction of ampere turns by a change in the magnetic circuit.

Silvanus Thompson has developed a table covering the above ground most exhaustively by the application of the formula given by Forbes.

Rise in temperature Fahr. = 225 × watts lost per square inch.

(*To be continued.*)

A RELIABLE NON-MAGNETIC WATCH AT LOW PRICE.

The Charmilles watch has rapidly come into favor among electrical workers on account of its non-magnetic qualities. It matters not how fine a watch may be, if it is not non-magnetic, it is no more reliable than the cheapest watch made, after the wearer has been within the influence of dynamos and other electrical devices.

This watch has been produced to meet a long felt want and growing demand for a reliable non-magnetic

CHARMILLES NON-MAGNETIC WATCH.

time-piece at a low price, and is especially suited to the requirements of motormen, engineers and all workers in the electrical field. It also embodies all the latest achievements in horological science.

The Charmilles watch is non-oxidizable and unaffected by moisture, and the non-magnetic balance and hair spring are guaranteed exempt from magnetic influence. It is open-face, stem-winding and setting, and in every way a most desirable time-piece. The cases of these watches are made of nickel and steel, the former being finished in old silver and the latter plain polished, black oxidized or with raised gold designs. They are made in a large number of attractive designs.

This watch is a reliable time keeper and is just the thing for electrical people. They can be had from any reliable jeweller throughout the United States.

The accompanying illustration is of a Charmilles watch with case of a design appropriate to the electrical trade.

A GOOD REPORT.—The report of the Columbus Street Railroad Company for September shows gross earnings of $59,031, an increase of $11,852 as compared with the same month of last year, and net $35,539, an increase of $17,996. For the nine months ending Sept. 30 the gross earnings were $421,167, an increase of $14,515 as compared with the corresponding period of last year, and net $223,385, an increase of $73,251.

DECISION IN THE ACCUMULATOR CASE.

Following is the full text of the decision of Judge Lacombe, of the U. S. Circuit Court, Southern District of New York, in the case of the Accumulator Company *vs.* the Edison Electric Illuminating Company, of New York, impleaded with the Electric Storage Battery Company, filed October 8 last:

The Battery Company, which is named as a defendant, but which being a non-resident has not been served, and does not appear, manufactures the articles alleged to infringe. The Illuminating Company has contracted to purchase a large number of them and is about to put them to use in this city. Complainant is the owner of Letters-Patent, Reissue No, 11,047, December 17, 1889, original No. 312,599, Febuary 17, 1885, to J. W. Swan for "Secondary Battery," a variety of electric storage battery. The original patent No. 312,599 was considered by this Court in Accumulator vs. Julien Co., 38 Fed. Rep. 117, and held invalid, as it described and claimed more than the inventor discovered. Thereupon the reissue was obtained and said reissue was considered by this Court and sustained in Accumulator Co. *vs.* N. Y. and Harlem R. R. Co. 50 Fed. Rep. 81, opinion by Judge Coxe. In an application, therefore, for preliminary injunction on the same patent the construction laid down in that opinion will be adhered to.

The claim of the patent is for—"A perforated or cellular plate for secondary batteries, having the perforations or cells extending through the plate and the active material or material to become active packed in the said perforations or cells only, substantially as described."

Judge Coxe held that although the art already showed plates in which the active material was packed into grooves or holes not extending through the plate, and also plates where the active material filled not only the perforations, but also the entire surface of the plate itself, Swan's combination in which the perforations extended through the plate and the material filled the perforations only was original with him. That it was not only new but useful, an important advance in the art, and that "the idea which has made these plates a commercial success was first given to the world in a practical embodiment by Mr. Swan." No new evidence tending to modify Judge Coxe's opinion being introduced it settles the law of this case, and the only question here is whether defendant's plates infringe.

These plates, which are for secondary batteries, are perforated plates, the perforations extend through the plate, the active material is found in the said perforations and in them only. Infringement by the completed structure is so plain, that defendant has been constrained to insist that Swan's patent is practically for a process and therefore, as defendant's process of making the plates is a different one, there is no infringement. Thus Swan constructed a plate with perforations or cells extending through it and *then* packed the material in the perforations; defendants arrange pastels or buttons of the material in a mould and then cast the plate around them. Manifestly the result is the same whether the material is packed within the bounding walls of the perforations, or whether the bounding walls of perforations are packed around the material. Defendants also insist that the material which they use is not active when the process of packing antimonious lead around it is complete and that it does not become active the moment it is placed in the battery fluid, but requires further electrolytic treatment before it becomes active. But the patent is not confined to active material, it includes "material to become active," and whether it becomes active by one process or another is apparently immaterial. The gist of Swan's invention, as found by Judge

(*Continued on page 222.*)

NEW CORPORATIONS.

American Electrical Heating Company, Detroit, Mich. Capital stock, $50,000.

Philadelphia and Neshaming Electric Railway Company, Philadelphia, Pa., by Thos. W. South, Tacony, Philadelphia; C. P. Tomlinson, Bustleton, Philadelphia; Frank F. Bell, Bristol, Bucks Co., Pa. Capital stock, $75,000.

The Hestonville and Overbrook Passenger Railway Company, Philadelphia, Pa., by John Hopkins, Issac Blum, Simom J. Martin, Philadelphia. Capital stock, $5,000.

Keystone Electric Street Railway Company, Philadelphia, Pa., by Thos. W. South, Tacony, Philadelphia, Pa.; Frank F. Bell, Bristol, Pa.; C. P. Tomlinson, Bustleton, Philadelphia, Pa. Capital stock, $180,000.

The Faraday Electric and Chemical Co., Kittery, Me., by W. W. Jacques, Newton, Mass.; Belle L. Ruggles, Reading, Mass.; James H. Flanagan, Boston, Mass. Capital stock, $150,000.

The Electric Match and Advertising Co., Cincinnati, Ohio, by Talton Embry, Geo. Shiner, Joseph T. Hornan, O. J. Wiggins and Wm. Montgomery. Capital stock, $10,000.

The New Mexico Electro-Chemical Reduction Co., Chicago, Ill., by Otto R. Barnett, Glenn E. Plumb and Clark Edward Ridpath. Capital stock, $100,000.

The Missouri District Telegraph Co., St. Louis, Mo., by L. C. Baker, B. H. Bohle, G. J. Frankle, C. H. Bristol and J. W. James. Capital stock, $250,000.

The Cornwall Telephone Co., Cornwall, Conn., by Geo. C. Harrigan and others. Capital stock, $2,000.

The Inter-State Fuel, Light and Power Co., Chicago, Ill., by J. I. McCauley. Capital stock, $6,000,000.

The Northern Electric Passenger Railway Co, Pottsville, Pa., by A. C. Milliken and others. Capital stock, $10,000.

The Reading and Pottstown Electric Railway Co., Reading, Pa., by J. A. Rigg. Capital stock, $10,000.

The Westlake Electrical Manufacturing Co., East St. Louis, Ill., by David Briggs and others. Capital stock, $100,000.

The Block Lighting and Power Co., New York, N. Y., by Albert M. Palmer and others. Capital stock, $50,000.

The Lancaster Railway Construction Co., Trenton, N. J., by Henry Baumgardner and others. Capital stock, $100,000.

Missouri District Telegraph Company, St. Louis, Mo., by L. C. Baker, R. H. Bohle, G. J. Fankle, C. H. Bristol, J. W. Jones, all of St. Louis. Capital stock, $250,000.

The Northern Electric Company, Chicago, Ill., by Joseph Kettlestrings, Geo. W. Furbock and W. I. Marshall. Capital stock, $25,000.

The Dolgeville Telephone Company, Albany, N. Y., to connect local points in and about the village of Dolgeville, Herkimer County and adjacent villages and towns. Incorporators are: Alfred Dolge, William S. Armstrong, Theodore Roth, of Dolgeville, and others. Capital stock, $5,000.

The Belvidere Telephone Company, Belvidere, Ill., by W. M. McRean, Omer H. Wright, jr., John B. Tripp and J. B. Balliet. Capital stock, $5,000.

Streets Run & Drawsburgh Railroad Company, Harrisburg, Pa., by Homer H. Swaney, McKeesport, Pa.; Jas. P. Wilson, Pittsburgh, Pa; A. R. Mackall, East Liverpool, O. Capital stock, $40,000.

Hughes Fare Register Company, Brooklyn, N. Y., by Andrew H. Hughes, John G. Lyon, of New York, and Harry F. Hughes, of Brooklyn. Capital stock, $10,000.

The Arctic Fan Company, Baltimore, Md., by Geo. W. Smith, John B. Maloney, John W. Hartsell, Harry O. Hartsell and Harry Tilgham. Capital stock, $50,000.

POSSIBLE CONTRACTS.

It is proposed to construct a telephone line from Vicksburg, Miss., to Port Gibson, for which purpose a company is now being organized.

L. C. Sarra, Pensacola, Fla., has been awarded a contract for the erection of an electric light plant for the Citizens' Electric Light and Power Company of that place. A 1,500 incandescent light dynamo and a 100-light arc dynamo will be needed.

The Charlotte Consolidated Construction Co., Charlotte, N. C., will introduce the incandescent system in that place, and the plant wille be located at Dilworth, N. C.

A telephone line is to be constructed from Asheville, N. C., to Weaverville, N. C.

William Campbell, Charlestown, W. Va., is in the market for telephone equipment.

BOOKS ON ELECTRIC RAILWAYS.

Every one connected with an electric railway should understand the principles involved and the practice. Below is a list of books any one of which is valuable for the purpose above indicated.

ELECTRIC RAILWAYS.

Crosby & Bell's Electric Railway in Theory and in Practice. 400 pages. Fully illustrated	$2 50
Fairchild's Street Railways; Their Construction, Operation and Maintenance. 500 pages. Profusely illustrated	4 00
Hering's Recent Progress in Electric Railways	1 00
Prindle's Electric Railways of Today	50
Reckenzaun's Electric Traction as Applied to Tramways	4 00
Trevert's Electric Railway Engineering	2 00

ELECTRIC POWER.

Atkinson's Electric Transformation of Power, and its Application by the Electric Motor, including Electric Railway Construction. 244 pages, 96 illustrations	2 00
Badt's Electric Transmission Hand-book. 97 pages, 22 illustrations	1 00
Du Moncel's Electricity as a Motive-Power	3 00
Flather's Dynamometers and the Measurement of Power	2 00
Grimshaw's Hints to Power Users	1 00
Kapp's Electric Transmission of Energy, and its Transformation, Subdivision and Distribution. A Practical Hand-book	3 00
Kilgour's Electrical Distribution: Its Theory and Practice. 424 pages, 174 illustrations	4 00
Picon's Electric Transmission of Energy	2 50
Verity's Electricity Up to Date, for Light, Power and Practice	75

Sent on receipt of price, postage free. The Electrical Age Publishing Co., World Building, New York.

(*Continued from page 220.*)

Coxe, was the *confining of the material which was to do the work within perforations which extended completely through the plate.* The advantages of such plates is pointed out in his opinion, and those which defendant threatens to use are plainly such plates. There is nothing in the patent or in Judge Coxe's opinion which supports the contention that the claim is other than what it appears to be—a claim for a completed article, not for a process of manufacture. Infringement is clear.

It is further contended on behalf of the defendant that complainant has been guilty of such laches as should preclude the granting of a preliminary injunction. In a case where this defendant, or its allied corporation was complainant, the Court of Appeals in this circuit held that the owner of a patent was under no obligation to sue every infringer forthwith upon discovery of the infringement, provided he proceeded with due dilligence against the one whom he did sue. Edison Electric Light Co., *et al vs.* Sawyer-Man Electric Co., 3 C. C. A., 605. There is no suggestion of any unreasonable delay in prosecuting the test suits against the Julien Co. and the N. Y. and Harlem R. R. Co. Judge Coxe's decree in the last named suit is dated April 12, 1892. The present action was begun in August, 1894. During the intermediate period and some years before, certainly since 1889, the Storage Battery Company made plates which differed from those sold to the Illuminating Company, both in the size of the plate and in the size of the buttons. The plate now complained of is 15 inches square and contains 256 buttons of active material, the older plates were 6 by 8 inches and contained 9 or 12 buttons. Both were equally infringements of the patent, which is not confined to plates or buttons of any particular, absolute or relative size. Complainant insists that it did not prosecute for infringement by the earlier plates, for the reason that it did not believe them to be commercially harmful. The grounds for that belief are said to be the relative size of plate and button. In the latter plates the loss by accident, while in use, of the contents of a single hole would not, it is asserted, practically destroy the usefulness of the plate, being only a loss of 1/256 of the active material. A similar accident to the older plate, however, would destroy its usefulness, as a single perforation holds 1/9 or 1/12 of the active material. This explanation seems a reasonable excuse for failing to prosecute against the older plates, and I find nothing in the transactions between the complainant's officers and those of the storage battery which should estop complainant from maintaining this action. In April, 1893, certainly both sides understood and expressed their understanding in writing that the question of infringement of the several patents owned by complainant would be tested by suit.

As to the Danish patent, the conclusion reached by Judge Coxe without argument, viz: that "it is not for the same invention as the Swan reissue" is concurred in by this Court, after argument.

Motion for preliminary injunction granted.

MOTION TO SUSPEND DENIED.

Judge Lacombe, of the U. S. Circuit Court, October 10, denied the motion of the Edison Electric Illuminating Company to suspend, pending appeal, the injunction granted by him as above, against the use of the chloride battery.

ECONOMY IN ELECTRIC POWER STATIONS.

In our issue of September 29 we gave an abstract of the paper of J. B. Craven, on the above-named title, which was read at the meeting of the Street Railway Association of the State of New York, in Syracuse, September 18, last. An interesting discussion followed the reading of the paper.

In answer to inquiries, Mr. Craven advised the use of direct-connected engines on small roads, of 15 to 25 cars, where the load is variable. He also advised the over-using the idler and giving the belt good surface contact on the pulley.

Refined oil is used for injecting into boilers, he said. He had had no experience with crude oil for that purpose.

If you put in the refined oil, said Mr. Craven, it reduces the scale from a hard substance into a slime, which is easily blown out, and when we open the boilers, as we do once a month, we find probably one-sixteenth of an inch of hard scale that is broken off very easily. We can clean the tubes in most cases as clean as when they were first put in. We inject a pint of oil in the course of ten hours' run, and it has given better satisfaction than anything we have had.

Regarding the use of a return wire, Mr. Craven said that the conditions of its use would depend upon the number of cars more than on the length of the road; but a road six miles long, with ten cars, he thought, would require a return wire as well as the bonding of the rail.

Mr. Issertel: You believe in a large return wire under any circumstances, do you?

Mr. Craven: It is brought down to a single question of calculation. A current requires so much area to return on, and if you do not supply it more power will be consumed getting the current back to the station.

Mr. Issertel: Yes; but with the rails they are using now, with two bonds, it is unnecessary to use return wire.

Mr. Craven: They cannot do it, for the reason that you are carrying out of your station, say, twenty-eight feeders, with a cross-section all the way from a half inch to an inch, and you cannot expect the current to be bought back on two bonds half an inch in diameter.

Mr. Seely: The cross section of a ninety-pound girder rail has a capacity to carry back current equal to about 0000 copper wire.

Mr. Issertel: That is the point; and with four rails bonded together you would have four times the carrying capacity. As it is a matter of a great deal of expense to use the return wire I do not see why the rail should not be sufficient.

Mr. Craven: I understand it costs a great deal of money to put it in, but if you do not put it in, and do not get sufficient capacity for the return current, you are going to use much more coal to supply the extra demands.

Mr. Seely: Do you believe, in using return wire, that they should be put in conduits, or the rail bonded back in sections—do you think there is any saving in placing return wire in contact with the earth, or should it be tapped in every thousand feet and then returned in conduits? I think that is the ideal construction, but it is extremely expensive.

Mr. Craven: In Buffalo we run an underground feeder system, and we are bringing in our return wires through these conduits

Mr. Seely: By that system you have the advantage of the fall of potential from the station to the point of contact of the rail. There is a small loss between that point and the generator. Small roads could not afford that.

Mr. Craven: In cases where they have not an underground system, lay the wire in the ground and not tap in on the pole.

NEW YORK NOTES.

Office of the Electrical Age,
First Floor, World Building,
New York, October 15, 1894.

E. H. Oswald, of the Benedict & Burnham Mfg. Co., 13 Murray street, New York, will be seen at the Atlanta convention. He will have a full line of samples of this company's celebrated rail bonds, both at the convention hall and the Aragon. This bond is a good thing and Mr. Oswald is very successful in convincing prospective customers of this fact. Besides Mr. Oswald, J. H. Woodward will represent the company.

The annual meeting of the stockholders of the Western Union Telegraph Co. was held on October 10. Last year's directors were re-elected. The following statement shows the result of the financial operations during the year ending June 30, last:

	1894.	1893.	Changes.
Total revenue..........	$21 852,655	$24,978,442	Dec. $3,125,787
Expenses..............	16 060,170	17,482,405	Dec. 1,422,235
Profits..............	$5.792,485	$7,496.037	Dec. $1,703,552
Interest and dividends..	5,671,671	5.565,196	Inc. 106 475
Surplus..............	$120.814	$1,930,841	Dec. $1,810,027
Surplus July 1.........	6,886.820	4.955,979	Dec. 1.730 841
Total surplus.........	$7,007,633	$6,886,820	Dec. $120,813

In the year over 1,300 miles of new pole line and nearly 22,000 miles of new wire were constructed. The lines taken down reduced net increase of pole line to 367 miles and net increase of wire to 21,591 miles. Over half new wire is copper. Total cost of additions to property was $557,022 and was paid for partly out of the year's surplus and partly out of proceeds of sale of some of the company's securities. Average toll per message was 30.5 cents against 31.2 last year. Average cost per message was 23.3 cents, against 22.7 cents last year. The higher cost of message is due to general depression of business and impracticability of reducing expenses at many small offices without impairing the standard of efficiency. The company has purchased since the close of the fiscal year 10,000 miles of copper wire, which will be erected before January 1 on important trunk routes. The company now operates 790,792 miles of wires through 21,166 offices. It transmitted last year 58,632,237 messages, as against 66,591,855 the previous year.

W. S. Barstow, general manager of the Edison Illuminating Co., Brooklyn, was married on September 4, to Miss Francoise M. Du Clos, of Highland Park, N. J.

W. T. H.

TRADE NOTE.

J. W. Parker & Co., 30 Cortlandt street, New York, have taken orders in the past two months for over 1,500 H.-P. in complete power plants.

CHARACTERISTICS OF A POPULAR RAILROAD.

Travellers find unexcelled accommodations and supreme comfort on the cars of the New York Central Railroad. American railways are noted for the advantages which they afford the travelling public, and there are none that surpass this splendidly equipped road.—*Paper Trade Journal.*

Electrical and Street Railway Patents.

Issued October 9, 1894.

527,050. Dynamic Electric Heater. Herman B. Collins, Fulton, assignor of one-half to Warren H. Boles, Syracuse, N. Y. Filed Sept. 22, 1892.

527,066. Device for Protecting Separately-Excited Generators. Benjamin G. Lamme, Pittsburgh, Pa., assignor to the Westinghouse Electric and Manufacturing Company, same place. Filed Feb. 28, 1894.

527,070. Electrical Converter. James W. Packard, Warren, Ohio. Filed Jan. 3, 1894.

527,071. Electrical Fuse-Box. James W. Packard, Warren, Ohio. Filed Jan. 3, 1894.

527,075. Running Compound-Wound Dynamo-Electric Machines in Multiple. William B. Potter, Schenectady, N. Y., assignor to the General Electric Company, of New York. Filed June 2, 1894.

527,092. Circuit-Controller for Regulators. Barton B. Ward, New York, N. Y. Filed Oct. 13, 1893.

527,098. Railway-Annunciator. Charles R. Alsop, Middletown, Conn., assignor to Lucy C. Alsop, same place. Filed Nov. 2, 1893.

527,110. Method of and Apparatus for Electro-deposition of Metals. Charles R. Fletcher, Boston, Mass. Filed June 20, 1894.

527 126. Electric Locomotive. Nicolas J. Raffard, Paris, France, assignor to the Thomson-Houston Electric Company, of Connecticut. Filed July 23, 1891. Renewed Apr. 13, 1894. Patented in France, Sept. 10, 1883, No. 157,466.

527,150. Electric Ore Amalgamating Apparatus. John C. Ludwig, San Francisco, Cal. Filed Mar. 5, 1894.

527,177. Electric Switch. Raymond S. Kelsch, Chicago, Ill. Filed May 28, 1894.

527,195. Alternating-Current Motor. Carl Coerper, Cologne, Germany. Filed May 15, 1894.

527,203. Spring-Buffer for Street-Cars. Henry A. Howe, New York, N. Y., assignor to himself, Joseph Livingston and Albert H. Gross, same place. Filed July 2, 1894.

527,211. Electric-Arc Lamp. Max Mayer, New York, N. Y., assignor to the Auerbach-Woolverton Electric Company, of New Jersey. Filed June 18, 1894.

527,214. Telephone-Transmitter. Thomas McCoubray, New York, N. Y. Filed Aug. 16, 1894.

527,224. Cloth-Cutting Machine. Arthur Thyll, New York, N. Y., assignor to the Electric Cutter Company, same place. Filed Nov. 7, 1891. Renewed Mar. 17, 1894.

527,225. Adjuster for Field-Magnets of Dynamo-Electric Machines or Motors. Montgomery Waddell, Bridgeport, Conn., assignor to Montgomery Waddell, receiver of the Waddell-Entz Company, of West Virginia. Filed Sept. 6, 1893.

527,228. Electric-Arc Lamp. John E. Woolverton, New York, N. Y., assignor by direct and mesne assignments to the Auerbach-Woolverton Electric Company, of New Jersey. Filed Feb. 9, 1894.

527,244. Electric Locomotion on Railways. Jean J. Heilmann, Paris, France. Filed Apr. 20, 1894. Patented in France, Feb. 22, 1894, No. 236 493; in Belgium, Feb. 24, 1894, No. 108,723, and in England' Mar. 12, 1894, No. 5,118.

527,257. Electrical Signal. Harry H. Wister, Colorado City, Colo. Filed Apr. 10, 1893.

527,265. Conduit System for Electric Railways. William A. Butler, New York, N. Y., assignor to John Gilmore Boyd, same place. Filed Apr. 20, 1894.

527,267. System of Electric Block-Signals for Railways. William M. Cuthbert, Brooklyn, N. Y. Filed Feb. 16, 1893.

527,270. Life-Saving Guard for Cars. Louis E. Dubois, Toronto, Canada. Filed Nov. 20, 1893.

527,294. Track-Switch for Electric Railways. Augustin F. Schinner, Milwaukee, Wis. Filed June 16, 1894.

527,298. Electric Battery. Milton E. Smith and Maurice F. Geer, Rochester, N. Y., assignors of one-third to Paul C. Brewer, same place. Filed Mar. 29, 1894.

527,301. Conduit Electric Railway. James E. Toole, Northumberland, Pa. Filed Jan. 24, 1894.

527,317. Insulator. Edward J. Bullock, Wallingford, Conn. Filed Nov. 27, 1893.

527,324. Electric Heater. Jesse R. Davis, Parkersburg, W. Va., assignor of one-third to Charles A. Wade, same place. Filed Feb. 24, 1894.

527,355. Trolley-Wire Support or Hanger. Sam C. Woodhead, Philadelphia, Pa. Filed Apr. 24, 1894.

527,379 Apparatus for Generating Electricity by Solar Heat. Melvin L. Severy, Boston, assignor of one-half to Francis Doane, Norwood, Mass. Filed Feb. 16, 1894.

527,387. Fare-Register. John W. Fowler, Northport, N. Y., and William J. England, El-Mora, and Anton E Nielsen, Elizabeth, N. J.; said Neilsen assignor to Alfred Atkinson, Brooklyn, N. Y. Filed Apr. 6, 1894.

527,393. Busy-Test for Multiple Switchboards Robert H. Polk, Savannah, Ga Filed Apr. 20, 1894.

ELECTRICAL AGE

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CONTENTS.

OUR REPORT NUMBER.

In our endeavor to give our readers as complete an account as possible of the doings at Atlanta last week, we are compelled to omit from this issue a good deal of other matter of interest. This, however, will appear in our next issue.

THE NEW PRESIDENT AT THE A. S. R. A.

We congratulate Mr. Joel Hurt on the honor of his election to the presidency of the American Street Railway Association, and the association on its good fortune in having selected so worthy and able a gentleman to guide its affairs during the coming year. Mr. Hurt is a man fitted in every way to direct the affairs of so important and influential a body; he has the ability; he has the confidence of the members; he has a worthy reputation back of him; he has ideas of his own, and he has the welfare of the association at heart.

MONTREAL.

A more delightful and appropriate place than Montreal for the next meeting of the American Street Railway Association could not have been selected. October is a delightful month anywhere in this general latitude, but it is particularly so in Montreal. Apart from the climate, the location and facilities of the city are such that a very successful meeting is assured from the very start. Those who attended the meeting in that city in 1891 of the National Electric Light Association will never forget the hospitality of the citizens on that occasion, and as our Canadian friends are always glad to have people from the "States" visit them, there is no doubt that the Street Railway Association will meet with a rousing reception.

THE CONVENTION.

The convention of the American Street Railway Association which was held in Atlanta last week was an unbounded success in every particular. There was an unusually large attendance, plenty of enthusiasm, a large and notable exhibition of supplies; valuable and practical papers were read at the meetings, and the spirit of good feeling seemed to pervade everything and everybody, however remotely concerned with the object of the convention—under such conditions, the meeting could not help being a success. The trip to and from Atlanta was a particularly interesting one and will long be remembered by those who were fortunate enough to take it. The citizens of Atlanta opened their doors and welcomed the association with true southern hospitality and made a deep impression upon the hearts and minds of the members, who in the main are "northerners." The people of Atlanta love their city and are proud of its history. Governor Northen thinks no place in the north offers such opportunities as it does for the development of industries, and in his address of welcome suggested the advisability of not only starting new enterprises in Atlanta but removing there existing ones. No doubt the state of Georgia and its capital offer extraordinary natural inducements for the upbuilding of industrial enterprises, and it is likely that some who heard and read Gov. Northen's remarks will be inclined to apply them to a practical test. How far they can be applied, however, remains for the engineer and economist to determine. The resulting effect of the Atlanta meeting cannot fail to be lasting and beneficial to all interested; it will certainly tend towards the perfection of electric railway engineering and practice. Many of the benefits the people in almost every town and city in the United States are now enjoying are directly traceable to the existence of electric railways in their midst, and the enterprise of the electric railway managers is largely inspired by reason of their member ship in the American Street Railway Association. Therefore the masses owe much to this worthy association—long may it live!

CONVENTION OF THE AMERICAN STREET RAILWAY ASSOCIATION.

FIRST DAY'S SESSION.—WEDNESDAY.

The thirteenth annual meeting of the American Street Railway Association was held in Machinery Hall, Piedmont Park, Atlanta, Ga., October 17–19, 1894.

President Henry C. Payne, of Milwaukee, Wis., called the meeting to order and introduced Hon. W. J. Northen, Governor of Georgia, who in the name of the people of the State and those of Atlanta in particular, extended a most hearty and cordial greeting to the members. Among other things, he said that he was sure that "after having looked upon the developments now being made upon these grounds and the prospect that awaits us in the development of our Exposition, that you will not only return to Atlanta then to visit our Exposition, but that you will bring your industries and settle in Georgia, and help us develop the great interests of this State." (Applause.)

Why not make street car wheels out of pig iron at the South manufactured at the South; why not make street railway rails out of pig iron at the South manufactured at the South—why not remove your industries from more expensive sections down to this section, where you buy cheaper raw material, where you have better advantages of manufacturing and your business interests can be better developed?

You have developed your own business in the South to a very great extent. We have one thousand six hundred and eleven miles of street railways in the South. The southern states have invested capital in this industry amounting to $71,060,000, and all that has been done within the last six years.

President Payne fittingly acknowledged Gov. Northen's welcome on behalf of the association and then read his address.

The report of the executive committee was then read. It refers to the effects of the industrial depression upon the street railway business. "The year has been a hard one," the report says, "but the outlook is encouraging."

Two amendments—one to the constitution and the other to the by-laws—were proposed by the Committee. The first has for its object the admission of individuals and companies, not street railways, as associate members, and the second provides that only morning sessions be held, in order that the delegates shall have more opportunity for social enjoyment, also more time to examine the exhibits, which have become an important feature of the meetings.

(Note.—If the foregoing amendments are adopted there will be two classes of membership—associate and active—and the meetings will open on Tuesday and continue for four days.)

The report of the treasurer was presented and showed the financial transactions of the year to have been:

Receipts	$8,290.79
Expenses	8,196.72
Balance	$94.07

The committee report on "The Best Method of Treating Accidents and Complaints" was then read, and a discussion followed.

"A Uniform System of Street Railway Accounts" was the subject of the next report, which was made by H. I. Bettis. This report was very voluminous, and was followed by an interesting discussion, in which Messrs. Perrine of Trenton, McNamara of Albany, Dyer of Augusta, and the president took part.

The session was then adjourned. After adjournment the delegates inspected the exhibits.

At four o'clock on Wednesday afternoon a visit was made to the car houses of the Atlanta Consolidated Street Railway Company, and from six to nine the same evening a reception to the delegates and accompanying ladies was tendered by the Capital City Club.

THURSDAY'S SESSION.

The Executive Committee held an executive session first thing and considered the subject of Transfers and Commutations, the general impression being that the privileges should not be extended further than is absolutely necessary.

The subject of the formation of a Street Railway Mutual Fire Insurance Co. was also taken up, and on motion of Russell Harrison the incoming officers and executive committee were appointed a committee to report on the subject.

Messrs. Littell, Perrine and Connette were appointed a committee to wait upon the officers of the Underwriters' Association of the South, with a view to securing better conditions and rates for insurance of street-railway properties, the office of the association being in Atlanta.

The Executive Session was then adjourned.

The paper "Can the T Rail be Satisfactorily Used in Paved Streets?" was then read. An abstract of this paper will be found elsewhere in this issue. Adjourned.

FRIDAY'S SESSION.

The first business was the reading of the report of the committee on "City and Suburban Railways," an abstract of which is given on another page in this issue. This report was followed by one on "The Rail Construction of the Terre Haute Street Railway Company," which was read by Mr. Russell Harrison.

A committee was appointed on the recommendation of M. K. Bowen, of the Chicago Street Railway Co., to investigate the subject of the validity of patented articles used by street railways.

An informal vote was taken on the advisability of adopting the amendments to the Constitution and By-laws, which amendments were suggested in the executive committee report.* It was the unanimous judgment of the members that the amendments should be adopted. Action on this subject will be taken at the next annual meeting.

Mr. Wm. Brophy, president of the New England Reserve Fund Association, Boston, was then introduced and made some remarks on insurance of electric stations. He thought each State street railway association should make application to the board of underwriters of the mutual companies which control its territory. He thought rates could be reduced somehow. His company has at this time $7,000,000 of property of this class, and for the last ten or twelve months its losses have been $2,300 on the seven millions—"showing that the electric business is not so hazardous as some people think it is."

Mr. Russell Harrison moved that a committee of five be appointed to take the matter up with the New England companies. Carried. The following named gentlemen were appointed: Messrs. Harrison, of Terre Haute; Dyer, of Augusta; Perrine, of Trenton, N. J.; Lusher, of Montreal; Baumhoff, of St. Louis.

Mr. Perrine offered a resolution, which was carried, "that the executive committee is hereby requested to take under consideration the question of the enlargement of the field and scope of the association, and submit a plan suggesting ways and means therefor at the next meeting of the association."

The nominating committee then made its report and

* See abstract of Executive Committee Report for the provisions of these amendments.

the following named gentlemen were elected for the ensuing year:

President, Joel Hurt, Atlanta, Ga.; vice-president, W. Worth Bean, St. Joseph, Mich.; 2d vice-president, John M. Cunningham, Boston, Mass.; 3d vice-president, Russell B. Harrison, Terre Haute, Ind.; secretary and treasurer, William J. Richardson, Brooklyn, N. Y. Executive committee: Henry C. Payne, Milwaukee, Wis.; W. H. Jackson, Nashville, Tenn.; D. G. Hamilton, St. Louis, Mo.; G. C. Cunningham, Montreal, Canada; J. N. Partridge, Brooklyn, N. Y.

The committee recommended Montreal, Canada, for the next meeting. A strong fight was made for Philadelphia, but a vote resulted, Montreal 38; Philadelphia, 17. Montreal was therefore decided upon as the place for the next meeting.

The reports of the committees on "Mail, Express and Freight Service on Street Railway Cars" "Transfers and Commutation," and "The Use of the Booster on Electric Railway Circuits," were then read by title only. Abstracts of the first and last named reports will be found in next week's issue.

The president-elect, Mr. Joel Hurt was, then escorted to the chair and made a few remarks, thanking the Association for the honor.

The thanks of the Association were extended to the retiring officers, and to the Atlanta Consolidated Street Railway Co., the Capital City Club, the local press and the citizens of Atlanta generally for courtesies, etc.

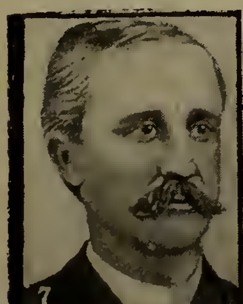
Reports from the following committees were then read by title only: "Destructive Arcing of 500-volt Fuses," "Brake Shoes," and "Power Brakes *vs.* Hand Brakes."

A committee was appointed to investigate the subject of the adoption of a standard style of brake-shoes, conduct experiments and to report the data collected and its conclusions, at the next meeting, without expense to the Association.

Mr. E A. Sperry made some remarks in reference to his electric brake, which was criticized in some points by Mr. E. J. Wessels, in his paper on "Power Brakes *vs.* Hand Brakes." He compared his system with the air brake system described by Mr. Wessels. He thought Mr. Wessels' criticisms were unjust and showed wherein he (Mr. Wessels) had erred.

A special paper by Allen R. Foote on "Taxation" was then read by title, after which the convention adjourned.

PRESIDENT JOEL HURT.



JOEL HURT, the newly elected president of the American Street Railway Association, is a man of progressive ideas. He is a southerner by birth, being born in Russell county, Alabama, in 1850. Through his own efforts he acquired an education, and was graduated from the University of Georgia, in 1871, with a degree of civil engineer. He was afterwards engaged in railroad construction work in the South and Southwest, and later entered the insurance business. In 1882 he became secretary of the Atlanta Home Insurance Company, which concern prospered abundantly under his business management. He was also identified with other enterprises and in 1891 became president of the Atlanta Consolidated Street Railway Company. He secured the consolidation of five street railway companies under one management and equipped them with the trolley system. His road is now one of the best constructed in the South and the system is managed in a most thorough business manner.

Mr. Hurt has been an active member of the association for a number of years, occupying the position of second vice-president during the years 1892–93. His election to the presidency gives great satisfaction to the members, and it is safe to predict that under his direction the association will, during the next year, grow in importance and numbers, and become a greater influence for public good than ever before. Mr. Hurt is a worker and a manager, and enjoys the respect and esteem of all who know him.

EXHIBITS.

H. J. Wightman & Co., of Scranton, Pa., had an exhibit of the Wightman Block Signal for electric railways in practical operation. This system is designed for use on single track roads, and is applicable at turn-outs or switches. In order to exhibit the system in actual working order, sections of trolley lines were suspended over the same, thus supplying the necessary power.

S. M. Balzer had an exhibit of the Vernon Counting Register of which Henry J. Winder, 129 Worth street, New York City, is general agent. This register was used on the turnstiles at the World's Fair at Chicago, and recorded with accuracy about 30,000,000 admissions to the ground. He also exhibited the Vernon Fare Register for street cars, which is practically the same as the counting register in mechanical construction.

Mr. James Partridge, general manager of the Partridge Carbon Co., Sandusky, Ohio, had a full line of this company's celebrated carbon brushes. These goods are generally acknowledged as standard, and certainly there are no better in the market. The gentlemen at the head of this business have had long experience in their line, and know exactly what is necessary to effect good results. The company's plant is a large one and the facilities are ample for the production of carbons in great quantities. The Partridge Carbon Brushes have such a good reputation that, once they have been tried, no argument is required to get a second order.

The Peckham Motor Truck and Wheel Company, Havemeyer Building, New York, as usual, was one of the most prominent exhibitors. The exhibit included a beautiful aluminium model of the Peckham cantilever truck and full size trucks of the various types, including the standard extra long, equipped with General Electric and Westinghouse motors. Peckham trucks are used very extensively and have an unapproachable reputation for easy riding, non-oscillation, ease of repair, simplicity of construction—in short, they are a near approach to a perfect truck. Mr. Edgar Peckham, the president, and W. E. Cook, vice-president, were in attendance.

Charles G. Smith, 350 and 352 Pearl street, New York —"Smith of New York"—had a full line of his celebrated lamps of every description, including combination lamps for electric cars, head-lights for electric and cable cars, signal lamps, burners, electric head-lights, etc., etc. Mr. Smith also exhibited a full line of French's improved silvered glass reflectors. Mr. T. C. Millen had charge of the exhibit.

The Walker Mfg. Company, of Cleveland, O., had a large exhibit.* This included a two motor truck complete, showing the rear suspension of the motors, also a 150 K. W. belt-driven generator. The company was represented by H. McL. Harding, of the New York department, and Sidney H. Short, J. M. Atkinson, B. M. Barr, of Cleveland, and the Kohlor Brothers of Chicago. Mr. R. M. Baylis was in charge of the exhibit.

The Baltimore Car Wheel Company, of Baltimore, Md., exhibited two Lord Baltimore car trucks, one of which was equipped with Westinghouse motors. J. Paul Baker, the secretary, was present at the exhibit.

John H. Graham & Co., 113 Chambers street, New York, were represented by C. A. Hoagland. Mr. Hoagland showed the "H. & C." sleet-cutting trolley wheel, which is a very effective device.

The Jewell Belting Company, of Hartford, Ct., had an exhibit of its well-known belts and the celebrated Jewell dynamo belt dressing. The company was represented by C. L. Tolles.

The Gennett Air Brake Company, 33 Wall street, New York, exhibited their air brake on two cars running on the Atlanta roads. These cars had been in operation for ten days and the action of the brakes has given excellent satisfaction. The company was represented by E. J. Wessels and George S. Lee, master mechanic.

The General Agency Company, 32 Park Pl., New York, exhibited a full line of oil and electric lamps. This company deals in steam and railway materials. Mr. Joseph R. Ellicott is president.

Frederic A. Lex represented A. Whitney & Sons' Car Wheel Works, Philadelphia, Pa., and had an exhibit of wheels of various styles manufactured by this concern. The new Cellular Tread Wheel was included in the exhibit and attracted a good deal of attention.

The J. G Brill Co., of Philadelphia, had a large display of their various makes of trucks, etc. A section of a car body was shown to exemplify the method of assembling the various parts. A detachable vestibule was exhibited, and also a wheel brake to work inside of the vestibule. Among the trucks was a No. 21 B complete, with solid forged axle-box frame, and a No. 22 maximum traction truck. The Brill Company had three cars running on the Consolidated Traction Co.'s lines during the convention, and an electric snow sweeper. The Brill Company was well represented. Mr. John A. Brill, vice-president, was present and was assisted by Samuel M. Curwen, central and southern agent; F. C. Randall, western agent, Chicago; Wm. H. Heulings, jr., and Geo. M. Haskell, eastern agent.

The H. W. Johns Mfg. Co., 87 Maiden Lane, New York, was represented by W. F. D. Crane, Henry G. Issertel, and W. H Gould. all of the New York office. These gentlemen had a display of a full line of their company's well-known insulating material, including moulded mica railway overhead supplies, vulcabeston controller pieces, magnet spools, etc , and an extensive exhibit of asbestos boiler covering. Mr. J. W. Perry, of the Philadelphia branch, and E. B. Hatch and H. Luscombe, of the Johns-Pratt Co. of Hartford, Conn., were also present in the interest of the company.

The Fibre Conduit Co., Orangeburg, N. Y., was represented by M. A. Maeff, C. E. Mr. Maeff had an exhibit of samples of fibre joints.

J. W. Godfrey, general manager of the New York Insulated Wire Co., New York, was on hand as usual. He arrived on Wednesday night and put up at the Aragon.

The Consolidated Car Heater Co., of Albany, N. Y., had an interesting exhibit of its well-known electric heaters. This company has ten heaters in actual use to one made by competitors. Their improved regulator switch was also shown. This switch gives five different intensities of heat. The company was represented by James L. McElroy, C. E., H. N. Ransom, of the electrical department, and E. A. Smith, general western agent.

The Fulton Truck and Foundry Company, of Cleveland. O., was represented by W. E. Haycox, president, and Frank A. Rogers, special sales agent of the Cleveland office. This company had an exhibit of their new steel truck and other appliances made by them. Many of the electric railroads of this country are using this company's appliances and nearly one hundred are using the new steel truck "Imperial."

The Cutter Electrical and Mfg. Co., 27 S, 11th street, Philadelphia, Pa., the well-known manufacturers of C-S. specialties, had their well-known C-S. automatic magnetic cut-outs on exhibition. Mr. W. E. Harrington, the inventor of this device, explained its advantages and merits, and the company was represented by Mr. C. E. Bibber—the great and only Bibber. He is getting in his fine work, judging from the number of railroads using these cut-outs and the favor with which they are regarded.

The Fiberite Co. and the Mason Electric Co., Chicago, had planned a very complete exhibit, particularly of the Medbery overhead material. The samples, however, were delayed on the road and failed to reach Atlanta until after the close of the convention. Mr. Mason, however, found his time fully occupied in greeting his many friends and in explaining the excellent record of the Medbery material. This material has during the last two years reached the front rank, and is now considered standard by a large number of the leading traction companies throughout the country.

The Michigan Electric Company, 47 State street, Detroit, Mich., was represented by J. E. Lockwood, president, and had a full line of overhead material on exhibition. Mr. George A. Mansfield is treasurer and manager of the company, which manufactures and deals in general electrical supplies.

The Sterling Supply and Manufacturing Co., 97 Bank street, New York, had an exhibit of the Sterling street car fender, Sterling sand box, Sterling counter and other articles manufactured by this company. The company was represented by J. J. Kennelly, superintendent; J. B. Benton, secretary, and John H. Carson, treasurer. A souvenir in the shape of a rolling blotter was given away.

The Brooklyn Car Wood and Veneer Works, 129 Degraw street, Brooklyn, N. Y., had a full line of complete seats and veneers for ceilings, seats and racks. Mr. W. B Le Van, jr., looked after the interests of the company. He also gave away a valuable souvenir on street-railway advertising.

The Sterling Company, Chicago, Ill., had an exhibition and working model of their water-tube boiler under pressure and steam. The heads of the drums were made of glass, thereby enabling one to look into the interior of the boiler and examine the circulation.

C. E Garey, 1648 Washington avenue, New York city, exhibited a car-door change-pocket.

P. M McLaren represented the Root Boiler manufactured by the Abendroth & Root Mfg. Co., of 21 Cliff st., New York city. His headquarters were at the "Aragon" Hotel.

Arthur S. Partridge, dealer in street-railway supplies, St. Louis, Mo , had an exhibit of the various goods handled by him. He presented his guests with lead pencils.

Frank A. McGee represented the E. S. Greeley & Company, 5 and 7 Dey street, New York city, and succeeded in making a good many converts in favor of the house's electric railway supplies.

The Berlin Iron Bridge Co., of East Berlin, Conn., had a characteristic exhibit. It consisted of a roof structure with Berlin Anti-Condensation Roof Lining, which was covered with galvanized iron. This style of construction is generally adopted in the erection of electric stations. The Berlin Iron Bridge Company has the inside track of roof construction work in this country, and a very large trade among electrical concerns, who always want the best of everything in the construction of their stations. The company was represented by J. C. Murphy, the erector, and John M. Field, assistant engineer. A neat little pamphlet distributed by these gentlemen contained testimonials from many electric and other concerns, regarding the satisfaction with the Berlin Iron Bridge Company's roofs.

E. H. Oswald and J. H. Woodward represented the Benedict & Burnham Mfg. Co., of 13 Murray street, New York city. They had samples of this company's well-known solid one-piece rail bonds, which are made of pure Lake Superior copper They have more contact surface than any other rail bonds, and are used by over fifty of the prominent railways in this country. These bonds have a rigid hold and never become loose; moreover, they are easily and quickly inserted in the rail. Samples of "Benedict" feeder and trolley wires were also exhibited; also magnet wires. Messrs. Oswald and Woodward were very active around the hotel and exhibition in the interests of their company.

Colonel E. D. Meier represented the Heine Safety Boiler Company, of St. Louis, Mo. These water-tube boilers are used by a great many of the street railways in the United States.

The Mather Electric Co. of Manchester, Ct., manufacturers of the Mather type of slow speed motors, etc., was represented by Mr. Perkins.

The Young Lock Nut Co., of 150 Broadway, New York, was represented by R. D. Stewart, who exhibited samples of the flexible adjustable bracket for electric street railway construction, manufactured by the Wrought Iron Bridge Co., of Canton, O., the Young Lock Nut and the Bromley Injector.

The Western Telephone Construction Co., 539–541 Monadnock Building, Chicago, Ill., was represented at the convention by Geo. F. Stitch, vice-president. This company is a large manufacturer and dealer in telephones and appliances and its instruments are very extensively used in this country.

The Card Electric Company, Mansfield, O., had an exhibit of Card single and double equipment of Card street car motors, series and parallel controller and single motor controllers. The company was represented by Geo. F. Card, electrician, Reid Carpenter, president, and John F. Card.

George L. Colgate, of 136 Liberty street, New York City, was around the exhibition impressing upon the delegates the importance of painting their poles with McIntosh pole paints. By the use of these paints the life of the poles is greatly extended. These paints, it is said, out-last and out-class anything of the kind in the market. They are made in all colors and can be used for both wood and iron. Mr. Colgate intended to have on exhibition a marble switchboard equipped with instruments, but unfortunately, through some misunderstanding, the board was sent to Illinois instead of Atlanta, much to Mr. Colgate's disappointment. It would have been greatly to the advantage of the street railway men could they have seen this board exhibit, as the instruments sold by the Colgate Company are well known for their reliability, simplicity and comparative cheapness.

The Niles Tool Works Co., of Hamilton, Ohio, was represented by Mr. W. A. Stadelman, who had on exhibition a pneumatic wheel press and lathe and a boring machine.

The R. D. Nuttall Company, Allegheny, Pa., exhibited a full line of supplies, including gears, pinions and tools. The company was represented by Arthur S. Partridge, of St. Louis, Mo.. C. N. Wood, of Boston, Mass.; C. A Cavagna, of Cincinnati, Ohio, and Charles J. Mayer, of Philadelphia, Pa

J. C. Shainwald, the Chicago representative of the Standard Paint Co. of New York, manufacturers of the celebrated "P" & "B" paints and other electrical products, was hustling about the hotels and exposition. "P. & B." paints and armature varnishes are standard goods for electric railways and other electrical concerns

The Ohio Brass Company, Mansfield, O., had an exhibit of railway supplies, and was represented by C. K. King, the manager of the railway department. Mr. King distributed a pretty souvenir in the shape of an illustrated catalogue of this company's goods.

The New York Electrical Works, 161 Washington street, New York, exhibited a full line of Brooklyn City Standard railway supplies, including section insulators, switches, strain insulators, hangers, etc. The company was represented by C. W. Van Fleet.

G. Frederic Collins, the railroad representative of the well-known house of Valentine & Company, 57 Broadway, New York, was actively engaged in securing orders for the celebrated Valentine varnishes and colors, which are so extensively used on street railways and steam roads in this country. When Mr Collins gets hold of a prospective customer, he becomes as sticky as the varnish he sells, but he, also like the varnish, gives a fine polish. He never tires of reciting the merits of the Valentine goods, and he is a firm believer in the necessity of all street railway companies using these colors and varnishes, mostly for the reason that in so doing expenses are cut down and dividends increased. Mr. Collins furnished all of the varnish used by the Consolidated Traction Company in Atlanta, and he managed to make a good many new friends for his company during the Convention.

Col. Benjamin F. Pilson, one of the most popular representatives of street railway supply manufacturers, was about the hotels and exposition. He received congratulations from his many friends for the handsome exhibit of Hale and Kilburn car seats, made by the Hale and Kilburn Mfg. Co., of Philadelphia, Pa. These goods are used on most every street railway and steam road in the country, and are very popular. Colonel Pilson has great success in getting orders for these car seats.

NOTES.

Mr. Thos A. Hurley, represented Holmes, Booth & Haydens, of Waterbury, Conn., and 37 Park Place, New York city. Mr. Hurley was hustling around the hotels and exposition after orders, and succeeded in his mission very satisfactorily.

Mr. George Meredith, representing the Seaboard Air Line, at Monroe, N. C., was about the exhibiton in the interest of his road.

Mr. George F. Porter, secretary of the National Electric Light Association, was a prominent attendant at the Convention. His object in going to Atlanta was to gain what information he could from the methods of the American Street Railway Associa ion for the benefit of the National Electric Light Association. He is ever on the alert in behalf of his association and never leaves a stone unturned if there is anything to be gained by turning it.

The Washburn & Moen Mfg. Co., of Worcester, Mass., and 16 Cliff street, New York, was ably represented by H. C. Willis of the Insulating Department. Mr. Willis made many new friends, and he did some good missionary work for his company. The wires and cables of this company are well known among electrical people as A1 in every respect, but the best goods made need to be pushed, and this company never had a more energetic pusher than Mr. Willis.

Captain Willard L. Candee, of the Okonite Company, enlivened the Convention with his presence. There is no one in the trade better known than the captain, and no one more favorably thought of. He has a host of friends who are always glad to see him. "Okonite" and Captain Candee are always on top at conventions.

Day's Kerite interests were represented at the convention by W. R. Brixey and F. G. Fuller. Day's Kerite wires are largely used in street railway work, and they have a very high reputation for excellence. The only award given at the World's Fair on rubber insulated aerial, underground and submarine cables was given to W. R. Brixey, the sole manufacturer of these wires. Mr. Brixey also received the highest award on electric light wires.

The Capital City Club extended to the visitors the privileges of its club house for fifteen days, and the Piedmont Driving Club extended like courtesies.

Charles A. Schieren & Co., the well-known manufacturers and tanners of leather belting, 45 Ferry street, New York city, were represented by Charles A. Schieren, Jr. Mr. Schieren distributed a handsome little pocket memorandum book. Charles A. Schieren & Co. have an extensive tannery at Bristol, Tenn., where all of their belting is tanned. This tannery is situated in the heart of the best oak bark region in the United States. It has a capacity of 200 hides per day. A photograph of the "Dixie" tannery, as the Bristol tannery is called, is shown on one cover of the memorandum book.

The Sperry Electric Railway Company had a car equipped with the Sperry system, running between the hotels and the convention hall. The car was also fitted with the Sperry electric brake. Passes were distributed among the members and their friends, entitling them to ride on this car for the purpose of inspecting the equipment and brake.

The St. Louis Car Company, St. Louis, Mo., distributed a neat little book entitled "Snap Shots of the World's Fair Through a Camera." This was quite a souvenir, and there was a great demand for it on account of the elegant illustrations of the World's Fair and the attractions thereat.

Wm. Hazelton, 3d., eastern agent of the Fulton Foundry Co., Cleveland, Ohio, was in attendance at the Convention. His office is in the Havemeyer Building, New York.

Mr. John A. Seely, of the complete Electric Construction Co., of New York, was at the Convention, accompanied by Mrs. Seely. They made many new friends.

The Johnson Company, of Johnstown, Pa , had a large and prominent representation. Col. Daniel Coolidge, vice-president of the company, was there; so was the popular Major H. C. Evans. the New York manager; W. E. Boughton, of the Philadelphia office; E. B. Entwisle, C. E., of Johnstown; O. E. Evans, of the Cincinnati office; A. S. Littlefield, of Chicago; W. W. Kingston, of Atlanta, and Eugene Thomas. Col. Coolidge and Major Evans are a strong team in themselves, and when they are around it means business. Both gentlemen are as well known to every railroad man in the United States as are the Johnson Company's rails and other manufactures It is a pleasure to know them. The other gentlemen associated with them are likewise thought of. The Johnson Company, as is well known, manufactures everything in the line of steel and iron work, making a specialty of rails, frogs and switches for street railways. The company is meeting with great success with its new truck.

THE BANQUET.

On Thursday night the large banquet hall at the Kimball House presented a scene that will never be forgotten by those present. It was the occasion of the banquet of the American Street Railway Association, which was a most magnificent affair. The walls of the room were artistically decorated with flags and bunting, tastefully and gracefully festooned, which, with rare tropical plants rendered the view an enchanting one. Many ladies were present in brilliant and elegant dresses. The tables were exquisitely and charmingly arranged with fruits and flowers, and the scene that was presented to the view on first entrance to the room was truly beautiful.

The banquet opened at 9 o'clock with the singing of the National Hymn, the guests joining enthusiastically, and throughout the entire banquet the band gave frequent selections, including "Dixie," "Home, Sweet Home" and other familiar airs.

The following is a copy of the menu:

Celery, Blue Points, Salted Almonds,
Manhattan Cocktail,
Green Turtle Clear, Queen Olives,
Sauternes.
Broiled Pompano, Sauce Tartar,
Duchesse Potatoes.
Fresh Lobster in cases a la Newberg
Pontet Canet.
Sweet Breads Glacé with fine French Peas.
Electric Punch. Wafers.
Roast Young Turkey with Cranberry Sauce,
Asparagus.
Pommery Sec.
Quail on Toast with Cresses.
Currant Jelly. Celery Salad.
Tutti Frutti Ice Cream with Cakes.
Assorted Fruits.
Roquefort and Edam Cheese with Bent's
Crackers, Mocha Coffee.
Creme de Menthe.

At 11:30 o'clock President Payne introduced Mr. J. H. Stedman, of Rochester, N. Y., who began the ceremonial of toast-making with a few interesting remarks.

The following named toasts were responded to: "Atlanta," by Hon. H. E. W. Palmer; "Our Association," by C. D. Wyman; "The Street Car a Factor in Modern Civilization," by L. Perrine, Jr.; "The Railroads and the Law," by Captain Henry Jackson; "The New South," by L. C. Levy; "The Technical Press," by J. H. McGraw; "The Local Press," by Lucian Knight; "Our Common Country," by Fleming du Bignon. The new president, Mr. Joel Hurt, was then called on and made a few remarks, thanking the members of the Convention for the honor bestowed upon him in electing him president, and after three rousing cheers for Atlanta and the New South, the most successful banquet ever given by the Association was brought to an end.

THE ROYAL BLUE SPECIAL.

A special train over the Royal Blue and Shenandoah Valley roads conveying delegates to Atlanta, left New York at 3:30 P. M., October 15. The train was composed entirely of Pullman sleeping cars, baggage and dining car, and was well filled with delegates, many of whom were accompanied by their wives and daughters. The train was under the personal charge of Mr. L. J. Ellis, eastern passenger agent of the Norfolk & Western Railroad. Mr. Ellis left nothing undone to secure the comfort and pleasure of the party, and was universally praised for the successful manner in which he accomplished the exacting duties imposed upon him. He made friends with every one in the party through his courteous manner, and all on the train was made comfortable during the entire trip. Everything passed off happily, the ladies especially enjoying themselves. It is hardly necessary to say that the gentlemen enjoyed themselves also, and made things lively during the trip. Four elaborate meals were served *en route.* There were seventy-eight persons in the party on this train.

The return trip to New York was a most interesting one. The special left Atlanta at 11 P. M., Friday. Prior to its departure a serenade was given by various members of the party, including J. H. Stedman, F. C. Randall, of the Brill Company; C. J. Field, George S. Whipps, of the Lewis & Fowler Mfg. Company; Messrs. Oswald and Woodward, of the Benedict & Burnham Mfg Co.; J. F. Ostrom, of the Pennsylvania Steel Co.; Major Evans, of the Johnson Company and others. The train reached Chattanooga at seven o'clock on Saturday morning, and after breakfast the Chattanooga Electric Railway Company placed special cars at the disposal of the party. They were taken to the foot of Lookout Mountain, where they were met by Mr. H. S. Chamberlain, of the Chattanooga Steam Road, which traverses the side of the mountain, terminating at the top. Mr. Chamberlain took charge of the guests and landed them at the Lookout Inn, where lunch was served. The party visited many points of interest about the mountain, from the top of which a grand view was had in every direction, including the Missionary Ridge battlefield, so celebrated in the history of the late war. General Warner, of Chattanooga, who accompanied the party, described the various points of interest with reference to the military operations all around the spot thirty years ago. The party then went down the mountain on the Lookout Inclined Cable Railway, of which H. C. Evans is president, and the electric railway cars were again boarded for a trip to the top of Missionary Ridge. They afterwards visited the Soldiers' Cemetery and then returned to the train, which resumed its progress. On Sunday morning the train arrived at the Natural Bridge station, where a stop was made for sightseeing. The trip from the train to the bridge was made in stage coaches. After a short stay the party returned to the train and the next stop was at Luray, where the marvelous Luray caverns were visited. One and a half hours were devoted to the inspection of this wonderful work of nature. The rays from the Thomson-Houston arc lamps had a most beautiful and weird effect upon the myriads of stalactites which suspend in great profusion from the roof of the caverns.

Leaving the caverns, the party boarded the train for home, arriving at New York, Monday, safe and well, under the fatherly care of Mr. Ellis, who put forth every endeavor and brought to his aid every facility to make the trip as enjoyable as possible to everyone. At the Luray station a set of resolutions which had been prepared by a committee consisting of Mr. Edgar Peckham, T. C. Martin, J. H. McGraw and Mr. Silver, addressed to Mr. L. J. Ellis, were read. They complimented Mr. Ellis on his excellent management of the train. They are to be suitably engrossed and presented to Mr. Ellis at a later date. A subscription was also taken up among the party for the purpose of purchasing a piece of silver to be presented to Mr. Ellis as a further testimonial of the appreciation of the party of his attentions. Testimonials were also tendered to Mr. J. M. Leavitt, the Pullman conductor of the train, for the excellent manner in which he cared for his patrons.

In every respect, the trip over the Royal Blue and Shenandoah Valley line was the most successful and enjoyable imaginable, and Mr. Ellis earned the praise that was accorded him.

The following is a copy of the resolutions above referred to :

NATURAL BRIDGE, VA., Oct. 21, 1894.

Whereas, a large number of those attending the Atlanta convention of the American Street Railway association have travelled to and from that city over the Shenandoah route, and

Whereas, the unqualified pleasure and the brilliant success of the railroad trip have been due to the unwearied efforts and thoughtful supervision of MR. LEROY J. ELLIS, Eastern passenger agent of the Norfolk & Western railway, be it therefore

Resolved, That the hearty thanks of the passengers by the special train personally conducted by Mr. Ellis, be and are hereby extended to that gentleman for his unremitting attention to their comfort and his prompt acquiescence in any suggestion that could be met.

Resolved, Further, that Mr. Ellis be and is hereby congratulated upon the striking punctuality in the adherence to the train schedule, as evidencing the high standard of railroad efficiency in the New South, and

Resolved, That a copy of these resolutions be engrossed and presented by a committee to Mr. Ellis, together with a souvenir that may serve to remind him of the occasion as well as of the high esteem in which the street railway men and street railway supply men hold a typical steam railroad man.

Committee for presentation :

E. PECKHAM,
W. J. RICHARDSON,
J. R. BETEEM,
J. H. MCGRAW,
W. S. SILVER,
H. C. EVANS,
Chairman, E. PECKHAM,
Secretary. T. C. MARTIN.

ATTENDANTS.

Following is a complete list of those in attendance at the Convention :

Ackerman, P. C., American Electrical Works, New York ; Acton, W. F., Norwalk Street Ry. Co., Norwalk, Ct ; Aitkin, John W., Lack. Valley Trac. Co., Carbondale, Pa.; Allen, E. H., Allen, Elec. and Sup. Co , Philadelphia, Pa.; Allen, G. A., R. & D. Mach. Wks., Atlanta, Ga.; Allen, J. C., Southern Elec. R. R. Co., St. Louis, Mo.; Adams, Jack P., Special Agent, Atlanta, Ga.; Anderson, Jr., C. C., Graton & Knight Mfg. Co., Atlanta, Ga.; Allen, J. H., Dixey Pub. Atlanta, Ga.; Atkinson, J. M., Walker Mfg. Co., Cleveland, Ohio ; Allen, W. B., Brownell Car Co., St. Louis, Mo.; Alpense, J. M., Walker Mfg. Co., Cleveland, Ohio; Adkin, J., Linden Street Ry. Co., St. Louis, Mo.; Akonnan, J. N., Worcester Con. Ry. Co, Worcester, Mass.; Adams, J.T., Atlanta Consol. Ry. Co., Atlanta, Ga.; A & B. Mfg. Co., New York; Allen, E. H., Car Equipt. Co., Philadelphia, Pa.; Allison, J. W , St. Louis Register Co., St. Louis, Mo.

Bushnell, E. M., Bushnell Mfg. Co., Easton, Pa.; Brixey, W. R., Kerite Wires, New York; Bachelder, M. D., Bachelder Co., Atlanta, Ga.; Burke, J. W., E. C. Burrows Co., Portland, Me.; Barnard, G. A., Buckeye Elec. Co., Cleveland, Ohio; Bibber, C. E., Cutter Elec. Mfg. Co., Philadelphia, Pa.; Baylor, A. K., Genl. Elec. Ry. Co., Pittsburgh, Pa ; Bailey, T. R., Gen. Elec. Ry. Co., Pittsburgh, Pa.; Barrett, C. E., Hale & Kilburn Mfg. Co., Philadelphia, Pa.; Bowman, S., Morris-Tasker Co., Philadelphia, Pa.; Bouchard, J. H., R. D. Nuttall Co., Allegheny, Pa.; Bradley, J. S., N. H. Car Register, New Haven, Conn.; Beadle, Ed., Ry. Register Co., New York; Bennett, J. B., St. Ry. Journal, New York; Boyd, J., Street Ry. Review, Chicago, Ill.; Benton, J. P., Sterling Sup. Co., New York; Babbitt, Jr., J. T., Washburn Car Wheel Co., Hartford, Conn.; Brown, R. S., Westinghouse Elec Co., Boston, Mass.; Bailey, T. P., Genl. Elec. Co., New York; Baylor, A. K., Citizens' Street Ry. Co., Kalamazoo, Mich.; Bowe, W. H., Walker Mfg Co., Cleveland, Ohio; Bayles, R. N., Walker Mfg. Co., Cleveland, Ohio; Belden, D. A., Aurora Street R. R Co., Aurora, Ill.; Bridges, E., Wayne Street R. R. Co., Dayton, Ohio; Bull, J. V., Easton Transit Co., Easton, Pa.; Brickford, J. H., Manchester Street Ry. Co., Manchester, N. H.; Breed, E. S., Central Ry. and Elec. Co., New Britain, Conn,; Brong, C. A., Clearfield Trac. Co., Phillipsburg, Pa.; Barnes. C. E., Plymouth and Kingston Ry., Plymouth, Mass.: Baumhoff, J. W., Linden Street Ry. Co., St. Louis, Mo.; Burke, M. F., Terre Haute Elec. Ry. Co., Terre Haute, Ind.; Baker, R. T., Washington and Georgetown Ry. Co., Washington, D. C.; Brown, O. B., C. M. and D. Ry. Co., Cincinnati, Ohio; Bradford, H. P., C. M. and D. Ry. Co., Cincinnati, Ohio; Bartlett, C. H., Manchester Str. et Ry Co., Manchester, N. H.; Ball, Robt., Washington, D. C.; Burg, E. H., Passenger Ry. Co., Harrisburg, Pa.; Ball, G. M., American Iron and Bolt Co., Cincinnati, Ohio; Ball, G. Mays, American Eng. Co., Atlanta, Ga.: Bragg, F. A., Bragg Fender Co., Troy, N. Y.; Ball, S. Mays, Geo. C. Beall & Co.. Birmingham and Atlanta, Ga.; Ball, Frank H., Ball & Wood Co., New York; Baird, M. E., Eddy Elec. Mfg. Co, Windsor, Conn.; Beetsin, J. R., Scranton Trac. Co., Scranton, Pa.; Benscoten, C. A., Southern Ry., Knoxville, Tenn.; Blackwell, J. H., Trenton Trac. Co., Trenton, N. J.; Blackwell, Mrs J. H., Trenton, N. J.; Boughton, W. E., The Johnson Co., Philadelphia, Pa.: Bradley, E. A., Waterbury Trac. Co., Waterbury, Conn.; Baldwin, Bert. L., M. E, Cincinnati, Ohio; Berg, Max A., Secretary Wallace Elec. Co., Chicago, Ill.: Baler, R. F., Columbia Ry. Co., Washington, D. C.; Benton, J. B, Fare Registers, New York city: Brophy, W. B, Insurance, Boston, Mass.: Baker, J W., The E. J. Burrows Co., Portland, Me.: Baker, R. L., Fountain Head R. R., Knoxville, Tenn.; Berry, Miss

Mary, Rome, Ga.; Bruner, H. C., Brick Filler Street Ry. Co., Pontiac, Ill.; Boyd, T. E., N. H. Register Co., New Haven, Conn.; Bragg, C. A., Philadelphia, Pa.; Brooks, W., Atlanta Equipt. Co., Atlanta, Ga.

Clark, W. J., Gen. Elec. Co., N. Y.; Crowley, Gen. Elec. Co., N. Y.; Corry, C. F., Jr., Wells & French Co., Chicago, Ill.; Clark, W. C., Westinghouse Elec. Co., Boston; Chidsey, A. W., Easton Transit Co, Easton, Pa.; Cunningham, J. W., Haverhill Street Ry. Co., Haverhill, Mass.; Clark, C. S., Lowell Street Ry. Co., Lawrence, Mass.; Card, J. F., Card Elec. Ry. Co., Mansfield, Ohio; Cameron, W. H., Milwaukee Street Ry. Co., Milwaukee, Wis.; Coolihan, E. L., Montgomery Street Ry. Co., Montgomery. Ala.; Cougot, P., New Orleans Trac. Co., New Orleans, La.; Connett, E. G., Nashville Trac. Co., Nashville, Tenn.; Cole, W. W., West Side Ry. Co., Elmira, N. Y.; Corson, H. H., Union Power Co., Nashville, Tenn.; Chur, Walter, Amer. Ry. Sup. Co., N. Y.; Cresson, G. A., Adams & Westlake Co., Chicago, Ill.; Curren, S. M., J. G. Brill Co., Philadelphia, Pa.; Carver, W. E., J. G. Brill Co., Philadelphia, Pa; Colgate, Geo. L., Geo. L. Colgate Co., N. Y.; Cornell, C. ., Hamilton, Ohio; Cobbs, I. M., Fairburn Eng. Co., Chicago, Ill.; Coun, C. I., Gen. Elec. Ry. Co., Pittsburgh, Pa; Crandell, W. M., Modemann Fender, Brooklyn, N. Y.; Cooke, W. J., McGuire Mfg. Co., Chicago, Ill.; Crother, H. F., New York Leather Belt Co., N. Y.; Collins, Fred., Valentine Varnish, N. Y.; Caldwell, E., *Street Railway Journal*, N. Y.; Clark, C. M., Scranton Trac. Co., Scranton, Pa.; Cole, W. H., West Side Street R. R. Co., Elmira, N. Y.; Coolidge, Dan'l, The Johnson Co., Johnstown, Pa.; Cook, Wm. E., Peckham M. T. & Wheel Co., New York; Crossman, T. E, Official Stenographer, Brooklyn; Crowley, H. J., Shamokin Street R. R. Co., Shamokin, Pa.; Candee, Willard L., Okonite, N. Y.; Case, Frank R., Hoopes & Townsend, Philadelphia, Pa.; Clayton, R A, Carterville, Ga.; Collins, G. F., Valentine Varnish, N. Y.; Crew, B. L., 33 W. Harris street, Atlanta, Ga.; Crawford, R. A., Crawford Mfg. Co., Pittsburgh, Pa.; Curwin, M. E., J. G. Brill Co., Philadelphia, Pa.; Corson, H. H., Gen'l Elec. Co., Cincinnati, O.; Carpenter, Rich., Citizen Elec. Ry., Mansfield, O.; Crane, W. F. D., H. W. Johns Mfg. Co., N. Y.; Clark, Chas. S., Penn Steel Co., Boston, Mass.; Carson, J. H., Sterling Supply Mfg. Co., N. Y.; Cochran, C. P., S. Elec. Works, Atlanta, Ga.; Cunningham. G. C., Montreal, Canada; Congot, P., Orleans R. R. Co., New Orleans, La.; Cicott, F. X., Pettingell-Andrews Co., N. Y.

Dick, H. C., Flood & Conklin Co.; Darr, W., Collins Park & Belt R. R., Atlanta, Ga.; Davis, Oscar, Banker, Atlanta, Ga.; Dederick, Levi, Car Fender, Albany, N. Y.; Doane, E. A., Civil Eng., Atlanta, Ga.; Dupone, A. B., Louisville Ry. Co., Louisville, Ky.; Davies, F. C., M. U. Ry. Co., Piqua, O.; Dean, D. B., Terre Haute Car Mfg., Terre Haute, Ind.; Dyer, D. B., Augusta Ry. Co., Augusta, Ga.; Dyer, P. M., West Chicago Street Ry. Co., Chicago, Ill.; Duncan, D. J., South Covington and Cincinnati Ry. Co., Covington, Ky.; Dodge, A. W., New Haven Street Ry., New Haven, Conn,; Dimmock, W. S., Omaha Elec. Ry. Co, Omaha, Neb.; Dunlap, G. F, Washington and Georgetown Ry. Co., Washington, D. C.; Davis, E. H., Williamsport Pass. Ry., Williamsport, Pa.; Douglas, W. E., Car, Philadelphia, Pa.; Dimmick, C. J. S., Dixie Pub., Atlanta, Ga.; Davis, H. C, Elec. Power, N. Y.; Degenhardt, F. G., Standard Cable, Pittsburgh, Pa.

Entwisle, E. B., Johnson Co., Johnstown, Pa.: Evans, H. B., Atlanta, Ga.; Evans, Powell, Wm. W. Wharton, Jr. & Co., Philadelphia, Pa.; Ewing, Geo. C., Ry. Supplies, Philadelphia, Pa.; Englund, A. H., International Register, Chicago, Ill.; Eakins, J. S., Atlanta, Ga.; Edwards, B E., La Crosse City Ry. Co., La Crosse, Ind.; Eno, W. G, Wilkesbarre & W. V. Trac. Co., Wilkesbarre, Pa.; Eno, J. W., Wilkesbarre & W. V. Trac. Co, Wilkesbarre, Pa.; Ellis, L. J., E P. A., N. & W. R. R., N. Y.; Evans, H. C., Johnson Co, N. Y.; Edgar, T. H., Georgia Elec. Light Co., Atlanta, Ga; Evans, D. E., Gainsville H Street Ry. Co., Gainsville, Ga.; Elikens, W. L., Pittsburgh Trac. Co., Pittsburgh, Pa.; Ehrnan, F. J., New Elec. Ry., Philadelphia, Pa.; End, W. G., Wilkesbarre Trac. Co., Wilkesbarre, Pa.; Ewing, F. W., Nashville Street Ry. Co., Nashville, Tenn.; Ervine, G. C. Composite Brake Shoe Co., Boston; Estes, F. A., R. D. Nuttall Co., Allegheny, Pa.

Fairchild, C. B., *Street Railway Journal*, N. Y.; Fagen, James, Wilkesbarre & Wyo. Valley Trac. Co., Wilkesbarre, Pa; Fawcett, Ed., Safety Switch Brake Co., Philadelphia; Field, C. J., Consult. Eng., Worcester, Mass.; Fuller, F. G., Day's Kerite, New York; Foster, H. A., Elec Power, . Y.; Fairbrother, H., N. Y. Leather Belting Co., N. Y.; Flynn, C. E., Central Ry. Co, Peoria, Ill.; Flag, S. J., *Atlanta Journal*, Atlanta, Ga; Fairbanks, C. E., Elec. Eng., N. Y., Fisher, W. F., Hoopes Mfg. Co., Springfield, O.; Foster, H. H., Dreher Mfg. Co., N. Y; Fliss, L. M., M. V. Ry. Co, Piqua, O.; Field, Jno. M., Berlin Iron Works, East Berlin, Conn.; Ferguson, W. L., City Elec. Ry. Co., Decatur, Ill.; Ford, D. J., Gloucester Street Ry Co., Gloucester, Mass.; Flick, L. M, Miami V. Ry. Co, Piqua, O.; Falk, C. J., Worcester Consl. Ry., Worcester, Mass.; Fagan, J., Wilkesbarre Trac. Co., Wilkesbarre, Pa; Ferguson, W. B., Worcester-Lancaster & Spence Ry., Worcester, Mass.; Felder, F. G., Kerite Wires, N. Y.; Fuller, C. M., Davis Car Shade, Portland, Me.; French, P. T., A. French Spring Co., Pittsburgh, Pa.; Fairbanks, C. E., Georgia Equipt. Co., Atlanta, Ga.; Fisher, W. H., Hoopes Mfg. Co., Springfield, Ohio; Flanders, C F., Morris Tasker Co., Philadelphia, Pa.

Goodrich, E. S., Hartford Street Ry. Co., Hartford, Conn.; Granten, Wm., H. W. Johns Mfg. Co., New York; Graham, John, Wilkes. and Wyo. Val. Trac. Co., Wilkesbarre, Pa.; Greene, B. E., *Electricity*, New York; Greenwood, Jr., L., Ball & Wood Co., New York; Glasier, A. A., Br ckton Street Ry. Co., Brockton, Mass.; Gerlemann, J. F., American Elec. Mfg. Co., St. Louis, Mo.; Green, O. G., Columbia Ry. Co, Columbia, N. C.; Griffin, J B., Hamilton Street Ry, Hamilton, Ont.; Gould, W. H., H. W. Johns Mfg. Co, Atlanta, Ga.; Graham, Geo. H., Chicago Elec. Truck Co., Chicago, Ill.; Green, E. M, City Elec. Ry. Co., Rome, Ga; Gillee, O. C., Wash and Geo. Ry., Washington, D. C.; Green, A., Roch. Street Ry, Rochester, N. Y.; Green, Chas., People's Street Ry., St. Louis, Mo.; Goodrich, E. S, Hamilton Street Ry. Co., Hamilton, Ont.; Goff, R. S., Globe Street Ry., Fall River, Mass.; Garth, R. L. W., Chicago Street Ry. Co., Chicago, Ill.; Gray, L. A., Adams & Westlake Co, Chicago, Ill.; Gait, H. C., Genl. Elec. Ry. Co., Pittsburgh, Pa.; Giles, A. F., Genl. Elec. Ry. Co., Pittsburgh, Pa.

Henry, W. L., Brockton Street Ry, Brockton, Mass.; Hanna, J. A., McGuire Truck Co., Chicago, Ill; Hatch, E. B., H. W. Johns Co, New York; Heywood, J. F., City and Suburban Street R. R. Co., Baltimore, Md.; Heinrich, R. O, Weston Elec. Inst. Co., Newark, N. J.; Higgins, E. E., Electrical Expert, New York; Huntress, F. E., Laconia Car Co., Laconia, N. H.; Hallenback, J. W., Wilkes. and Wyo. Val. Trac. Co., Wilkesbarre, Pa; Hunt, W. T., Electrical Age, New York; Hunt, Mrs. W. T., Brooklyn; Hunt, Master Walter T., Brooklyn; Hurley, P. E., Trenton Pass. Ry. Co., Trenton, N. J.; Hurt, Joel, Atlanta Cons. Street Ry. Co., Atlanta, Ga.; Hurt, H. N., Atlanta Cons. Street Ry. Co, Atlanta, Ga.; Hale, W. C., V. P. Atlanta Trac. Co, Atlanta, Ga.; Hale, Mrs. W. C., Atlanta, Ga.; Hoch, Sydney, Central Elec. Htg. Co., New York; Hazelton, Jr., Wm., Wheels; Harris, G. H., Elec., Birmingham Ry. and Electric Co, Birmingham, Ala; Harrington, W. E., Camden House R. R. Co., Camden, N. J.; Hobson, B. J., Hutchison, Kansas; Hoffman, A. M., Falk Mfg. Co., Milwaukee, Wis.; Hotes, E. B, Secretary Johns-Pratt Co., Hartford, Conn.; Hazelrigg, S. F., Youngstown Street Ry. Co., Youngstown, Ohio; Hurley, Thos. A., Holmes, Booth & Hayden, Waterbury, Conn.; Harding, H. M. L., Walker Mfg. Co., New York; Heyward, J. F., Genl. City and Sub. Ry. Co., Grand Rapids, Mich.; Heaskell, Geo. M., J. G. Brill Co., Philadelphia, Pa.; Hoffman, Jos., Genl. Elec. Co., Schenectady, N. Y.; Hough, A. H., Brush Elec. Co., Cleveland, Ohio; Harris, Mrs. K. E., Birmingham, Ala.; Hardin, Miss Lucille, Rome, Ga; Houck, C. A. B., Hazelton, Pa.; Hendrickson, B. V., Brooklyn, N. Y.; Harrison, R. B., Terre Haute Elec. Ry., Terre Haute, Ind.; Hamilton, D. G., Missouri Ry. Co, St. Louis, Mo.; Hunter, R. S., Springfield Ry. Co., Springfield, Ohio; Hood, W. S., Springfield Ry. Co., Springfield, Ohio; Howard, W., Youngstown Street Ry. Co., Youngstown, Ohio; Hunter, F. W., Nash. Trac. Co., Nashville, Tenn.; Hayden, C. W. Mil. Street Ry., Milwaukee, Wis.; Hurty, J. H., Macon Street Ry. Co., Macon, Ga.; Huppie, G. B., Des Moines Street Ry. Co., Des Moines, Iowa; Hendrickson, B. F., Bay City Street Ry. Co., Bay City, Mich.; Hank, C. A. B., Lehigh Trac. Co., Hazelton, Pa.; Helle, G. W., Union Ry. Co., Utica. N. Y.; Haskell, G. M., J. G. Brill Car Co., Philadelphia, Pa.; Heuling, W. H., J. G. Brill Car Co., Philadelphia, Pa.; Hopkins, J. H., Barney & Smith Car Co., Dayton, Ohio; Hills, L. P., Davis Car Shade, Portland, Me.; Hoagland, C. A., J. A. Graham Co., New York.

Issertel, H. G., H. W. Johns Mfg. Co., N. Y.

Jones, B. J, Sargeant & Lundy, Chicago, Ill; Jewell, W. S., Toledo Cons. Ry., Toledo, Ohio; Johnson, G. S., Cons. Street Ry. Co., Grand Rapids, Mich.; Jackson, J. H., Wilmington, Del.; Johnston, W. J., *Electrical World*, N. Y.; Johnston, Mrs. W. J., N. Y.; Jenkins, T. W., Cincinnati, Newport and Cov. Ry. Co., Cincinnati, Ohio; Johns, J. W., Citizens' Street Ry. Co., Kalamazoo, Mich; Jones, J G., Citizens' Street Ry. Co., Memphis, Tenn.; Jones, C. L., Milwaukee Street Ry. Co., Milwaukee, Wis.; Jones, F. W., Anniston Cordage Co, Anniston, Ala.; Jerome, R. S., Central Elec. Heating Co., N. Y.

Kilgour, B. L., 5th and Walnut streets, Cincinnati, Ohio; Kenfield, H. J, *Street Railway Review*, Chicago, Ill.; King, J., City Elec Ry Co., Rome, Ga.; Kirke, H. L., Westinghouse Co., Boston; Knight, W. H., Gen. Elec. Co., N. Y.; Kohler, G. A., Walker Mfg. Co., Chicago, Ill.; Kohler, F. H., Walker Mfg. Co., Chicago, Ill.; Koche, J., Cleveland City Ry. Co., Cleveland, O.; Knight, F. H., Easton Trac. Co., Easton, Pa.; Kobusch, G. J., Citizen's Street Ry., Kalamazoo, Mich.; Krotz, A. S., Springfield Ry., Springfield, Ohio; Kittridge, A. M., Barney & Smith Co., Dayton, Ohio; Kelly, W. M., Carnegie Steel Works, Atlanta, Ga.; Kingston, W. W., The Johnson Co., Johnstown, Pa.; King, C. K., Ohio Brass Co., Mansfield, Ohio; Kennedy, J. J., Sterling Supply Co., N. Y.

Landon, E. T., D. D., E. B. & B. R. R. Co., New York; Linberry, W. H., Trenton Trolley Wagon, Trenton, N. J.; Luscomb,

H. H., H. W. Johns Co., New York; Leavitt, J. M., C. R. R. of N. J.; Le Van, Jr., H. B., Brooklyn Car Wood and Veneer Works, Street Ry. Advertising Co., Veneer Seating and Church Furn. Co., Brooklyn, N. Y.; Leen, R., 610 Hackley street, Cincinnati, Ohio; Larendon, W. S., Civil Eng., Atlanta, Ga.; Lawless, E. J., Eastern Agent American Car Works; Lockwood, R. M., Michigan Elec. Co., Detroit, Mich.; Lens, C. O., Graham Equipt. Co., Providence, R. I.; Leonhardt, Wm., Pneumatic Fender Co., Baltimore, Md.; Littell, H W., New Orleans, La.; Linn, J. B., Sperry Elec. Ry., Cincinnati, O.; Linburg, W. H., Steinway System, Brooklyn, N. Y.; Leen, P., Cincinnati Street Ry. Co., Cincinnati, Ohio; Lodge, Geo., New Elec. Ry., Philadelphia, Pa.; Laidless, E. J., Amer. Car Co., St. Louis; Lenon, W. H., Brooklyn Car, Wood and Veneer Co., Brooklyn, N. Y.; Litach, P. F., Brass Foundry and Machine Works, Ft. Wayne, Ind.; Lidenger, F. L., Dayton Mfg. Co, Dayton, O.; Lyle, C. S., J. M. Emerson & Son, N. Y.; Lee, Geo. L., Genett Air Brake Co., N. Y.; Laughthede, J. E., Quaker City Car Equipt. Co., Philadelphia, Pa.

Marshall, J. L, Columbia Elec. Rld. Co., Columbus, S. C.; Morehead, H. B, C. M. & D. Rld., Cincinnati, Ohio; Martin, T. C., *Electrical Engineer*, New York; Meier, E. D., Heine Safety Boiler Co., St. Louis; Meixell, J. C., Wilkes. and Wyo. Vall. Trac. Co., Wilkesbarre, Pa.; McAdoo, M. R., Paterson Ry. Co., Paterson, N. J.; McCardell, J. R., McCardell, West & Co., Trenton, N. J.; McGraw, J. H., *Street Railway Journal*, New York; Mastell, F. L., C. R. of N. J.; Morgan, J. W., Camden, Glou. and Woodbury Ry. Co., Camden, N. J.; Meyers, L. E, Chicago, Ill.; Mayer, C. J., Nuttal Co., Philadelphia, Pa.; Mason, W. R., Medbury Trolley Supplies, Chicago, Ill.; Mannie, Moses, Present Street R. R., Natchez, Miss.; Milner, J. M.; Mendell, C. E., New Bedford, Mass.; Morrell, F. A., Brooklyn, N. Y.; Moore, Geo. C., Rochester Car Wheel Works, Rochester, N. Y.; McLaren, P. M, Abendroth & Root Co., N. Y.; McCallister, H., Camden, Gloucester and Woodbury R. R., Gloucester, N. J.; Meaker, J. G, Walker Mfg. Co., Cleveland, Ohio; Marshall, J. L., Columbia Street Ry. Co., Columbia, S. C.; McClary, J. B, Birmingham Street Ry. Co., Birmingham, Ala.; McCredle, J., Cincinnati, Newport and Cov., Cincinnati, O.; Musser, F. B., Pass. Ry. Co., Harrisburg, Pa.; McKinney, C. A., Houston Street Ry. Co., Houston, Texas; McLaughlin, J. F., New Elec. Ry., Philadelphia, Pa.; McCarthey, J. G., E. E. W. E. & M. Co., Newark, N. J.; Magee, F. A., E. S. Greeley & Co., N. Y.; Markle, A., Lehigh Trac. Co., Hazleton, Pa.; McCredor, James, Albany, N. Y.; Maloche, F. J., Orleans R. R. Co., New Orleans, La.; Moon, H. A., Wadham Oil and Grease Co., Milwaukee, Wis.; Means, G. C., Westinghouse Elec. Co., Boston; Myers, L. E., Aurora Street Ry. Co., Aurora, Ill., McNamara, J., Albany Ry., Albany, N. Y.; Minday, E. J., Louisville Ry. Co., Louisville, Ky.; Mahoney, Dan, People's Ry., St. Louis, Mo.; McFarland, Electric Ry., Savannah, Ga.; McKinley, W. R., Springfield Ry., Springfield, O.; Miley, C E., Springfield Ry., Springfield, O.; McCollough, R, St. Louis Rld. Co., St. Louis, Mo.; Moore, G. C., Taunton Ry. Co., Taunton, Mass.; McConathy, J. H., Binghamton Wagon Co., Binghamton, N Y.; McClay, J. R., Albany Car Heating Co., Albany, N. Y.; McLaughlin, J. A., Electric Co., Philadelphia, Pa.; Miles, Fred., Southern Elec. Works, Atlanta, Ga.; Myers, G., Standard Ry. Sup. Co., Chicago, Ill.; Millen, T. C., Smith of New York, N. Y.

Nyman, Howard, Rock Creek Ry. Co., Washington, D. C.; Noble, W., P. C. M. and D. Rld Co., Cincinnati, Ohio; Nick, S. J., Elec. Ry. Equipt. Co., Cincinnati, Ohio; Netherent, E. S., Paige Iron Works, Baltimore, Md.; Newse, H O., Scarrett Car Seat Co., St. Louis, Mo.

Ostrom, J. F., M. N. and S. Ry. Co., Steelton, Pa.; Outcault, R. F., Artist, New York; Orr, A. M., M. U. Ry. Co., Piqua, Ohio; Oswald, E. M., Benedict & Burnham Co., New York.

Packer, Eldridge, Hughes Fare Register Co., New York; Pearson, Henry, Springfield Street Ry. Co., Springfield, Mass.; Peckham, Edgar, Peckham M. T. and Wheel Co., New York; Pierce, Geo. W., Stamford Street Ry. Co., Stamford, Conn.; Perrine, Jr., L., Trenton Pass. Ry. Co., Trenton, N. J; Perry, J. W., H. W. Johns Co., New York; Porter, Geo. F., National Elec. Lt. Ass'n, New York; Powell, J. W., Cons. Street Ry. Co., Atlanta, Ga.; Pool, H. W., *Street Ry. Journal*, New York; Poe, Geo., Car Fender, Albany, New York; Polk, J. S., Des Moines, Iowa; Prall, E. J., Elec. Engineer; Pierson, C. H., Union Depot Ry., St. Louis, Mo.; Pierce, G. W., Supt. Street Ry., Stamford, Conn.; Partridge, Jas., Partridge Carbon Co., Sandusky, Ohio; Pease, E., Savannah, Ga; Potter, W. B., Genl. Elec. Co., New York; Partridge, J. S., Bklyn. and Newtown Ry. Co., Brooklyn, N. Y.; Patterson, W. H., Bloomington City Ry. Co., Bloomington, Ill.; Pennington, T. C., Chicago City Ry. Co., Chicago, Ill.; Passilague, T. W., Enterprise Ry. Co., Charleston, S. C.; Perkins, T. C., Mather Elec. Co., Manchester, Conn; Payne, H. C., Milwaukee Street Ry. Co., Milwaukee, Wis.; Pond, A. E., Winchester Ave. Ry., New Haven, Conn.; Pratt, M. D., M. T. and S., Steelton, Pa.; Pratt, C. B., Worcester Cons. Ry., Worcester, Mass.; Parks, J. G, Wash. and Georgetown Ry., Washington, D. C.; Pratt, E. J., Southwest Missouri Elec. Ry., Webb City, Mo.; Pugh, J. L., Dorner & Dutton Mfg. Co., Cleveland, Ohio; Powers, E. L., Elec. Pub. Co., Chicago, Ill.; Price, C. W., *Elec. Review*, New York; Pilson, B. T., Hale & Kilburn Co., Philadelphia, Pa.; Perry, J. W., H. W. Johns Co., New York; Pratt, G. S., Jackson & Sharpe Co., Wilmington, Del.; Pomeroy, J., Pomeroy & Fisher, New York; Paige, H. W., Paige Iron Works, Baltimore, Md.; Partridge, Arthur, Nuttall Ry. Supplies, St. Louis, Mo; Pugh, J. W., John Stephenson Co., New York.

Richardson, W. J., Amn. Street Ry. Assn.; Richardson, Mrs. W. J., Brooklyn; Rose, R. M., Norwalk Street Ry. Co., Norwalk, Conn.; Ross, E. E., Chapman Valve Co., Indian Orchard, Mass.; Rogers, F. A., Fulton Truck & Foundry Co., Cleveland, Ohio; Rhea, R. M., West End Street R. R. Co., Knoxville, Tenn.; Reed, W. P., Salt Lake City Ry., Salt Lake City, Utah; Robinson, Wm., manager R. E. F. & S. Co., Boston, Mass.; Reinoehl, C. W., Penn Steel Co., Steelton, Pa.; Ranson, H. N., Consolidated Car-Heating Co., Albany, N. Y.; Rhotehamel, J. H., Columbia I. L. Co., St. Louis, Mo.; Record, Ed., Vacuum Oil Co., Rochester, N. Y.; Rogers, L. H., Brush Elec. Co., Cleveland, Ohio; Rus, R., Norwalk, Conn.; Rush, C. O., Bay City Ry. Co., Bay City, Mich.; Rink, H., Easton Traction Co., Easton, Pa.; Rodenburg, J. S, Traction Co., Easton, Pa.; Richards, E. J., Pass. and Belt Ry., Lexington, Ky.; Rugg, J. E., Pitts. Traction Co., Pittsburgh, Pa.; Randell, T. C., J. G. Brill Car Co., Philadelphia, Pa.; Ross, E. L., Chapman Valve Mfg. Co., Indian Orchard, Mass.; Rogers, W. E. H., Fulton Foundry & Truck Co., Mansfield, Ohio; Reinhall, F. M., Genl. Elec. Ry. Co., Pittsburgh, Pa.; Regenstein, J., Georgia Equipt. Co., Atlanta, Ga.; Russell, F. D., Rochester Car-Wheel Works, Rochester, N. Y.

Smith, H. W., Smith Closed Conduit Co., Newark, N. J.; St. John Wm., Safety Cons. Heating and Lighting Co.; Shainwald, J. C., Standard Paint Co., New York; Smith, E. A., Cons. Car-Htg. Co., Chicago, Ill.; Stevenson, Jas., Armature Winder Co., Atlanta, Ga.; Smith, C. H., Troy City Ry. Co., Troy, N.Y.; Smith, C. T., Thos. Smith & Co., New York; Short, S. H., Walker Mfg., Co., Cleveland, Ohio; Samns, B. S., Westinghouse Co., Boston; Stewart, B. F., A. Whitney & Son, Philadelphia, Pa.; Sargent, C. S., West End Street R. R. Co., Boston; Sullivan, P. F., Lowell, Sub. Street Ry., Lowell, Mass.; Smith, B. G., Lacrosse Street Ry. Co., Lacrosse, Wis.; Simmes, R., Mobile Street Ry. Co., Mobile, Ala.; Shaw, E. P, Winchester Ave. Street Ry. Co., New Haven, Conn.; Smith, W. N., N. O. Traction Co., New Orleans, La.; Stone, E. K., Quincy Horse Ry., Quincy, Ill.; Shaffel, W. H., Asbury Park Street Ry., Asbury Park, N. J.; Seibell, G. F., Taunton Ry. Co., Taunton, Mass.; Shaw, E. P., Haverhill & A. Ry. Co., Haverhill, Mass.; Somerset, H. J., Winnipeg Elec. Ry., Winnipeg, Mass.; Scrugham, G. E., Craighead Eng. Co., Cincinnati, Ohio; Stadelman, W. A., Niles Tool Works, Hamilton, Ohio; St. John, W., Pintsch Gas System, New York; Simmons, E. A., *Street Railway Gazette*, New York; Stump, C. E., *Street Railway Gazette*, New York; Sinclair, W. H., Galv. City Railroad, Galveston, Tex.; Schieren, jr., Chas. A., Chas. A. Schieren & Co., New York; Seely, John A., Complete Const. Co., New York; Seely, Mrs. J. A., New York; Shepardson, H. O., Waterbury Traction Co., Waterbury, Conn.; Silver, Wm. S., Graduated Car Springs, New York; Smith, E. N., Penn Steel Co., Philadelphia, Pa.; Smith, Mrs. E. N., Philadelphia, Pa.; Sloane, F. H., City & Suburbs Ry Co., Baltimore, Md.; Smith, J. T., Citizens' Street Ry. Co., Fishkill, N. Y.; Stedman, J. H., Transfer System, Rochester, N. Y.; Stevenson, Samuel M., N. & W. R. R., New York; Seguin, W. P., Frost Veneer Seat Co., New York; Seguin, Miss Gertrude, New York; Seddon, W. L., Atlanta Traction Co., Atlanta, Ga.; Stanley, C. T., Cincinnati, Ohio; Smith, W. A., Omaha Street R. R Co., Omaha, Neb.; Stratton, Jas. A., Ry. & Elec. Co., Birmingham, Ala.; Smith, J. F., Citizens' Street Ry., Fishkill, N. Y.; Stevens, E. H., J. C. & C. Street Ry. Co., Johnson City, Texas; Scott, R. F., Elec., Montgomery Street Ry. Co., Montgomery, Ala.; Smith, J. A., Cin. Incline Ry. Co., Mount Auburn, Cincinnati, Ohio; Stanwood, F. H., Stanwood Mfg. Co., Chicago, Ill.

Taylor, W. H., *Street Railway Journal*, New York; Thompson, S. B., City & Suburbs Ry. Co. Baltimore; Tolles, C. L., Jewell Belting Co., Hartford, Conn.; Thomas, E. P., Johnson Co., Hartford, Conn.; Turner, A. M., Hammond Street Ry. Co.; Thomas, R. L., National Washer Co., New York; Taft, Benj., Boston, Mass.; Taylor, John, Taylor Truck, Troy, N. Y.; Tarris, E., Ry. & Elec. Co., Birmingham, Ala.; Tyson, L. D., West End Street Ry. Co., Knoxville, Tenn.; Tullie, A C., Met. Street Ry., New York; Titus, A. C., Newport Street Ry. Co., Newport, R. I.; Thompson, A. C., Missouri Ry. Co., St. Louis, Mo.; Trawick, G. W., Genl. Elec. Ry. Co., Pittsburgh, Pa.; Taylor, W. H., Pratt & Letchworth, Buffalo, N. Y.

Uriah, J. K., Galveston Street Ry. Co., Galveston, Tex.

Vincent, C. R., Ball & Wood Co, New York; Van Dorn, N. S., Fitzgerald-Van Dorn Co.; Vosburg, A. C., New Process Raw Hide Co., Syracuse, N. Y.; Van Fleet, C. W. N. Y. Elec. Works, New York; Vail, J. H., Poughkeepsie Street Ry., N. Y.; Vandergripp, F. B., Car, Philadelphia, Pa.

Whipps, G. W., Lewis & Fowler Co., Brooklyn, N. Y.; Wadham, E. A., Wadham Oil & Grease Co., Milwaukee, Wis.; Wightman, H. J., H. J. Wightman Co., Scranton, Pa.; Wallace, A., Col-

(*Continued on page 234.*)

NEW SYSTEM OF CAR PROPULSION.

At the Kimball House, Atlanta, Ga., was exhibited, during the convention, a new system of street car propulsion that attracted a good deal of attention. It is named "The New Electric Railway System," and is the invention of James F. McLaughlin, of Philadelphia. Existing trolley lines can be equipped with this system with very little alteration. No change in power-house equipment, motors, cars or roadbed is necessary; the overhead construction, however, is taken down and relegated to the scrap heap.

A car equipped on this system has an electrical "controller" bolted underneath the floor and the trolley pole is taken off.

To equip the roadbed a space 18 inches in width is dug between the rails, the conduit is fastened down on top of the sleepers and the street repaved or cemented over the conduit, leaving a solid roadbed, with a flat level strip one inch in width, running along the top of the conduit, parallel with the rails and flush with the street. There is no slot. The strip is composed of a series of flat iron rails separated at intervals by non-conducting material. With this equipment and the proper current in the conductor placed within the conduit, cars may be run with great facility in either direction and as fast or slow as may be desired.

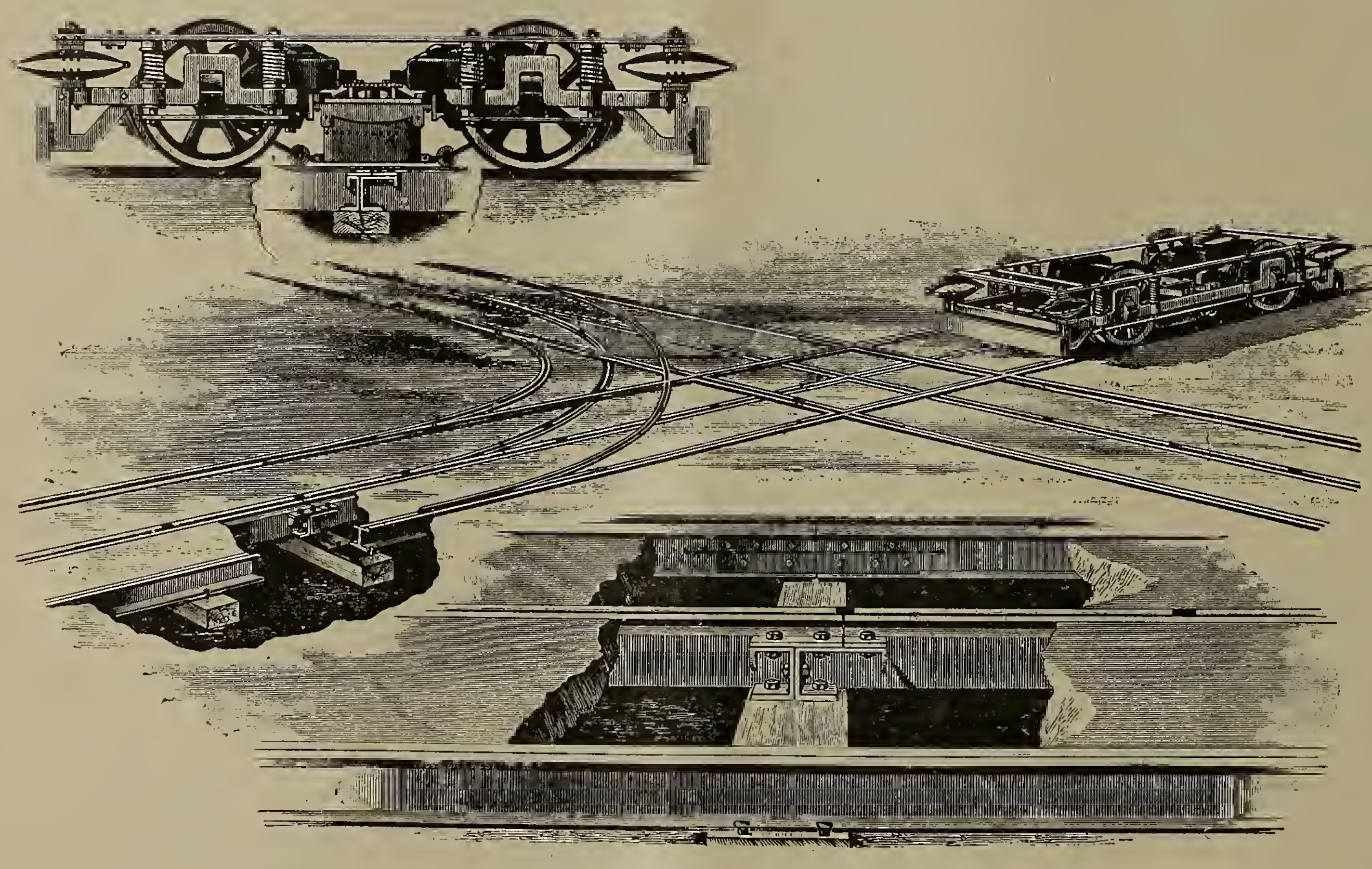
This system is not complicated and there is nothing to get out of order, neither is its operation interfered with by the presence of snow or ice, and while the current is on, the cars, it is said, cannot be thrown over the tracks.

The conductor is so insulated and isolated that no part of the current escapes. The "secret" of the system lies in the "controller" that is fastened under the car. It is stated that by use of the "controller" any quantity of electricity within the limits of the amount carried by the conductor can be utilized for the propulsion of the cars. The cars are lighted from the same source.

This is the first time that this system has been shown to the public, and a company has been organized to equip existing or new roads with it. It is claimed to be a safe, cheap, reliable and durable system. It is entirely covered by patents and does not infringe on anybody else's.

Further particulars regarding this system can be had from George Lodge, 1200 S. Third street, Philadelphia, Pa., who is the manager of the company, or Hon. William W. Ker, 608 Chestnut street, Philadelphia. Contracts have been closed to install plants in Atlanta, Ga., Philadelphia, Pa., and other cities.

The above illustration shows the method of roadbed construction and the "controller" attached to the car truck. The illustration also shows the ease with which lines can be made to cross each other and junctions effected, which is one of the special claims of the company for its system.



NEW ELECTRIC RAILWAY SYSTEM.

(*Continued from page* 233.)

umbia Elec. Ry. Co., Columbia, S. C.; White, H. B., Calumet Elec. Street Ry., Chicago, Ill.; Wason, C. W., Cleveland City Ry., Cleveland, Ohio; Williams, W. M., Easton Traction Co., Easton, Pa.; Wakefield, R. S., Queen City Ry. Co., Dallas, Tex.; Wrie, T. K., Galveston City Ry. Co., Galveston, Texas; Wattby, G. E., Jamestown Street Ry. Co., Jamestown, N. Y.; Wylap, J. T., Macon & Indian Spring Ry., Macon, Ga.; Williams, C. H., Manchester Street Ry., Manchester, Conn; Wendell, S. S., Union Street Ry., New Bedford, Mass.; Williams, S. A., Rochester Street Ry., Rochester, N. Y.; Wight, C. L., Toledo Consolidated Ry., Toledo, Ohio; Woodward, C. F., Wakefield & Stoneham Ry., Wakefield, Mass.; Williams, C. H., American Eng. Co., Atlanta, Ga.; Woodward, J. H., Benedict & Burnham Co., N. Y.; Wandegus, F. B., Consolidated Car Heating Co., Albany, N.Y.; White, T. C., Central Brass Co., St. Louis; Wood, C. N., R. D. Nuttall Co., Allegheny, Pa.; Windsor, H. H., *Street Railway Review*, Chicago, Ill.; Wessels, E. J., Genett Air Brake Co., New York; Weirs, Geo. L., Lewis & Fowler Fare Register, New York; Winsor, H. J., Vernon Fare Register Co., New York; Woodruff, R. S., Trenton Pass Ry. Co., Trenton, N. J.; Willis, H. C., Washburn & Moen Mfg. Co., N. Y.; Wyman, E. B., Central Elec. Heating Co., N. Y.; Wicks, S. J., Cincinnati, Ohio; Wakefield, R. S., Queen City Ry. Co., Dallas, Texas; Wirt, H. C., Schenectady, N. Y.; Woods, C. N., Boston, Mass.; Wight, C. L., Toledo Consolidated Street Ry. Co., Toledo, Ohio.

Yardly, J. H., Philadelphia Car Wheel Co., Philadelphia, Pa.

PRINCIPLES OF DYNAMO DESIGN.

Owing to the pressure on our columns this week, of the Atlanta Convention report, we are compelled to omit the instalment of Mr. Harrison's article intended for this issue.

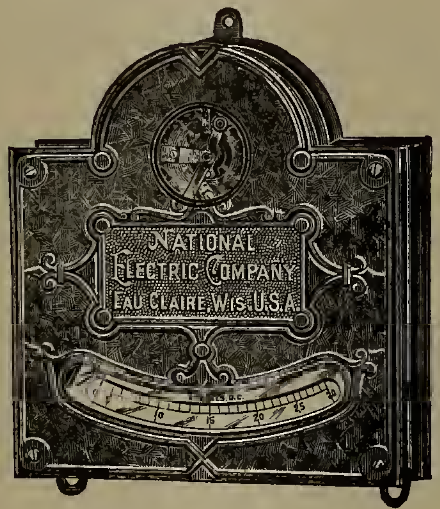
It will appear in our next issue.

NATIONAL SWITCHBOARD INDICATORS.

The National Electric Company, of Eau Claire, Wis., has equipped a special department in its factory for the manufacture of National switchboard indicators, which have been received with considerable favor among electric station managers.

These voltmeters and ammeters have been brought out to meet the general demand for high-grade instruments of this class at moderate cost, and they are made for either alternating or direct current work.

Essentially, the movement consists of a solenoid with a small eccentrically fixed armature that acts magnetically upon a minute movable armature attached to the pointer. It is simple in its construction and reliable in its indications. All National indicators are designed to remain constantly in circuit and they give accurate direct readings at all times. The energy absorbed by the instruments is inappreciable.



NATIONAL INDICATOR.

The instruments are of artistic design, mounted in iron cases, which act as a magnetic shield, and are finely finished. The movement of the instruments is exposed to full view, as shown in the above illustration.

These indicators are made in sizes suitable for stations of all capacities.

THE AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS.

The 90th meeting of this Institute was held in New York on the evening of October 17. A paper by Lieut. Samuel Reber, entitled "Theory of Two and Three-Phase Motors" was read, and was followed by one by Charles Proteus Steinmetz on the "Theory of the Synchronous Motor." Lieut. Reber's paper gave an approximate solution of the two and three-phase motors in which the change of magnetic properties of the iron and magnetic leakage were neglected, the coefficients of self induction being considered constant, while the mutual induction between the armature and field coils was assumed to follow a sine law and the field supposed to be without projecting pole-pieces. The paper was a complete mathematical discussion of these assumptions, and was illustrated by various curves.

Mr. Steinmetz's paper was also of an extremely mathematical character, and tended to prove that the true mechanical power characteristics of the synchronous motor can be determined only in the case of the particular conditions of the installation under consideration.

A meeting of Western members was also held at Chicago at the same time, at the Armour Institute, at which the same papers were read by Prof. W. M. Stine.

Brooklyn Institute of Arts and Sciences.—Prof. W. A. Anthony, on October 22, delivered before the department of electricity the second lecture in the course of "Electricity and its Applications in the Arts and Sciences."

A BEAUTIFUL SOUVENIR NUMBER.

The *Street Railway Journal* commemorates its tenth anniversary and the Atlanta meeting of the American Street Railway Association with a souvenir number that is really remarkable as an artistic production. It is printed on plate paper throughout and most beautifully illustrated with half-tone engravings. Its reading pages are full of interesting matter, and the issue will be a valuable one to preserve for reference. In every way it is the finest example we have ever seen of the printers' and engravers' art and illustrates the substantial character of trade journalism. Among the many features contained in the reading pages is a short history of the street railway industry, which is fully illustrated. It contains over 400 illustrations, among which are more than 125 portraits of street railway men.

PNEUMATIC SYSTEM OF PROPELLING STREET CARS.

The Pneumatic Power and Motor Company, 55 Dey Street, New York, gave an exhibition of its system of motive power for the transportation of passengers and freight, at the above address, on October 13.

This is claimed to be a perfect system of pneumatic power transmission, adaptable to steam, street, or elevated roads. A model car was in practical operation on a short length of track laid on the floor. The car moved to and fro with great ease and under perfect control, and its speed could be varied with facility.

The advantages claimed for this system are that no complicated or expensive plant is necessary; there is no limit to power or speed; no smoke, cinders, or noise; low cost of maintenance and great simplicity of operation. It is stated that every pound of power is applied to the cars on the track, and that not one pound is lost or wasted. A comparative statement given out by the company sets forth that six miles of double track on the pneumatic system costs $257,000 to instal, which is about $21,415 per mile, and the cost of operating the same is $318. The system is the invention of G. H. Goebel, who is president of the company. Mr. Chas. J. Fleck is the general manager.

The exhibition was successful.

NEW CORPORATIONS.

The Nowotny Electric Co., Cincinnati, O., by L. R. Keck, John S. Nowotny, A. G. Corre, Claude Ashbrooke and H. B Emerson. Capital stock, $25,000.

American Electrical Heating Co., Detroit, Mich. Capital stock, $50,000.

The Chillicothe Electric Railroad, Light & Power Company, Chillicothe, O. Capital stock, $100,000.

The Key West Light & Power Company, Key West, Fla., by John L. Philbrick, president; Geo. W. Allen, secretary, and Joseph C. Whalton, Jr., treasurer. Capital stock, $125,000.

The Clifton Park Passenger Railway Co., Baltimore, Md. Capital stock, $50,000.

The Missouri District Telegraph Co., St. Joseph, Mo., by L. C. Baker, B. H. Bohle, G. J. Fankle, C. H. Bristol and J. W. James. Capital stock, $250,000.

Cape Girardeau Water-Works and Electric Light Company, Cape Girardeau, Mo., by Leon J. Albert, David A. Glenn and Richard E. Gannon, of Cape Girardeau, and Thomas W. Gannon, Patrick Fitzgerald and others, of Cairo, Ill. Capital stock, $100,000.

The North Shore Electric Road, Chicago, Ill., by J. L. Cochran, B. H. Louderback and Dunlap Smith. Capital stock, $10,000,000.

The Dauphin Light, Heat & Power Company, Harrisburg, Pa., by Joseph Pyne, Mercer B. Tate, J. Grant Koons, H. Ross Coover, Ezra L. Fackler. Capital stock, $50,000.

Dundee Electric Light Company, Dundee, Mich. Capital stock, $12,000.

The Auto-Electric Company, Grand Rapids, Mich. Capital stock, $15,000,

The American Electric Smelting Co., of Wheeling, W. Va., has been organized with J. A. Campbell, president.

POSSIBLE CONTRACTS.

A. R. Smith, of Rock Hill, S. C., contemplates the erection of a telephone exchange and line.

Ford & Kellogg, Chattanooga, Tenn., are in the market for second-hand electric light apparatus, both arc and incandescent. They will be pleased to hear from manufacturers.

The Williams Ice Co., St. Petersburg, Fla., is in the market for machinery for a 500-incandescent electric light plant, complete.

The Palatka Electric Light, Power and Supply Co., Palatka, Fla , is in the market for a one and two 25 K. W. dynamos of 110 volts, lamps, wire, etc. They will also want a 50 H. P. boiler and a 40 H. P. automatic high speed engine.

G. L. Hogan, of Chicago, Ill., can give particulars regarding a new company just organized for the purpose of establishing an electric light plant in Lawrenceburg, Ky.

The Griffin Electric Light and Water Works, Griffin, Ga., are in the market for a fire alarm system.

J. M. Ingle, Asheville, N. C., desires quotations on telephone supplies.

J. C. Jackson & Son, of Wilsonville, Ala., are in the market for telephone supplies, and desire estimates on the cost of telephone systems.

The Mayor of Lynchburg, Va., can give information regarding the erection of an electric light plant in that city.

The Missouri and Kansas Telephone Co., St. Joseph, Mo., is going to place its wires underground.

The Mayor of Apalachicola, Fla., can give particulars regarding proposed electric light plant and water-works in that place.

The Clifton Passenger Railroad Co., of Baltimore, Md., just organized, will erect a power plant.

Dealers in electric light line material may find it to their advantage to address the Meridian Gas Light Co., Meridian, Miss. This company is installing an electric light power station.

The Columbia Electric Light Co., Columbia, S. C., contemplates the enlargement of its plant.

The Chesapeake and Ohio Railroad Co. proposes to build a new station at Ashland, Ky., to cost $50,000.

Wellshouse & Son, Atlanta, Ga., are going to erect a six-story building.

The Chesapeake and Atlantic Transportation Co., Baltimore, Md., is remodelling its warehouse into an office building on a large scale.

The Queen & Crescent Route will build a new station in New Orleans, La.

The Business Men's Association, Norfolk, Va., can give particulars regarding the contemplated erection of a six-story business building to cost $125,000.

It is reported that the Chesapeake and Ohio Railroad Co. intends to greatly enlarge its property in Norfolk, Va.

The Terminal Arcade Co., St. Louis, Mo., intends to erect a five-story hotel to cost $150,000.

The Y. M. C. A., St. Louis, Mo., will erect a new building with all the latest improvements. Tully & Clarke are the architects.

The Nashville Traction Co., Nashville, Tenn., intends to introduce extensive improvements on its lines, and will lay new rails.

Joseph T. Allyn, president of the Norfolk and Atlantic Street Railroad Co., has asked the Norfolk, Va , City Council for a franchise to build an electric railway from Sewell's Point to Veu de l'Eau.

The St. Augustine Electric Light Co., St. Augustine, Fla., has secured a franchise for the building of its road.

The Searcy Rope and Yarn Mills, Tuscaloosa, Ala., wants a 40-light incandescent dynamo.

The Jacksonville Oil Mill Co., Jacksonville, Fla., intends to buy an electric light plant.

An election will be held on November 14, in Dawson, Ga., to decide as to issuing bonds for the purpose of building an electric light plant. The Mayor can give further particulars.

Robert R. Zell, Baltimore, Md., intends to build an ice-skating rink in New Orleans, La., to cost $100,000.

Holt, Gant & Holt, Eton College, N. C., intend to put an electric light plant into their cotton mill.

E. C. Heins, of Ridgeway, S. C., is to build a telephone line to Camden, a distance of 25 miles.

It is proposed to erect new buildings and make other improvements at the asylum in Weston, W. Va. The improvements will cost $90,000.

The Victoria Phosphate Company, Newberry, Fla., intends to introduce the electric system on its roads. For further particulars address J. A. Little, Prest., Jacksonville, Fla.

The Saginaw Electric Street Railway Company, Bay City, Mich., intends to extend its line to Saginaw. Work will be commenced in the Spring.

Julian Fishburne and others have petitioned the Charleston, S. C., city council for a franchise to build and operate an electric street railway in that city.

The Delaware & Schuylkill Electric Railroad Company, Philadelphia, Pa., has closed a contract with Bloomer Bros & Co., Havemeyer Building, New York city, for the construction of a trolley line between Frankford and Germantown. The Hevner system of construction will be adopted.

The Cumberland Valley Traction Company, Harrisburg, Pa., has decided to complete its branch line to Carlisle and Boiling Springs.

An intramural electric railway will be built on the grounds of the Cotton States and International Exposition, Atlanta, Ga , the contract for the same having been closed.

The plant of the Allegheny Light Company, Pittsburgh, Pa., was damaged by fire a few nights ago to the extent of $10,000.

NEW YORK NOTES.

A special meeting of the Brooklyn Bridge trustees was held on October 16, to consider the bids for lighting the cars by electricity and the report of Superintendent Martin on the subject. Trustee Skinner raised an objection to Superintendent Martin's report in favor of the overhead trolley system of lighting of the Electrical & Mechanical Engineering Company. He contended that the bids had not been properly or fairly prepared, and as they were expressly for overhead trolley lighting, they excluded from competition all other companies' systems differing from this particular one. He knew various other companies who would be willing to test their systems. As the result of this argument, the specifications were returned to Superintendent Martin, with instructions to have them so changed that all electric lighting companies could compete.

OKONITE PRODUCTS.

In the manufacture of high-class insulated wires and cables for electric light, street railway, telegraph and telephone service, aerial, underground and submarine, the reputation of the Okonite Company, Limited, New York and London, is world-wide. Every known precautionary measure is taken to make its products perfect in workmanship and absolutely reliable, and thus maintain the original high standard ot excellence which gave them instant popularity when introduced ten years ago, and which has kept them steadily at the front.

All the copper wire used is of the highest grade, drawn true throughout and inspected in every particular before leaving the factory at Passaic, N. J., and tested for all possible faults during the various stages of manufacture into insulated wires and cables. The same careful attention is extended to all other departments; only skilled labor being employed and much specially designed machinery being used.

For street railway feed wire purposes, Okonite has proved a most efficient and profitable insulation. It is tough and durable, will not crack when exposed to the severest changes in temperature and has the highest of insulating qualities. Eminent electrical engineers with large experience in the electric railway field endorse Okonite insulated wire strongly, and once used it is generally a permanent fixture in the equipment of the plant.

For electric lighting, telegraph and telephone service the Okonite wires and cables are standard goods. Miles upon miles are used annually in this class of work, both in this country and abroad, for it must be remembered that the business of this concern is not confined to the United States only, but extends throughout the continental countries of Europe, a branch establishment at Manchester, Eng., supplying the trade abroad.

Other Okonite products are the "Manson" and "Okonite" tape for making water-proof joints, etc., both popular beyond measure for the work intended.

One who has been closely identified with the rise of Okonite products and the fortunes of the Okonite Company, Ltd., is Capt. Willard L. Candee, one of the original promoters of the business, and at present one of the American directors. The "Captain," as he is popularly referred to, has a genial personality, and his enterprising business management has contributed largely to the attainment of the enviable position occupied by the Okonite Company, Ltd., among industrial concerns to-day.

TRADE NOTES.

Morris, Tasker & Co., 222 and 224 South Third street, Philadelphia, have made arrangements by which they become sole manufacturers of the Duggan Patent Adjustable Bracket. These brackets are made of wrought-iron pipe and are the cheapest and best, while being the simplest form of bracket that is manufactured at the present time. The price has been lately very much reduced, so that any road can afford to buy them. They can be purchased direct from the manufacturers, Messrs. Morris, Tasker & Co., or from Burnham & Duggan Railway Appliance Co., Boston.

The Interior Conduit and Insulation Company, 44 Broad street, New York city, has just issued its circular and price list, No. 20, of Iron Armored Insulating Conduit, Single Tube System. It is fully illustrated with cuts of the various parts of the system and gives a comprehensive description of each. Various tools necessary for the handling and installation of the conduit are also illustrated.

OURSELVES AS OTHERS SEE US.

The *Herald*, of Glasgow, Scotland, speaking of the "Four-Track Series,"—the New York Central's guide book—says:

"No effort is made in this country to produce railway guide books that can compete with this series. The scope of the books gives every opportunity for the display of the varied charms of American scenery, there being views on the Hudson River, in the Adirondack Mountains and Catskills, on the St. Lawrence, Niagara Falls, etc. The great feature of the guides is the admirable pictures."

A copy of the illustrated catalogue containing a thorough review of the "Four-Track Series"—books, maps and etchings—will be sent free by mail, postpaid, to any address in the world, by George H. Daniels, General Passenger Agent, New York Central & Hudson River Railroad, Grand Central Station, New York.

Dividend.—The Chesapeake and Ohio Telephone Co., Washington, D. C., has declared a dividend of 50 cents per share, payable October 29.

Died.—John C. English, secretary and manager of the Bridgeport Electric Light Company, Bridgeport, Conn., died a few days ago.

Electrical and Street Railway Patents.

Issued October 16, 1894.

527,414. Electric Cable. Thomas J. Dewees, Palmyra, N. J., assignor to the Electric Cable Construction and Maintenance Company, of Pennsylvania. Filed June 20, 1894.

527,415. Dynamo-Electric Machine. Ezra Fawcett, Alliance, assignor of one-half to Leonard W. Bradley, Cleveland, Ohio. Filed Feb. 15, 1894.

527,436. Primary Battery and Portable Electric Lamp. Samuel W. Maquay, London, England. Filed Jan. 4, 1894. Patented in England, Feb. 13, 1893, No. 3,210; in France Nov. 17, 1893, No. 234,126; in Belgium Nov. 23, 1893, No. 107,327; in Cape of Good Hope, Jan. 15, 1894, No. 898; in New South Wales Jan. 29, 1894, No. 4,852; in South African Republic Feb. 2, 1894, No. 598; in New Zealand Feb. 5, 1894, No. 6,654; in Victoria Feb. 9, 1894, No. 11,139, and in India Apr. 10, 1894, No. 98.

527,446. Sand-Delivering Mechanism for Street-Cars. Alexander Parrant, Worcester, Mass. Filed May 11, 1894.

527,461. Apparatus for Signaling the Approach of Street-Cars. Garland B. St. John, Kalamazoo, Mich., assignor of one-half to Charles D. Fuller, same place. Filed Nov. 27, 1893.

527,501. Multiple Safety Cut-Out. James F. McLoughlin, Philadelphia, Pa. Filed Jan. 18, 1890.

527,518. Secret Telegraphy. Alfred P. Weaver, Jackson, Mich. Filed Dec. 26, 1893.

527,523. Snow-Plow for Street-Railways. Francis W. Dean, Cambridge, and Wm E. Mathews, Boston, assignors to the Taunton Locomotive Manufacturing Company, Taunton, Mass. Filed July 25, 1894.

527,528. Electric Clock. Carl Gullberg, Jersey City, N. J. Filed Sept. 16, 1893.

527,546. Trolley. William H. Bache, Bound Brook, N. J. Filed Oct. 31, 1893.

527,556. Weather Protecting Covering for Electrical Conductors. Edwin J. Houston, Philadelphia, Pa. Filed Nov. 17, 1891.

527,559. Electric-Arc Lamp. Alfred H. Moses, Jr., St. Louis, Mo., assignor of one-half to Jules S. Bache & Co., New York, N. Y. Filed Jan. 21, 1893.

527,601. Conduit Electric Railway. Oliver B. Finn. Philadelphia, Pa. Filed Mar. 16, 1894.

527,623. Shade-Holder for Incandescent Lamps. Edgar A. Russell, and Nathan W. Crandall, Wallingford, Ct., assignors to the Housatonic Manufacturing Company, same place. Filed May 31, 1894.

527,637. Switch-Actuating Mechanism. Samuel Walker and LeGrand Marshall, Milwaukee, Wis. Filed Aug. 21, 1893.

527,646. Safety Apparatus for Street-Railway Cars. James J. Andrews, Hempstead, and Theodore Mott, Far Rockaway, N. Y. Filed Mar. 8, 1894.

527,715. Car-Fender. Herman B. Ogden, Brooklyn, N. Y. Filed Jan. 24, 1894.

527,730. Rheostat. Alton J. Shaw, Muskegon, Mich. Filed Mar. 15, 1894.

527,759. Telephone-Call Register. Wm. T. Gentry, Atlanta, Ga. Filed Apr. 20, 1894.

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CONTENTS.

THE CLEVELAND CONVENTION.

We are informed by Secretary G. F. Porter, of the National Electric Light Association, that the selection of Cleveland, Ohio, by the Executive Committee, as the place of the next meeting of that Association has been confirmed, and that it is now definitely settled that the next convention will be held in that city on February 19, 20 and 21, 1895. This information will be received with general satisfaction in the trade. The announcement that friction existed among the members of the executive committee was received with regret. The association's affairs have been conducted in the past wiih such uniform harmony that the report of discord in its councils came in the nature of a shock. We are glad that the differences have been adjusted, and that things are moving along smoothly again. All hands should now pull together with the object of making the Cleveland meeting a success in every respect.

CONVENTION PAPERS.

The abstracts of papers read at the Atlanta convention which were intended for last week's issue appear in this issue. They were unavoidably omitted last week.

LIGHTING THE BRIDGE CARS.

It having been finally decided to light the cars on the Brooklyn Bridge by electricity,the result of the undertaking of the successful contractor will be watched with keen interest. There is no doubt in the minds of the promoters of the system as to the success of their work, but as yet nothing definite can be learned of the plans. It is stated that the current will be generated at the power house and conveyed to the cars by means of overhead wires and trolleys.

The Brooklyn Bridge offers the best possible conditions for successfully lighting cars by electricity. The steam roads are watching for an efficient and reliable system, and they may be able to learn something from the Brooklyn-Bridge plant.

THE BOOSTER SYSTEM OF FEEDING.

One of the most interesting and practical papers read at the Atlanta convention was that of Messrs. Vail and Wynkoop, on the Booster system for electric railways. By its use the loss in transmission is overcome by automatically raising the initial voltage above that of the bus-bars by an amount which may exactly equal the drop in potential on the feeder at that instant, thus practically taking up the drop on the line. By this means a practically uniform voltage is secured at the service end of the feeder under all conditions of load. The Booster, as is well known, is a generator connected in series on the feeder whose pressure is to be raised, and by a special field winding and compounding the normal pressure is increased. The Booster system has been applied with success to the feeders of constant potential electric light plants, and Messrs. Vail and Wynkoop brought it to the attention of the street railway delegates as a practical aid to the economic solution of the "medium long-distance electric railway problem." By its use they claim that it is possible for many electric railway companies to extend their lines from 10 to 20 miles from the power station and at the same time keep the investment within reasonable limits. The motor which drives the Booster takes its power from the bus-bars, but the power required is proportional to the load on the line. By this arrangement the interest on copper investment is nominal, while in direct feeding the large amount of capital invested in the pole line accrues interest day and night irrespective of the traffic. We give on another page an abstract of this interesting paper, which received deep attention from the delegates.

THE USE OF THE BOOSTER ON ELECTRIC RAILWAY CIRCUITS.*

The question of investment in copper is one which has always been a bugbear to the street-railway manager, and is today the most serious problem confronting the operating company, inasmuch as it tends to restrict the extension of long distance lines for serving suburban traffic. Since the cost of copper for a given service increases directly as the square of the distance, the necessary investment becomes prohibitory when the line extends more than three or four miles from the station.

The well-known booster system, invented by Mr. W. S. Barstow, and applied by him with great success to the feeders of constant potential electric lighting plants covering large areas, is worthy of our careful investigation, as it promises to offer a practical aid to the economic solution of what may be called the medium long distance electric railway problem.

With direct feeding we can overcome the loss in transmitting energy only by incurring the heavy cost of copper as a first investment. With the booster system, we overcome the loss in transmission by incurring the

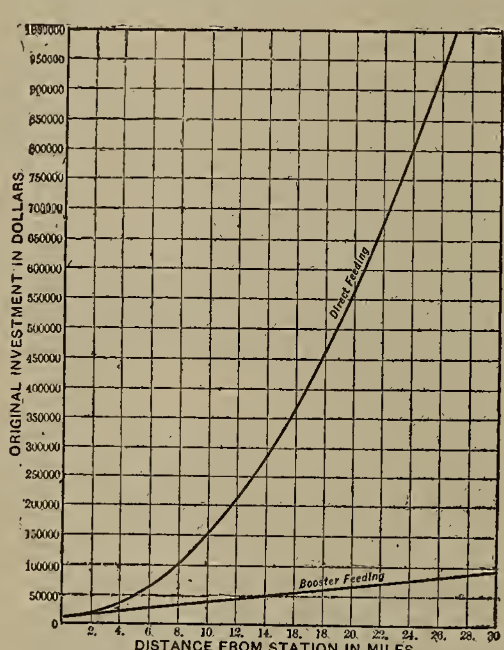


DIAGRAM I.—INITIAL COST OF STEAM AND GENERATING PLANT, COPPER AND SPECIAL APPARATUS FOR DELIVERING 200 AMPERES AT 500 VOLTS.

cost of operation of a machine which shall automatically raise the initial voltage above that of the bus bars by an amount which may exactly equal the drop in potential on the feeder at that instant.

When using this machine, we calculate our feeder for ampere capacity only, and constantly maintain the pressure at the service end of the feeder equal to the pressure at the bus bars, irrespective of the length of the feeder or the load.

In any given distance the cost of a direct feeder increases the square of the distance, while the cost of the booster feeder is directly proportional to the number of miles. These characteristics of the latter system result in a reduction of first cost of from 25 to 75 per cent. as compared with the first cost of the ordinary direct feeding methods of our present practice; and it thereby becomes possible for numerous electric street railway companies to extend their lines into suburban localities from ten to twenty miles distant from the power station, at the same time retaining the investment within reasonable limits.

An inspection of diagram No. 1 shows at once the immense superiority of the booster system over direct feeding in cases where first cost is the essential feature. It will be noted that the curves have been carried out for the entire thirty miles, without regard to the practical voltage limit in direct current machines, or the point at which the cost of operating an independent station becomes less than operating from the main station.

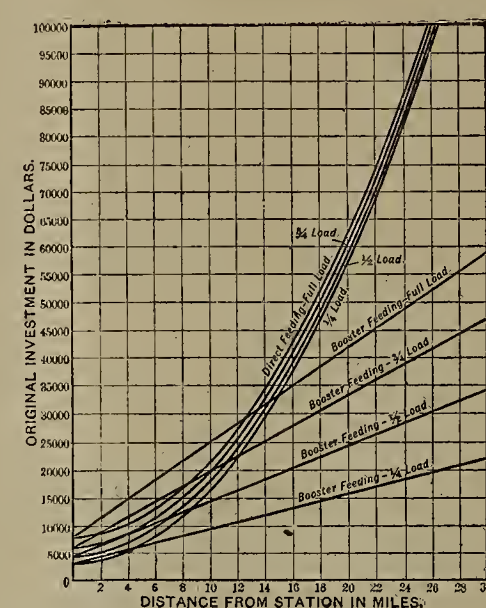
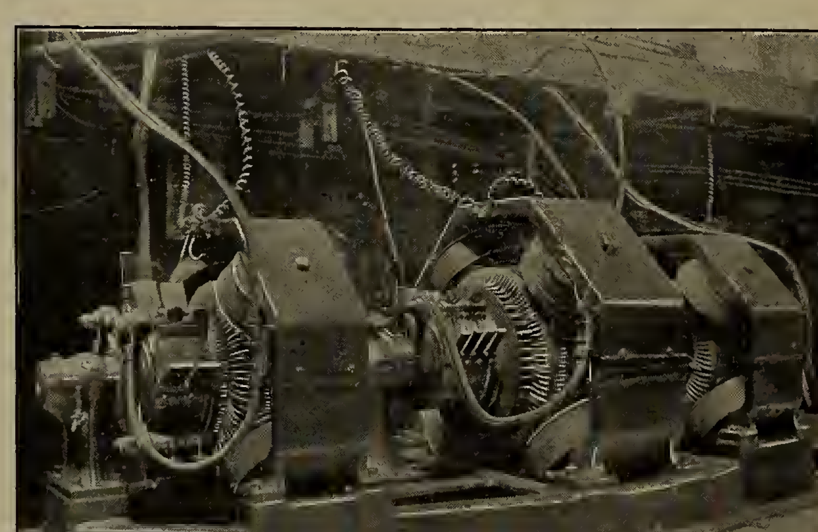


DIAGRAM II.—OPERATING EXPENSES OF PLANT DELIVERING 200 AMPERES AT 500 VOLTS, INCLUDING COAL, OIL, WASTE, WATER, LABOR; AND INTEREST AND DEPRECIATION ON THE INVESTMENT.

Diagram I shows that for distances greater than one and one-half miles it will cost less to instal a booster system than to place copper and machinery in the usual manner for feeding direct. In cases where motive power is water, costing little or nothing per H. P., these curves give at once the relative economy of the two methods; but ordinarily on account of the consumption of coal, the loss in the line (represented in the new method by the power required to operate the booster) becomes an important factor in the discussion, and it is necessary to establish equations for the operating expenses, taking into account the fixed charges of interest and depreciation on the investment, as well as the cost of furnishing the required power.



DOUBLE BOOSTER, OPERATING TWO FEEDERS.

Diagram II represents these equations plotted for varying values of M, being taken at 40.

The intersection of the upper curve with the upper straight line is the point at which the booster system costs as much to operate as does the direct system.

*Abstract of Committee Report read at the Convention of the American Street Railway Association, Atlanta, Ga., October 17, 18, and 19, 1894.

This distance we find to be twelve and one-half miles. For shorter distances, direct feeding is more economical, while for longer distances the booster system has an absolute advantage.

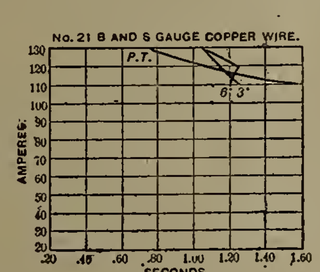
A careful study of these diagrams demonstrates in what the economy of the booster system consists. While the method we have outlined may seem like robbing Peter to pay Paul, it must be remembered that in direct feeding there is a large amount of capital invested in the pole line, accruing interest day and night, in storm and sunshine, irrespective of the traffic on the line; while with booster feeding, the interest on copper investment is nominal, the power required to drive the booster itself being proportional to the load on the line. Thus we can readily understand why, under the conditions given, with an average load of one-quarter the maximum, the booster system is absolutely more economical than the direct feeding system for distances over four and one-half miles.

J. H. VAIL, S. H. WYNKOOP, } *Committee.*

DESTRUCTIVE ARCING OF 500-VOLT FUSES.*

The destructive effects of the arc accompanying the opening of 500 volt circuits with switches, lightning arresters and fuses, has led the writer to inquire into this phenomena, particularly in reference to fuse practice. A series of carefully conducted tests were made to find the relation between the fusing currents of different size copper wires ranging from No. 30 to No. 21, B. & S. gauge, the time required to open the circuit, and to what extent the arc contributed to the time required.

An inclined trackway was constructed, having two copper tracks upon which a traveller, consisting of a



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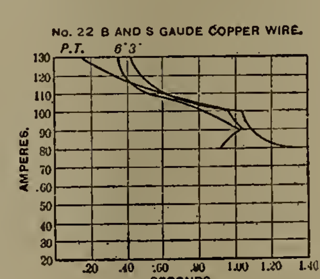

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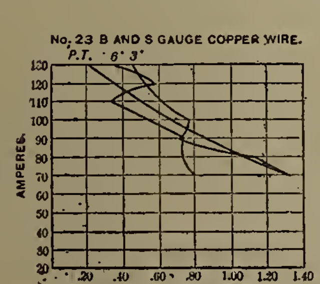

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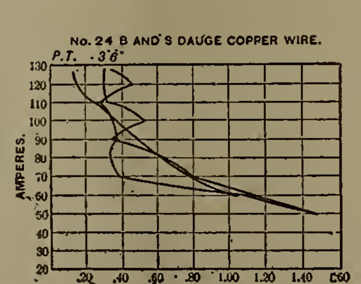


No. 4

block of hard wood having copper plates in contact with the tracks, could run, the circuit from rail to rail of track being completed through an electro-magnet on top of the traveller. Parallel with and alongside of the track was a raised board, on which a paper was attached.

An impress was made on paper by a lever on the traveller, when released by electro-magnet, owing to stoppage of current.

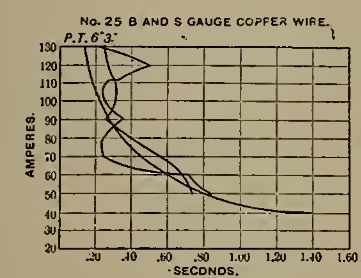
Before tests were made the trackway was carefully calibrated as regards time for traveller to go from top to bottom and the intermediate points, resulting in knowing the time to $\frac{1}{100}$ of a second.

The tests were conducted across the bus bars of switchboard of the Camden Horse R. R. Co., Camden, N. J. Average voltage, 515 volts.

Before throwing a fuse in circuit, a water rheostat was set, using a Weston ammeter for this purpose, so that the current desired would flow through the fuse when the circuit was completed by the traveller on the trackway.

The different size fuse wires were subject to the following limitations: the time of the traveller running full length on the trackway 1.5 seconds; the current ranging from 20 to 130 amperes in 10 ampere steps.

The smaller fuse wires would fuse with the minimum current of 20 amperes, and in all instances inside of the 1.5 arc limit. Consequently, the curves show a wide



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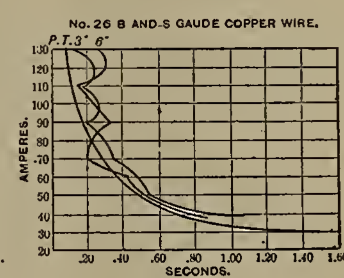

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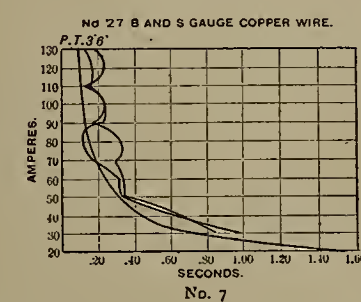

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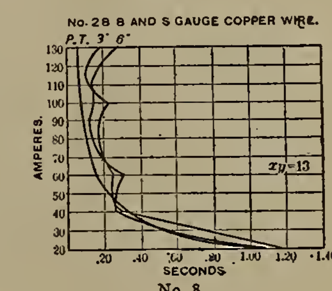


No. 8

range, but in the larger size wires, a greater current was required to fuse the wires in the 1.5 second limitation, consequently the curves given for the larger fuse wires show less and less range as the fuse wires increase in size.

In order to strike an average, the tests were repeated under similar conditions as regards current and gauge wire with a 3" horizontal fuse, a 6" vertical fuse, both of which were connected to a standard form of fuse block, also a 4½" fuse, the average in length of the 3" and 6" was employed connected in a specially constructed fuse block, which absolutely prevented any arcing of the terminals. In other words, the fusing of the fuse wire could not burn the terminals to which it was attached.

The results recorded graphically in the following charts give, therefore, the time required in fractions of a second for the circuit to be opened under identically similar conditions as regards current and gauge of wire for a 3", a 6" unprotected, and a 4½" protected terminal fuse.

The curves as given in chart No. 8 for No. 28 B. & S. copper wire, illustrates excellently the erratic character of the fusing of wires under conditions as observed in the practice of today.

The time required to open a protected terminal fuse wire becomes less and less as current increases and grows less regularly, showing that a regular law is followed. The curve is an hyperbola having its asymptotes for its axes, and the equation for it is $xy = 13$ for No. 28 cop. Whereas the two unprotected terminal fuses are uncertain and show in a very pronounced manner wherein the terminals contribute to this end, the conclusion one is forced to draw is that a fuse wire in practice, when it fuses, does not do as it was intended to, open the circuit, but establishes a condition, though the time may be limited, wherein the terminals act as a magazine to furnish the gas through which the circuit is continued. The curves throughout do not show any superiority of the 6" fuse over the 3". Looking at the

*Abstract of committee report read at the Convention of the American Street Railway Association, Atlanta, Ga., October 17, 18, and 19, 1894.

results in comparison, as given by the Board of Fire Underwriters, the very point they should have observed was overlooked, to wit, the continuance of the arc through but a short period of time, at the expense of the terminals, and the possibility of the vicious gas thus generated coming in contact with other circuits and establishing other and more serious conditions, such as short circuits and possible fires.

Not to be misunderstood, while the tests are as herein recorded show no superiority of the 6″ unprotected terminal fuse wire over the 3″ unprotected terminal fuse wire, the 6″ fuse wire is unquestionably safer when conditions are more extreme, such as for instance when a short circuit occurs.

The determining factor in this matter of fuses is: What are the conditions required to protect against absolute short circuits across the bus bars of a large power station, 500 volt switchboard? Tests are conducted showing how fuses act under conditions that are predetermined, certain currents which are made to flow, etc., but you never see anything published or advice given in this matter of fuses for the condition which really occurs the most frequently, that is, absolute short circuits. The Board of Fire Underwriters' report, herewith attached, gives the different length fuse blocks required for 10 amperes, 20, 30, 40, and so on.

Now the requirements and limitations as prescribed in the Board of Fire Underwriters' report are true and perfectly safe when the fuse "blows" under the conditions as outlined in the tests, as made by the committee appointed to make such tests.

But on an absolute short circuit across bus bars, as above stated, a 10 ampere fuse block constructed as specified, will, instead of protecting one when most in need of such protection, burn up in the most vicious way, and will open magnetic cut-outs in a power station requiring currents up to 1,000 amperes to open. Understand, the fuse does not itself do this, but the arc established at the expense of the terminals is the immediate and sole cause, and the circuit must be opened elsewhere. As stated, the magnetic cut-outs above referred to open the circuit.

The conclusions one is forced to draw from the above tests and the general literature upon the subject of fuses are as follows:

First.—The proper and only fuse block to be used is one having protected terminals.

Second.—That fuse blocks should be furnished so that the terminals would not be burned under conditions approaching an absolute short circuit across the bus bars of a 500 volt power station.

Third.—That magnetic cut-outs are immeasurably preferable under all circumstances.

W. E. Harrington,
Committee.

TRANSFERS ON STREET RAILWAYS.*

BY J. N. BECKLEY.

The carrying of a passenger from any part of a city reached by the lines of a street railway to any other part of such city, reached by the lines of the same railway, for a single fare is, speaking broadly, a new thing in street railway operation. Ten years, even five years ago, the manager who had the temerity to advise his board of directors to establish a liberal transfer system would have, probably, been regarded as unfit for his position. To-day, the most successful companies have come to realize that in this matter of transfers, as well as in other matters, it pays to treat the riding public liberally.

One of the most important things to do, and to do promptly, is to educate the average man and woman to ride That this is largely a matter of education every street railway manager knows. When a new line is opened, even through a thickly settled district, the people for some time continue to walk. Bad weather, the necessity of haste, or some other thing induces a person to ride once. The next time he rides with less inducement, especially if the cars are clean, the service prompt, and if he does not have to pay more than five cents to get to his destination. So the habit grows, and soon the rule is to ride when, before, it was the exception. A liberal transfer system, properly guarded to prevent fraud, pays. This is, I think, now generally recognized. Local conditions and arrangements of lines must be considered in determining the regulations to be adopted. The rules intended to safeguard the company are important. Perhaps equally important is the making of rules broad enough to encourage riding.

If a transfer system is adopted, it is best not to hedge it in too much by narrow restrictions, or to so complicate its details, as to involve labor and expend money unnecessarily. It is expedient also to appear to be making most liberal concessions to the public, especially as such concessions—presumptive or real—conduce to our own benefit. The punching "to and from"—the limit of privilege to use at absolute junctions as fixed spots—different forms, and even different colors for different issuing lines, may in most cases be avoided. If we secure a proper form of ticket, we can be protected in less complicated ways, and it is usually possible with careful arrangement to cover all requirements in one form. If series and consecutive numbers be employed, we can easily trace all issues by them instead of by old methods. If we use the series and consecutive numbers, we allot a certain quantity of tickets to each conductor and follow him by them, and should avoid minor details that interfere with or complicate the more important ones.

Mr. Beckley then directs how the tickets should be printed, made up, etc., and calls attention to the importance of arranging the form of the ticket clearly, and otherwise making it as simple as possible in order to facilitate the work of punching.

By putting the transfer business into the hands of the conductors, he says, we cater to the convenience of passengers, and we obviate delays in traffic, consequent upon stopping cars to transfer. We save the large expense of transfer agents, and, in my judgment, do not increase leakage, for it is as easy for transfer agents to stand in with conductors to defraud the company as it is for conductors to combine with each other. The numerous and continual frauds perpetrated upon transfer agents, by people who get transfers without having paid any fare, is too well understood to require discussion.

We have adopted a system of "faces identification"† for moral effect, and especially for use at the noon hour, when abuse in transfers is most frequent. They are, I understand, now in use in Minneapolis, St. Paul, New Haven, Binghamton and Scranton.

In conclusion, I need only add that our liberal system of transfer has proved a good investment, and that our form of ticket is efficient and protective. Simple, convenient and safe, yet systematic, distinct and business-like, it protects our interests, while it saves us all former waste and a vast amount of useless labor.

Membership of the A. S. R. A.—There were 181 street railway companies registered as members of the American Street Railway Association on September 15, last.

* Abstract of Committee report read at the Convention of the American Street Railway Association, Atlanta, Ga., October 17, 18 and 19, 1894.

† See page 130 Electrical Age, September 8, 1894, for description of this system of transfer.

PRINCIPLES OF DYNAMO DESIGN.

BY NEWTON HARRISON, E. E.

(*Continued from Page 220.*)

To apply this table an example may be cited as given by himself as follows :

A core one inch in diameter requires 2,400 ampere turns with a limiting temperature of not more than 50° Fahrenheit—what volume of coil is necessary if the current is one ampere?

A No. 20 S. W. G. wound one-half an inch deep would give 220 turns per inch length. A coil 11 inches long and a little over one-half an inch deep (or 10 layers) would give 2,400 turns. The table indicates that if this wire carried 1.013 amperes and was wound 3.9 inches deep, 225° Fahrenheit rise of temperature would result. If wound only one-half an inch, about 30° rise would occur, and with but one ampere, a little less.

To try the next thinner wire: No. 22 S. W. G. at 2,000 amperes per square inch will carry 1.23 amperes, and heats up 225° Fahrenheit, if wound 1.13 inches deep. Therefore to heat only 50° F., a winding one-quarter of an inch deep or slightly more, to 14 layers will complete the proper design.

As the depth is 14 layers the length of the coil will be at 24 turns to the inch $\frac{2,000}{14} = 172$ and $\frac{172}{24} = 7$ inches, as there are 2,400 turns and 624 to the square inch $\frac{2,400}{624} = 3\ 85$ sq. inches of cross section to winding and 26.95 cubic inches of winding.

A formula limiting the maximum current with a temperature of 90° Fahr., never to be exceeded above the atmosphere for the maximum current in a coil, is

$$\text{greatest current} = .63\sqrt{\frac{s}{r}}$$

s = sq. inches of surface of coils.
r = resistance of coils.

$$\text{For shunt coils greatest } E = .63\sqrt{\frac{s}{r}}$$

As an illustration, calling the surface = 28.278 square inches

resistance = .036 ohms.

DIMENSIONS.					PERMISSIBLE AMPERAGE, PROBABLE HEATING AND PERMISSIBLE DEPTH.											
S.W. G.	Diam. (inch.)	Section (Square Inch bare.)	Turns to Linear Inch Covered	Turns per Square Inch Covered	At 1000 Amperes to Square Inch.			At 2000 Amperes to Square Inch.			At 3000 Amperes to Square Inch.			At 4000 Amperes to Square Inch.		
					A.	F.	D.	A.	F.	D.	A.	F.	D.	A.	F.	D.
22	.028	00062	23.81	624.	.616	2.28	4.5	1.23	9.12	1.13	1.85	20.52	.50	2.46	36.5	.28
20	.036	.0010	20.00	440.	1.018	3.18	3.9	2.036	12.72	.87	3.05	28.62	.43	4.07	50.9	.24
19	.040	.0012	18.52	377.	1.26	3.56	3.6	2.52	14.24	.92	3.78	32.04	.41	5 04	57.0	.23
18	.048	.0018	16.13	286.	1.81	4.64	3.3	3.62	18.56	.83	5.43	41.76	.37	7.24	74.2	.21
17	.056	.0024	14.28	224.	2.4	5.47	3.2	4.8	21.9	.79	7.2	49.2	.35	9.6	87.5	.19
16	.064	.0032	12.83	181.	3.2	6.57	3.0	6.4	26.3	.74	9.6	59.1	.33	12.8	105.1	.18
15	.072	.0040	11.63	149.	4.0	7.40	2.9	8.0	29.6	.72	12.0	66.6	.32	16.0	118.4	.17
14	.080	.0050	10.64	124.	5.0	8.46	2.8	10.0	33.8	.70	15.0	76.3	.31	20.0	135.4	.17
13	.092	.0060	9.44	98.2	6.6	9.97	2.7	13.2	39.9	.67	19.8	89.7	.30	26.4	159.5	.16
12	.104	.0085	8.48	79.1	8.5	11.53	2.6	17.0	46.1	.65	25.5	103.8	.29	34.0	184.4	.16
11	.116	.0105	7.69	65.0	10.5	12.8	2.5	21.0	51.2	.63	31.5	115.2	.28	42.0	204.8	.16
10	.128	.0128	7.04	54.5	12.8	14.3	2.4	25.6	57.2	.61	38.4	128.7	.27	51.2	228.8	.15
9	.144	.0163	6.33	44.1	16.3	16.4	2.4	32.6	65.6	.60	48.9	147.6	.27	65.2	262.4	.15
8	.160	.0201	5.74	36.3	20.1	18.4	2.3	40.2	73.6	.59	60.3	165.6	.26	80.4	294.4	.15
7	.176	.0243	5.26	30.4	24.3	20.4	2.3	48.6	81.6	.58	72.9	183.6	.26	97.2	326.4	.15
Stranded																
7/22	.840	.0043	9.62	101.8	4.3	6.73	4.0	8.6	26.9	.99	12.9	24.6	.44	17.2	107.7	.25
7/20	.108	.0072	7.81	67.1	7.13	8.94	3.7	14.3	35.7	.92	21.4	80.5	.48	28.5	143.0	.23
7/18	.144	.0128	6.09	40.8	12.7	12.4	3.4	25.4	49.6	.83	38.1	111.6	.39	50.8	198.4	.21
7/16	.192	.0229	5.10	28.6	22.9	17.2	3.2	45.8	68.7	.79	68.7	154.5	.35	91.6	274.7	.20
7/15	.216	.0289	4.27	20.1	28.9	19.5	3.1	57.8	78.0	.78	86.7	175.4	.34	115.6	311.8	.20
7/14	.240	.0356	3.87	16.5	35.6	21.8	3.1	71.2	87.1	.76	106.8	195.9	.34	142.4	348.3	.19
7/13	.276	.0462	3.38	12.6	46.2	24.7	3.0	92.4	98.8	.74	138.6	222.3	.33	184.8	395.2	.19
7/12	.312	.0595	3.01	9.97	59.5	28.5	2.9	179.0	114.0	.72	178.5	256.5	.32	238.0	456.0	.18

Figures in columns marked A signify number of amperes that the wire carries. Figures in columns marked F signify number of degrees (Fahrenheit) that the coil will warm up if there is only one layer of wire, and on the assumption that the heat is radiated only from the outer service of the coil; they are calculated by the following modication of Forbes rule:—

Rise in temperature (Fahrenheit degrees) = 225 x number of watts lost per square inch.
= 159 x sectional area x number of turns to one inch — (at 1,000 amperes per square inch).

Figures in column D are the depth in inches to which wire may be wound if 1 watt be lost by each square inch of radiating surface, the outside radiating surface of the coil only being considered.

Rule of calculating a 7-strand cable : Diameter of cable = 1.34 x diameter of equivalent round wire.

Figures under heading "Turns to 1 Linear Inch," are calculated for cotton-covered wires of average thicknesses of coverings used for the different gauges, viz, 14 mils additional diameter on round wires (from No. 22) and 20 mils on stranded or square wire.

Figures under heading "Turns per Square Inch," as calculated from preceding, allowing 10 per cent. for bedding of layers.

Resistance (ohms) of coil of copper wire, occupying V cubic inches of coil space, and of which the gauge is d mils uncovered and D mils covered, may be approximately calculated by the rule :—

$$\text{(Formala)}\quad \text{Ohms} = 960000\,\frac{V}{D^2\,d^2}$$

$$\text{greatest } C = .63\sqrt{\frac{28,278}{.036}} = 17.64 \text{ amperes,}$$

for a coil whose core is 2 inches in diameter, winding one-half an inch deep, length three inches and size wire No. 8 B & S or 10 S. W. G.

TABLES OF DIFFERENT GAUGES, WITH THEIR RESPECTIVE DIAMETERS AND AREAS

Standard.			Brown & Sharp.			Birmingham.		
No. of Guage	Diam. in. Dec. Inches	Area in CM=d²	No. of Gauge	Diam. in Dec. Inches	Area in CM=d²	No. of Ga'ge	Diam in Dec. Inch's	Area in CM=d²
6–0	.464	215296	4–0	.460	211600	4–0	.454	206116
5–0	.432	186824				3–0	.425	180625
4–0	.400	160000	3–0	.409	167805			
3–0	.372	138384	2–0	.364	133079	2–0	.380	144400
2–0	.348	121104				0	.340	115600
0	.324	104976	0	.324	105592			
1	.300	90000				1	.300	90000
2	.276	76176	1	.289	83694	2	.284	80656
3	.252	63504	2	.257	66373	3	.259	67081
4	.232	53824	3	.229	52634	4	.238	56644
5	.212	44944				5	.220	48400
6	.192	36864	4	.204	41742	6	.203	41209
7	.176	20976	5	.181	33102	7	180	32400
8	.160	25600	6	.162	26244	8	.165	27225
9	.144	20736	7	.1443	20822	9	.148	21904
10	.128	16384	8	.1285	16512	10	.134	17956
11	.116	13456	9	.1144	13110	11	.120	14400
12	.104	10816	10	.1019	10381	12	.109	11881
13	.092	8464	11	.0907	8226	13	.095	9025
14	.080	6400	12	.0808	6528	14	083	6889
15	.072	5184	13	.072	5184	15	.072	5184
16	.064	4096	14	.0641	4110	16	.065	4225
17	.056	3136	15	.0571	3260	17	.058	3364
18	.048	2304	16	.0508	2581	18	.049	2401
			17	.0452	2044	19	.042	1764
19	.040	1600	18	.0403	1624			
20	.036	1296	19	.0359	1253	20	.035	1225
21	.032	1024	20	.032	1024	21	.032	1024
22	.028	784	21	.0285	820	22	.028	784
23	.024	576	22	.0253	626	23	.025	625
24	.022	484	23	.0226	510	24	.022	484
25	.020	400	24	.0201	404	25	.020	400
26	.018	324	25	.0179	320	26	.018	324

The greatest E. M. F. can also be calculated, but in this case would be exceedingly small, due to the low resistance of the coil and the limited capacity of the wire;

$$\text{the greatest } E = .63\sqrt{.036 \times 28.278}$$
$$= .63504 \text{ volt, or less than that}$$

used for the shunts of platers.

(*To be Continued.*)

THE ELECTRIC RAILWAY IN OTTAWA, CAN.

The Montreal *Herald*, in referring to the electric railway system in Ottawa, says : Four years ago the right to build and operate an electric railway in Ottawa was going a-begging. There were few who were daring enough to believe that it was an enterprise that gave a reasonable expectation of profitable investment. The result, however, is that it has paid a handsome dividend from the start, but not greater than the enterprising gentlemen who made the venture are fairly entitled to. The road is controlled by the firm of expert electricians, Messrs. Ahearn and Soper, who built and equipped it, and it is recognized wherever electric railways are mentioned as a model of its kind. It was the pioneer electric railway of any mention in Canada, and its management were the first to demonstrate the practicability of giving an uninterrupted service throughout the winter season.

ELECTRICITY IN THE MANUFACTURE OF ARMOR PLATES.

A dispatch from Pittsburgh, Pa., states that the Carnegie Steel Company has made an important improvement in the manufacture of armor plates for battle ships. In the process of harveyizing plates, the custom has been to leave a soft strip running the entire length of the plate for the purpose of bolting. This soft surface has always been considered dangerous and large enough for a projectile to pierce. The improvement, it is said, consists in applying the electric current in such a way to the plate as to draw the temper only at the spot where the bolt is to be inserted and does not affect the surrounding portions of the metal.

PERSONAL.—Mr. Frank S. De Ronde, general sales agent of the Standard Paint Company of New York city, was, on Thursday evening, October 11, married to Miss Kate Weaver Bennett, of Teaneck, Englewood, N. J. The ceremony was private, only the near relatives and most intimate friends of the contracting parties being present. The decorations of the house for the occasion were of the most elaborate character. Mr. and Mrs. De Ronde will spend their honeymoon in the South, and on their return will reside in Englewood. We extend to Mr. De Ronde and his bride our sincere congratulations on this happy occasion.

SUGGESTIONS.—A contemporary has just issued a little pamphlet entitled the "Growth of the Electrical Industries of America, with suggestions as to how the activity in this new and promising branch of engineering can be turned to practical account." The pamphlet contains 48 pages, 11 of which are devoted to the electrical industries and 37 to the so-called "suggestions," which are nothing more nor less than blasts from its own horn.

A GOOD REPORT.—We have received a copy of the report of the president of the Binghamton, N. Y., Railroad Company to the stock and bondholders of that concern. The gross receipts for 1894 were $115,931.07, an increase of $22,002.11, as compared with those of 1893; and the operating expenses for the year ending October 1, 1894, were $66,929.51, showing an increase of $13,-505.30, as compared with the previous year, leaving a balance of $49,001,56, which is an increase of $8,496.81 over the last year's report.

DEATH OF AN OLD ELECTRICIAN.—F. A. Kirby, an old-time electrician, died at his home in Sayville, L. I., on October 16, of heart disease. Mr. Kirby was an Englishman by birth, having been born in London, and at one time was associated with Prof. S. F. B. Morse, the inventor of the telegraph. He was 79 years of age.

TO RESIGN THE RECEIVERSHIP.—Montgomery Waddell has asked Judge Shumway of the Superior Court, Bridgeport, Conn., that his resignation as receiver of the Waddell-Entz Company be accepted and a successor be appointed. A hearing was given in the court above named on October 26.

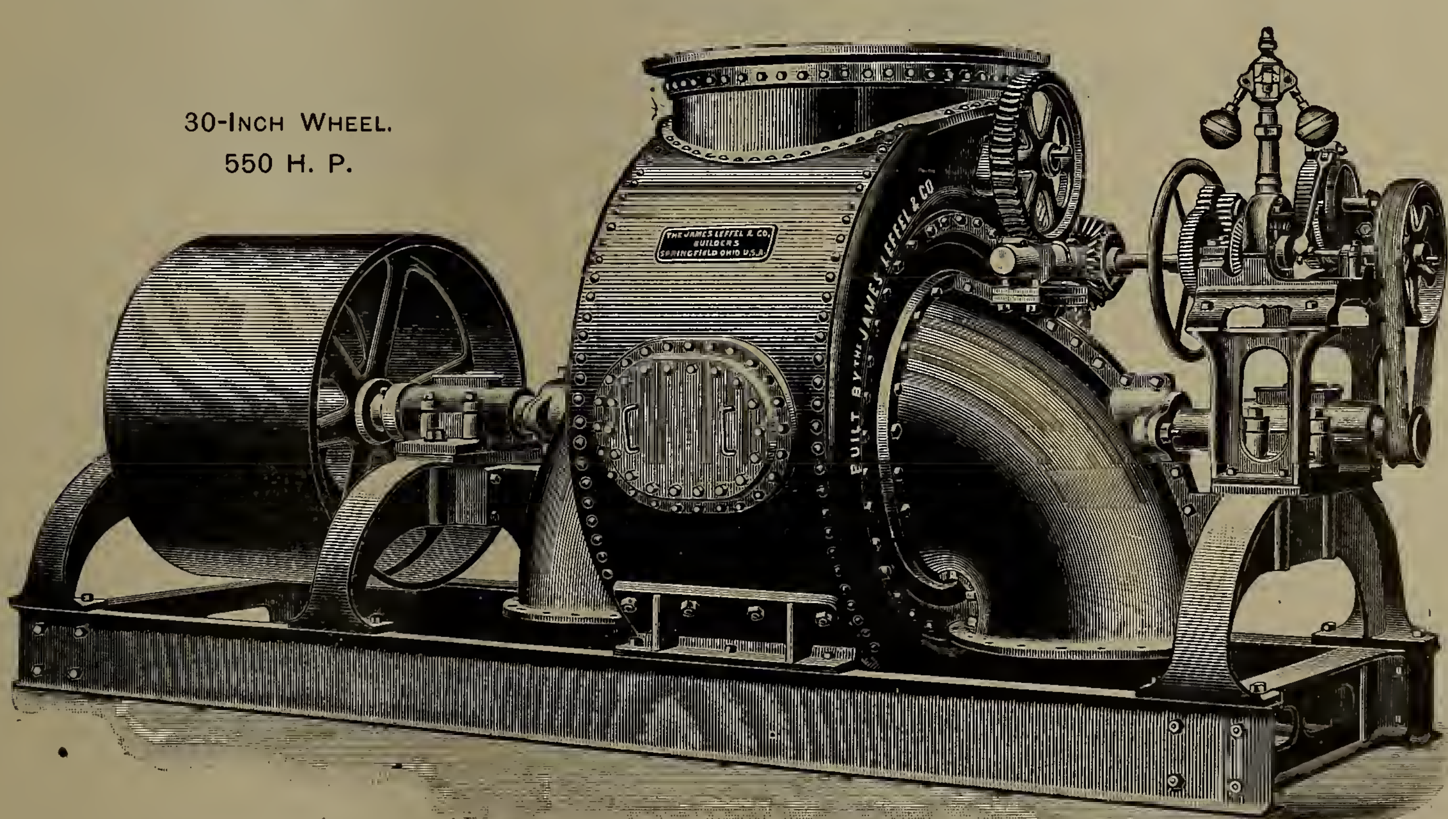
NEW DOUBLE DISCHARGE TURBINE.

The illustration herewith represents a very unique and pretty design of a new type of turbine wheel on horizontal shaft. It is an exact reproduction from a photograph of a wheel in actual practice driving a portion of a large electric plant, where several others of the same design and style are in use, under a working head pressure of 90 feet.

The water enters vertically on the top. The design, however, admits of receiving the water at any inclination from a vertical to a horizontal line. The wheel is so constructed as to divide the water into two equal portions on receiving it from the guides; these equal quantities each operate upon a wheel, which discharges the water horizontally in opposite directions on the performance of its work.

This method of application of water to a turbine entirely avoids end thrusts or end pressure of the shaft; in other words, it prevents the water from getting between the wheel and any part of the casing, avoiding loss of power therefrom. The wheel illustrated is 30 inches in diameter and of 550 horse-power capacity. Its regulation is nicely secured automatically by means of a governor shown in the cut. It has a pulley of 42 inches face, 48 inches diameter, transmitting the whole power through a 40-inch belt to the electrical machinery. The design is essentially the same as that of the two turbines each 1,200 horse power built for the Cliff Company, at Niagara Falls, except that in those wheels neither pulleys nor governors are used, the power being applied directly to the machinery at each end of the water-wheel shaft on each side of the turbine.

These wheels are highly efficient as motors for electric light, electric power and various other purposes. Three pairs of a modification of the type of wheel illus-



NEW DOUBLE DISCHARGE JAMES LEFFEL TURBINE.

trated were recently supplied to an electrical plant in Mexico; each pair being 20 inches in diameter and of 600 horse power; nearly 1,800 aggregate horse power. The transmission in this instance was 18 miles. Further particulars concerning the details of turbines of this type may be obtained by addressing James Leffel & Company, Springfield, Ohio, who make a specialty of this design and line of work.

A MINIATURE ELECTRIC YACHT.

The accompanying illustration shows the Premier electric yacht, which has attracted considerable attention during the past season. It is built of the best materials, finely painted and varnished, and is an ornament as well as a toy for the boy. It is 26 inches in length and 6½ inches beam, and is guaranteed to beat any other similar craft.

The motive power consists of one No. 1 Premier motor and one cell of special boat battery. The motor is suspended on a bracket and geared direct with the

MINIATURE ELECTRIC YACHT.

propeller shaft. It, as well as the battery, can be taken out of the boat and replaced within a minute. There are no adjustments to make and no rubber belts to give out when the boat is out of reach.

The battery supplies current from one to two hours on one charge of five fluid ounces of solution. It will not tip over and there are no glass jars to break.

The motor drives the boat at a speed of about three miles an hour. The propeller is 2¼ inches in diameter and has two blades set at a 45 degree pitch. The screw, as well as the boat itself, were designed and built under the direct supervision of an ex-United States naval engineer. All the lines of the boat are natural and as an easy running craft it cannot be equalled.

M. R. Rodrigues, of 17 and 19 Whipple street, Brooklyn, N. Y., is the manufacturer of this interesting little craft, and we understand that these boats have been a great favorite during the past season. Many have been sold to individuals, who in many cases have duplicated their orders. The trade is well pleased with them, as they are constructed with the view of getting the best results from a craft of this class.

Mr. Rodrigues has a challenge standing to meet any electric yacht with one of his.

AN IMPROVED SHAPER.

The accompanying engraving represents a new shaper brought out by Gould & Eberhardt, Newark, N. J.

It is operated by an improved crank motion; is positive in length of stroke, and will plane to a line, which is essential where accurate work is required, as in die work, etc. This motion also gives an unusually quick return stroke, by which, on short work, double the number of strokes can be obtained.

All bearings are large and long, especially the bearing of the ram in the frame.

Indexes are provided to tell the workman the length of stroke for which the machine is set at any position of the ram, also for changes of feed which are made by means of screw and crank.

Work can be fastened in a variety of ways for which provision is made. The vise swivels; is graduated to set any angle, and can also be fastened to the side of the angle. By removing the angle work can be fastened to the apron direct.

A surface plate also permits work to be done which is impossible otherwise. The vise is provided with a pair of adjustable centres for planing small work, fluting reamers, taps, etc., and a pair of special jaws for holding taper work.

An improvement especially noticeable on this shaper is the extension base, which, besides giving a large foundation to the machine, acts as a support to the work table, thus increasing the accuracy of the work when taking heavy cuts.

The design of the base is such as to form a pan around the machine to catch oil drippings, etc., and thus preserve a neat appearance to the floor around the machine.

These shapers are built in nine different sizes. Further information can be had by addressing the builders.

THE A. I. E. E. ON THE PACIFIC COAST.

At an informal meeting of the members of the American Institute of Electrical Engineers living in San Francisco and vicinity, held in that city on September 22, last, the following resolutions were unanimously adopted:

Resolved: "That we respectfully petition the Council to appoint a local secretary of the Institute for the Pacific Coast."

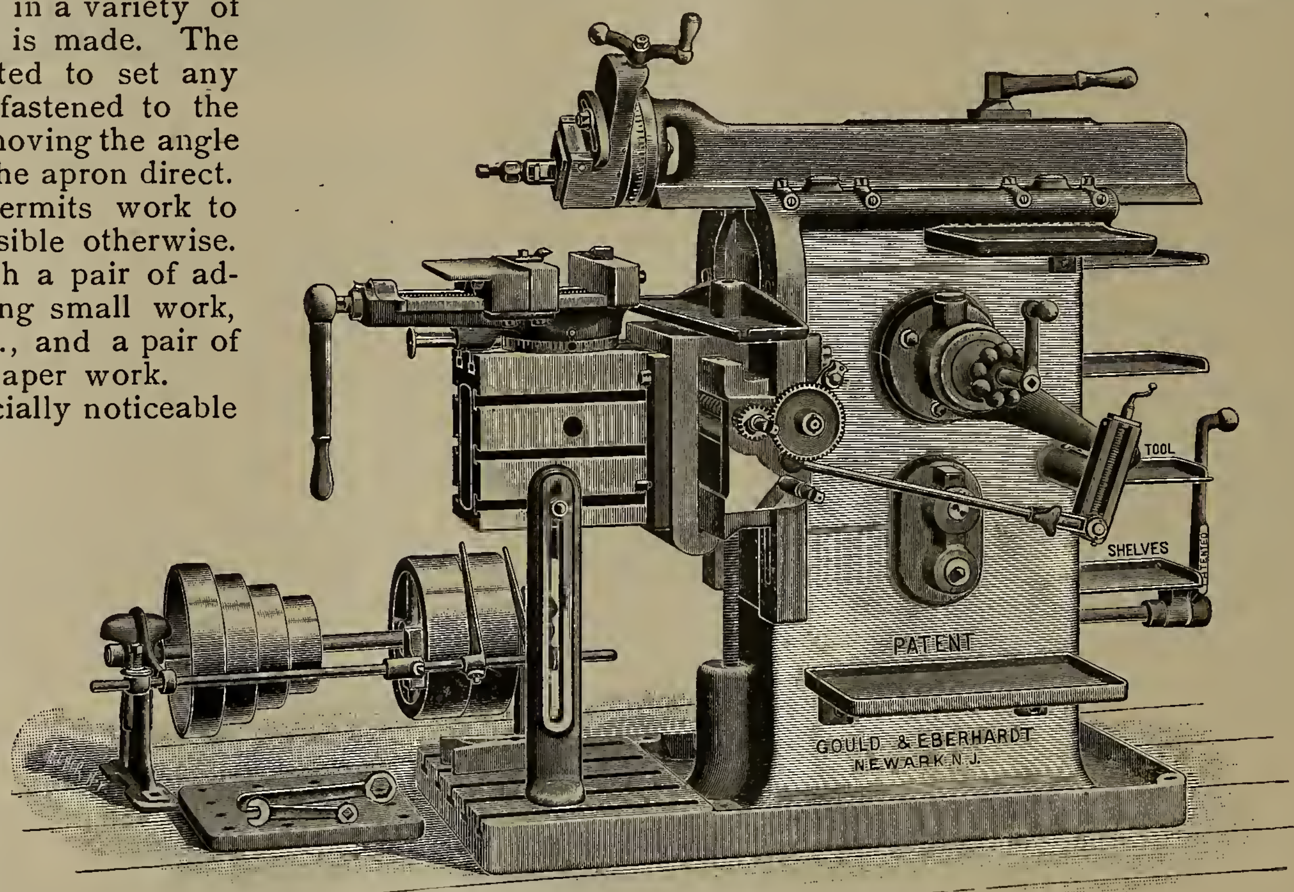
Resolved: "That we unanimously recommend for this office, should it be erected, Prof. F. A. C. Perrine of Stanford University.

Resolved: "That W. F. C. Hasson be appointed to forward these resolutions to the secretary of the American Institute of Electrical Engineers, with the request that he present them to the Council."

A committee consisting of C. L. Cory, G. P. Low and F. F. Barbour, was appointed to consider the matter of holding local meetings.

COMMUTATOR BARS.—Speaking of street-car commutators, the question of commutator bars is a most important one. There is probably nothing better in the market than the Billings & Spencer Company's Patent Drop Forged Commutator Bar. These bars, as is well known, are free from blow holes. They are dropped from pure unalloyed wrought copper and are guaranteed to be free from all imperfections. In the repairing of street-car motors it is advisable to put in the best commutator bars procurable. Mr. Charles J. Bogue, 206 Centre street, New York city, makes a specialty of manufacturing and refilling commutators of street-car motors with these bars. He also makes a specialty of rewinding street-car motor armatures, and has extraordinary facilities which enable him to guarantee quick and expert work at the lowest prices.

TO INCREASE TRACTION.—"Magnetic Sand" is said to be the latest manifestation of Mr. Edison's genius. The "sand," which is from Mr. Edison's mines at Ogden, N. J., is said to provide a perfect electrical contact through snow and ice and prevents the slipping of trolley car wheels.



GOULD & EBERHARDT'S IMPROVED SHAPER.

HOW THE RAPID TRANSIT VOTE MIGHT PROFIT THE PEOPLE.

J. M. BATCHELOR.

The power asked by the Rapid Transit commissioners to gain possession of fifty millions of this city's resources by popular vote at the coming election, for them to do with what they see fit without any further responsibility to the people than their own sweet wills, is a marvelous request and expectation of this fast age.

The chances of their getting what they request, in view of the general ignorance of the voting masses of just what the rapid transit vote required of them calls for, are not so remote that intelligent citizens have not just cause for serious alarm at what will be the outcome of it all.

That the underground plan, which is the best this commission cares to offer for the proposed sum, coupled with an additional cost of nobody knows what, is not wanted in this city, was clearly proved when that plan received no indorsement either from investors or any people at all acquainted with what an underground system of rapid transit really means.

To put such a job on the public, and compel them to pay for it whether they think it advisable or not, merely because a lot of voters who, in consenting to it, do not and in the nature of things cannot know what they are voting for, is a literal robbery that ought to be stopped before it begins.

Any one at all familiar with the underground system of London, and its dreadful drawbacks in the shape of impure ventilation and forced conveyance in comparative darkness, with all the risks which that darkness develops, must for the preservation of his or her health and peace of mind condemn any such proposition.

If this commission could be induced before election to bind themselves to the construction of solid four track viaducts through and between blocks of houses from the lower to the upper outskirts of the city, two tracks to be for express and the others for intermediate service, and have this viaduct hedged in by walls of masonry sufficiently high to keep trains that run off the track from getting off the viaduct, such a proposition ought to receive general approval.

The suggestion to the elevated roads to construct double-deckers for express service, not having been acted upon by the Manhattan Company, and the great need of this city to have a better form of rapid transit than that now in existence, more or less obliges the construction of some system that will not prove a failure when put into service.

The solid viaduct system here suggested is in operation in London, Philadelphia and Jersey City, and contains fewer drawbacks in point of safety, convenience, light and air, than any other yet proposed; it may have its disadvantages, but something must be done to keep the population that desires to live here from going out of the city and state.

Not only should this growing population be provided for, but the people already here urgently demand a more satisfactory rapid transit.

The masonry viaduct system would, in passing between the avenues, prove no drawback to the avenues, and none worth considering to the streets across which by means of arched bridges of full width spans it might pass.

Of course the right of "eminent domain" would be called in play, in the obtainment of the right of way, and condemned property would cost something; but from all that can be learned about the cost of constructing tunnels, elevated viaducts would be incomparably less.

If such a viaduct were constructed, it would be a permanent thing, and might be made as imperishable as solid masonry can make it. It could be used for either steam, electricity, or any other power best adapted to it; this choice of motive power being a secondary matter, the roadbed's construction being the all-important consideration.

Fewer repairs would be needed for such a structure than any other yet proposed, a particular worth the serious consideration of the public so long as their money pays for it. It would, when once built, be there to stay, and would give travellers plenty of light and air, and prove itself as safe if not safer in transportation than any roadbed system yet proposed.

If the commission would publicly state their determination to build such a roadway or roadways with the money they ask in the public vote, there is no apparent reason why the matter should not receive general support.

A tunnel system could never compete with the existing elevated roads; about everybody prefers to travel in the light and open air, to being imprisoned in dark and badly ventilated chambers.

NEW CORPORATIONS.

Electric Messenger Company, Pittsburgh, Pa., by W. S. Miller, J. N. Pew and W. T. Marshall. Capital stock, $25,000.

Eclipse Electrical Company, St. Louis, Mo., by Charles F. Smith, I. Fajaris and E. C. H. Foelkers. Capital stock, $9,000.

Pittsburgh Trolley Pole Company, Pittsburgh, Pa., by John D. Biggert, R. S. Robb, Samuel R. Wilson. Capital stock, $5,000.

Home Telephone Company, Uniontown, Fayette Co., Pa., by Wm. C. McCormick, Albert Inks, O. J. Sturgis. Capital stock, $6,000.

Wayne Electric Light and Steam Heat Company, Wayne, Delaware Co., Pa., by Hermann Wendell, Frank Smith and Walter B. Smith. Capital stock, $1,000.

The Williams Valley Street Railway Company, Harrisburg, Pa., by C. A. Barnhard, Moses Mervine, Geo. C. Kachel. Capital stock, $100,000.

The Ironton Street Railroad Light and Power Company, Ironton, O., with a capital stock of $100,000.

Commonwealth Electric Construction Company, Camden, Pa. Capital stock, $100,000.

The Imperial Electrical Bell and Fire Alarm Mfg. Company, Huntington, W. Va., by James K. Olney and others.

The Jamestown and Lake Erie Railway Company, Albany, N. Y., by Henry W. Cannon and others. Capital stock, $250,000.

The Nokomis Electric Light and Power Company, Nokomis, Ill., by Geo. Bliss and others. Capital stock, $10,000.

The Thompson-Brown Electric Company, New York, N. Y., by M. W. Brown and others. Capital stock, $25,000.

The H. T. Paiste Company, Philadelphia, Pa., by Henry T. Paiste and others. Capital stock, $20,000.

The Bethlehem and Nazareth Electric Street Railway Company, Bethlehem, Pa., by Henry W. Rupp and others. Capital stock, $100,000.

The Faraday Electric and Chemical Company, Kittery, Me. Capital stock, $150,000.

The London Electric Company, London, Ontario. Capital stock, $250,000.

The Pacific Electrical Company, San Francisco, Cal. Capital stock, $30,000.

The Kansas City Traction Company, Kansas City, Kans., by Bird S. Colen, of Brooklyn; W. J. Smith and W. H. Lucas, of Kansas City, Mo.; C. W. Trickett, Frank D. Hutchins and C. F. Hutchins, of Kansas City, Kans. Capital stock, $1,000,000.

Excelsior Springs Gas Light and Fuel Company, Excelsior Springs, Mo., by Robert C. Massie, F. A. Tucker and L. L. Dimmitt. Capital stock, $20,000.

The Citizens' Gas and Electric Power Company, Lafayette, Ind., by L. C. Somerville, A. O. Behm and Laban Sparks.

The Peekskill-Cortlandt Electric Railway Company, Albany, N. Y., by Edward Peckham, Benj. Norton and others. Capital stock, $150,000.

The Peter Electric Conduit Railway Construction Company, Milwaukee, Wis. Capital stock, $500,000.

The Jenney Electric Conduit Company, Chicago, Ill. Capital stock, $5,000,000.

The Wadsworth General Electric Company, Wadsworth, O., by J. A. Clark and others. Capital stock, $10,000.

The Patterson Ice, Manufacturing and Supply Company, Patterson, La., for the purpose of erecting an electric light plant, steam laundry and ice factory. S. L. Degravelles is president; G. A. Rousel, vice-president, and C. L. Degravelles, secretary and treasurer.

POSSIBLE CONTRACTS.

Preparations are being made in Cuthbert, Ga., for the construction of an electric light plant and water-works. Mayor Robert L. Moye can give further particulars.

The Graham, Bluefield Electric Light & Power Company, Graham, Va., will at once commence operations in the construction of its proposed plant.

W. W. Griffin, of Atlanta, Ga., has been given the contract to build the Manufacturers' Building for the exposition in that city.

A company is to be organized in Moberly, Mo., for the purpose of establishing an electric light plant. Address J. S. Bowers.

A $30,000 court-house is to be built in Bay City, Texas.

Henry Diehl, of Louisville, Ky., has prepared plans for a storage warehouse to cost $150,000.

Theo. C. Link, of St. Louis, Mo., has completed the plans for the $150,000 hotel for the Terminal Arcade Company.

Gustavus Schuckmann, of St. Louis, Mo , can give information regarding the proposed construction of a $300,000 fire proof building.

Furness, Evans & Co., of Washington, D. C., can give information regarding the construction of a $40,000 dwelling of Mrs. G. W. Childs, Philadelphia, Pa.

The West Chicago Street Railway Company, Chicago, Ill., will build an electric power house, at 47 Western avenue, to cost $120,000; and a car house will also be erected on West Madison street to cost $75,000.

The Mutual Electric Light & Power Company, of Chicago, Ill., will build a power house on 89th street, to cost $70,000.

The Sacramento Light and Power Company, Sacramento, Cal., has closed a contract with the General Electric Company for a water-power electric equipment, for the transmission of electric power from Folsom, Cal., 20 miles distant to Sacramento.

Topeka and St. Joseph capitalists are talking about building a trolley line between Atchison, Kan., and St. Joseph, Mo.

J. A. Little, president of the Victoria Phosphate Company, Newberry, Fla., can give information regarding the proposition to operate this company's railway by electricity.

The citizens of Duluth Heights, Duluth, Minn., are anxious to have an electric light plant established in that place.

The Central Ohio Electric Railway Company, Mount Vernon, O., has been granted the right of way on the highways of various counties. The company proposes to connect the various towns within the territory by electric railway.

The electric light plant at Indian Orchard, Mass., is to be enlarged.

EXHIBITS AT THE ATLANTA CONVENTION.

The Electrical Age gave a fuller account of the exhibits at the Atlanta convention than any other paper, which necessarily took up a good deal of our space last week. Even with the liberal allowance of room we were not able to get all in. We therefore give in this issue what we were not able to get in last week. They follow:

Mr. H. C. Willis, of the insulating department of the Washburn & Moen Mfg. Co., the largest wire manufacturers in the country, is pushing the Chicago wire bonds. Mr. Willis swears by these bonds and claims that they are the best in the United States. They are made of pure, soft-drawn copper. The bond is held in place in the rail by a steel centre pin, which spreads the copper, thus making a perfect contact. At the Atlanta convention he had samples of 500,000 c. m. feeder cables and rubber car wires, as well as dynamo leads, trolley and span wires, etc.

Mr. Eldredge Packer, of the Eldredge-Hughes Fare Register Company, was on the Royal Blue Special to Atlanta. Mr. Packer is one of the best known men in the trade and also one of the most sociable. He made many new friends on the way and there, but was called away early in the game, it is said, to take a big order for his registers from a large railroad company near New York City.

The Guarantors Liability Indemnity Company, of Philadelphia, Pa., of which Richard Loper is general manager, was on the grounds paving the way for business among street railway people. Mr. Loper distributed among the delegates a handsome leather pocket case.

The International Register Company, 197 S. Canal street, Chicago, manufacturers of the well known fare registers, had an exhibit of these goods, and was represented by A. H. England, secretary and manager of the company.

The New England Engineering Co., of Waterbury, Ct., had an exhibit of Breed emergency wagons, for trolley construction and repairs.

The Smith & Vaile Company, manufacturers of duplex steam pumps, Dayton, O., was represented by John W. Taylor, of Atlanta, Ga. Mr. Taylor had an exhibit of these well-known pumps.

The Central Electric Heating Co., 24 and 28 Cortlandt street, New York city, showed some of the American electric heaters for street cars. The company was represented by Edward B. Wyman, manager of the railway department, assisted by R. S. Jerome and Sydney Och, salesmen.

The Wallace Electric Company, of 307 Dearborn st., Chicago, Ill., exhibited Fletcher's Rapid Transit Switch and the Peoria Trolley Wheel.

William Robinson, general manager of the Robinson Radial Truck Company, and Robinson Electric Truck & Supply Company, 620 Atlantic avenue, Boston, Mass., represented the interests of these two concerns.

The United States Street Car Fender Company, 300 Bennett Building, New York, manufacturers of the Modemann Car Fender, was represented by B. V. Hendrickson.

Mr. A. Hoffman represented the Falk Mfg. Co., ot Milwaukee, Wis., and exhibited the Falk Trolley. Mr. Hoffman and Mr. Falk together own the patents. The Falk continuous rail cast welded joint section was also shown at the exhibit. This company has its own cupola for melting the iron used for laying rails on this system.

E. V. Faucett, vice president and general manager of the Safety Clutch Brake Company, 31st and Ludlow streets, Philadelphia, Pa., exhibited the Safety Clutch

Brake, which is very simple in construction and reliable. It is giving good satisfaction wherever it is used.

The St. Louis Register Company, of St. Louis, Mo., exhibited a full line of fare registers, and was represented by W. J. Allison, manager, assisted by G. Rein.

The New Haven Car Register Company, New Haven, Conn., had a display of the New Haven Fare Registers of the various styles made. This company was represented by F. Coleman Boyd, vice-president and general manager, and J. S. Bradley secretary, and treasurer.

C. M. Fuller, of Portland, Me., and L. R. Hills, of Atlanta, Ga., had an exhibit of Davis shades for railway coaches, street railway cars, and steamships.

John W. Baker represented the E. F. Burrowes Company, of Portland, Me., and distributed samples of "Oakette" for car curtains.

The Russ Car Fender Company, of Washington, D.C., had an exhibit of its car fender in charge of A. B. Russ. These fenders will be placed on the street car lines in Washington.

The R. Bliss Mfg. Co., of Pawtucket, R. I., showed the well-known patent car platform gates, for steam, electric, cable and horse cars. The Georgia Equipment Company, 39 and 40 Gould Building, Atlanta, Ga., represented the Bliss Mfg. Company at the convention.

The Leonhardt Pneumatic Safety Car Fender Company, Baltimore, Md., was represented by William Leonhardt, president and N. M. Rittenhouse, treasurer. They had on exhibition one of their fenders, which is claimed to be unfailing in its action.

The R. A. Crawford Mfg. Co., 35 Water street, Pittsburgh, Pa., had on exhibition its automatic fenders for street cars. The company was represented by C. N. Wood, of the Boston agency and C. P. Mayor, of the Philadelphia agency.

H. F. Evans, the western agent of the Hartford Woven Wire Mattress Company, Hartford, Conn., had an exhibition of Roberts' patent woven wire car seats of different styles. These seats are highly thought of by street railway managers.

The Taylor Electric Truck Company, 556 Fulton street, Troy, N. Y., was represented by exhibits of the well-known Taylor electric truck and the Empire State radial truck, both of which are used on street railways and highly esteemed. Mr. John Taylor was the personal representative of the company.

The Crawford Fender was exhibited in practical operation on the Atlanta street railways during the Convention. Mr. R A. Crawford, manager of the company, distributed coupon tickets good on the Atlanta roads, transferring the bearer to the fender exhibit He gave away a little pocket memorandum book. These fenders are made in Pittsburgh, Pa.

Wadham's Oil & Grease Company, Milwaukee, Wis., exhibited samples of their well-known lubricants and greases for use on electric and cable railways.

The New York Car Wheel Works, Buffalo, N. Y., had a large exhibit of their well-known wheels, and were represented by R. J. Mercur.

Jas S. Cook & Co., Atlanta, Ga., had a large Corliss engine on exhibition, which was covered with bunting.

The Hollis Automatic Cut-out was exhibited by R. W. Hollis, of Atlanta, Ga. This cut-out offers absolute protection to motors. He also exhibited his electric elevator controller and a combination double pole switch and rheostat.

The Adams & Westlake Co., 110 Ontario street, Chicago, Ill., exhibited a full line of sheet steel head-lights, street car gongs, brake handles, change slides and other goods manufactured by it. The head-light is both simple and durable in construction, and is claimed to be superior to any surface road head-light ever placed upon the market.

The Ajax Metal Co., 46 and 52 Richmond street, Philadelphia, Pa., was well represented by Colonel Benjamin F. Pilson. Col. Pilson is well-known to all street railway people, especially those in the South. Ajax metal is largely used on the Southern roads and is highly thought of. Its merits are such that no long story is necessary to commend it to those who know it. The Consolidated Traction Co., of Atlanta, is using this metal with great success and satisfaction, in all the journal boxes of its cars.

Charles L. Cornell, of Hamilton, Ohio, had on exhibition one of his arc head lights for street cars, in practical operation. In appearance it resembles a simple arc lamp, but is very much smaller and is made up in a very excellent manner. It gives a brilliant light and satisfaction.

E. F. de Witt, of the firm of E. F. de Witt & Co., Lansingburgh, N. Y., had on exhibition one of their well-known Common Sense Sand Boxes. These boxes have the reputation of working every time and under all circumstances, which are very important requirements in a device of this character. The use of these boxes, we notice, is steadily growing.

Luiburg, Sickel & Co., of Trenton, N. J., exhibited a "Trenton" trolley wagon.

The Chapman Valve Mfg. Company, 14 N. Canal street, Chicago, Ill., had an exhibit of these well-known valves. The company's interests were represented by Edmund W. Buss, western manager, and Edward L. Ross, mechanical engineer at the works.

F. R. Angell represented the National Malleable Castings Company, of Chicago, Ill. He had a full line of overhead material, showing the character of the work, also castings of the Van Dorn coupling.

The Chicago Raw Hide Mfg. Co., 75 and 77 Ohio street, Chicago, Ill., had an exhibit of raw hide gears.

The Fitzgerald-Van Dorn Company, of Lincoln, Neb., exhibited the Van Dorn automatic draw bar for elevated, electric, cable and horse railways. Mr. Van Dorn, general manager, was present at the convention.

The Harris life guard for electric and cable cars was to have been exhibited, but the guard did not arrive from Boston in season.

The Graton & Knight Mfg Co., Atlanta, Ga., extended an invitation to all delegates to visit their store, Nos. 36 and 38 West Alabama street, where they had a large stock of belting. Mr. Harry W. Anderson is manager of the company.

The General Electric Company had a large and notable exhibit. It consisted of motors, controllers and other car equipment parts, station switchboard, panels, line material, wattmeters, etc. Besides the exhibit at Piedmont Park, the General Electric Co. made a special exhibit of the cars on the Atlanta Street Railway operated on its system. The combination of motors and the "K." controller was thus shown. The main exhibit comprised, with other things, several sizes of generator and feeder panels for station switchboards, with the necessary instruments mounted thereon. The line material exhibited embodied improvements of an important character, and the portable Thomson Recording Wattmeter for testing on moving cars attracted considerable attention. The exhibit was illuminated by Thomson '93 arc lamps for railway circuits, connected in series and operating on the railway lines. Samples of underground feeder tubing, junction-boxes, taps, etc., were also shown. The interests of the General Electric Co. were looked after by Mr. W. J. Clark, general manager of the railway department. He was ably assisted by Messrs. W. H. Knight, chief engineer of the railway department, Theo. P. Bailey, H. H. Corson, H. J. Crowley, W. B. Potter, H. C. Wirt, A. K. Baylor, and J. R. Lovejoy, general manager supply department.

NEW YORK ELECTRICAL SOCIETY.

A meeting of the New York Electrical Society will be held at Columbia College, Madison Ave. and 49th street, on Thursday evening, November 1, at 8 o'clock. Mr. Joseph Sachs will give a lecture on "Is There a Solution of the Electric Conduit Railway Problem?" The lecture will be fully illustrated with lantern slides, showing the leading types of conduit construction, and several leading street railway men and electricians are expected to take part in the discussion.

HENRY ELECTRICAL CLUB.

This club, which is the outcome of the course of lectures delivered at Cooper Union last winter, in connection with the University extension and under the auspices of Columbia College, has just completed arrangements with the American Institute of the City of New York to become the Electrical Section of the same.

Hereafter it will meet every Wednesday evening, at the rooms of the Institute, 111–115 West 38th street.

The object of the club is to hold informal discussions and have papers on practical subjects presented. In addition, one lecture will be given each month, by some specialist on an announced subject.

The officers for the ensuing year are: President, W. H. Freedman, E. E.; First Vice-President, L. H. Laudy, Ph. D.; Second Vice-President, Max Osterberg, E. E.; Secretary, George Whitefield.

PERSONAL.

Mr. Maxwell M. Mayer, who has been connected with the Zucker & Levett Chemical Company for the last four years as electrical engineer and superintendent, has embarked in business on his own account. Mr. Mayer has located his factory at 411 E. 107th street, New York, where he will manufacture motors and dynamos for power, light and plating. He has the best of facilities for turning out his new machines, which will shortly be ready for the market. Mr. Mayer is a young man, full of energy and determination, and will certainly make a success of his new enterprise—he embodies all of the qualities to make a success of the undertaking. He has had a large experience in electrical engineering, having been formerly connected with the C. & C. Motor Co., the Continental Dynamo Co., the C. W. Hunt Co., and the New Century Electric Co. The dynamos manufactured by the Zucker & Levett Chemical Co. are of Mr. Mayer's design and patent. Five hundred of them are in daily use in this country, Canada, South America and Europe.

Mr. C. G. Ferguson, formerly connected with *Electric Power* of this city, is now business manager of *The Journalist*. Mr. Ferguson's many friends wish him success.

The Oakman Electric Company, of 136 Liberty street, New York, was organized last spring. The business is now conducted by Henry B. Oakman and Harry M. Shaw, the latter having purchased a half interest on the 15th of last September. These two gentlemen are well known for their enterprise and integrity. The company is handling a big line of goods, including Honrberger transformers, Defiance lightning arresters, Monarch arc light cut-outs, New England switches, McNutt incandescent lamps, C. & H. Rheostats, Excelsior porcelain cut-outs, Imperial insulating paint, Imperial insulating tape, R. R. Carbon Brushes and Shaw's incandescent street fixtures. They are also agents for the Wenstrom dynamos and motors, Burns' trolley base, O. E. C. flush switches, etc.

NEW YORK NOTES.

Office of the Electrical Age,
First Floor, World Building,
New York, October 29, 1894.

The Electrical and Mechanical Engineering and Trading Co., 39 Cortlandt street, has received the contract to light the cars on the Brooklyn Bridge by electricity. Each car is to be lighted by ten 16 c. p. lamps, there being sixty cars to be so lighted. The cost of the plant, according to the figures of the successful bidder, will be $18,135, and it will cost $1,350 a year to maintain the same. The system is to be in operation within 90 days. The plant will consist of two high speed automatic cut off engines, each engine driving a multipolar direct driven generator. The generating plant will be located in the power station at the Brooklyn end of the bridge. The specifications drawn by Chief Engineer Martin, under which the contract has been awarded, were exceedingly rigid in every detail, requiring the best method of construction that is known at this stage of the art.

Seventy-five new cars have been put on the Third Avenue Cable road, including some new smokers.

The Board of Works of Newark, N. J., will be recommended to place all electric wires in the city thoroughfares underground, and that where there are no conduits they should be constructed.

Justice Ingraham, in the Supreme Court, on October 25, granted a decision in the action brought against the Union Railway Company to restrain it from building its line through 135th street, this city. The action was brought by James Rogers, who claimed that the acts under which the company claimed the right to operate and construct their road were unconstitutional. The company maintains that the act of 1863, under which the franchise was granted, was ratified by the laws of 1894. Judge Ingraham, however, holds that the act of 1894 is void, as it conflicts with the constitutional provision that "no private or local bill can contain more than one subject, and that must be expressed in its title." W. T. H.

TRADE NOTES.

The George L. Colgate Co. has taken one of the floors in the new addition to the Electrical Exchange, 136 Liberty street, city, and will largely increase its stock of Keystone voltmeters and ammeters, Climax iron-clad rheostats and McIntosh paint for poles. This paint is an excellent protection and preservative. The Colgate Co. is rushed with orders for rheostats. This concern is headquarters for general electrical supplies.

The Foster Engineering Co., of Newark, N. J., report that among recent orders received for their Pressure Regulators to be applied to dynamo engines are two 4-inch for the U. S. battle-ship "Texas;" one 5 inch for the U. S. armored cruiser "Brooklyn;" one 3-inch and one 4-inch for the U. S. armored cruiser "Indiana;" five 7-inch for the Providence Steam Engine Co.; two 8-inch for the Corliss Engine Co., of Providence, and one 4-inch for the Western Union Telegraph Company's building. The latter is to deliver steam to three dynamo engines, and to meet specifications is required to maintain within one pound a uniform delivery pressure of 45 lbs. regardless of change of initial or boiler pressure, which ranges from 60 to 100 lbs., and regardless of change of load or number of engines in operation.

The Paragon Insulating Company, 1021 Society for Savings, Cleveland, O., has issued a neat little pamphlet of its insulating paints and compounds. Acme insulating paint has been thoroughly tested and is put upon the market as a first-class article. "Asphlatuk" is the name of the compound and is recommended to wire manufacturers and conduit companies as an excellent insulator and penetrator.

H. W. Johns Mfg. Co., of 87 Maiden Lane, New York city, has issued a neat pamphlet giving illustrations of the United States cruisers, power and steam heating plants, and many of the largest public and private buildings, factories, etc., throughout the country where this company's asbestos pipe and boiler coverings are used.

We have received from the Electrical & Mechanical Engineering & Trading Company, 39 Cortlandt street, New York city, a pamphlet giving a reprint of the paper of J. H. Vail and S. H. Wynkoop, on "The Use of the Booster on Electric Railway Circuits," read at the Atlanta Convention of the Street Railway Association. Besides this paper the pamphlet gives other electrical railway information of value, in tabular form.

Baker & Co., of Newark, N J., the well-known assayers and smelters, and gold, silver and platinum refiners, have just issued the third edition of their pamphlet entitled "Data Concerning Platinum, Etc." It gives considerable data concerning this metal, and the various tools and utensils made by this firm are fully illustrated.

The Belknap Motor Co., of Portland, Me., manufacturers of the celebrated B. C. dynamos and electric motors, are the manufacturers of the composite graphite and copper-woven wire brushes so largely used by electric light street railway companies. These brushes contain all the essential qualities of graphite and copper. They are said to be the most economical brush made.

Mr. Chas. J. Bogue, 206 Centre street, New York city, has just issued price list "A" of street-car commutators. These commutators are of the Billings & Spencer Company's patent, and drop forged and free from blow holes.

The Thompson-Brown Electric Co., formally opened its store at 97 High street, Boston, Mass., in the afternoon and evening of October 25 last. A large number of persons interested in electrical matters called to extend their congratulations to the new concern, and wish it long and successful career. The officers of this company are George Thompson, Jr., president, and Maybin W. Brown, treasurer. H. P. Brown and F. E. Pettingell are also connected with the company.

CHARACTERISTICS OF A POPULAR RAILROAD.

Travellers find unexcelled accommodations and supreme comfort on the cars of the New York Central Railroad. American railways are noted for the advantages which they afford the travelling public, and there are none that surpass this splendidly equipped road.—*Paper Trade Journal.*

Electrical and Street Railway Patents.

Issued October 23, 1894.

527,766. Metal Brush for Dynamos. Wilhelm vom Braucke, Thmerterbach, near Westig, Germany. Filed July 2, 1894.

527,776. Electric Motor for Dynamo. Cornelius F. Daniels, Macon, Ga. Filed Dec. 2, 1891.

527,786. Self-Winding Electric Clock. Emil G. Hammer, Brooklyn, N. Y. Filed July 18, 1893.

527,788. Electric Uterine Battery. Charles E. Hebard, Grand Rapids, Mich., assignor of one-fourth to Hanford C. Keith, Rhinelander, Wis. Filed July 11, 1894.

527,813. Life-Guard for Street Cars. John F. Ryan, Toronto, Canada. Filed Dec. 9, 1893.

527,826. Carbon for Electric Lights. Edward G. Acheson, Monongahela City, Pa. Filed Aug. 25, 1894.

527,827. Machine for Black-Leading Electrotype Matrices. Oliver B. Beach, Stony Creek, Conn. Filed Aug. 23, 1893.

527,830. Process of Treating Lead Hydrate Produced by Electrolysis. Arthur B. Browne, Cambridge, Mass., assignor to the American Lead Company, Kittery, Me. Filed Jan. 10, 1894.

527,839. Annunciator-Signal. Isaiah H. Farnham, Wellesley, Mass., assignor, by mesne assignments, to the Western Electric Company, of Illinois. Filed Feb. 23, 1894.

527,840. Support for Trolley Wires. Frederick C. Fisk, Buffalo, N. Y. Filed Mar. 1, 1894.

527,857. Transformer System for Electric Railways. Maurice Hutin and Maurice Leblanc, Paris, France, assignor to the Société Anonyme pour la Transmission de la Force par l'Electricité, same place. Filed Nov. 16, 1892. Patented in France Nov. 5, 1890, No. 209,-323.

527,861. Method of Manufacturing Elements or Plates for Secondary Batteries. Hugh F. Kirkpatrick-Picard and Henry Thame, London, England. Filed Jan. 10, 1894.

527,864. Carbon-Holder for Arc Lamps. Erwin Lavens, Brooklyn, assignor to the General Incandescent Arc Light Company, New York, N. Y. Filed March 17, 1894.

527,873. Closed-Conduit Electric Railway. James F. McLaughlin, Philadelphia, Pa. Filed Apr. 5, 1894.

527,874. Closed-Conduit Electric Railway. James F. McLoughlin, Philadelphia, Pa. Filed May 24, 1894.

527,894. Automatic Safety-Grip for Inclined Railways. Orison M. Smith, Duluth, Minn., assignor of two-thirds to M. J. Davis, E. J. McLaughlin, H. Bridgeman, and N. F. Russell, same place. Filed May 19, 1894.

527,901. Electric-Arc Lamp. Hans O. Swoboda, New York, N Y., assignor to the General Incandescent Arc Light Company, of New York. Filed March 2, 1894.

527,920. Trolley-Wire Support. Montraville M. Wood, Chicago, Ill., assignor to the Wallace Electric Company, same place. Filed Apr. 30, 1894.

527,927. Electric Motor for Railway-Cars Norman C. Bassett, Lynn, assignor to the General Electric Company, Boston, Mass. Filed June 28, 1893.

527,947. Method of and Means for Controlling Electric Cars. Harry P. Davis, Pittsburgh, Pa., assignor to the Westinghouse Electric and Manufacturing Company, same place. Filed Mar. 29, 1894.

527,958. Electrical Signaling System. Bradley A. Fiske, U. S. Navy. Filed May 13, 1892. Renewed Sept. 15, 1894.

527,977. Automatic Electrical Boot-Blacking Machine. John O. Heinze, Jr , Lynn, Mass. Filed Apr. 2, 1894.

527,989. Combined Regulating Incandescent Lamp and Socket. Chas. A Hussey, New York, N. Y. Filed May 14, 1894.

527,990. Electric and Gravity Pleasure-Railway. Chas. A. Idler, Atlantic City, N. J. Filed June 26, 1894.

528,014. Electric Switch. James F. McLaughlin, Philadelphia, Pa , assignor to James W. Difenderfer, same place, and Theodore H. Gehly, York, Pa. Filed May 6, 1893.

528,021. Electric-Lighting System. Geo. J. Parfitt and Geo. J. T. J. Parfitt, Keynsham, England. Filed July 12, 1892.

528,040. Telephone Circuit and Signal. Theodore Spencer, Cambridge, assignor to the American Bell Telephone Company, Boston, Mass. Filed Nov. 18, 1893.

528,048. Car-Fender. Henry P. Weale, Boston, assignor of two-thirds to Geo. L. Richards and Henry E. Turner, Malden, Mass. Filed Apr. 27, 1894.

528,057. Car-Fender. Sylvanus D. Wright, New York, N. Y. Filed Dec. 20, 1893.

528,075. Combined Telephonic and Signaling System. Henry A. Chase, Boston, Mass., assignor to Albert Watts, same place. Filed June 25, 1894.

528,101. Trolley-Wire Switch-Plate. Gustavus A. Huben, Springfield, Ohio. Filed Feb. 23, 1894.

528,119. Electric-Arc Lamp. Sigmund Bergmann, New York, N. Y. Filed Apr. 6, 1894.

528,121. Alternating-Current Motor. Chas. T. Child, Ashland, Va.., assignor to the Electric Power Company, of Maine. Filed Dec. 22, 1893.

528,127. Circuit-Changer for Electric Signaling Systems. John F. Hunter and Samuel H. Lough, Seattle, Wash. Filed Sept. 3, 1892.

ELECTRICAL AGE

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NEW YORK, NOVEMBER 10, 1894.

CONTENTS.

UNCERTAINTY AND DANGERS OF CABLE ROADS.

A broken strand of the cable on the Broadway line in this city one day last week rendered the grip of a car inoperative, causing the car to "run away." In its uncontrollable flight it collided with the car ahead, and that with the next car, and the third with the fourth. The streets were crowded at the time and it is nothing short of a wonder that no one was hurt. Accidents of this character are so frequent on this and other cables lines in this city that we are surprised that something has not been done to avoid them. The electric signal system is a step in this direction, but in this case the cars were in motion for three blocks or more after the signal was sent in. This was time enough to accomplish great damage and loss of life, but it so happened that the affair was unattended with such results. This lurking danger is not the only objectionable feature of a cable system. When a broken strand gets tangled with a grip and the car creates consternation for a while, everything connected with the system stops and remains in this condition of inertness for an indefinite period of time. Meanwhile those who desire to ride must walk if they want to make any progress. There are no strands to break in an electric system of propulsion. The cable is the most unreliable system of street-car propulsion on account of uncertainty in the cable. There is no uncertainty about the electric system. Of course, any system is liable to derangement, but we think that the electric system is the most reliable and the cable the most unreliable. The cable companies should take the "bull by the horns;" throw the cable out of the conduit, put a copper conductor in its place, and use the power of the engines to generate electric current instead of moving a heavy cable. They must make the change sooner or later—the sooner the better for themselves and the public.

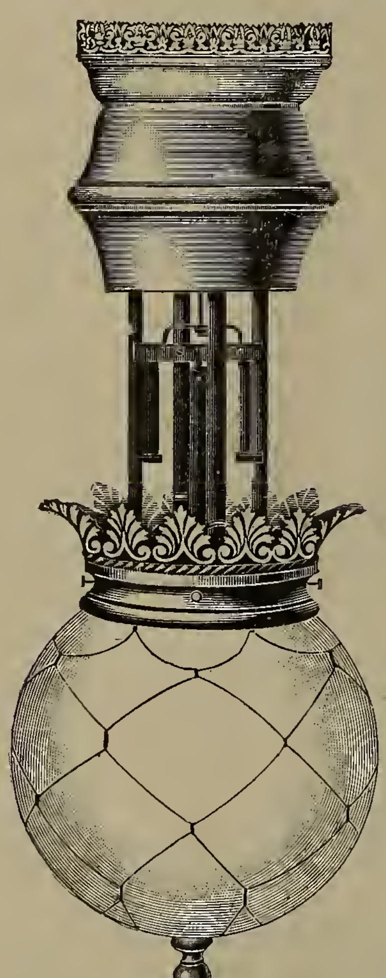
DELIBERATE PERVERSION OF FACTS.

One of the most unfair thrusts at the "trolley" that we have seen for some time is that contained in the New York Morning *Sun*, of November 5. This paper, which pretends to represent honesty, justice and fair dealing, forgets its principles at times and allows its prejudice to so garble facts that no one but an idiot can fail to see that some unwholesome influence is operating on the mind of its great editor. In the issue referred to an article is published headed "Two Trolley Victims." According to the story a policeman was, on Sunday last, knocked down by a trolley car in Brooklyn, and sustained a compound fracture of the left leg. An ambulance was called and on the way to the hospital the ambulance horse ran away, causing the vehicle to collide with another trolley car. The driver of the ambulance was thrown out by the shock and received severe injuries. These facts, which are taken from the *Sun's* article, are sufficient to illustrate our point. The perversity of the facts lies in the heading of the article, and it is manifestly unfair to charge the two accidents to the trolley. We suppose the *Sun* editor reasons in support of his position that "if" there had been no trolley the policeman would not have been injured; if the policeman had not been injured the ambulance would not have been called; if the ambulance had not been called the horse would not have run away; if the horse had not run away there would not have been a collision, and if there had been no collision the driver of the ambulance would not have been injured—therefore the trolley is to blame. The editor of the *Sun* should look sharper to his headlines and stick closer to the practice of the principles the paper so ostentatiously advocates.

THE IMPERIAL LAMP.

The Imperial incandescent arc lamp, which has recently made its appearance and which is meeting with satisfactory success in practice, has a promise of a successful career. This lamp contains several features of special merit, chief of which are steadiness of light, ease of trimming, increase of light over an incandescent amp for same power and simplicity in construction.

The mechanism of the Imperial lamp is different to that of other lamps of this character. The feeding is accomplished by a positive ratchet movement. When the resistance of the arc causes sufficient current to pass through the shunt coil, the armature of the latter is attracted and at the same time the circuit is broken, which, demagnetizing the shunt coil, allows the armature to drop back. The dropping of the armature actuates a pawl which moves a wheel one tooth and



IMPERIAL LAMP.

causes the upper carbon to drop $\frac{1}{250}$ of an inch. The feeding, therefore, is so slight each time and the arc practically not varying in length at all, that the light is maintained absolutely steady.

The cut-out embodies a new principle.

These lamps are notably short, the total length of the 12 hour lamp being only 26 inches, and that of the 8-hour lamp 22 inches. They are adjusted to burn 8-amperes for two in series on a voltage from 1 o to 118 direct current. Each lamp gives 1,000 candle-power.

To give an idea of the superiority of this lamp in the matter of candle-power as compared with incandescent lamps, the following figures tell their own story. It takes sixteen 16-c.-p. incandescent lamps to consume 8-amperes of current, giving a total candle-power of 256.

Two Imperial lamps consuming the same quantity of current give a candle-power of 2,000.

The Imperial lamp can be placed in circuit singly as well as two in series, and the resistance is furnished mounted on the lamp or furnished separately, as desired.

In the construction of these lamps the manufacturers, the Imperial Electric Lamp Co., 249 Broadway, New York, employ the best of materials and workmen. The Standard lamps are finished in japan and polished brass, and the ornamental lamps in a great variety of ways, including dull brass, polished brass, old brass, wrought iron, gilt, etc.

The Imperial lamp is handsome in appearance, and an ornament amid the most elegant surroundings. Our large illustration shows some of these lamps in use at the Barrett House, Broadway and 43d street, New York, where four of them have already been installed and more are to be put in.

SUBMARINE DETECTOR.

A year ago the Russian Monitor "Rusalka" foundered in the Gulf of Finland, and until recently the exact location of the wreck has been unknown. The position of the unlucky vessel was determined by the use of an instrument devised by Captain McEvoy, and called a "Submarine Detector." This instrument and its use are thus described in the London *Electrical Review*:

The apparatus is based on the principle of Prof. Hughes's induction balance, and it consists simply of an electrical arrangement contained in a small mahogany box, which is carried on board the searching vessel, and a sinker, which is trailed along the bottom. The sinker also contains an electrical arrangement, and is connected with that in the box by a light electrical cable of any required length. The apparatus includes a small battery and an automatic contact breaker, which opens and closes the battery circuit at short intervals. The battery circuit includes two primary coils, one in the box and the other in the sinker. Each primary coil has its secondary coil, and both the primaries and secondaries are respectively connected up by conductors, which are enclosed in the suspending cable. In the searching vessel there is a telephone, which is included in the secondary circuit. The apparatus is adjusted so that under ordinary circumstances there is silence in the telephone. When, however, the sinker approaches a mass of metal, the balance is upset, and sounds become audible in the telephone, while they are reduced in intensity as the sinker recedes from the metallic object. Three hundred feet of electrical cable were employed with the detector in searching for the "Rusalka," and the depths searched varied from 15 to 50 fathoms. The search was continued for several weeks, and the exact position of the foundered vessel was at length placed beyond all question, as every time the searching steamer passed over a given spot the electric indicator of the detector sounded loudly, thus affording evidence that a large mass of metal was submerged below. After the vessel had been located the divers descended and examined her, the result of their examination being, so far as is at present known, that she had foundered through serious damage to her stern.

PROTECTION OF FIRE ALARM SYSTEMS.

Any device for the protection of fire alarm systems against an excessive flow of current should not open the circuit, but should introduce a sufficient amount of resistance to prevent such a flow and at the same time maintain the efficiency of the current; this resistance to be introduced automatically and removed in the same way when the danger is passed.—*Capt. Wm. Brophy, before the convention of Fire Chiefs, Montreal.*

IMPERIAL LAMPS IN THE HALL OF THE BARRETT HOUSE, NEW YORK.

THE "MICHIGAN" OVERHEAD MATERIAL.

This is the name of a complete line of overhead material that has been in use on various railroads for the past two years, during which time the different devices have been subjected to the most severe test possible, and have proved their merit.

The devices comprising this line are all the inventions of practical men who have had years of experience in erecting and operating trolley lines. The span wire which, when the bell is screwed down on the complete clamp, draws the wire upwards in the centre. As, however, the saddle holds the wire down at the outer end of the clamp, it will be seen that a slight rounding bend is thus formed in the wire (see Fig 8) and that the clamp just fills this bend, thus preserving a perfectly straight lower side of wire and clamp, so that there is not the slightest shoulder for trolley wheels to strike against. This feature is one of the greatest importance, and not

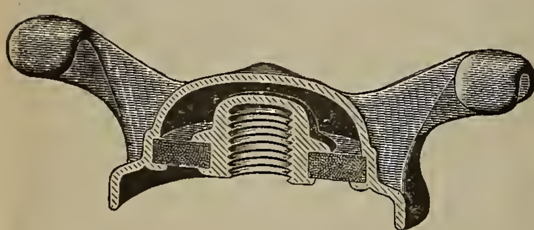


FIG. 1.

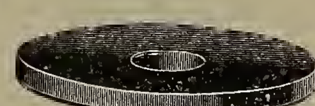


FIG. 2.

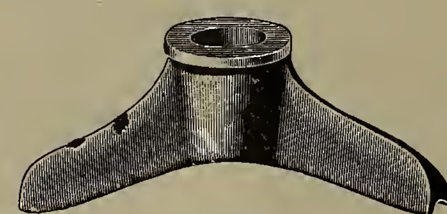


FIG. 3.

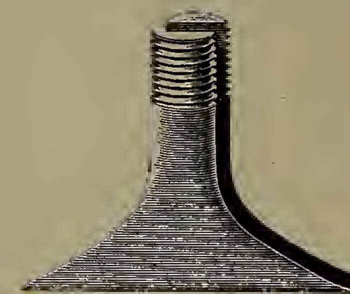


FIG. 4.

hanger is used more than any other overhead device, and three illustrations of this article are given herewith, first, all apart; second, partly assembled, and third completely assembled and in place on the wire. In the first set, fig. 1 is a sectional view of the bell, and shows also the inside insulating washer and the nut; Fig. 2 shows the outside insulating washer; Fig. 3, the saddle, and fig. 4, the clamp. The inside insulating washer is held in place against the shoulder in the bell by means of lugs which are cast onto the bell and then clinched against the under side of washer, these being shown in only secures a strong grip on the trolley wire, but also results in a much longer life for trolley wheels and harps.

These hangers, as well as the other devices included in this line of overhead material, are made both in brass and malleable iron.

This line of overhead material also includes single and double curve, barn, swinging and bracket hangers; also section insulators, splicing plates, switches, cross-overs and the other devices that go to make up a complete line. All of these have been designed so as to

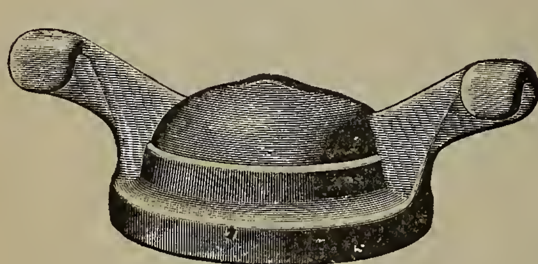


FIG. 5.

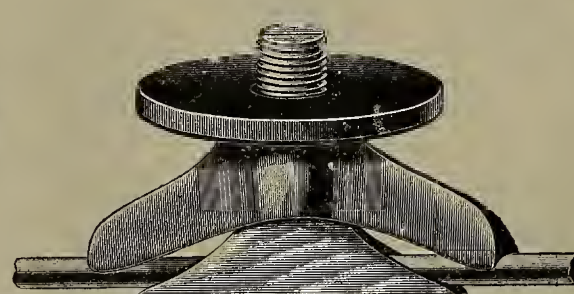


FIG. 6.

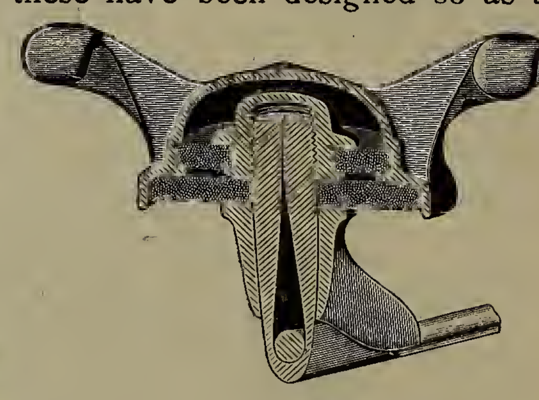


FIG. 7.

Fig. 1 as projecting inward from bell on the under side of washer. The nut shown in Fig. 1 fits into a square hole in the insulating washer and is held in place by its flanged head on top and cast lugs underneath, which are also clinched against the under side of washer. Fig. 5 shows the outside view of bell, and Fig 6 the view of clamp, saddle and lower insulating washer, all in place on the trolley wire, ready for the bell to be screwed down for the purpose of clamping the wire.

avoid shoulders and projections which trolley wheels might strike against, and also to allow of their being quickly put in place on the wires without the use of any special tools. In these respects it is claimed that they are superior to any other yet designed. These goods are manufactured by the Michigan Electric Company, of Detroit, Mich.

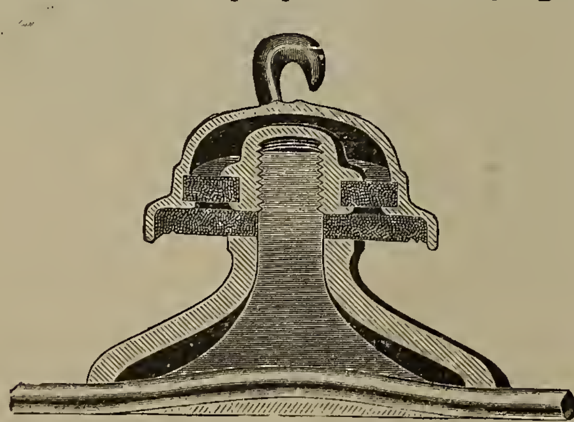


FIG. 8.

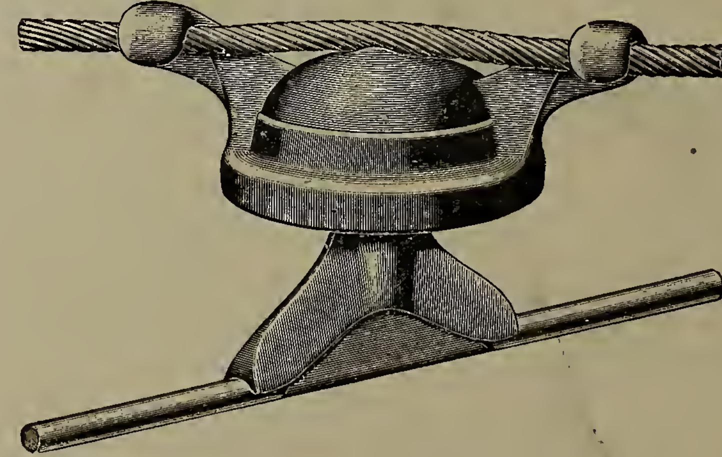


FIG. 9.

Fig. 7 is a cross sectional and Fig. 8 a longitudinal sectional view of the complete hanger in place on the wire, and Fig. 9 an outside view of same

As is plainly shown, the clamp is a split screw, stirrup shaped, which passes completely around the wire, and

On account of the use of non-union marble, it is reported that a strike was ordered by the Board of Walking Delegates in the power house of the Broadway Cable Railroad, Houston street and Broadway. The strike was averted, however.

PRINCIPLES OF DYNAMO DESIGN.

BY NEWTON HARRISON, E. E.

(*Continued from Page 244.*)

Esson has produced a formula covering the same ground that is worthy of attention.

He employs a constant in his calculations and advises a rise of not more than 70° to 75° Centig. or 126° to 135° Fahr.

The Formula is

$$C^\circ = \frac{W \times 355}{S}$$

C° = Centig. degrees
S = Cooling surface of coils in square cms.
W = $C^2 R$ or watts of heat.

If modified to English units of a familiar type we have

$$F^\circ = \frac{W \times 102.24}{S^1}$$

F° = Fahr. degrees.
S^1 = Cooling surface in sq. inches.
$W = C^2 R$.

As an illustration of its applicability, take a coil of the following dimensions wound one-half an inch deep:

Diameter = 3 inches.
Length = 3 inches.
Cylindrical surface = 28.3 sq. inches.
Current = .5 amperes.
Resistance = 100 ohms.

$$\text{Then } F^\circ = \frac{25 \times 102.24}{28\ 3} = 90.3^\circ \text{ Fahrenheit.}$$

Upon examining such a formula with reference to the preceding—that is to say—an allowance of one or preferably two sq. inches per watt for radiation, it is seen that if the energy consumed in raising one sq. inch 1° Fahr. be calculated for, it will be, if $F^\circ = 1$ and S_1 1.

$$1^\circ = \frac{102.24\ W}{1 \text{ sq inch.}}$$

Therefore W or $C^2 R$ must equal $\frac{1}{102}$ of a watt per degree rise in temperature per sq. inch, or with one watt and one sq. inch an increase of 102.24° Fahr.

Thompson expects a much greater rise than this, as seen below:

Thompson 225° per watt per sq. inch.
Esson 102° " " "

The difference is very striking, and virtually inclines the reader to accept of that with the greatest factor of safety.

With a deep winding, adopting such empirical language, 225° F. will represent per watt more nearly the actual heat than the lesser standard.

Even such an allowance as the above has been increased, so that it is not thought to be extravagant design to allow two square inches per watt for radiation.

The field winding of dynamos is best designed by starting with a certain basis for losses in the field.

Prof. Jackson has compiled the following table for this purpose.

TABLE OF $C^2 R$ LOSS IN FIELD WINDINGS OF SHUNT AND SERIES DYNAMOS.

R. being taken as cold resistance at about 25° *C.* (75° *F.*)
Per cent. of full load according to the average American practice.

Capacity of Dynamo.	Loss in Per Cent.
5 kilowatts.	4.5
10 "	3.6
15 "	3.1
20 "	2.8
25 "	2.5
30 "	2.3
35 "	2.1
40 "	1.9
50 "	1.7
60 "	1.5
75 "	1.3
100 "	1.1

R, and therefore the loss, increases one per cent. of its value for each 2½° C. rise in temperature.

As the rise in temperature usually amounts to about 70° to 100° F. for every .3 to .4 watt per square inch, it will assume a higher value at the core itself, or about one-half of a watt per square inch of core surface.

It will be practicable therefore to make the length of core such, that one-half a watt will be radiated for each square inch, thus determining by this means the size of the core with respect to the energy dissipated at heat.

(*To be Continued.*)

CAN THE T RAIL BE SATISFACTORILY USED ON PAVED STREETS?*

BY STRATHEARN HENDRIE.

The tendency of the larger cities in this country—in fact we might say in all the cities of this country—during the past ten or twelve years has been towards smoother and better paved streets, and the general public, watching the progress of its city officials, has become in many places impatient of the action of the street railway people in maintaining the old forms of rail, which make a ridge on the smooth surface of a first-class modern street in an American city. Our travellers have come home from England and the Continent extolling the grooved rail, and our city officials have in many cases forced either the English grooved rail or its American modification upon the railway companies. No street railway man hankers after the grooved head before he gets it, or enjoys it after he has put it in, and he therefore fights its introduction, demanding to be left alone, as he was, with his centre bearing or five inch tram head. What we would show him—and through and beyond him his public—is that he can progress in the direction of their desires for a smooth street, and can give them something even more satisfactory to them than their favorite grooved rail.

For the street railway man, questions of price, joints, quick delivery, competition, coal pile and construction combine to recommend the T rail. The old argument for the tram head—that the steel paving for the three inches is the cheapest in the end—no longer holds good in these days of good street pavements and rapid transit. Wagon traffic goes where it belongs—on the side of the street. To those who can still use the clean headed, old center bearing rail, we can only say, "You lucky dogs;" to most of us it is lost forever. As a substitute for this, where old grants are being renewed or

* Abstract of Committee report read at the Convention of the American Street Railway Association, Atlanta, Ga., October 17, 18 and 19, 1894.

new ones made, the grooved headed rail has been in many places hastily, and, we believe, unadvisedly, required. While the suggestion of a T rail, for use in paved streets in cities, is startling to the average citizen, alderman or city engineer, and is in most cases impatiently rejected by them, yet we must recollect that the mention of a rail, such as steam roads use, calls up in their minds, the idea of four or five inches of steel standing up above the street and dilapidated plank crossings with half drawn spikes, and we should go patiently to work to teach them, that as there is more than one way to supply motive power to a car, so there is more than one way of putting a rail in the street.

The general consensus of opinion of twenty-six roads which answered the inquiries of the committee, and of the officials of the cities in which they run, is that if you can once get down a hundred yards of T rail and make a decent job of the paving, neither the officials nor the citizens will permit you to use anything else in the future. The main thing is to make your paving job a neat and good one. In three of the other cities, where there is at present no T rail, but which are blessed with enlightened city officials, the T rail is about to be made a requirement on the companies.

Modern street railway construction and street paving imply a broken stone, concrete or other solid foundation, a high girder or T rail and a brick, asphalt or granite surface to the street in the larger cities, or cedar block, cobble or macadam in the smaller ones.

Asphalt or macadam can be paved as easily to a T rail as any other. They should be laid flush, and room should be made for the flange by running a railroad freight car, or other car having a larger flange than the street car, over the track before it is opened for traffic. Bricks are now moulded by many paving brick manufacturers to fit girder and T rails, those for the latter allowing a space for the flange of the car-wheel. Whether it is more expensive to chip the corners of granite or Medina blocks or to leave them intact a short distance from the head of the rail and fill the space thus made with asphalt, creosoted wood or concrete, is open to question, but, in either case a first-class job can be made. The writer is familiar with two excellent pieces of fifty-six pound T rail construction on chairs, in one of which the pavement consists of six-inch cedar blocks, and in the other of small three or four inch cobble stones, both paved close to the rail with no filling.

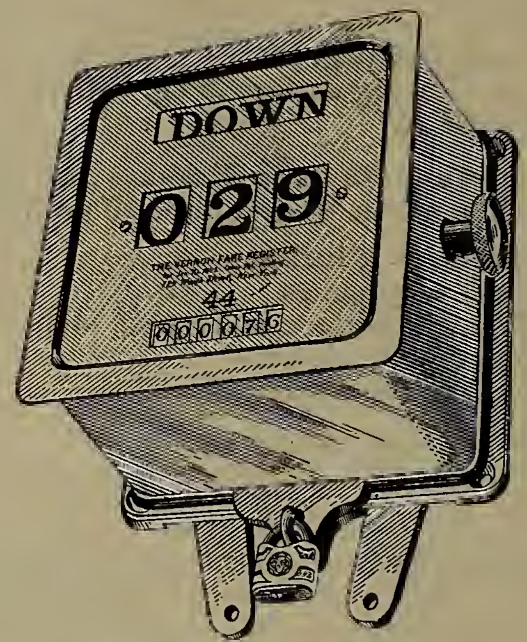
It may be useful in your arguments with city officials in favor of a T rail as against a grooved girder, to insist that a T rail is a girder rail with a head differing less from that of the grooved girder than this does from the tram or centre bearing head. Also the substitution, in this country, of the steel base and upright member of the girder for the wooden stringer, took place before the introduction of the grooved rail, and was due to entirely different causes, and certainly has not been brought about by any demand for smooth streets originating with the cities or citizens.

ELECTRICITY AT THE WORLD'S FAIR.

One of the most interesting books published is that of J. P. Barrett, entitled "Electricity at the World's Columbian Exposition." It gives a history of this wonderful department of the wonderful show; also describes the exhibits in considerable detail, and is full of elegant illustrations. Everyone interested in electricity should have a copy for reference. It is an invaluable work of this character. Send $2.50 to the ELECTRICAL AGE, New York, and get a copy of the book by return mail.

THE VERNON FARE REGISTER.

The Vernon Fare Register, exhibited for the first time at the recent Atlanta convention, is the latest competitor in this particular field of street railway equipment. It is based on a standard high-speed revolution counter which has been selling for many years and which was finally adopted on the turnstiles used at the Chicago Columbian Exposition in 1893, replacing a counter which was at first tried with unsatisfactory results. During the great fair, the Vernon counter recorded visitors to the grounds and admissions to the Ferris wheel to the number of about 30,000,000, and testimonials to its absolute accuracy were given to the manufacturer, S. N. Balzer, of New York. It was an easy transition on the part of Mr. Balzer to adapt the Vernon counter to the street car service. This was done under the personal supervision of expert street railway men, whose object was to secure a fare register that "the conductors could not beat and which would not beat the conductors." The mechanism of the Vernon is so simple and its parts so substantial that it has fully met these conditions. The Vernon has no springs or pawls



VERNON FARE REGISTER.

which are apt to get out of order. It is geared throughout like a piece of clock-work. Its wheels are brass and its gears are steel, making it positive in action. It cannot "jump," and it is moreover so good a piece of scientific mechanism that it will stand very hard usage without detriment. In proof of this it need only be said that the Vernon counters used at Chicago have been officially certified as showing "no signs of wear at the close of the fair."

The Vernon has been adopted as the standard register of the Consolidated Traction Company, of New Jersey, where a large number of these machines have been in use for some months. Mr. David Young, the general manager of the company, praises them highly for the perfect satisfaction they have given in his service. This register is entirely "up to date" in every respect, and it attracted considerable attention at Atlanta from street railway men on account of its simplicity of construction, lightness and beautiful appearance.

ADDRESS BY PROF. HOUSTON.—Prof. E. J. Houston's address before the Medico Chirurgical College, Philadelphia, Pa., as printed in the *Times and Register* of that city, is an interesting paper. Prof. Houston urges upon the students the necessity of close attention to study in order to fit themselves for the highest realization of their professional activity. He sums up the requirements of a physician, as he understands them, and states that he should be a cultured, intelligent, sympathetic and courteous gentleman.

DYNAMO CURRENTS FOR FIRE ALARM WIRES.

BY B. S. FLANDER.

In a paper read by Mr. Flander, superintendent of the fire alarm system, Boston, at the recent convention in Montreal of the National Association of Fire Engineers, that gentleman speaks with great favor regarding the employment of dynamo currents for the operation of fire alarm wires.

Mr. Flander says: "The question of employing the dynamo for operating the fire alarm system of Boston first presented itself to my mind early in the year 1891, when I commenced a careful study of the problem and instituted a series of thorough and exhaustive experiments with the view of ascertaining whether or not it would be practicable to adopt a system in place of the modified form of gravity battery then in use.

"I procured a motor generator of comparatively low voltage and applied it to one of the circuits, which, like all the others in the system, required a constant current. The first tests were conducted with great caution, a supplementry battery being held in readiness to be applied at a moment's notice should any failure in the experiment be developed; but from the first it proved to be substantially successful, the only difficulty experienced being a tendency on the part of the field magnet to heat by constant service, and I was obliged to make a trial of several machines with different windings before I obtained satisfactory results.

"The apparatus finally adopted, which has been in constant use during the past year, is constructed in a very compact and convenient form, and has thus far been driven by the 110-volt current supplied by the Edison Electric Illuminating Company, the output to the generator being equal to about 100 volts, giving away nearly one ampere of current.

"After a few weeks of trial of the single circuit connection, I placed a group of six circuits in multiple connection, each circuit being equipped with a rheostat for facilitating the matter of regulating the current to the amount required.

"I purposely selected circuits whose battery requirements were as exacting as any others in the entire system, the average need of each being about 50 volts, with 4-100 of an ampere of current.

"There had been an aggregate of 350 cells of gravity type in use to supply these circuits with a sufficient amount of current for their service, and I found no difficulty whatever in obtaining from this generator all that was required, with an excess of current in reserve to supply for at least as many more if necessary.

"The constancy and steadiness of the current thus obtained, together with the facility for instantaneously increasing or decreasing it to meet the varying conditions of the circuits, have thoroughly convinced me, after a trial extending through so many months, that the dynamo is greatly superior in all respects to any form of galvanic battery yet in use in the fire alarm service.

"In conclusion I have to say that the results of these experiments justify me in expressing the unqualified opinion that the adoption of this system will be one of the greatest improvements in fire alarm service considered in recent years."

Electric Torpedo Boat.—A dispatch from Melbourne, Australia, states that Mr. Allen, a resident of that city, has invented an electric submarine torpedo boat which, he claims, can be sunk to any depth and can be run as a surface boat. It has, so says the dispatch, received the approval of prominent naval officers.

ATLANTA CONVENTION ECHOES.

The address read by President H. C. Payne at the recent convention in Atlanta, of the American Street Railway Association, was a well-planned and practical document. Among other things, Mr. Payne refers to the effects of the financial stringency and business depression on the street railway interests. These conditions, he said, had their compensations, for they had enforced economies in operation, and in other ways brought the business to a more healthy basis. He confidently anticipated a slow but gradual return to normal business conditions.

Referring to street railway investments, he said: The American capitalist is quick to discover promising fields for the investment of capital, and I think it is safe to say that never in the history of our country has there been a more rapid development than has come from the application of electricity to transportation purposes. In the anxiety to secure franchises and to reconstruct street railways, very excessive valuations have been placed upon, and paid for the right to operate by electricity in our large cities. This has led the representatives of the people to believe that there is a present value attached to franchises far beyond that which the facts will sustain. Consequently, these conditions have led to a fruitful field for the legislator, as well as for the assessor, from whose tender solicitude for the welfare of the people the street railways, whose prosperity contributes to much to the general good, have suffered. The interest as well as the inclination of most managers tends toward giving as liberal and good a service to the public as the patronage will justify. * * *

The question of insurance has become a perplexing one. In many instances the larger systems find it very difficult to obtain insurance in sufficient amounts to cover their risks, and I think the common experience is that rates have increased to such an extent as to be so burdensome as to justify us in considering the propriety of organizing a mutual insurance association.

THE EDISON LAMP BEFORE THE SUPREME COURT.

The Supreme Court of the United States, according to a despatch from Washington, on October 29, is giving attention to the appeal from the decision of the Circuit Court for the western district of Pennsylvania, in the case of the Consolidated Electric Light Company vs. the McKeesport Gas Company. Judge McKenna, of the Circuit Court, on October 5, 1889, rendered a decision in favor of the latter named company.

A final decree, holding that the patent issued to Sawyer & Man in 1885 was invalid, was entered October 10, 1890. From this decree the Consolidated Company appealed. The briefs of counsel in the case are books of about 300 pages each, and they contain an epitome of the history of the art of electric lighting which would probably secure their introduction as text-books on the subject if the authors so desired.

The matter in controversy is the patent for an improvement in incandescent lamps, in the use of carbon made from fibrous material and in the form of an arch, horseshoe or loop.

Modern Progress is the name of a new monthly journal which has just made its appearance in Erie, Pa. It is "the busy man's record of the world's industrial advance." Electrical subjects take up a good portion of space in its columns. It is published monthly by the Modern Progress Co.

AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS.

At the meeting of Council held at 12 West 31st street, October 17, the following Associate Members were elected:

Cole, John R., sales agent, New York Insulated Wire Co., 102 Sacramento street, San Francisco, Cal.

Davis, Harold McGill, advertising manager, *Electric Power*, 36 Cortlandt street, N. Y.; residence, 212 Clinton street, Brooklyn, N. Y.

Dommerque, Franz J., chief draughtsman, Chicago Telephone Co.; residence, 71 Potomac avenue, Chicago, Ill.

Duncan, Thomas, electrician, Laboratory Fort Wayne Electric Corporation, 407 Broadway, Fort Wayne, Ind.

Dunn, Kingsley G., electrician, Palace Hotel, San Francisco, Cal.

Etheridge, Chas. Locke, Chicago Telephone Co.; residence 4714 Kenwood avenue, Chicago, Ill.

Eyre, M. K., assistant to manager of lamp sales, General Electric Co., Harrison, N. J.; residence, 42 S. Washington square, New York.

Ford, James S., electrician, Chicago Telephone Co., Engineering Department, Chicago, Ill.

Hadley, Arthur L., assistant electrician to Chief Electrician and General Superintendent Fort Wayne Electric Corporation, 149 Griffith street, Fort Wayne, Ind.

Jones, Arthur W., representative for S. Africa General Electric Co., Port Elizabeth, S. Africa.

Keller, Chas. L., Chicago Telephone Co., Chicago, Ill.

Larned, Sherwood, J., electrical engineer, Chicago Telephone Co., 203 Washington street, Chicago, Ill.

Noxon, C. Per Lee, contracting electrical engineer, 628 Mission street, San Francisco, Cal.

O'Connell, J. J., telephone engineer, Chicago Telephone Co.; residence, 76 Eugene street, Chicago, Ill.

Olivetti, Camillò, Ivrea, Italy.

Rhodes, S. Arthur, electrician, Chief Testing Department, Chicago Telephone Co., Chicago, Ill.; residence, 429 N. Pine avenue, Austin, Ill.

Roylance, L. St. D., electrical engineer, with W. L. Brown, 2636 Howard street, San Francisco, Cal.

Sackett, Ward M., assistant chief draughtsman, Chicago Telephone Co., Chicago; residence, 3249 Groveland avenue, Chicago, Ill.

Sanderson, Edwin N., New England manager, Westinghouse Electric Mfg. Co., 620 Atlantic avenue, Boston, Mass.; residence, Newton Centre, Mass.

Slater, Frederick R., assistant superintendent of Buildings and Grounds, Columbia College; residence, 103 W. 48th street, New York city.

Strauss, Herman A., electrical engineer, Westinghouse Electric & Mfg. Co., 29 Plane street; residence, 10 Clay street, Newark, N. J.

LETTERS TO THE EDITOR.

ELECTRICAL STORMS AND CYCLONES.

Memphis, Tenn., 11 October, 1894.

Editor the Electrical Age:

In the report of an experiment by M. Ch. V. Sergen, made to the Academy of Sciences, Paris (Nature, August 30), it is said, "An electrical discharge produces a whirling movement in the gas through which it is discharged which may be said to be a cyclone on a small scale, so completely are the phenomena of cyclones reproduced. The particles appear to describe a trajectory, which may be represented by a screw of variable pitch traced on a conical surface.

Assuming that the experiment is reversible, which is reasonable, and that a rotary motion of a gas, the common air for instance, will produce an electrical discharge, we have the first step in experimental proof, as far as the writer knows, that an electrical storm is a function, an inseparable accompaniment, a product of a cyclone. And that two currents of air, say a N.W. and and a S. W. wind crossing at right angles, or nearly so, also produce electrical discharges—an opinion the result of observation which the writer has maintained for many years. The effect of the currents is greatly increased and is in proportion to the quantity of solid matter, dust particles, which it is now generally conceded form a nucleus upon which vapor gathers and condenses. This point is now being discussed by Prof. P. G. Tait, on one side, and Lord Kelvin on the other. The writer has contended (*Journal of the Telegraph*, 1877) that electricity is a concomitant of matter and inseparable from it; that is, that electrical effects were appreciable only in connection with matter—ordinary matter. It was further added that the dust was lifted at the equator and carried north in the air currents. But, without regard to these early opinions, the experiment of M. Sergens seems well worthy of the best consideration of meteorologists. David Flanery.

BRITISH TELEGRAPH STATISTICS.

The report of Postmaster-General Morley, of the British Postal service for the year ended March 31, 1894, contains, under the head of telegraph service, some interesting figures. The following table shows the receipts, expenses and excess or deficit of the telegraph service for each of the past ten years, and the number of telegrams sent each year:

Year.	*Receipts.*	*Expenses.*	*Excess.*	*Deficit.*	*Telegrams sent.*
1885..........	£1,755,118	£1,731,040	£24,078	....	33,278,459
1886	1,759,169	1,733,105	25,064	....	39,146,283
1887..........	1,855,686	1,939,764	......	£84,078	50,243,639
1888..........	1,959,404	1,928,159	31,247	....	53,403,425
1889..........	2,094,048	1,969,096	124,952	....	57,765,347
1890..........	2,325,715	2,179,921	145,794	....	62,403,399
1891..........	2,416,691	2,265,338	151,353	....	66,409,211
1892..........	2,508,138	2,507,012	1,126	....	69,685,480
1893..........	2,486,791	2,567,018	....	80,227	69,907,848
1884..........	2,534,264	2,641,518	....	107,254	70,899,498

The report also says that the Eastern Extension Telegraph Company have, by arrangement with Her Majesty's government, completed the laying of a cable from Singapore to Labuan, and thence to Hong Kong, thus duplicating the existing communication between Singapore and Hong Kong and providing a route entirely under British control.

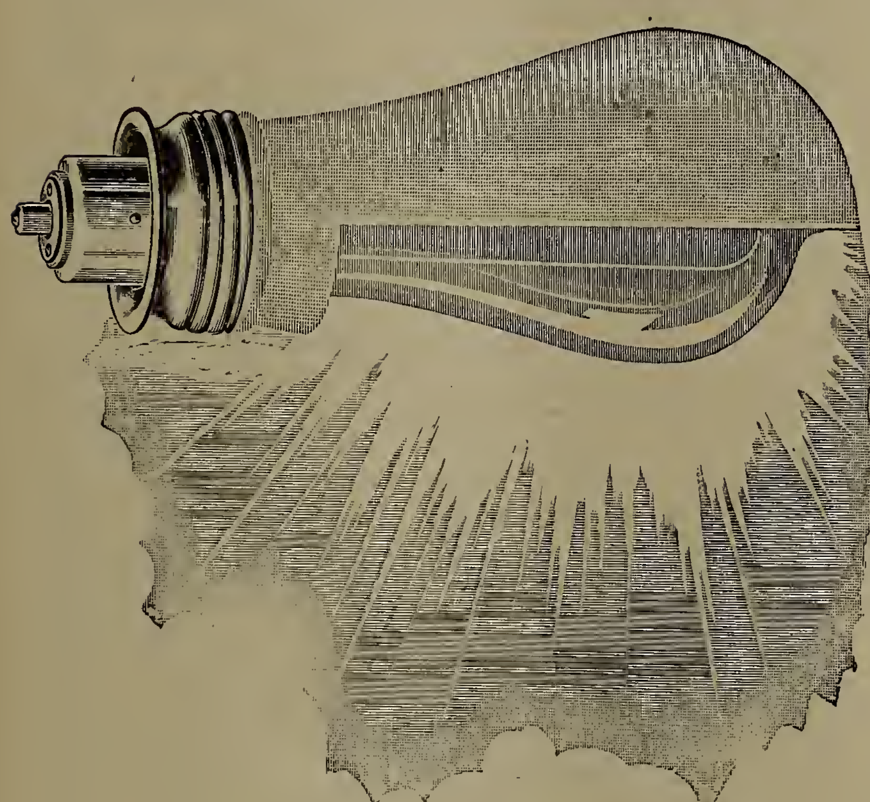
LITERARY.

The New Science Review is the name of a monthly magazine which made its first appearance September 1, this year. It is conducted by J. M. Stoddart, and published by the Transatlantic Publishing Company, 63 Fifth avenue, New York. *The New Science Review* is a miscellany of thought and discovery, and it seems to us will find and develop a field of its own. Its contributors are men of science and literary attainments, and they handle their subjects in a scholarly manner; they let technical considerations alone, as these do not come within the province of the magazine. Advanced and original thinkers in the scientific world will no doubt find this new magazine interesting and profitable reading. In size *The New Science Review* is about the same as that of other standard magazines. It is printed on clear white paper and in clear, easily read type.

HALF-REFLECTOR SHADES.

One of the most popular incandescent lamp shades in the market, and one that has stood the test of time, is the half reflector shade illustrated herewith. These shades are designed for chandeliers, or billiard tables, and for any incandescent lamp that is not placed in a perpendicular position. It conforms to the shape of the incandescent bulb, covering one-half of it, and is movable around the same so as to direct and concentrate the rays of light in any direction at will. These shades are made in various styles—opal, silvered and in all colors for fancy lighting.

The new McCreary specialty, No. 29, is a half shade made of green and white porcelain, the process of manufacture being patented. The shade is made of two sheets of porcelain flashed together, forming, as far as appearance goes, a solid piece of material. The outside surface is the green porcelain and the inside white.



HALF REFLECTOR SHADE.

The white surface, of course, has great reflecting power, while the green shade on the outside is an agreeable one to the eye and breaks the intensity of the light. These porcelain shades are imported; they are easily kept clean. The material from which they are made is known in the trade as flashed porcelain.

These desirable shades are made by A. A. McCreary, 136 Liberty street, New York, the well-known dealer in patented reflectors and electrical specialties for incandescent electric lighting.

THE TELEPHONE.

There is no good reason why everyone should not know the telephone more intimately when one dollar will buy a copy of "The Telephone Hand Book," by H. Laws Webb. This little work is written in a remarkably clear style and the text is well illustrated. It requires no mental effort to understand the subject as elucidated in this book.

The telephone is more intimately connected with our private affairs than any other electrical apparatus and everyone should understand it. Send one dollar to the Electrical Age, New York, and get a copy.

MAIL, EXPRESS AND FREIGHT SERVICE ON STREET RAILWAY CARS.*

In order to ascertain as well as possible how much has already been done, a circular asking for information in regard to mail, express and freight service was sent to every street railroad company in North America. Nine hundred and seventy-eight letters were sent out and four hundred and thirteen replies were received. These replies are tabulated below. As a great many railroads were not heard from, it cannot be assumed that the table is absolutely correct, but it is probable that most of the railroads having such a service answered the circular. Roads which are enumerated as having express or freight services are only those which have this service fully developed. The carrying of packages by conductors of passenger cars was not called express service, but is enumerated in a separate column. From some of the states, notably Pennsylvania, Rhode Island and Massachusetts, it was reported that the transportation of express and freight by street railroads was prohibited by state law, and many of the roads answered that their franchises allowed only the transportation of passengers.

The rate charged on express matter was usually five or ten cents per package, while the freight rates vary from four to ten cents per one hundred pounds. The mail is usually carried either under a direct contract with the Government, or under a sub-contract with a mail contractor. The income from the transportation of the mails varies according to the amount of mail, the number of trips per day, and the length of the haul, from $100 to $1,000 per annum.

TABLE OF MAIL, EXPRESS, AND FREIGHT SERVICES IN NORTH AMERICA.

	Any form of Such Service.	Under Contract with Express Co. or U. S Government.	Haul Steam R. R. Freight Cars over Street R. R. Tracks.	Operate Special Cars for this Service.	Carry Small bundles on Passenger Cars for Pay.	Contemplate Such Service.	Distribute Matter Beyond Station.	Use Combination Express and Passenger Car.
Mail........	62	58	....	5	....	10	...	....
Express.....	35	8	...	9	31	7	2	8
Freight	55	....	6	37	....	12	2	....

MAIL SERVICE.

That the street railroads of this country are already alive to the possibilities of the mail service is shown by the table. Sixty-two street railroads are now carrying Uncle Sam's mail, while fifty-eight have government contracts. Most of these railways are suburban roads or roads joining towns; but the postal authorities realizing the advantage of quick delivery and collection, are now beginning to make arrangements with the large city systems for transportation of the mails from main post-offices to branches and for distribution and collection throughout the city.

Various methods of utilizing street-railways for this purpose have been proposed by different local post-office authorities. In one large western city, in which all the roads are controlled by one company, it was proposed to equip one car of each line with a mail

*Abstract of report read before the American Street Railway Association Convention Atlanta, Ga., October 17, 1894.

receptacle. At stated times the carriers along the route were to meet this car and drop into the receptacle all the mail collected by them, which was in turn to be taken from the receptacle as the car passed the main post-office. This plan, however, did not meet with the approval of the great fathers at Washington, and in consequence was abandoned by the local authorities. Any system of this kind would greatly expedite the collection of mails, but the weak point seems to be that no provision is made for their distribution.

The only method of handling a large mail service, in which it is necessary to collect and distribute along the route, and handle it satisfactory both to the patrons of the road and the post-office department, seems to be in the use of a separate car—an independent mail car in charge of a railway mail clerk. This system is already in use on street railroads in St. Louis, Brooklyn, and several other places, and so far as we can learn is giving excellent satisfaction, both to the railway companies and the post-office authorities. The mail is quickly and promptly handled; the service is regular and certain; great and small quantities of mail may be collected and distributed with equal facility, the residents along the line are greatly accommodated, and no interruption or inconvenience to the passenger traffic need result.

EXPRESS AND FREIGHT SERVICE.

The answers to the circulars showed that thirty-five roads are now engaged in the express business, while fifty-five are hauling freight. As a matter of fact, however, few roads through the country are doing a regular freight business, most of the so-called freight services partaking more of the nature of express. As operated upon street railways, the distinction between express and light freight service is so ill-defined that it is deemed best to consider both subjects together.

There are many points in the street railroad as now conducted which make it almost an ideal agent for the transportation of packages and light freight. The great number of points reached by the cars the absolute certainty with which they run, the thousand and one precautions taken against any stoppage of however short a duration, the rapidity with which distant points are reached, and many other causes combine to make the street railroad of today a common carrier of exceptional advantages, when only short distances are considered. Many conditions will suggest themselves to railway managers in which an express or freight service may be made a paying institution. In the case of a town in which the railway station is some distance from the business part of the town, there can be no quicker, safer and better plan of conveying express and freight to some distributing point in the heart of the town, than by the street railroad. Whether or not this will pay depends upon the amount of material, the competition, the distance, and the scope of the street railway franchise. A case often met with through the country is that of two towns connected by an electric railroad, one of which, having no steam railroad, is obliged to get all its supplies through the other town. The installation of a freight service of some kind would at once suggest itself in this case, and the profits would depend upon the size of the towns, the character and occupation of the inhabitants, the distance between the towns, etc.

The operation of an express service on large city systems has not been attempted to any great extent, but it has been contended by some enthusiasts on the subject that a street car express service will eventually take the place of the many city deliveries and city express wagons now in use. As an example of a city road operating an express and freight service involving collection and a house to house delivery, we cite the case of the Southern Railway of St. Louis, which has been operating an express service on this plan for almost two years.

Information received from several of the states, as before stated, shows that in some places the transportation of freight or express over street railroad tracks is prohibited by state law or municipal ordinance, and it has been suggested that associations of managers of street railroads in those states be formed for the purpose of securing favorable legislation. The enactment of these laws may be due to hostile steam railroad influence, or it may be due to a misconception of the nature of the services which street railroads would put in operation. Surely, a smooth-running electric car, moving swiftly onward, would not prove such a nuisance as the great lumbering wagons which block the streets of our large cities. Where a freight or express service is needed, the accommodation to the public would be so great that many citizens might be enlisted on the side of the railroads to secure the proper legislation.

In closing, it would perhaps be well to note some of the principal points which, it is hoped, have been brought out in this paper:

1. That a mail service involving collection and distribution is best handled on a separate car, operated on the same plan as a U. S. Railway Mail Car.
2. That it is supposed that a great advantage arising from the transportation of the mails comes from the fact that the road is under the protection of the government, and is thus secure from riots, strikes and blockades.
3. That the most promising opening for an express or freight service is a road running between two towns, or a city road running through well-populated suburbs.
4. That the question, whether or not such a service will pay is entirely a local question, and must be estimated for each road separately, under existing conditions.
5. That there are cases when it would be advisable to operate such a service, independent of the profits, in order to accommodate the patrons of the road and to induce building along the line of the road.
6. That such a service operated upon the ordinary street railroad must not be allowed to interfere in the least with the passenger traffic.
7. That in states having laws prohibiting this service, associations of railway managers should be formed to secure favorable legislation.

RICHARD McCULLOCH,
Committee.

ELECTRICITY TO REPLACE STEAM.

Recently there was a test at Schenectady, N. Y., which showed that the electric locomotive pulled a steam locomotive—advantages of conditions all in favor of the latter—with ease and without apparent effort. The improvements since the World's Fair test have done this. Next in importance to the Baltimore and Ohio tunnel electric motor work, which is being pushed rapidly to completion, is the use of these electric motors on the Metropolitan R. R., of Chicago. This latter road will soon be in operation. Many railway managers are watching this test with a view to adoption. It is now expected that electric motors will be sold to locomotive builders as headlights are sold, which would enable any of the large locomotive builders to construct according to their own designs. Electric motors are being rapidly simplified to that end. This has already been done in the case of the Metropolitan road.

Le Bel Electric Kindler Company, Portland, Me., has been organized by E. Dudley Freeman, president, Yarmouth, Me., Geo. Hall, treasurer, of Ogdensburg, N. Y. Capital stock, $300,000.

NEW BOOKS.

ELECTRICITY AT THE WORLD'S COLUMBIAN EXPOSITION. By J. P. Barrett, Chief of the Department of Electricity at the World's Fair. R. R. Donnelly & Sons Company, Chicago. 501 pages and profusely illustrated. Price, $2.50.

This book gives a description of most of the exhibits displayed in the Electricity Building at the World's Fair, the author selecting for description only those that seemed to him to be worthy of consideration. The main purpose of Mr. Barrett has been to preserve an accurate and complete record of this department of the great show, not as much for the people as for those engaged in electrical work. The latter will find the work of extreme interest and value, which are enhanced by the fact, as stated in the preface, that the author has been especially careful in his statements urging accuracy for technical finish in the production of the book.

Every feature of the electrical exhibition is fully described in twenty-eight chapters of which the book is composed, and every branch of the electrical art and science as exemplified at the fair is considered in detail.

The illustrations, particularly of the night lighting effects, are excellent, and anyone who is interested at all in electrical progress, should, by all means, have a copy of this work. A record of the electrical exhibits is what has been aimed at by the author and he seems to have succeeded remarkably well in his efforts. The book is full of facts and figures, and is one of that class that becomes more valuable as time rolls by. At the rear of the book is a list of awards on electrical exhibits.

THE TELEPHONE HAND-BOOK. By Herbert Laws Webb. Electrician Publishing Co., Chicago. 146 pages, with 128 illustrations. Price, $1.00.

This little book has been produced to meet the demand for a practical book on telephone working and management, and, with the exception of a few chapters dealing with certain forms of transmitters and receivers used in Europe, is based entirely on standard American practice. Most of the illustrations have been especially executed for the elucidation of the text, and are remarkably clear and simple. The language is also as clear and simple; and those who have read other works and writings of Mr Webb know that no one is better able to explain technical matters more clearly than he. An understanding of this interesting subject, as developed in "The Telephone Hand-Book," requires little mental effort, so plainly is the matter treated, and we predict a large sale for this work once its existence and character become better known. The art of telephony is most comprehensively treated both as to theory and practice. Mr. Webb is a well known expert in this branch of electrical application, and those who study the pages of this little book can therefore feel that in their pursuit of information on the telephone they are being tutored by a master-mind.

A LABORATORY MANUAL OF PHYSICS AND APPLIED ELECTRICITY. Vol. II. Arranged and Edited by Edward L. Nichols, professor of Physics in Cornell University. Macmillan & Co., New York, pp. 444, illustrated. Price, $3.25.

The first volume consists of a laboratory course in general physics for beginners, and the present volume is intended for students who have completed such a course and who are prepared to take up special work. Parts I, II and III treat of applied Electricity, Heat and Photometry, and have been especially written for those who are in training to become electrical engineers. Part I relates to experiments with direct current apparatus; Part II to experiments with alternating currents; Part III, senior courses in heat and photometry; and Part IV gives outlines of advanced work in general physics. All through the book references are given to standard works on the various subjects, and altogether this new manual will form an important addition to the student's library and aid him in the prosecution of his studies. The type of the text is clear, the subject of each experiment being printed in full face type to better catch the eye and render reference easier. The diagrams are also very clearly rendered.

ELECTRICITY, ELECTROMETER MAGNETISM AND ELECTROLYSIS. By G. Chrystal, M. A., LL.D., Edinburgh, and W. N. Shaw, M. A., F. R. S., Cambridge. Macmillan & Co., New York. 276 pages, 49 illustrations. Price, $1.60.

This work is reprinted from the ninth Edition of the Encyclopedia Britannica, and will be valuable to the student of electricity in its segregated form. Marginal notes greatly aid in the search for particular subjects. On account of the completeness of these articles as they appear in the Encyclopedia Britannica, no doubt this volume will find a large sale. It is not everyone who can afford to possess a complete set of the encyclopedia, and those interested in the electrical scince who are not so fortunate will hail with delight the separation, and publication in a volume by itself, of the portion of the work devoted to electricity, etc. The price brings it within the reach of all.

CENTRAL STATION BOOKKEEPING AND SUGGESTED FORMS, WITH AN APPENDIX FOR STREET RAILWAYS. By Horatio A. Foster, New York. The W. J. Johnston Co., Ltd. Cloth, 139 pages, 75 forms and diagrams. Price, $2.50.

The importance of going more deeply into the costs of operation and management of central stations can scarcely be exaggerated, and no central station manager can be in the best shape to do business in times of close competition with gas and other companies until he knows the cost of every item going to make up the total unit cost of supplying the electric current to his customers. It is in order to enable him to put his business on a rational basis as suggested above that this work has been written, and the well-known competency of the author to undertake the task is assurance that it may be consulted and followed with confidence.

The book contains diagrams for the organization of the staff of electrical central stations, the classification of accounts and reports, and includes sample forms for every department. As the name indicates, the work is devoted mainly to the accounting department, both of central stations and street railways, and outlines a complete scheme for its organization and rountine which will enable the management to determine at any moment the condition of business, and particularly the unit cost of the generation and distribution of current In an Appendix is furnished a classification of accounts of electric street railways, together with instructions, forms of books, etc., necessary to carry it out, the other necessary forms being in Part II.

ELECTRICAL TABLES.

"ELECTRICAL TABLES and MEMORANDA," is the title of a valuable little reference book for engineers, electricians and others interested in the electrical science It contains a great deal of valuable information and a number of illustrations and diagrams. It is only 1⅞ by 2⅝ inches in size, and can easily be carried in the vest pocket. The author of this convenient little work is Prof. S. P. Thompson, and the price is only 50 cents per copy. For sale by the ELECTRICAL AGE Publishing Co., World Building, New York.

NEW YORK NOTES.

Office of the Electrical Age,
World Building, New York,
November 5, 1894.

In the window of the Holtzer-Cabot Electric Co., 114 Liberty street, may be seen one of the new H. C. window turn-tables driven by a Class M, O O motor with speed regulator. This machine is very powerful and noiseless in its operation, and is, besides, self-regulating. It will run on either direct or alternating current. On the periphery of the turn-table are placed four 16 c. p. lamps, 90° apart, and as the turn-table revolves, each lamp is successfully lighted as its approaches and passes the front of the window—each lamp being cut in and out once during each revolution. Half shades of ground glass are placed around the lamps, each having a distinctive color. The speed of the table can be varied by a regulator. The standard size of the table is 14 inches, the one on exhibition in the window, however, being 24 inches. Mr. David Chalmers, the New York manager, reports that these devices are taking very nicely.

The General Incandescent Arc Light Company, First avenue and 32d street, has on exhibition in its show rooms a large line of arc lamps of unique designs, to burn on direct current, taking only from 2 to 10 amperes. It is worth a trip to the works to see these beautiful lamps. Thousands of them are in use to-day all over the country.

Mr. J. W. Gladstone, manager of the Edison Mfg. Co., 110 E. 23d street, New York, wears a smile over the condition of business, which he reports is quite lively just now. He is one of the busiest men in New York, and keeps his factory busy also in filling his orders.

The report of the Third Avenue Railroad Company for the quarter ending September 30 shows gross earnings of $614,819, an increase of $157,528 as compared with the same period last year; operating expenses, $312,975; increase, $40,226; net earnings, $301,844; increase, $117,302; surplus, $221,577; increase, $94,422.

On Thursday afternoon last week, a strand in the Broadway cable became entangled with a grip of a car and prevented the release of the cable by the gripman. The result was that the car "ran away" and collided with the car ahead of it, and the seeond car with the third, until four cars were thus brought together. The accident occurred between 9th and 14th streets, and when it was discovered that something was wrong, the conductor on the disabled car jumped off and signaled the power house, by means of the company's conduit signal system, to have the engine stopped. By the time the car reached 14th street the cable stopped, and some time afterwards the wrecking wagon came along and separated the cars. No one was hurt, but a good deal of excitement attended the mad rush of the cars through the streets.

It is reported that the Suburban Traction Company, of Orange, N. J., is in financial difficulties It is stated that the cause of the trouble is the accident which occurred last August on the Eagle Rock section of the road. As the result of that accident suits aggregating $172,000 have been brought against the company, and while many of the claims are without foundation, as far as personal injuries are concerned, the effect has been to frighten off capitalists with whom the company has been negotiating for the purpose of securing funds to enable it to liquidate its indebtedness and prosecutes other plans of improvement.

The International Electric Company, 35 and 37 Frankfort street, city, will, on November 15, move to larger and more convenient quarters at 76 Beekman street. This company manufactures electrical instruments, making Ruhmkorff induction coils a specialty. It also does general experimental work and perfects inventions. Mr. B. Tropp is the electrician, and G. Huerstel, manager.

The firm of Noll & Sibley has just been organized and opened offices in the Postal Telegraph Building, Broadway and Murray street, city. It is composed of Frederick Noll and C. C. Sibley, both being well known and popular in the trade. They will act as manufacturers' agents for electrical supplies.

W. T. H.

NO PATENT GAZETTE.

For some reason, as yet unknown to us, our copy of the weekly *Patent Gazette* for last week had failed to reach us at the time of going to press on this issue. Whether the failure is due to the small-pox scare in Washington or not, we do not know. We hope, however, to be able to publish the record in our next issue.

Lecture — On November 9, at 8 p. m., Mr. A. E. Woolf will deliver a lecture before the Department of Electricity, Brooklyn Institute of Arts and Sciences, on "Disinfection on a Large Scale by Electrolized Sea-Water." The lecture, which will be given in the Art Building, Montague street, will be illustrated by experimental demonstrations.

Earthquake.—An earthquake visited Mexico the evening of November 2, doing considerable damage to buildings. In their fright drivers of street cars deserted their posts to kneel down in prayer. The electric lights were extinguished, by reason of the "dynamo axle in the plant leaping from the bed," as the press despatch states it.

Valuable Index —*The Engineering Magazine*, of New York, inaugurated with its October number a "Review of the Industrial Press," which no doubt will be found very valuable. In this section of the magazine are reviewed the principal articles in the technical and industrial press, also an index of the same properly classified. This index and review will serve a valuable purpose to those having occasion to refer to literature on special subjects, and it forms a very important feature in this well-known magazine. The editor intends to develop the plan and scope of the work to the highest possible limit.

HOW TO MANAGE DYNAMOS AND MOTORS.

Everyone having charge of a dynamo or motor should know how to manage these machines properly. Trouble is liable to occur at any time, and to be able to determine the cause by the symptoms and how to apply the remedy is a knowledge that every operator should possess. The book entitled "Practical Management of Dynamos and Motors," and written by the well-known electrical authorities, Prof. F. B. Crocker and Dr. S. S. Wheeler, gives plain directions for the management of these machines. It costs but $1.00 a copy, and can be purchased at the office of The Electrical Age, New York.

PERSONAL.

Mr. H. C. Willis, of the Washburn & Moen Mfg. Co., 16 Cliff street, city, is about to engage in a venture that promises to bring him comfort and happiness. On November 7 he will marry Miss Jessie M. Robinson, daughter of F. S. Robinson, of Richmond, Va. Mr. Willis' many friends as well as ourselves wish him and his better half a long life of happiness.

Electricity on the Canals. — In an interview with Mr. Frank W. Hawley, vice-president of the Cataract General Electric Company when that gentleman was in Syracuse a few days ago, in answer to a question as to whether he thought the adoption of electricity as a motive power on railroads in New York State would render canal improvements necessary in order to compete with them, he said "Most decidedly. It is a question of ten years at the most," he said, "when freight and passenger trains will be propelled by electricity, and in order to wield any influence whatever on the great problem of transportation, the canals must not only be improved, but also make use of electric propulsion."

NEW CORPORATIONS.

The Pacific Electric Co., Pacific, Mo., by A. H. Brown, A. Kappitz, G. H. Gross, S. B. Whitsett, C. C. Close, L. L. Seaburn and A. F. Mantel. Capital stock, $5,000.

The East Shroudsburgh and Matamoras Railroad Co., Harrisburg, Pa., by Simon Freidburger, G. H. Lang, J. S. Pottsdamer. Capital stock, $400,000.

The Mutual Gas Electric Co., Brooklyn, N. Y., by Aquila W. Wanamaker, Thomas Peterson and Chas. H. Selig. Capital stock, $100,000.

The Missouri District Telegraph Co., Kansas City, Mo., by L. C. Baker, M. D. Wood and J. W. Murphy. Capital stock, $50,000.

The American Safety Heat, Light and Power Co., Baltimore, Md., by R. D. Bradley, G. M. Russum, Jos. Knell, G. W. Knell and G. L. Rogers. Capital stock, $50,000.

The Maryland Safety Light, Heat and Power Co., Baltimore, Md., by Jas. Knell, Henry C. Barranger, E. C. Wallman, Geo. W. Knell and R. D. Bradley. Capital stock, $50,000.

The American, Heat, Light and Power Co., Nashua, N. H. Capital stock, $1,000,000.

Hanover Telephone Co., Hanover, York Co., Pa., by H. E. Young, Geo. D. Gitt, J. J. Bonrad. Capital stock, $10,000.

The People's Telephone Co., Leavenworth, Kansas, by L. P. Rothschild, J. N. B. Fagler, W. T. Hunt, Alex. Rothberg and W. N. Todd. Capital stock, $30,000.

The Farmers' & Merchants' Suburban Railroad Company and Fair Association, of Independence, Kansas, by M. J. Paul, M. F. Wood, Edwin Foster, J. H. Brewster, Jos. Chandler, O. P. Ergenbright and J. W. Wright. Capital stock, $20,000.

The Lake George Improvement Co., Albany, N. Y., by Edwin R. Zeebach, Chas. R. Mott, C. R. West, Lake George; Geo. Tanner, Jerome Benton, and John Coolidge of Bolton Landing. Capital stock, $1,000.

The Columbia, Ironville and Mt. Joy Street Railway Co., Columbia, Pa., by Wm. H. Boyer, Saml. R. Russell, Anthony H. Dillman. Capital stock, $300,000.

Anchor Electric Co., Portland, Me., by Phillip M. Reynolds, Horatio C. Hawks and Norman Marshall. Capital stock, $75,000.

Los Angeles, San Francisco and Salt Lake Railway Co., Los Angeles, Cal. Capital stock, $12,000,000.

POSSIBLE CONTRACTS.

The Hartford Light and Power Co., of Hartford, Ct., is to supply the power for the Hartford Street Railway Company.

The new electric light company in Springfield, Ill., has fixed upon a location for its plant.

Captain John M. Brinker, Buffalo, N. Y., is securing consents for right of way for a double track electric road between Buffalo and Lewiston.

The shares of the new electric railroad to be constructed between Marlboro and Westboro, Mass., have been nearly all disposed of, and it is likely that active operations will soon be commenced.

The Interurban Electric Railway, Appleton, Wis., ha been granted a franchise to construct an electric line.

It is reported that a California syndicate is negotiating for the building of an electric road from Miami and Sedalia, Mo., to the coal mines in that section.

Work on the Norristown and Chestnut Hill Electric Railroad, Norristown, Pa., it is stated, will be commenced at once.

J. M. Coe, of Berea, O., has been granted a franchise to build an electric railway in that vicinity.

E. H. McNight, of Bowling Green, O., has been granted right of way for an electric railroad to Perrysburg and Portage.

Julian Fishburne, Charleston, S. C., has been granted a franchise to build an electric railroad.

Surveys for an electric railroad between Eureka Springs and Harrison, Ark., will soon be commenced. The distance is 45 miles, and considerable structural work will be necessary on the line. F. L. Hamilton, of Harrison, Ky., has charge of the project.

It is proposed to change the Henderson Street Railway, Henderson, Ky., from horse to electric power. J. W. Alsop, Owensboro, Ky., can give further information.

The Jackson and Suburban Railway Co., Jackson, Tenn., proposes to introduce electricity on its line.

An electric railway is to be constructed between Tampa and Palmetto, Fla. R. W. Easley and W. H. Kendrick, Tampa, Fla., are interested in the project.

The Mayor of Frederick, Md., can give information regarding bids for a new dynamo for the electric light station in that place.

A second-hand 200-incandescent electric light plant is wanted by John E. Thorpp & Sons, of Trenton, N. J.

Address the Warnell Lumber and Veneer Co., Warnell, Fla., for particulars regarding an electric light plant which they desire to install.

M. M. Holman & Co., Dadeville, Ala., can give particulars regarding the proposed construction of a telephone line between Ozark and Dadeville.

A company is being organized in Daytona, Fla., for the purpose of constructing an electric street railroad and electric light plant.

A telephone system is to be established in Aberdeen, Miss. For further particulars address Mr. Soock, electrician.

The Lynchburg Telephone Co., Lynchburg, Va., has been granted a franchise. The new company is composed of W. P. Roberts, Walter Pettyjohn, H. P. Woodson, Edgar Franklin and others.

The Chesapeake and Ohio Railroad Company intends to build a plant at Richmond, Va., for the charging of storage batteries used in lighting passenger trains.

The High Point Cumberland Island Co., High Point, Ga., with a capital stock of $3,000,000, will erect a large hotel.

A $75,000 hotel is to be built in Statesboro, Ga., by Robert Lester.

The Athens Electric Railroad Company, Athens, Ga., will seek a charter from the legislature next session. T. P. Hunnicutt is superintendent.

The Turnbull Electric Lamp Mfg. Co., New Orleans, La., for the purpose of manufacturing the Turnbull incandescent lamp, etc. The directors are Jos. C. Turnbull, Charles Boster, Emile F. Del Bondio, E. F. Hoppe, Peter Blaise, F. Rickerts, H. Opits and D. F. B. Chaffe, with Mr Hoppe as president, Mr. Bondio, vice-president and Mr. Boster, treasurer. Capital stock, $300,000.

Chicago Central Electric Railway Company, Chicago, Ill., by George B. Waterman, William B. Odell and Charles A. Boos. Capital stock, $1,000,000.

TRADE NOTES.

James J. Pearson, 106 Liberty street, well known in the electrical trade, is conducting the business of manufacturing machines and repairing the same. He makes model making a specialty, and no one is better qualified to conduct such a business than he. His training has been such as to give him valuable experience in this line, and those wishing work of a character coming within the scope of Mr. Pearson's business, will be doing themselves justice to see him. He is prepared to manufacture electrical or mechanical apparatus and can turn anything from an 8 inch shaft to a microscopical article.

The Oakman Electric Co., 136 Liberty street, is doing an excellent business. They lately closed a contract for a complete line of electric supplies, in cut-outs, sockets, switches, wire, porcelain, etc., for a stock order for a big electrical supply and construction company. They have also filled orders during the past week for one 125 and one 40 and one 25-light Wenstrom dynamos and several thousand McNutt incandescent lamps; also 14 C. & H. rheostats from 1-H. P. to 60-K. W.

The Sterling Supply and Mfg. Co., 97 Bank street, city, is equipping all the Broadway cable cars with the celebrated Sterling fenders.

S. W. Rushmore, dynamo works, Jersey City, N. J., has secured the contract to rebuild the electrical apparatus of the Gettysburg Electric Railway Company, of Gettysburg, Pa., which was lately burned out. Mr. Rushmore will put in a marble switchboard, 10 by 20 feet. He has also obtained a contract to equip and repair the Attleboro, Mass., Electric Railway plant. He can "Rush more" work through his shop than ten other men.

The Lunkenheimer Company, of Cincinnati, Ohio, has just issued its 1895 catalogue and price list. All of the steam-fitting goods made by this company are fully illustrated by well executed cuts.

Messrs. Wm. Biddle, Jr., and James G. Biddle have severed their connection as joint managers of the physical and electrical departments of Queen & Co., Philadelphia. Mr. James G. Biddle's present address is 119 S. Fourth street, Room 28, where he will be glad to hear from prospective purchasers of scientific apparatus.

The Sterling Supply and Manufacturing Co., 97 Bank street, New York, has just issued a catalogue of its various street railway supplies, including fare registers, gates, fenders, sand boxes, etc.

The Railroad Signal Lamp and Lantern Co., 447 W. 53d street, New York, was represented at the Atlanta Convention by Col. Benjamin F. Pilson. He was hustling around the hotels and exposition to see that no possible buyers slipped past his eagle eye. This company has an excellent representative in the colonel.

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NEW YORK, NOVEMBER 17, 1894.

CONTENTS.

TO BREAK ENGLISH MONOPOLY.

A dispatch from Buenos Ayres, Argentina, states that a bill has been introduced in the Brazilian Congress providing for the purchase by the Brazilian government of the Western and Brazilian Telegraph Company and an issue of five per cent. bonds for the purpose. It is stated that this measure will put an end to the monopoly enjoyed by the English cable companies in communicating with Brazil, and opens the way for cheaper and more direct telegraphic communication between the United States and Brazil.

THE CLEVELAND CONVENTION.

The next convention of the National Electric Light Association will be held in Cleveland, Ohio, in about three months from this time, and there is already considerable preliminary talking and planning. There is every promise that it will be a largely attended meeting, and that the exhibition of supplies will be unusually extensive. The business men of the country begin to feel a little easier regarding the condition of trade, and its effect is already being felt along electrical lines. In February the business of the country will have settled down for a year's boom, and it is safe to predict that things will be much better in 1895. Electrical supply men should begin to stir themselves, and be represented at the convention.

IMPROVING BUSINESS.

The effect on business of the result of the recent elections is unmistakable. There is a feeling everywhere that an era of activity is at hand, and everybody seems to be buoyant and happy at the prospects. Business can not be carried on these times in a half-hearted fashion. It requires whole-souled energy to keep things a-going, and if there is not determination and perseverance back of it business will not succeed. To maintain this determination and perseverance there must be a feeling of sanguineness to impel us to greater efforts. The whole thing narrowed down may be stated thus: Business will revive if all unite in the belief that the time is ripe for such revival. However favorable all material conditions are, little can be accomplished without the personal element. We believe all the material and immaterial conditions are present now, and that business will thrive from now on. Things look that way.

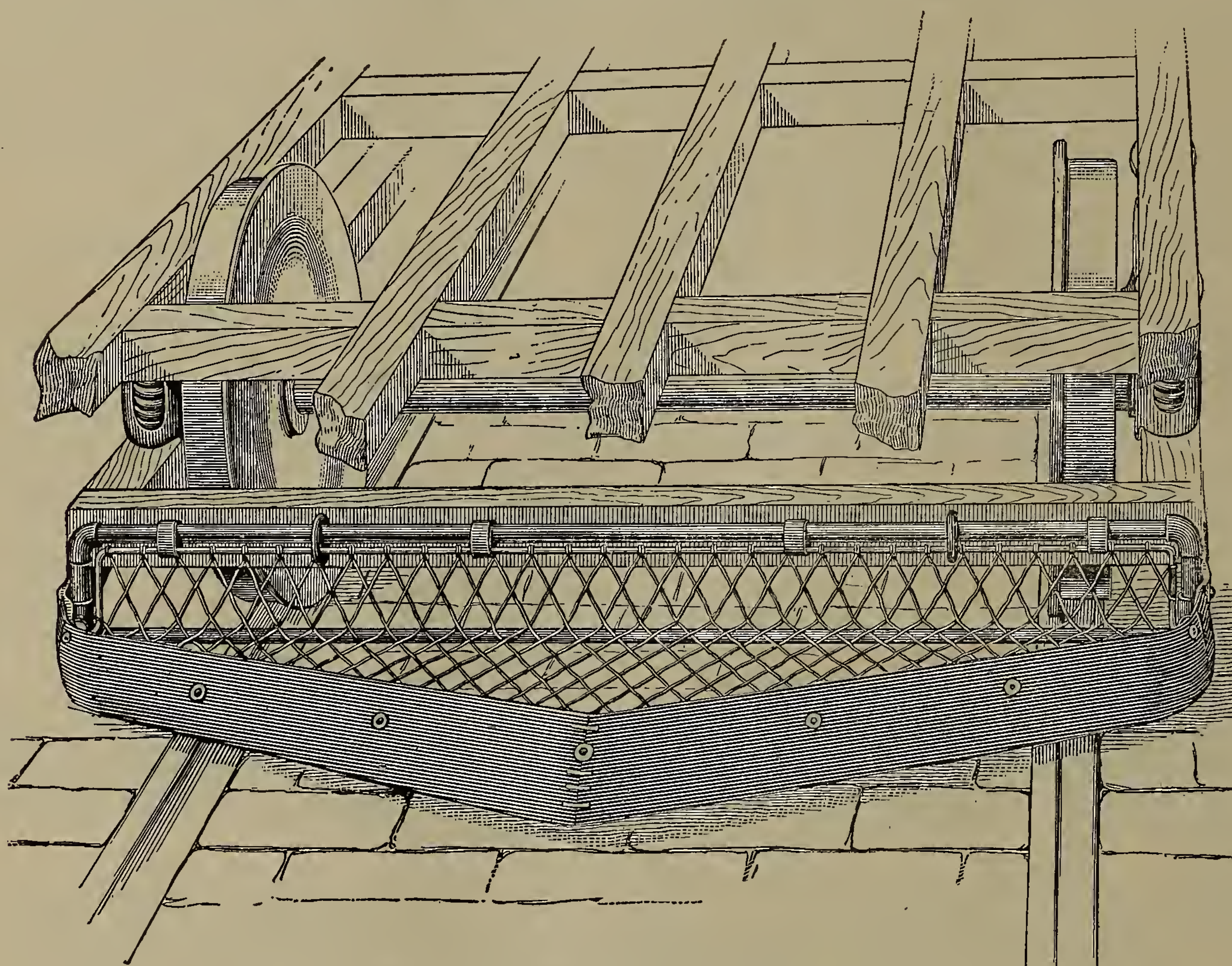
HOW TO USE CHOKING COILS.

We doubt if any electric light company in this country would debase itself to such an extent as to permit to be carried on such a practice as that referred to by Rankin Kennedy, the English electrical engineer, in an article published on another page in this issue. It is evident from what Mr. Kennedy says that the English companies are taking advantage of consumers by using choking coils instead of transformers to reduce the pressure on the consumer's circuit. He calls attention to the fact that while the pressure is actually reduced, yet the consumer still has to pay for the full pressure, and may pay for 100 volts and use only 50. The supply companies are the gainers by the use of chokers, for energy is saved to them by their use. Mr. Kennedy advises that the choker should not be used for any but very small reductions. Choking coils have their advantages in practice; but what Mr. Kennedy aims at is to call attention to the turning of this advantage altogether on the side of the supply company, while the consumer gets none of it.

THE STERLING FENDER.

The most important problem in connection with modern systems of street car propulsion is that of providing means for saving life in case a person accidentally or otherwise falls in front of a moving car. Since the advent of cable and electric systems, fenders without number have been devised for the purpose above indicated, but very few of them indeed have fulfilled the important requirements a device of this character should possess. The trouble with most of them is that they are altogether too complicated for practical use.

A reliable and serviceable fender should be simple in construction, strong and certain in action. The simpler a piece of mechanism is made the better, and this is as true of a street car fender as of a steam engine. It is not to be wondered at, therefore, that the fender which has proved itself to be most reliable in the performance of its functions is of the simplest possible design and construction. Not many fenders can come up to this standard. The one illustrated herewith, however, has performed its part so well that it is attracting the degree of attention among street railway managers that its merit deserves.



STERLING FENDER APPLIED TO CAR TRUCK.

The Sterling street car fender is especially adapted to city lines, as it is made to be attached to the car truck in such a manner as to be out of the way of possible damage from collision with other vehicles. It is designed to be carried as close to the track as practicable, and its shape is such as to throw any body on the track aside and away from the rails, thus preventing contact with the wheels. The requirements of absolute safety to life and protection to the fender itself are realized in this device without mechanism.

The Sterling fender is made of wrought iron pipe, woven wire and rubber belting, is adjustable to any desired height from the track and attachable to any truck. It has been adopted by the Metropolitan Street Railway Co., of New York, and the Third Avenue Cable Road, of the same city, and is used on all the cars of these companies.

Reference to our two illustrations shows at a glance the construction and application of these fenders. It is quite impossible for a body lying on or between the rails to pass under the fender and get under the wheels, as the guard is so close to the track as to render such an occurrence impossible.

The Sterling fender, which has been attracting a great deal of attention among street railway people through its reliability of action, is made by the Sterling Supply and Mfg. Co., of 97 Bank street, New York city.

CHOKING COILS v. RESISTANCES.

BY RANKIN KENNEDY.

In the early days of the alternating current and transformer system, the author warmly advocated its adoption on account of its many advantages. Since then it has been generally adopted, in a very modified form, and in some places with undoubted success. But if the present practices are narrowly investigated, it will be found that many of the advantages claimed for this system are not obtained by the consumer of electrical energy.

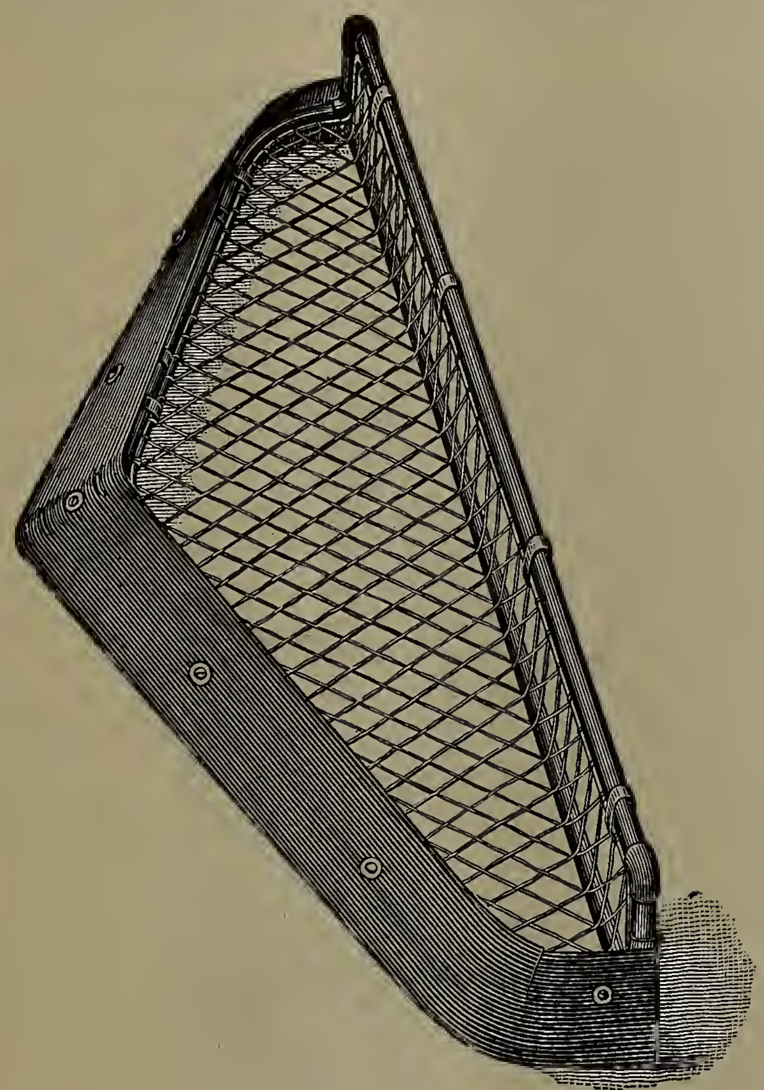
That individual is perhaps worse off in an alternating current supply than he is in a continuous current supply district, and that for many reasons, one of them being the subject of this communication, and for those reasons the author, although still in favor of alternating currents wherever they can be employed so as to attain their advantages, is decidedly averse to their use for public supply, according to what is known as the best practice in this line of electrical engineering.

Passing over in the meantime the other objectionable points in present practice, the question of choking coils *versus* resistances may be considered.

The advantages of choking coils over resistances were claimed no later than the last B. A. meeting, by Prof. S. P. Thompson, and so far as his claims went we may readily admit them, but as a public instructor whose deliverances are accepted, he ought to have limited them by certain qualifications, for it all depends on its position in the circuit whether a choking coil has any advantages over a resistance from the consumer's point of view.

A choking coil saves nothing more than a resistance if the coil is on the consumer's side of the meter. The coil may reduce the pressure on the consumer's apparatus, but he still has to pay on his 100 or 110-volt main pressure, so that although he is using only 50 volts, he is still paying for 100 volts.

But the supply company gains enormously by the use of chokers, for the energy is saved to them by the use



STERLING FENDER.

of these coils; they reduce the load on the dynamos while yet the full pressure remains on the consumer's meter.

It is commonly misrepresented to consumers that by using a choker instead of a resistance they do not waste energy; certainly they don't waste the energy of the supply, but they do most certainly make him pay for the energy saved to the company, or works, and which he does not use.

The lesson to be taught to consumers is this: if the supply is too high in pressure for any purpose for which it is to be used, reduce it by a transformer; never use a choker except for very small reductions.

Why the Board of Trade measuring department should blink these facts is a mystery. They carefully look into one per cent. errors in meters, etc., while right under their nose consumers are paying for from 20 to 30 per cent. more energy than they actually use in many cases.

It may be said the consumers are themselves to blame for using chokers instead of transformers; quite so, but consumers are not yet educated up to that point, and as supply authorities do not put them up to the wrinkle, and professors teach the saving in chokers without qualifications, it is time now to raise the question.

This question involves the meter question.

The choker is a gift horse and we may be pardoned for looking in the mouth, unless it is placed on the supplier's side of the meter, and that meter is an alternating energy meter, not a current meter like the Schallenberger; if a current meter is used then it matters not where the choker is, it saves nothing to the consumer.

In any case, the choker cannot be held up as one of the advantages of the alternating current unless it reduces the readings of the meters. If it does not do that, the consumer may as well use a resistance, but he is always safe in using a transformer and thereby securing any savings for himself.

From the supplier's point of view the choker is a fine thing. If everybody used a choker, from 100 to 50 volts, the suppliers would be paid exactly twice over for the energy supplied.—*Electrical Review*, London.

TAXATION.

BY A R. FOOTE.

In a paper on this subj ct read before the recent convention of the American Street Railway Association in Atlanta, Ga , Mr. Foote subdivides his theme into four sections, as follows: (1) Taxes: Why are they paid? (2) Taxes: Why and how is payment evaded? (3) Taxes: By whom should they be paid? (4) Taxes: How can a just system be established?

After arguing at length on each of these subjects, Mr. Foote proposed a method of providing a just system of taxation, as follows:

1. All charges for the support of the government and for all other public purposes are taxes.

2. All property shall be assessed for taxation at its full value in current funds. All exchangeable products upon which labor has been expended, the ownership of which is protected by law, are property. Securities representing the ownership and the value of property are not property and shall not be taxed.

3. The tax levy shall be laid at a uniform rate per cent. on the assessed value of all property for the same tax levied within the jurisdiction of the state and of each division thereof.

4. All property assessed for taxation shall be entered in the books of the tax assessor for the tax district in which it is located, in the name of the owner, user, or person having the property in charge.

5. Bills for taxes shall be made in the name of the owner, user, or person having the property in charge, as entered in the assessors' books, and the payment of the same shall be a legal payment for the full amount of the tax bill of any debt or obligation of any kind due from such person to the true owner of the property upon which the levy was made.

6. Tax bills shall be a lien upon the property on which the levy was made and may be sold for non-payment, as provided by law.

7. Property shall not be taxed in any way except as herein provided. Tax assessments shall be made but once in each year and the levy for all state, county and municipal taxes shall be entered in the same bill. Charges shall not be made by state, county, municipal or other public authorities, for the support of the government or any other public purpose, except a property tax, for the right or privilege of engaging in any industry, business or vocation.

8. The legislature may exempt the whole of any class of property from taxation, but it shall not make any partial exemption by authorizing a decrease in valuation, or of the rate per cent. of a tax levy for one or

more classes of property less than the unexempted whole of a class, nor shall it exempt a part of the property of any class.

9. Special assessments and tax levies may be made, in consideration for special benefits accuring from public improvements, upon all property securing an increment of value by reason of such improvements.

10. Fines may be assessed and collected for violations of law ; charges may be assessed and collected for costs of courts in all legal procedures ; for costs of records on all recorded instruments or documents ; for all public inspections, supervision and audits ; and license fees may be assessed and collected for the control of all places of public amusement ; the regulation or suppression of all immoral practices ; the protection of health ; and the supervision of public nuisances.

11. The legislature shall not delegate the right to exercise the power of taxation for any purpose, to any political division of the state or other public authority without providing by law that the books of accounts of such division shall be kept as directed by the State Comptroller, who shall audit all such accounts annually.

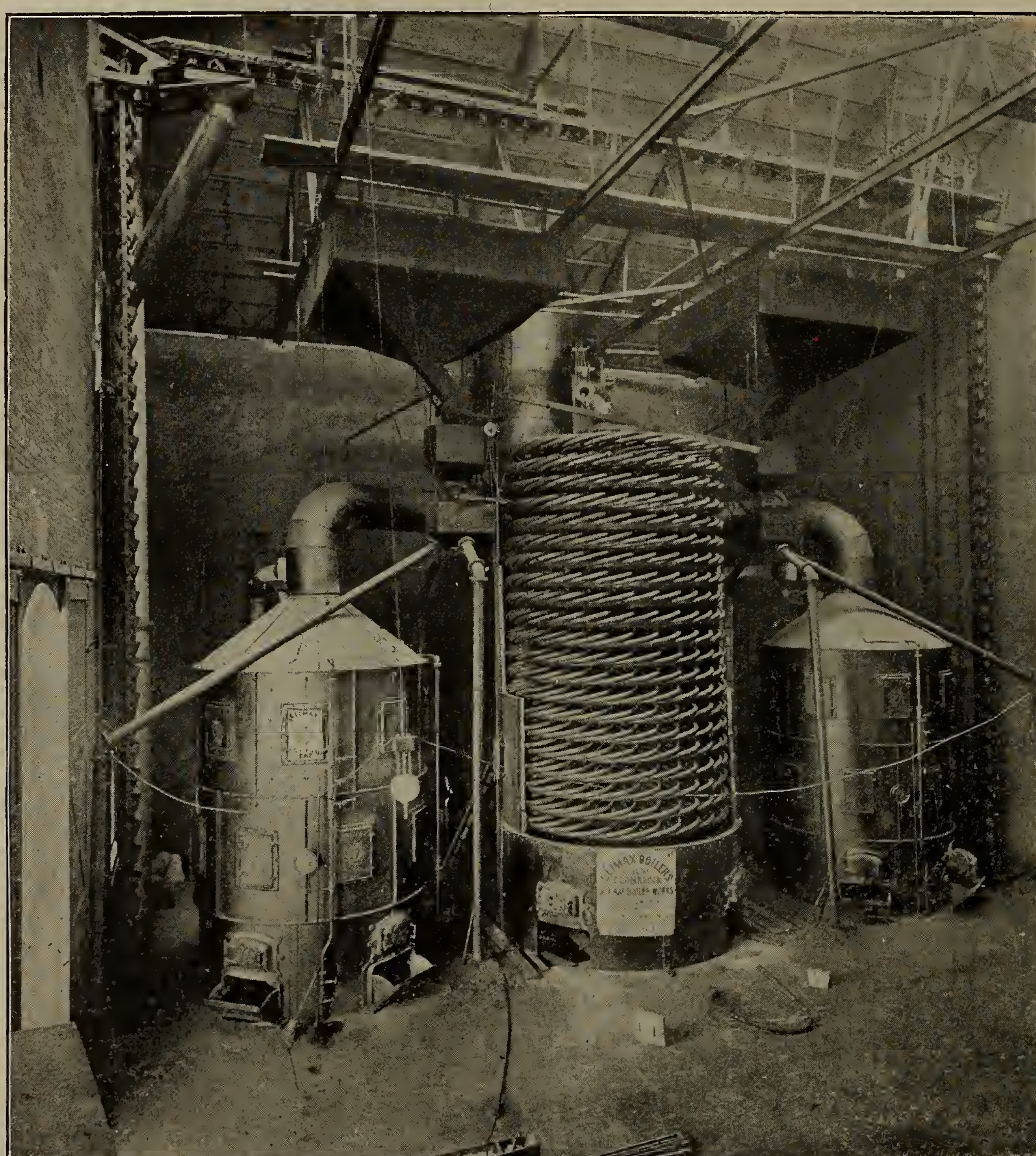
Address Wanted.—The address is desired of W. F. Stocker, an electrician, at one time employed in New York city. Any one knowing the whereabouts of the gentleman please communicate with Electrical Age.

THE "CLIMAX" BOILER.

A steam boiler is a thing that is little subject to fickle changes in opinion ; where it has a reputation it is because it has some merit back of it. A reputation for a boiler cannot be made in a day or to stand on claims alone ; the boiler must prove itself to be able to meet all the claims made for it, or it receives no recognition in the trade.

The "Climax" boiler furnishes a good illustration of these facts It stands today one of the foremost boilers in use, and it has earned its reputation on its merit. It is a favorite boiler among electric light and power station managers and is giving the greatest satisfaction.

The "Climax" boiler is of the upright type, and is claimed to be the most efficient steam generator made. Its chief advantages are: economy in floor space and economy in fuel, both of the utmost importance to station managers, and steam users in general, especially in cities where ground is valuable.



CLIMAX BOILERS.

The steam generator proper consists of loop-shaped tubes and a vertical cylinder extending through the whole height of the boiler, around which the tubes are arranged. The cylinder is similar in construction to any ordinary cylindrical boiler shell, is perfectly steam-tight and is provided with the usual manhole plate.

Within the cylinder is arranged another cylinder, whose upper end is open and lower end closed. The bottom of this cylinder rests on brackets riveted to the outer cylinder and the upper end of the inner cylinder extends up to about the water line.

The lower ends of the tubes are connected to the inner cylinder by short tubes crossing the annular space. These short tubes are simply driven into the main tubes. The other end of these need not be, nor are they expanded, as perfectly steam-tight joints are not necessary.

The fire box surrounds the outer cylinder and is annular in form.

The ratio of grate to heating surface in these generators is about one to fifty, which results in rapid generation of steam and high fuel economy.

These boilers attracted considerable and favorable attention at the World's Fair. There were three of them on exhibition, one, said to be the largest steam generator ever constructed, having a capacity of 1,000 nominal horse power. The other two were of 500 H. P. each.

A test of the 500 H. P. Climax boilers was made at the plant of the Brush Electric Co., of Baltimore, Md., with splendid results under actual conditions, 748.2-H. P. being developed, with an evaporation of 10.3 pounds of water per pound of fuel.

Our illustration shows the three boilers referred to above. The 1,000-H. P. boiler is between the two of 500-H. P. as shown, and has the casing removed in order to show the tube system.

Among the concerns now using these boilers, which are manufactured by the Climax Steam Boiler Works, of Brooklyn, N. Y., may be mentioned the following: Edison Electric Illuminating Co., Williamsburg, N. Y., 1,200-H. P., standard style of setting; New York Steam Co., 59th street station, New York city, two of 1,000-H. P. Edison Electric Illuminating Co., Lebanon, Pa., two of 350-H. P. The Delaware Valley Electric Railway Co., Stroudsburg Pa., two of 400-H. P. The Inter County Street Railway Co., Tamaqua, Pa., two 400-H. P. Merrimac Manufacturing Co., Lowell, Mass., two 100-H. P. The New York Belting and Packing Co., Passaic, N. J., two 600 H. P., and the Hazelton Steam Heating Co., Hazelton, Pa, two 200-H. P. boilers.

The Climax boilers are so constructed as to render it easy to effect repairs. Any one of the sections may be removed without disturbing the others, when it is necessary to replace a tube.

PRINCIPLES OF DYNAMO DESIGN.

BY NEWTON HARRISON, E. E.

(*Continued from Page 257.*)

The remarkable discrepancy observable between the constants of Thompson or Forbes and Esson, is due to the fact that Esson takes into account the radiating properties of the adjacent metallic parts. In Forbes' experiment the wire was probably wound upon a body having less radiating surface than a coil on a dynamo, which naturally caused the heat to be almost entirely spent in raising the temperature of the wire to 225° F.

Esson depends upon the conducting power of the core and pole-pieces to partially radiate the heat that aggregates, due to C^2R losses in the field. With this point in view the constant would more nearly approach the value as given by him. But it is a well-known fact that some makers of electrical machinery wind upon the core direct with the proper insulation underneath, while others, who slip their coils on, use a sleeve which necessitates a bed of air between the core and winding of a variable thickness.

Again, it is a known practice for makers to drill the flanges of magnet coils to accelerate radiation, and others to employ brass instead of rubber or fibre flanges. And in cases where the coil, if of square cross-section, is in close proximity to the body of the machine, a rapid dissipation of heat occurs. All these things combined show how arbitrary a rule necessarily is, unless these conditions be carefully considered and allowed for.

The system of assuming a certain rise in temperature and then constructing a formula based upon that fact will enable us to arrive at a certain current giving rise to that temperature and thus indirectly determining the size of the wire to be used.

In the formula already given

C = current
S = sq. inches of surface
R = resistance

$$C = .63\sqrt{\frac{S}{R}}$$

the limiting temperature is 90 F., but the resistance R must be taken at the working temperature of the coil; the increased heat naturally causing a corresponding increase in the resistance of the coils. As a means of considering this increase in resistance, the following rule holds true.

The resistance of copper increases as the temperature rises .21 of one per cent for each degree Fahrenheit, and .38 of one per cent. per degree Centigrade, or,

increase Fahr. = .0021 of an ohm per degree,
Centig. = .0038 " " "

A coil of 10 ohms resistance cold, would increase in resistance if its temperature be raised 50° Fahr as follows:

$$50 \times .0021 = .105$$
$$\text{and } .105 \times 10 = 1.05 \text{ ohms,}$$

therefore the resistance of the coil with an increased temperature of 50° F. would be 11.05 ohms.

A rise of 90° F. is the basis of the above formula; this is rather a large increase if the machine be operating in summer weather with the temperature at 90° F. This growth of heat would mean a total temperature of 180° F., which is too great for ordinary practice. Another writer, however, gives a similar formula based upon a lower temperature of 75° F. and an allowance of two square inches per watt for radiation; we then have

$$2\,C^2R = S, \text{ or surface in square inches,}$$
$$C^2 = 5\frac{S}{R}$$
$$C = .7\sqrt{\frac{S}{R}}$$

Windings must never be too deep, because with ordinary current densities in the coil the inner layers will become greatly heated; the object of all these ways and means being solely to preserve as nearly as possible a uniform temperature throughout the coil within certain limits; and this can only be effected by having the current density in the wire, the depth of winding and the radiating surface designed to meet the exigencies of the case.

In the specifications for dynamos it is the practice to call for a limited rise of temperature of not more than 100° Fahr. above the surrounding air.

At a current density of 800 to 1,000 amperes per square inch, the heat will not increase 50° Fahr. above the atmosphere.

With short, stumpy magnets the heat is likely to be greater because of the greater depth of winding, the rough rule already given of one-half watt per square inch at the core and one watt for every two square inches at the outer surface, from one standpoint determines the depth of winding.

We are then confronted with the difficulty, perhaps, of lack of space for the requisite turns. In this case an elongated core would be necessary, or the specific induction, and therefore the ampere turns, decreased. This again would necessitate a greater cross-section of core if a stated number of lines of force be desired, which would also give an increased surface for radiation. This method, if not carried out to excess, constitutes a very useful means of keeping the heat within the limits of practice.

(*To be Continued.*)

THE COMPTON AUTOMATIC AND ELECTRIC SERVICE SYSTEM.

Electricity is without question the most faithful servant man ever had. It is hardly possible to name a desire that electricity cannot be made to directly or indirectly fulfil. It lights our buildings, propels our street cars, calls our servants, protects our valuables, relieves us of pain, cures disease and performs thousands of other duties for the benefit and comfort of mankind. Every day brings forth some new and useful application of this wonderful force; there seems to be no limit to possibilities in its use.

One of the most useful and valuable applications of electric current is in the regulation of heat in our homes, offices, warehouses, and the operation of valves, dampers, etc., without personal attention.

Regarding the regulation of temperature—very few people appreciate its importance. The health of thousands upon thousands is impaired in cold weather by the sudden variations of temperature that are the natural consequence of our modern ways of living. People are apt to overheat their homes and then when they go out of doors the sudden change of temperature gives them cold, and if nothing worse results they are lucky. If we could only maintain a proper and uniform temperature indoors there would not be so much sickness and the undertakers' business would not be so profitable. But how to accomplish this seemingly impossible feat is the problem. No one doubts that a uniform temperature can be maintained, but when we consider the labor and time involved to attain this result the idea is at once given up as impracticable.

The importance of even temperature and the practicable impossibility of securing it by the aid of the personal factor led inventors to seek to attain this object by the use of automatic machinery. One result of such efforts is the system herewith described. This is the simplest method of carrying the idea into practice that we have yet seen, and it seems to us that when it becomes better known it will find a very extensive use.

The Compton magnet thermostat (Fig. 1) is a device that is sensitive to changes of temperature and is the heart of the system. It consists essentially of a blade or bar composed of two different metals suspended rigidly between two magnets. The magnets are adjustable by means of the pointer shown in the illustration, the pointer being set at the temperature it is desired to maintain. After the thermostat is set at a given temperature, a rise or fall of one degree above or below the fixed point causes the closing of a circuit and the operation of an electric motor which in turn controls the heat-regulating apparatus, thus controlling the temperature within the predetermined limits. An increase of temperature expands the thermostat blade, which automatically closes a circuit causing the electric motor to operate, which in its revolution checks the draft of the heating apparatus or closes a valve if it be connected with a radiator. The moment the temperature falls one degree below the given temperature another circuit is automatically closed by the contraction of the bar; the direction of the motor's revolution is reversed and the draft is closed or the valve opened as the case may be, and the temperature rises in consequence.

FIG. 1.

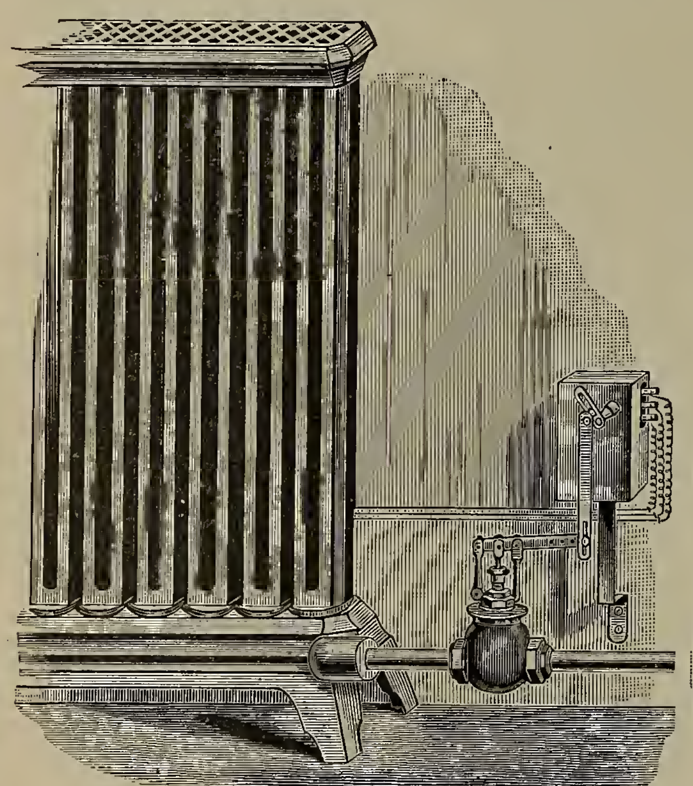


FIG. 2.

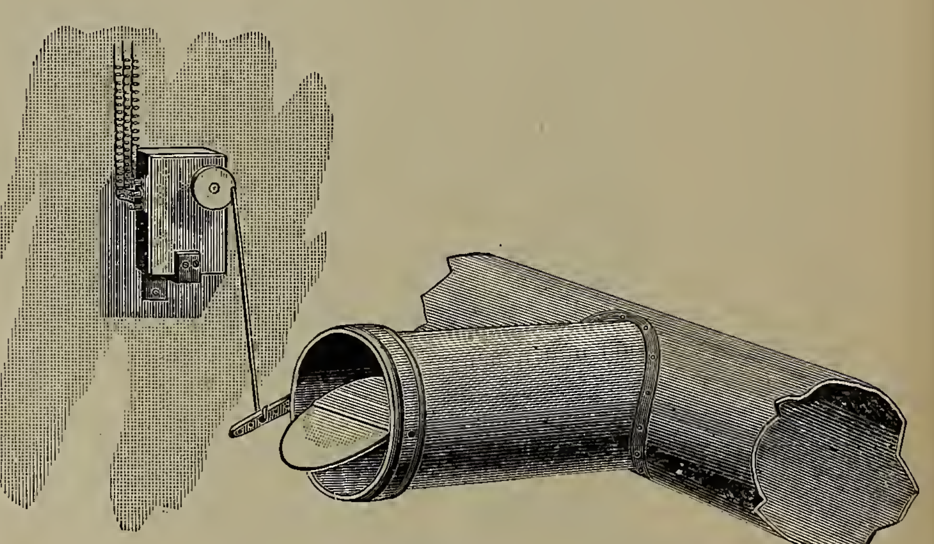


FIG. 3.

The thermostat is placed on the wall of the room in which it is desired to regulate the temperature, and a small three-wire cable connects it with the electric motor, which may be placed in any convenient position, to open and close the heat controlling apparatus.

Four cells of ordinary open circuit battery are all that is required to operate the motor.

The system is extremely flexible in its application. Several rooms may be heated at different temperatures if desired, and this implies that they can as well be heated to the same degree. By the use of a specially constructed annunciator in connection with the thermostats, changes in temperature are instantly made known. Where the system is used in factories, an annunciator placed in the engine room indicates to the engineer the temperature in the various rooms equipped with thermostats.

The opening and closing of valves of any size can be automatically effected by the use of the Valve Controller, which is an integral part of this system, and the valves may be located at any point distant from the thermostat or circuit closer. In a factory the engine may be automatically stopped from any part of the building or plant, in case of accident, without the intervention of the engineer, and the engine may likewise be started.

Among other valuable applications of the Electric Valve Controller may be mentioned its use in connection with fire extinguishing apparatus in buildings, opening and closing of reservoir valves, the regulation of dampers, and the maintenance of steam pressure at a given point.

It does not require any argument to prove that this system is a fuel and labor saver, and for this reason alone is entitled to the consideration of those having use for such apparatus. By its use an even steam pressure can be constantly maintained, and it will find a valuable application in electric light stations, factories and all other plants using stationary engines.

This system is named "The Automatic and Electric Service System ;" is the invention of Melvin D. Compton, and is controlled by the Compton Electric Service Co., whose main offices are in the Postal Telegraph Building, New York city. It is the result of years of patient and costly experiments and tests, and it is offered to the public with the assurance that it will meet the demand for a reliable automatic service within the wide range of its application.

Fig. 2 shows the Valve Controller as applied to the control of a steam radiator, and Fig. 3 shows the application as a damper regulator for the maintenance of steam pressure.

"WHAT ELECTRICITY IS."

An article under this title appears in the *New Science Review* for October, 1894, the author of which undertakes to answer the question, "What is Electricity?" In order to lead the reader up to the main question he first considers the natural forces, gravitation and heat. Examples are given of how these forces are manifested and how energy is changed from one form to another. Every form of force, the author says, should be regarded as a different method in which energy makes itself known to the senses. He calls particular attention to the important fact that "resistance of one kind or another is always the agent that acts to alter energy from one form to another," and suggests that electricity is simply a form or manifestation that energy may assume under given conditions, and generally it is a mere transitory stage between the mechanical form and the heat form. "In most operations," he continues, "mechanical force passes to the heat form without passing through the electric form; but whenever magnetism is brought into play as a resistance that must be overcome, then mechanical power applied to overcome this resistance always becomes electricity if only momentarily in its passage from the mechanical to the heat form." In conclusion, he asks if the question "What is Electricity?" cannot be answered in a fairly satisfactory way by saying that it is simply a form that energy may assume while undergoing transformation from the mechanical, or the chemical form, to the heat form or the reverse.

The name of the author is not revealed for the reason, as explained by the editor, that it was thought that a discussion on the subject would be more free and open if the author's name were for the present withheld.

Fire.—The electric light plant in Hackensack, N. J., was destroyed by fire on November 6. The company expected to resume street lighting in 36 hours.

"MAGNETIC SAND."

The Suburban Traction Co., Orange, N. J., and the Consolidated Traction Co., Newark, N. J., are making experiments with magnetic-ore concentrates as a substitute for track sand. The concentrates is a good conductor of electricity, and the object of its use in place of sand is to insure good contact with the rails through any non-magnetic substance, such as dirt, sand, mud, leaves, snow, etc., also in hill-climbing to prevent the breaking of contact, as is usual where ordinary sand is used. The ore concentrates come from the works of the New Jersey and Pennsylvania Concentrating Works at Edison, Sussex Co., N. J. Mr. Thos. A. Edison is president of this company.

French Justice.—On March 2, 1891, an explosion of gas occurred in a Paris restaurant, and this gave rise to an action between the Parisian Gas Company and the Parisian Compressed Air and Electricity Company, better known as the Popp Company, over the question of the payment of the damage resulting. The court held the Gas Company liable partly for not being more prompt in their attention to the leakage when reports were made of the escape of gas, and the Popp Company was likewise held partly liable on account of not providing proper insulation for its electric light service cable. The Popp Company was mulcted to the extent of 75 per cent. of the total damage and the Gas Company 25 per cent. It seems that the gas escaped through two holes in the pipe, which were evidently made by electrolytic action, and in some way the accumulation of gas in the cellar became ignited, with damaging results both to person and property.

Successful Suit.—Edward Batchelor, of Philadelphia, who owns much property along the line of the Asbury Park and Belmar Electric Railway, has won his case in the Supreme Court of New Jersey, against that company. He attacked the validity of the company's franchise and was successful. This stops the company from running its road through Neptune City, Avon and Belmar. The railroad company will appeal to the Court of Errors and Appeals.

Berlin-Vienna Telephone.—The opening of the telephone line between Berlin, Germany, and Vienna, Austria, which will take place in a few days, will be a notable affair. The Austrian Emperor will sit at the Vienna end and the German Emperor at Berlin, and the two will exchange appropriate greetings on the memorable occasion.

Number of Incandescent Lamps in Use.—According to trustworthy statistics there were used in central station plants in the United States, at the end of the year, 1893, 2,500,000, incandescent lamps, and in isolated plants about 1,500,000 more, making a total of 4,000,000.

THE TELEPHONE.

There is no good reason why everyone should not know the telephone more intimately when one dollar will buy a copy of "The Telephone Hand Book," by H. Laws Webb. This little work is written in a remarkably clear style and the text is well illustrated. It requires no mental effort to understand the subject as elucidated in this book.

The telephone is more intimately connected with our private affairs than any other electrical apparatus and everyone should understand it. Send one dollar to the Electrical Age, New York, and get a copy.

NEW YORK NOTES.

Office of the Electrical Age,
First Floor, World Building,
New York, November 12, 1894.

During his rounds in the trade and among manufacturers your representative found every one busy and running up to full capacity.

The Law Battery Company, 85 John street, have been running their factory night and day for the past few weeks, in order to keep even with the orders. This pressure, too, came after enlarging the factory and putting on more hands.

The New York Leather Link Belt Co., Ferry and Cliff streets, have just completed a 42-inch link belt, the largest ever made in this country.

Stanley & Patterson, manufacturers and dealers in general electrical supplies, 32 Frankfort street, are so busy that they are now talking of enlarging their facilities.

Chas. A. Schieren & Co , Ferry and Cliff streets, makers of the celebrated perforated leather belts, are running their factory to its full capacity to fill orders promptly.

Fred'k Pearce, 79 John street, manufacturer of police and fire department electrical apparatus, has enough work to keep his factory going full blast. He has on exhibition some fine examples of work in the electro-mechanical art.

The Electric Construction and Supply Co., 18 Cortlandt street, report a large demand for their new arc lamps. The Brooklyn Edison Company is greatly pleased with the performance of these lamps in street lighting. The "Ward" arc lamps for direct current circuits are fast being sold under the stimulus of low prices and only a few more are left.

The Oakman Electric Co., 136 Liberty street, report an active trade in their specialties.

The Geo L Colgate Co., 136 Liberty street, are moving into larger quarters in the same building, but have to do it gradually as they are so busy.

The Okonite Co.'s factory is running to its full capacity, trade is so brisk with them. There exists a big demand for Okonite insulated wires and cables for electric light and power purposes.

W. R. Brixey, 203 Broadway, has so many orders for Kerite wires and cables that we hear that he is talking about enlarging his producing facilities.

The Safety Insulated Wire and Cable Company, 234 W. 29th street, are so busy that they cannot take the time just yet to move into their new offices.

Mr. H. C. Willis, of the insulated wire department of the Washburn & Moen Manufacturing Co., 16 Cliff street, has returned from his wedding trip. He looks happy and has entered on a campaign of active hustling for business.

The Consolidated Traction Company, Jersey City, N. J , has decided to equip all of its cars with safety fenders.

J. S. Du Vall, manager of the New York office of the Ball Engine Co., of Erie, Pa., has severed his connectiion with that company and taken the management of the business of F. R. Chinnock, contractor for electric light and power plants, 143 Liberty street, city.

The citizens of New York on Tuesday, November 6, at the polls, authorized the city to assume the task of building the underground rapid transit railway system which has been under consideration by the Rapid Transit Commissioners for so long. The proposition was carried by a majority of 68,125 votes. The Board will begin work at once preparing plans, etc.

Rear Admiral Bancroft Gherardi, U. S. N., who was retired from active service on November 10, was navigating officer of the U. S. Steamship "Niagara" at the laying of the first Atlantic Cable, in 1858.

The wind and snow storm on the night of November 5 did a great deal of damage to the telegraph lines east of New York city. The wet snow stuck to the wires in such quantities as to break them down. On the Shore Line between New Haven and New London, 12 miles of poles were down. and poles in many other directions were also broken by the extraordinary strain put upon them. The impaired facilities worked serious disadvantage on election night, delaying the returns from the eastern states considerably.

Noll & Sibley, 902 Postal Telegraph Building, New York, which firm was organized early in October of this year, now represents several large industries and have made arrangements with several others. The firm is a manufacturers' agent. Both Messrs. Noll and Sibley have been connected with the electrical trade as manufacturers, dealers, contractors and constructors for the past 15 years, and are thorough business men. They are negotiating with several managers of Edison and other central stations, with a view to becoming resident buyers in New York for these concerns. They will buy for all classes of trade throughout the United States on a small commission, and on account of their recognized ability in this direction there is already a large demand for their services. Among other things they are handling arc and incandescent lamps and electrical supplies of every character, from a push button to a dynamo, and from a single lamp to a complete central station outfit.

W. T. H.

HOW TO MANAGE DYNAMOS AND MOTORS.

Everyone having charge of a dynamo or motor should know how to manage these machines properly. Trouble is liable to occur at any time, and to be able to determine the cause by the symptoms and how to apply the remedy is a knowledge that every operator should possess. The book entitled "Practical Management of Dynamos and Motors," and written by the well-known electrical authorities, Prof. F. B. Crocker and Dr. S. S. Wheeler, gives plain directions for the management of these machines. It costs but $1.00 a copy, and can be purchased at the office of The Electrical Age, New York.

Enlarging the Schenectady Works.—A dispatch from Schenectady, November 6, says that the General Electric Company will erect two new buildings at its plant in that place. These will be used for a storehouse and a laboratory. The recent determination of the company, the dispatch says, to do some of the motor work at the Lynn factory, is for the purpose of avoiding overloading the Schenectady Works.

Another Life of Edison.—Besides being a distinguished inventor and the recipient of innumerable honors, Mr. Thomas A. Edison may rightfully claim the distinction of having been selected oftener than any other living man as the subject of biographical effusions. An English firm has just issued "The Life and Inventions of Thomas Alva Edison." Mr. Edison has a greater number of lives than any cat that ever lived.

A BIG CONTRACT.

It is reported that Mr. Charles T. Yerkes has decided to equip the lines of the North Chicago Street Railway Company and the West Side Street Railway Company, Chicago, with electricity. He has signed a contract with the General Electric Company, the latter company agreeing to deliver to the Chicago parties, on or before March 1, 1895, six hundred electric motors, and generators with a total capacity of 3600 H. P. The present contract, it is stated, amounts to $500,000, but to equip the entire systems, as contemplated, will involve an outlay of $4,000,000.

It is stated that the present working force of the General Electric Company will have to be considerably increased in order to fill this and other large contracts which it has under way. There are now employed at the Lynn and Schenectady shops 4,700 men.

Enjoined.—It is reported that the Westinghouse Electric and Mfg. Co. has been enjoined from moving the machinery from the Newark, N. J., shops to the Brinton, Pa., works. It is stated that the United States Electric Light Company, whose plant in Newark was leased by the Westinghouse Company for fifty years, took this action on account of the alleged fact that not a dollar has ever been paid on this account. The lease guaranteed four per cent. upon the United States stock for the first year, five per cent. the next, and six per cent. for the remainder of the lease.

POSSIBLE CONTRACTS.

The plant of the Standard Underground Cable Co., Pittsburgh, Pa., was recently damaged by fire to the extent of $2,000.

The plant of the Ceramine City Electric Light Co., East Liverpool, O., was damaged by fire a few days ago. Loss, $20,000; insurance, $8,000.

An electric light plant and water-works are to be established in Alexandria, La., to cost $40,000.

John B. Stetson, of Philadelphia, is organizing a company in De Land, Fla., to construct and operate an electric road, ice plant and electric light plant.

The American Magneto Telephone Co., Kokomo, Ind., has obtained a franchise to construct a telephone system in Cedartown, Ga.

The New Orleans Traction Co., New Orleans, La., contemplates the erection of a power house to cost $50,000.

The South-Western Telephone Co., Houston, Tex., will erect a $50,000 fireproof building.

H. C. McFarlane, of West Tampa, Fla., can give information regarding the building of a $10,000 club and opera house in that place.

The Citizens' Railway Co., St. Louis, Mo., is to be equipped with electricity. Robert McCulloch is the general manager.

Geo. C. Fox, president of the St. Louis and South-Western Street Ry. Co., St. Louis, Mo., can give information regarding the application for a franchise to build an electric road.

The Leroy Hydraulic Electric Co., Buffalo, N. Y., has been granted permission to string wires and erect poles in various parts of the city.

The County Commissioners, Akron, Ohio, have granted a franchise to the Akron, Bedford and Cleveland Electric Railway Co. Work is to be commenced about April 1 next.

It is stated that a company has been organized in Baltimore, Md., to establish a plant at Coniwingo, on the Susquehanna River, 35 miles from that city, for the purpose of generating electric power.

The car sheds of the Nashville Electric Railway, Nashville, Tenn., were entirely destroyed by fire a few days ago. Several electric cars were consumed. The total loss is placed at $20,000, and the insurance partial.

The plant of the Portland General Electric Company, Portland, Ore., was almost destroyed by fire recently.

The Mayor of Frederickton, Mo., can give information regarding an electric lighting contract about to be let.

NEW CORPORATIONS.

The F. P. Electric Company, Chicago, Ill., by Edward J. Frost, Chas. W. McCorkle and E. W. Cramer. Capital stock, $500,000.

Cambridge Electric Light Company, Cambridge, Henry Co., Ill., by D. D. Lamb, Henry White and others. Capital stock, $10,000.

The Michigan Lighting Company, West Bay City, Mich., by Frank Mohr, George Standacher and Edward McGinnis. Capital stock, $10,000.

The Power Development Company, San Francisco, Cal., by Albert Miller, Edward W. Hopkins, Chas. A. Grow, Chas. Webb Howard, and Carroll N. Beal. Capital stock, $500,000.

The United Traction Company, Pottsville, Schuylkill Co., Pa., by Chas. H. Barritt, Wayne, Pa.; Wm. A. Barritt, Jr., St. Davids, Pa. Capital stock, $100,000.

The Cleveland and Elyria Electric Company, Cleveland, Ohio, by F. T. Pomeroy, M. A. Sprague, A. W. Bishop, C. W. D. Miller, Leon M. Roe, Will Christy and A. H. Pomeroy. Capital stock, $200,000.

The Pittsburg and Arlington Avenue Street Railway Company, Pittsburg, Pa. Capital stock, $21,000.

The Salina Telephone Co., Salina, Texas. Capital stock, $10,000.

Wm. Boardman Tobey and others, of Springfield, Mass., have organized a company with a capital stock of $125,000, to manufacture electrical machinery.

The Michigan Lighting Company, Jackson, Mich. Capital stock, $10,000.

The Equipment Construction Company, Albany, N. Y., by Montgomery R. Johnson, Thos. P. Nightingale, of Utica, Lina Beecher, Charles A. Seaver and Joseph W. Holmes, of Batavia. Capital stock, $10,000.

The Chappaqua Electric Light & Power Company, Chappaqua, N. Y., by Frank B. Selleck, Bertha G. Selleck of New York City, and John S. Quinby of Chappaqua, Westchester Co. Capital stock, $30,000.

Westlake Electrical Mfg. Co., East St. Louis, Mo., by Charles T. Westlake, David Biggs and others. Capital stock, $100,000.

The Polar Star Mill, Electric Light and Power Company, Faribault, Minn., by James Hunter, R. G. Weatherstone and James Hughes. Capital stock, $50,000.

The Phœnix National Telephone Company, Indianapolis, Ind., by Marlin Caldwell, John W. Parrish and Jacob Frankel. Capital stock, $100,000.

(*Continued on Page 278.*)

STEAM ENGINE ECONOMY FROM SUPERHEATING.

Granting the fact of a large initial condensation of the steam in an engine cylinder, due to the antecedent cooling of the wall during expansion and exhaust in the previous stroke, the question is in what way it can be diminished. There are four known means of diminishing the prejudicial condensing action of the cylinder wall—the steam jacket, superheating, multiple stage expansion, and high rotational speed. But as each of these means attacks the same source of loss, and borrows an economy by arresting the waste, it is not to be expected that they can be used in combination without, to some extent, neutralizing each other's action. At the same time, by no one of these methods has the whole condensing action in the cylinder been hitherto prevented. Two questions are, therefore, open in any given case—which of these methods is the most convenient and least costly to use? And next, one of these methods being adopted, will it still pay to adopt supplementary a second also?

It is to one of these methods, which seems to have been hitherto too much neglected, that the author wishes to draw attention. Superheating the steam not only attacks cylinder condensation in the most direct and effective way, but it seems to be specially suitable to be adopted as a supplement to one of the other methods of economizing steam.

In 1855–6 Hirn published the results of the first complete engine experiments in which the amounts of heat expended in doing work, and in various ways wasted, were separately determined. He was led at once to perceive the importance of the condensations and re-evaporations which go on within the cylinder. He attributed these to the action of the conducting cylinder wall, and consequently he proceeded at once to examine the action of the steam jacket, and the extent to which it diminished the cylinder condensation. Then a more effective way of conveying a supply of heat to the cylinder wall presented itself. By superheating the steam before admission, it was provided with the means of heating the cylinder wall without condensing. In 1855 and 1856 Hirn carried out comparative trials, both with a simple and a Woolf engine, with ordinary and superheated steam. From the first, Hirn satisfied himself that the marked economy in the trials with superheated steam was due entirely to the exchange of heat with the cylinder wall during admission, for he found that even with steam superheated to 460 degrees Fahrenheit the superheat was lost, and an appreciable part of the steam condensed before cut off.

Soon after the demonstration by Hirn of the fact of an important initial condensation in steam engines, and the proof that this could be reduced and an important economy realized by the use of superheated steam, many patents were taken out for different forms of superheaters, and many engineers applied superheating apparatus to marine and land engines.—Prof. W. C. Unwin, in *Cassier's Magazine* for November.

AN INVITATION.

Secretary Pope, of the American Institute of Electrical Engineers, informs us that the second general meeting of the Society of Naval Architects and Marine Engineers will be held at 12 W. 31st street, this city, November 15 and 16. The Institute of Electrical Engineers has been cordially invited to attend this meeting. Papers of special interest to electrical engineers will be read, among them being one by Mr. S. Dana Greene, entitled, "Electricity on Shipboard; its Present Position and Future Development."

MAGNETIC CLUB DINNER.

The Magnetic Club will hold its autumn dinner at 6:30 P. M., November 21, at Jaeger's, corner Madison avenue and 59th street, New York city. Hon. J. D. Reid, U. S. Consul to Dunfermline, Scotland, will be the guest of the club. Delegates to the annual meeting of the Telegraphers' Mutual Benefit Association (which meeting will be held the same day), will also attend the dinner, and a special programme of entertainment in addition to the dinner has been provided. An enjoyable time is expected.

THE ELECTRIC CONDUIT RAILWAY PROBLEM.

A large audience, including many prominent street railway men, listened to the lecture of Joseph Sachs before the New York Electrical Society, on the evening of November 1, at Columbia College, New York. The subject of Mr. Sachs' lecture was, "Is there a Solution of the Electric Conduit Railway Problem?"

Mr. Sachs was introduced by President C. O. Mailloux with a few appropriate remarks. He said that scarcely twelve years ago there was not in existence an inch of electric railway; today there are hundreds of miles.

There exists today an imperative demand, he said, for a substitute of the trolley, the main objection to which is the overhead wires. Two substitutes had been offered—the storage battery and the underground conduit systems. All storage battery systems, he said, had proved failures in the past. Recent successes in the storage battery would, however, probably bring the system to the front.

He spoke of the proclivity of inventors to devising underground conduit systems, and stated that over one-half of the patents issued on electric railways were for underground systems.

Mr. Sachs then projected on the screen lantern illustrations of the principal underground conduit systems. He divided them into six classes, namely: (1) open slot conduits; (2) movable lip or covered conduits; (3) surface contact; (4) electro-magnetic systems; (5) open conduits with sectional conductors and electro-magnetic switches, and (6) induction systems.

The first illustration of the screen showed the celebrated Bentley-Knight system, the first road operated under which was opened in 1884. This was the first underground system ever put to practical test He next showed the Blackpool conduit system, which is in successful operation in Blackpool, England, today, and even paying dividends.

The Siemens & Halske system in Buda Pesth was next shown. This line is 60 miles in length, double track and has installed sixty cars. He doubted if such a conduit system would operate on this side of the Atlantic.

He next showed sectional views of the Love conduit system, different forms of which are in operation in Chicago and Washington. The Griffin conduit, which was next shown, he thought contained some possibilities, and the Zell conduit system was also suggestive, he thought. He pointed out the several points of disadvantage in open slot systems.

The second-class of railways—the movable lip or covered conduit—was next considered. In this form, he said, the aim had been to protect the wire, which was done by either covering the slot or the chamber containing the conductor—the covering being in sections, which were readily displaced by the advancing trolley car.

In this class the Vandepoele system was probably the best known. The flexible lips which protected the conductor were pushed aside by the car as it moved along, the lips falling back into place after the car had passed. The Bunce system, which was next illustrated, had shutters in short sections which were displaced by the car, falling back into place after the car had passed the section.

The Peterson system was next shown. This system was fully described on page 134 of the Electrical Age, of March 24, 1894. The feature of this system consists of a sectional covering above the conductor chamber, which is displaced by car connection.

Regarding the second class of systems, Mr. Sachs gave it as his opinion that there was no flexible material known that would stand the strain of every-day work, and this feature of this class of systems, he considered was its weak point.

The surface contact systems was next considered and the examples given were the Lineff, the Vandepoele magnetic surface contact, the system of Lieut. Jarvis Patten, and the McElroy, Nicholson and McTighe system. A system which was included in this class was described as having the switch and cut-out mechanism in stations placed on posts and away entirely from the road bed. This invention was of G. T. Wood The Siemens electro-magnetic system was next shown, as was also that of Lieut. Patten.

Mr. Sachs then gave an illustration of the Johnson-Lundell system, which had been experimentally tested uptown, New York city.

The next class of railways that received his attention was the open conduit systems, using sectional conductors and electro-magnetic switches. Representatives of this class were the Lawrence system, which had a mechanical switch, and the Munsie Cole system. The latter system was in many respects similar to that invented by G. T. Wood and experimentally tested at Coney Island a year or two ago. Other systems of this class were shown, and Mr Sachs stated that the sectional conductor system possessed little advantage over continuous conductors.

The Mansfield system was a departure from the ordinary practice. in having the conductor above the surface, and the Henry system, an illustration of which was shown was of the raised sectional contact class, another form of which was that of the Feltrow system, which employed a flexible cable.

As an example of the last class, Mr. Sachs gave an illustration of the Dewey induction system, which is operated by alternating current, the primary coils being located along the road bed and the secondary coils on the car. He, however, stated regarding alternating current systems, that they were as yet inefficient mainly on account of there being no satisfactory alternating current motors.

He then summarized the various systems, pointing out the weak points of each. The only commercial, practical system that had been evolved, he said, was the open slot conduit. The principal trouble with them in this country was due to poor construction and high voltage, both of which were the main causes of failures. The only successful results, he said, had been obtained where low voltages had been used—say about 300 volts. The principal trouble with the open slot problem was primarily the construction of the conduit.

He then pointed out how a successful conduit system should be built, how voltage (as low as 300, if possible) should be used and the conduit should be used as the return.

Mr. Sachs then showed a drawing of a form of conduit with the conductor suspended therein, devised by himself and another gentleman, with the object of securing the $50,000 prize offered by the Metropolitan Traction Co., of New York. They did not get the prize, he exclaimed. In general he thought that the main point in the conduit system was low voltage.

He referred to the new system of the General Electric Company, which is operated practically on the three-wire plan. By using the conduit itself as the neutral wire and two wires in the conduit, a fairly even distribution and balance can be secured, the main point gained being the low voltage.

He saw a great promise in the alternating current systems, the main question involved being that of the motor. He described a method which would be operative under present conditions. On the car he would place a synchronous motor, which would be in operation at all times. The transfer of the motion to the car would be accomplished by a clutch, hydraulic gear, or a pneumatic gear. For the latter he saw great promise. By using any one of these gears, the triphase system could be applied, using the conduit itself as a conductor.

The system of H. Ward Leonard was then briefly described and Mr. Sachs thought it possessed a good many advantages.

To sum up all that had been said he stated that the question was not "Can we build an underground system? but was "What will such a system cost?" He was confident that a successful system cou'd be built, which would cost no less than from $30 000 to $40,000 per mile. In comparing the cost of electric conduit systems, the problem should be made with cable system and not the trolley.

He referred to the belief in many quarters that the trolley would be displaced by the conduit, if ever a successful conduit system was brought out, but he thought that these fears were groundless. The trolley had a field of its own and would always keep it. The conduit system, on account of its cost, could never go in any other than large cities, where the traffic would justify the expense, and it was in these cities mainly where the objection to the overhead trolley existed. The successful conduit system, he stated, should have few parts.

In conclusion Mr. Sachs expressed the belief that the problem would and could be solved.

Mr. Sachs showed a blue print of the system of underground conduit which is now being installed on Lenox avenue, New York city, by the General Electric Company. This experimental line will be three miles in length. The two conductors will be placed within the conduit ; the main points of the system were that the insulators were located in the man-holes and were easily accessible at all times. The voltage that will be used will be between 250 and 300.

At the close of Mr. Sachs' remarks an interesting discussion took place, in which many prominent electric railway people present took part. Mr. Townsend Walcott criticized the system suggested by Mr. Sachs of using and operating a conduit road on the three-wire system.

Mr. Stetson, of the General Electric Company, made some remarks regarding conduit systems, and was followed by Mr. C. B. Fairchild, editor of the *Street Railway Journal*, who spoke at length on the various street railway systems.

Robert Lundell, inventor of the Lundell system, C. J. Field and E. A. Merrill also made some pertinent remarks. and the discussion was closed by Mr. Sachs, who stated that the best support for conductors in conduits was the top support, where they would be high and dry. He gave it as his opinion that the alternating current system was rapidly coming to the front, and that the alternating current motor was rapidly approaching perfection.

After a vote of thanks to Mr. Sachs the meeting adjourned.

(*Continued from Page 275.*)

The Eureka Electric Mfg. Company, St. Louis, Mo., by Alfred Bevis, C. H. Longstreth, Daniel W. Smith. Capital stock, $30,000.

The Eclipse Electrical Co., St. Louis, Mo., by Chas. F. Smith, I. Fajaris and E. C. H. Feolkers. Capital stock, $9,000.

The Pacific Electric Co., Pacific, Mo., by A. H. Brown, A. Kappitz, G. H. Gross, S. B. Whitsett, C. C. Close, L. L. Sraburn and A. F. Mantel. Capital stock, $5,000.

The Imperial Electrical Bell and Fire Alarm Mfg. Co., Huntington, W. V., by Jas. K. Olney and others.

The Union Telephone Co., Parkersburg, W. Va. Incorporators, C. H. Shattuck, of Parkersburg; E. M. Gilkenson, of Romney; J. B. Finley, of Parsons, and S. F. Sherrick, of Marietta. Capital stock, $150,000.

The Minnesota Harrison Telephone Construction Co., Minneapolis, Minn., by Chas. H. Maxey. Thos F. Hurley, W. A. Edwards, Geo. E. Maxwell, B. W. Taylor, Geo. E. Hays, of Minneapolis; and W. N. Stewart, of St. Paul. Capital stock, $250,000.

The Union Traction Co., Hackensack, N. J., by G. Burnap, Frank Gardner of Brooklyn, and others. Capital stock, $500,000.

The Dayton Long Distance Telephone Co., Dayton, Ohio, by J C. Patterson, Jno. P. Breene, Gov. J. B. Thomas, Prof. E. T. Brewster, W. H. Shank, W. M. Whitmore and James E. Cronin.

Sinaloa Electric Light and Power Co, Des Moines, Ia., by Jesus and Joachim and Carlos Escovar. Capital stock, $20,000.

The Canton Mutual Telephone Co., Canton, Ohio, by F. D. McKelvey, Jos. A. Linville, B. N. Winings, H. E. McKelvey and Geo. O. McKelvey. Capital stock, $10,000.

The Coalport-Irvona Light, Heat and Power Co., Coalport, Pa., by R. A. Holden and others. Capital stock, $10,000.

Wilder-Sloss Electric Hotel Call Co., Chicago, Ill., by Louis Stein, August Binswanger and Ed. R. Wilder. Capital stock, $250,000.

The Mt. Gilead Electric Light and Power Co., Mt. Gilead, Ohio. Capital stock, $15 000.

The Cook County Electric Railway Light and Power Co., Chicago, Ill., by Chas. Greenwood and others. Capital stock, $500,000.

The Woodville, Hopkinton and Westboro Electric Railway Co., Westboro, Mass., by D. G Underwood, of Malden, Mass., and A. M. Bridgman, of Brockton, Mass. Capital stock, $50,000.

TRADE NOTES.

The Interior Telephone Co, 203 Broadway, city, has just issued a neat catalogue of the Colvin system of local, long distance and interior telephone.

Big bargains in silk and cotton flexible cord, in various sizes as well as other lines of electric light supplies, ironclad rheostats, etc., are found at The Geo. L. Colgate Co., 136 Liberty street, New York. These goods are going fast.

The American Manufacturing and Engineering Co., 143 Liberty street, New York city, has received a letter from A. K. Bonta, superintendent of motive power of the North Hudson County Railway Co., Hoboken, N. J., in which the subscriber reports on the car lighting system of the first-named company. This system, which was described and illustrated in the ELECTRICAL AGE August 11, of this year, has been in use on the North Hudson County roads for the past six months, and Mr Bonta reports that it has given his company perfect satisfaction, and that the batteries had never had any attention since they were installed. He expresses the belief that the system is "the proper thing for street car lighting and will pay for itself in a short time."

Mr. F. S. Meserole is meeting with success in the sale of the apparatus of the La Roche Electrical Works, Philadelphia. Mr. Meserole has his office at 136 Liberty street, room 307, where he will be pleased at any time to furnish information to prospective buyers of the popular direct or alternating current La Roche dynamos and general lighting apparatus. A copy of the latest catalogue can be had on application.

The Partridge Carbon Co., Sandusky, Ohio. has just issued a neat catalogue and price-list of its self-lubricating dynamo and motor brushes.

The Sperry Electric Co., Cleveland, Ohio, has just issued a catalogue of apparatus, describing its well-known system of street car propulsion. The Sperry electric brake is also fully described, and the catalogue is illustrated in an artistic manner.

A new steam engine has just been brought out. All eccentrics, piston rods, valves, stems, stuffing boxes, cross-heads, fly-wheels, etc., are dispensed with, resulting in great reduction of friction, less complication and fewer parts. It is applicable direct to small dynamos, pumps, exhaust fans and blowers. It is made by the Cross Engine Company, of 109 Liberty street, New York. It is simple and compact in construction, economical in operation, reliable and high speed. It is, besides, light in weight for a given power and low in cost. One of these Cross engines is in practicable operation in the company's office at the address given above.

J. Jones & Son, 67 Cortlandt street, New York, report a lively trade. The September business showed 15 per cent. more sales than any preceding month, and the October business exceeded that of September by 25 per cent.

The Weir Frog Co., of Cincinnati, Ohio, whose wares are so largely used throughout the country on all the principal street and steam roads, was represented at the Atlanta Convention last month by Col. B. F. Pilson. Col. Pilson was on the alert in the interests of this company, and succeeded in getting favorable recognition and a good many orders.

IMPROVING.—Captain Wm. Brophy, of Boston, is fast recovering from an attack of insomnia with which he has been affected for several months past. It compelled him to cease work entirely and take absolute rest. We are informed that he is now rapidly regaining his strength and spirits.

CHARACTERISTICS OF A POPULAR RAILROAD.

Travellers find unexcelled accommodations and supreme comfort on the cars of the New York Central Railroad. American railways are noted for the advantages which they afford the travelling public, and there are none that surpass this splendidly equipped road.—*Paper Trade Journal.*

There is some talk in Milwaukee of building an electric railway from that city to Chicago, and the project will be carried forward if sufficient support is promised.

The Rockville & Ellington Electric Tramway Co., Rockville, Conn., is trying to obtain the privilege of extending its line to Talcottville.

Electrical and Street Railway Patents.

Issued October 30 and November 6, 1894.

ISSUED OCTOBER 30.

528,149. Trolley-Catcher. Woodson D. Cobb, Fort Worth, Tex. Filed May 29, 1894.

528,184. Electric-Arc Lamp. Rudolph Segerdahl, Chicago, Ill. Filed Feb. 26, 1894.

528,185. Automatic Electromagnetic Cut-Out. Lucius T. Stanley, Brooklyn, N. Y., and Alfred E. Braddell, Philadelphia, Pa., assignors to Henry B. Cutter, Philadelphia, Pa. Filed Aug. 22, 1893. Renewed June 1, 1894.

528,188. Electric Transformer. Elihu Thomson, Lynn, Mass., assignor to the Thomson-Houston Electric Company, of Connecticut. Filed Jan. 29, 1890.

528,204. Armature for Dynamo-Electric Machines and Method of Making Same. Thomas H. Hicks, Detroit, Mich. Filed July 14, 1893.

528,205. Conduit Electric Railway. Julius L. Hornig, St. Louis, Mo., assignor of one-half to Theodore H. Wurmb, same place. Filed Feb. 19, 1894.

528,245. Electric Railway-Signal. Adoniram J. Wilson, Port Chester, N. Y., assignor to the Hall Signal Company, of Maine. Filed Nov 21, 1892.

528,246. Electric Railway-Signal. Adoniram J. Wilson, Port Chester N. Y., assignor to the Hall Signal Company, of Maine. Filed Dec. 16, 1892. Renewed Mar. 28, 1894.

528,286. Galvanic Battery. Martin M. Clark, Chicago, Ill., assignor to the Western Electric Company, same place. Filed May 27, 1893.

528,291. Underground Conduit. James F. Cummings, Detroit, Mich., assignor of one-half to Eugene M. Engelman, Milwaukee, Wis. Filed Jan. 16, 1894.

528,298. Car-Fender William G. Kerr, Providence, R. I. Filed Jan. 22, 1894.

528,301. Art of Coating Electric Conductors. Albert F. Montgomery, Lincoln, R. I., assignor to Lawrence Abraham Lockwood, same place. Filed July 2, 1894.

528,302. Car-Brake. Peter McMullen, Buffalo, N. Y., assignor of one-half to Michael Callahan, same place. Filed Oct. 9, 1893.

528,330. Conduit System for Electric Railways. John B. Linn, Cleveland, assignor of one-half to Oliver S. Kelly, Springfield, Ohio. Filed Dec. 9, 1893.

528,379. Closed-Conduit Electric Railway. James F. McLaughlin, Philadelphia, Pa. Filed May 10, 1894.

528,390. Mechanical Telephone. Jerome Prince, Milford, Mass, assignor by direct and mesne assignments to the Musical Telephone Company, same place and Saco, Me. Filed May 16, 1894.

528,430. Electromagnetic Switch. John G. Hartel, Keokuk, Iowa; Florence L Hartel, administratrix of said John G. Hartel, deceased. Filed Dec. 2, 1893.

528,438. Safety Device for Electric Cars. John M. Kelly, Rochester, N. Y. Filed Nov. 21, 1892.

528,444. Electric Signaling Apparatus for Block Systems. Matthew S. Reiley, Washington, D. C., assignor of sixty-seven ninety-sixths to Robert E. L. White, George W. White, James M. White and Fred. R. Miller, same place. Filed June 13, 1894.

528,445. Secondary Battery. John E. Rhetts, Salem, Ind. Filed Nov. 22, 1893.

528,465. Electric Machine for Railway Systems. Edward Deming, New York, N. Y., assignor of three-fourths to Samuel Corn, Henry Corn, Adolph Kaufman and Isaac Stern, same place. Filed May 2", 1893.

528,477. Supply System for Electric Railways. Chas H. Harkins, St. Louis, Mo. Filed Dec. 9, 1893.

528,494. Closed Conduit for Electric Railways William E. Stearns, Berlin, Conn., assignor by direct and mesne assignments of one-third to David L. Bradt, John P. Coghlin and Frank O. Plummer. Worcester, Mass. Filed Apr. 7, 1894.

ISSUED NOVEMBER 6.

528,529. Plug for Establishing Electrical Connections. Charles W. Brown, Montreal, Canada, assignor to the Bell Telephone Company of Canada, Limited, same place. Filed Jan. 16, 1894.

528,539. Rheostat. John C. Fyfe, Chicago, Ill., assignor of one-half to James Hayes, same place. Filed Apr. 27, 1894.

528,547. Electrically-Operated Elevators. Elias Marshall, Boston, Mass. Filed Jan. 20, 1894.

528,561. Trolley-Wire Clip. James W. Perry, Philadelphia, Pa., assignor to the Johns-Pratt Company, Hartford, Conn. Filed May 5, 1894.

528,564. Electrical Retoucher. Charles M. Savage, Warren, Pa. Filed Mar. 17, 1894.

528,566. Combined Municipal Telegraph and Telephone System. Harry M. Seitzinger, Wilkesbarre, Pa. Filed May 28, 1894.

528,586. Apparatus for Electro-deposition. Henry L. Bridgman, Blue Island, Ill. Filed Oct. 3, 1893.

528,587. Apparatus for Electro-deposition. Henry L. Bridgman, Blue Island, Ill. Filed Oct. 3, 1893.

528,589. Electric Burglar-Alarm. Wilmot A. Brownell, Boston Mass., and James B. Seager, Hancock, Mich. Filed Jan. 31, 1894.

528,590. Telephone-Exchange System. Wallace Childs, Fort Smith, Ark. Original application filed May 27, 1890. Divided and this application filed May 12, 1891.

528,591. Telegraphic and Telephonic Exchange System. Wallace Childs, Fort Smith, Ark. Filed May 27, 1890 Renewed Apr. 21, 1894.

528,592. Telephony. Frank R. Colvin, New York, N Y. Filed July 26, 1894.

528,608. Utilizing Electric Motors for Operating Machinery. Ernst Richter. Berlin, Germany, assignor to Siemens & Halske, same place. Filed May 31, 1893.

528,620. Electric Hoisting Machinery. Alton J. Shaw

Muskegon, Mich., assignor to the Shaw Electric Crane Company, same place. Filed June 25, 1894.

528,640. Telephone. William C. Lockwood and John M. Lockwood, Brooklyn, N. Y. Filed June 14, 1894.

528,642. Electric-Arc Lamp. Alfred H. Moses, Jr., New York, N. Y. Filed Jan. 8, 1894.

528,647. Storage-Battery. Charles J. Reed, Philadelphia, Pa., assignor to the Reed Electric Company, same place. Filed June 5, 1894.

528,648. Storage-Battery. Charles J. Reed, Philadelphia, Pa., assignor to the Reed Electric Company, same place. Filed June 8, 1894.

528,669. Galvanic Battery. Mortimer M. Hayden, New York, N. Y. Filed Feb. 21, 1894.

528,678. Electric Alarm-Clock. Michael McDonnell, New Bedford, Mass. Filed May 29, 1894.

528,684. Electric-Arc Lamp. Charles E. Ongley, New York, N. Y., assignor to George J. Schoetfel, same place. Filed Feb. 17, 1894.

528,685. Trolley-Catcher. Albert S. Osborn, Rochester, N. Y. Filed May 9, 1894.

528,740. Seondary Battery. Elias M. Poston, Springfield, Ohio. Filed Jan. 29, 1894.

528,766. Fender and Brake for Street-Cars. Jacob S. Detrick, Baltimore, Md. Filed Oct. 11, 1893.

528,767. Trolley Line Breaker. Charles H. Dey and Johan M. Anderson, Boston, Mass. Filed Feb. 16, 1894.

528,778. Electrical Transformer. Rudolph M. Hunter, Philadelphia, Pa., assignor to the Thomson-Houston Electric Company, of Connecticut. Filed Apr. 6, 1894.

528,788. Bond for Electric Railways. Henry B. Nichols and Frederick H. Lincoln, Philadelphia, Pa. Filed Sept. 20, 1894.

528,796. Motor for Street-Cars. Harvey S. Park, Chicago, Ill. Filed Dec. 5, 1893.

528,836. Means or Apparatus for Effecting and Controlling the Supply of Hydrocarbon to Hydrocarbon Motors. James E. Weyman and James A. Drake, Guilford, England. Filed Nov. 6, 1893. Patented in England Aug. 21, 1891, No. 14,133.

528,860. Brake for Railway-Cars. John R. Cribbs Verona, Pa. Filed Mar. 10, 1894.

528,867. Automatic Railway-Switch. Charles F. Duval, Boston, Mass. Filed Nov. 25, 1893.

528,870. Apparatus for Measuring Electricity. William Friese-Greene, London, England, assignor of one-half to Charles Brawn, same place. Filed Mar. 28, 1894. Patented in England Nov. 5, 1892, No. 19,959.

528,881. Electric Leak-Alarm. Charles C. Kahne, Andrew A. Adkins, Winfield S. Peirce, John E. Martin and George F. Kahne, Ashland, Ky. Filed July 6, 1894.

528,893. Rheostat. Alton J. Shaw, Muskegon, Mich. Filed Apr. 10, 1894.

528,894. Rheostat. Alton J. Shaw, Muskegon, Mich. Filed Apr. 10, 1894.

528,898. Railway Electric Switch. Walter V. Ash, and Joseph H. Ash, Newark, N. J., assignors of one-half to the Ash Automatic Electric Switch Company, of New Jersey. Filed July 5, 1894.

528,900. Electric Switch. Frank G. Bolles, Washington, D. C., assignor of one-third to Paul Eaton, same place. Filed Mar. 27, 1894.

528,907. Rheostat and Heater. Robert C. Mitchell, New York, assignor of one-half to Henry W. Vail, Brooklyn, N. Y. Filed Jan. 17, 1894.

528,911. Coin-operated Electric Apparatus. John Elfering, Cincinnati, Ohio. Filed Aug. 30, 1889. Renewed Apr. 7, 1890.

ELECTRICAL AGE

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CONTENTS.

THE BATE REFRIGERATING CASE.

The Bate refrigerating case, which has been referred to frequently in legal decisions in cases affecting the validity of certain electrical patents, is now before the United States Supreme Court. The question to be decided by the court is a most important one and whichever way it goes the interpretation of a provision in the patent laws, over which there has in late years existed an honest difference of opinion, will be settled for all time. The result will have a most important bearing on American inventions on which foreign patents have been obtained; and the life of some of the strongest electrical patents hinges on the settlement of this important question.

TROLLEY MAIL SERVICE.

In his annual report the second assistant Postmaster-General advocates the more extensive use of electric railways for the collection and distribution of United States mail in cities. In some of the largest cities trolley mail cars have been tried and found to render excellent service in the handling of mail matter. There can be no doubt of the value of such service, and the United States mail car on trolley lines will, before long, be as familiar objects as the ordinary cars are. Truly it may be said that the electric railway is one of the most potent agencies of modern times for promoting the welfare of the people.

THE INSTITUTE'S NEW HEAD-QUARTERS.

We think that every resident member of the American Institute of Electrical Engineers will admit the wisdom of the Council in removing the office down town to a more central location. Probably ninety per cent., at least, of such members have their business quarters down town, and many of these will be glad of the advantages offered by the convenience of the new headquarters. The Institute headquarters can now be put to a more useful purpose than was possible with them up-town. It is quite proper to continue the holding of the monthly meetings up-town, for at night the conditions, respecting convenience, are entirely reversed—most every one lives up-town. The association headquarters, under the new arrangements, will offer many of the advantages of a club house, and will be a neutral territory where all can meet on the level. We think it would be a wise move to add some club features at headquarters; these, however, should be incidental.

A GREAT PROBLEM.

Will sea-going steamers ever be propelled by electric power? This is a question that interests many, and occupies the thoughts of a considerable number of inventors at the present time. It is generally admitted that it is impossible to do this under present conditions, but, as Prof. Elihu Thomson stated a few months ago, new discoveries may be made that will completely revolutionize the present methods of accomplishing results. The only way that seems open for the successful use of electric power for the propulsion of ships is to obtain the current by the direct transformation of the energy contained in coal. At the present time, however, this much desired end seems to lie in the very remote future. Still, who will dare to say what the future will or will not develop? Mr. G. Emil Hesse has hopes of the ultimate solution of the great problem, and seeks, in a short article on another page, to prepare the minds of those interested for its coming. When it does come it will involve many present methods of doing things, and he indicates one direction in which inventors could profitably devote their attention with a view to the easy adjustment of the new conditions with one another.

THE DONALDSON-MACRAE ACCUMULATOR.

Frequent allusions have been made in the Electrical Age of late to the Donaldson-Macrae accumulator, and for the information of those whose attention has been attracted to the subject by these references we give below a description and several illustrations of these well-known batteries.

In the manufacture of storage batteries the tendency has been to decrease the thickness of the plates. The result of this necessarily involves, to considerable extent, the mechanical stability of the plates. The Donaldson-Macrae Company, however, make their plates on

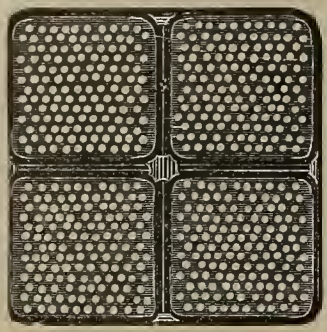


FIG. 1.

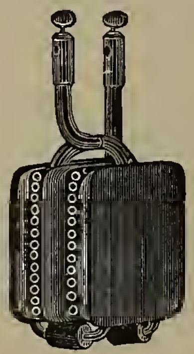


FIG. 2.

the reverse principle, which insures greater strength and durability. The elements are about one inch in thickness, and are made of chemically pure lead in the form of a punctured tray, the openings being filled with active material under a heavy pressure. Two filled trays are then placed face to face, with a thin sheet of lead between them, and the whole burned together in the form of a solid cake or section. The plates are separated by rubber rods, the ends of which are inserted in the perforations of the plates. By this method of construction and assembling a perfect circulation of the liquid is obtained, and the possibility of short circuiting entirely avoided, since the active material is held in place by the lead covering.

Elements can be made of any size and burned to-

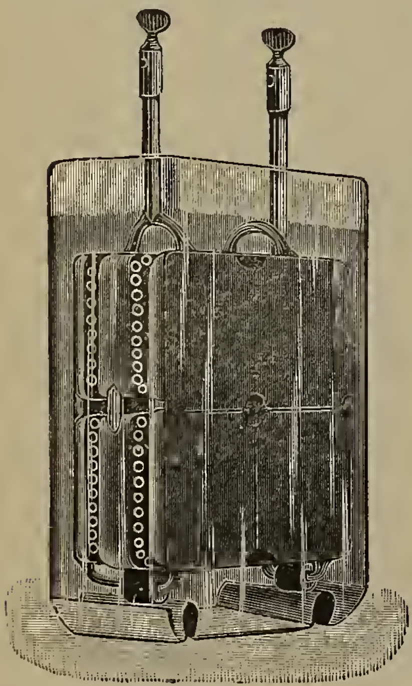


FIG. 3.

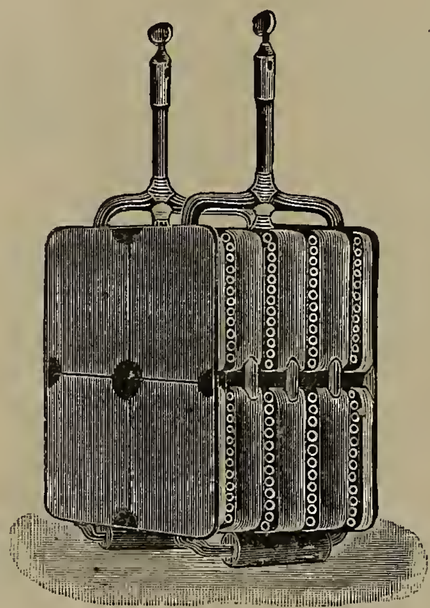


FIG. 4.

gether in any shape to suit the space they are to occupy.

This battery is not a new thing, but has withstood the test of considerable time with the most saticfactory results. The manufacturers claim that it cannot buckle and gives a larger output per pound of lead than any other storage battery made.

Fig. 1 represents four sections burned together forming one of the plates of the company's "D" type of cell.

Fig. 2 shows a "3 A" element, which is composed of two sections, the half negatives being on the outside, and fig. 3 represents type "3 D" element in a glass jar. The elements are composed of four complete sections for the positive plate, and the two outside plates, which are negatives, are made up of four half sections each.

The "5 D" element, which is made of sixteen sections, is shown in fig. 4, and fig. 5 gives a view of a Cautery battery designed for physicians' use, also for portable electric lighting and small motor work. The battery is provided with a regulating rheostat, and gives a current up to 25 or 30 amperes at four volts pressure. This battery is encased in a strong oak box, which is practically watertight. In ordinary use this battery will last two months or more before charging is necessary, depending, of course, on the amount of current taken from it.

The Donaldson-Macrae Electric Company, Baltimore, Md., is licensee of the Consolidated Electric Storage Company, of New York.

Among the users of Donaldson-Macrae accumulators are the Gray National Telautograph Company, of Chicago; Johns Hopkins University, Baltimore, Md.; University of Chicago; University of Nebraska, Columbia Phonograph Company and the American Gramophone Company. The Postal Telegraph-Cable Company, at

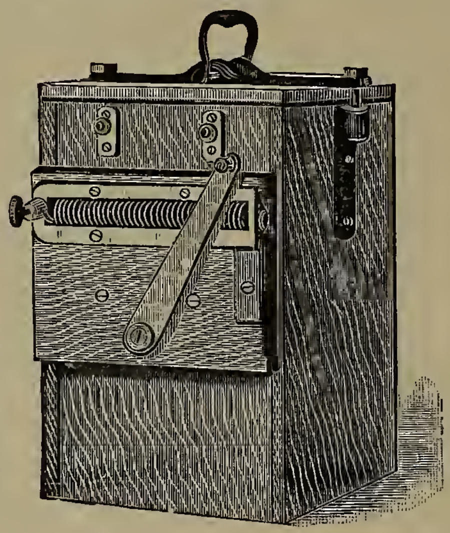


FIG. 5.

Baltimore, are using these batteries very extensively on their wires, and they and other concerns using them report very satisfactory results.

TROLLEY POSTAL SERVICE.

The report of the second Assistant Postmaster General, just made public in Washington, discusses the adaptability of the electric trolley system for the transportation of mails. It says:

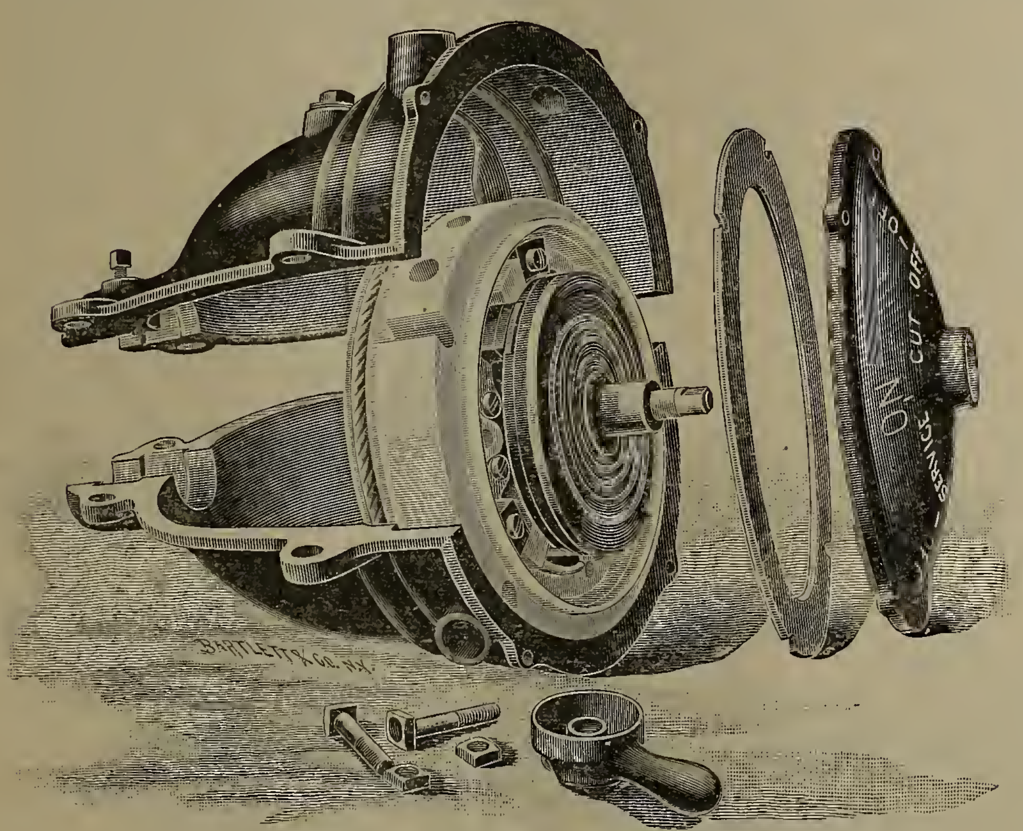
The electric car line is becoming each year a more important factor in mail transportation. Service is now in operation on forty-seven such lines at the rates fixed by law for the carriage of mails on steam roads. The routes thus far established are comparatively short, the longest being but eighteen miles in length. Consideration is now being given to the feasibility of utilizing electric and other rapid motor street car lines to facilitate the transportation of mails in the important cities between the main Post-Office and branch offices and to and from the railway stations. A plan of this kind would probably include the running of a special car over the several street lines for the exclusive use of the mail service, not only for carrying locked pouches, but in which a certain amount of distribution would be possible.

Aluminum Hawsers.—It is stated that the United States Navy Department is testing aluminum wire with a view to ascertaining its availability for hawsers.

JOHNSON-VAN VLECK SERVICE END CUT-OUT.

The accompanying illustrations show the improved service end cut-out of the Interior Conduit and Insulation Company, New York city. It is placed at the inlet of the three-wire system to buildings and is the point at which all the circuits for light and power are controlled.

In case of fire the cut-out is accessible to firemen. Its advantages over a triple break-down switch are apparent, as it is thoroughly waterproof. The switch is almost always placed in a location where there is more or less dampness.



JOHNSON-VAN VLECK CUT-OUT.

The construction, application and method of installing the cut-out are evident from an inspection of the illustrations. The piece of pipe enclosing three conductors embedded in insulating material, is a standard article of manufacture, as are the flexible conductors used within the iron case.

This cut-out is being generally called for in architects' specifications. It was devised by Mr. E. H. Johnson, president of the Interior Conduit and Insulation Co., in conjunction with Mr. J. H Van Vleck, electrician of the Edison Illuminating Co., New York.

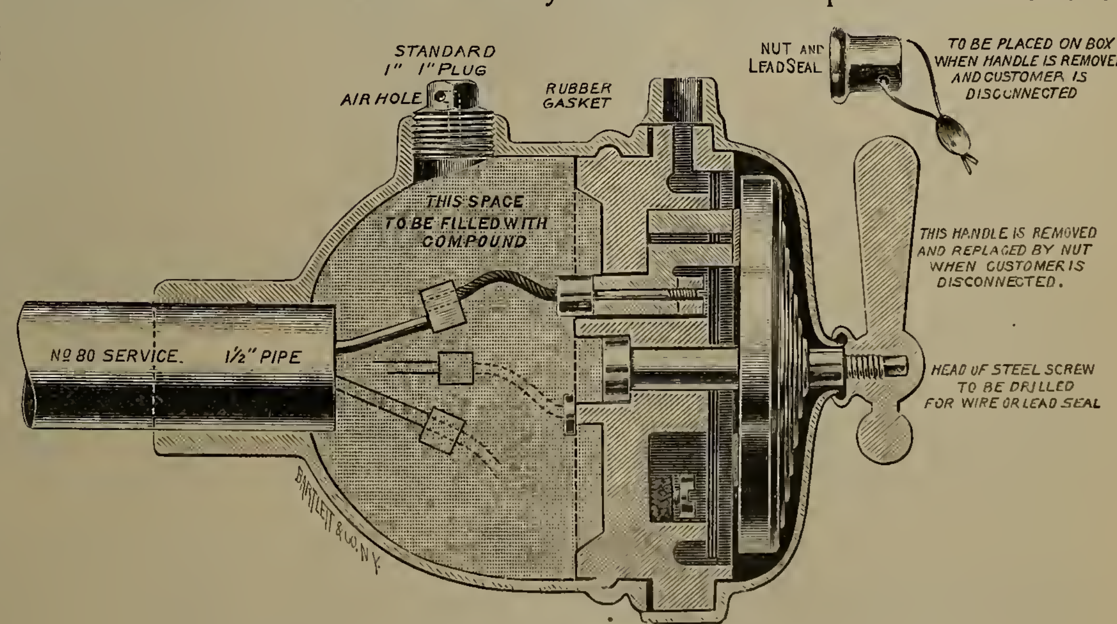
LEGAL.

The American Graphophone Company, Washington, D. C, has warned all users of the Edison phonograph against infringement.

The Western Electric Company has brought suit in Boston, against the Holtzer-Cabot Electric Company for alleged infringement of magneto call-bell patents. A similar suit has also been brought against the Harrison International Telephone Company, and it is said to be the purpose of the Western Electric Company to protect its interests as affected by these patents.

ELECTRIC RAILROADS IN THE SOUTH.

In a recent issue the *Manufacturers' Record*, of Baltimore, publishes an interesting article on the electric railroads in the South. The greatest wealth creator which this age or any other has ever known, it says, is rapid transit in the shape of electric or cable railways. Steam roads develop value and make prosperous sections that were non-progressive before their advent; manufacturers, taking raw material, turn it into finished product, thus creating new values; hence a manufacturing community is more prosperous and progressive than a trading or mercantile place. But the great wealth creator is the electric line. That is a product of the last five or six years. It is a new power in the business world—a power which is just beginning to be understood—a power which people generally do not yet fully comprehend, but the effect of which they are beginning to see. In the past the growth of cities has been hampered and restricted by the difficulty of travel from one part to another, resulting in an ever-increasing congestion of population. The business man as well as the day laborer is compelled to economize his time. He must live near his place of business, though the distance is measured more by the time consumed in going from the latter to his home than by the mileage. As cities grew population increased in density, spreading out from the central points only as forced by absolute demand for house room. Under these circumstances undeveloped or suburban real estate increased in value slowly. There were no means by which any development could be brought about in advance of the ordinary growths of the city. Merchants and manufacturers could, by hard work, great energy, able judgment, increase their wealth more rapidly than the wealth or population of their city increased, but the real-estate owner was not so fortunately situated. But rapid transit has revo-



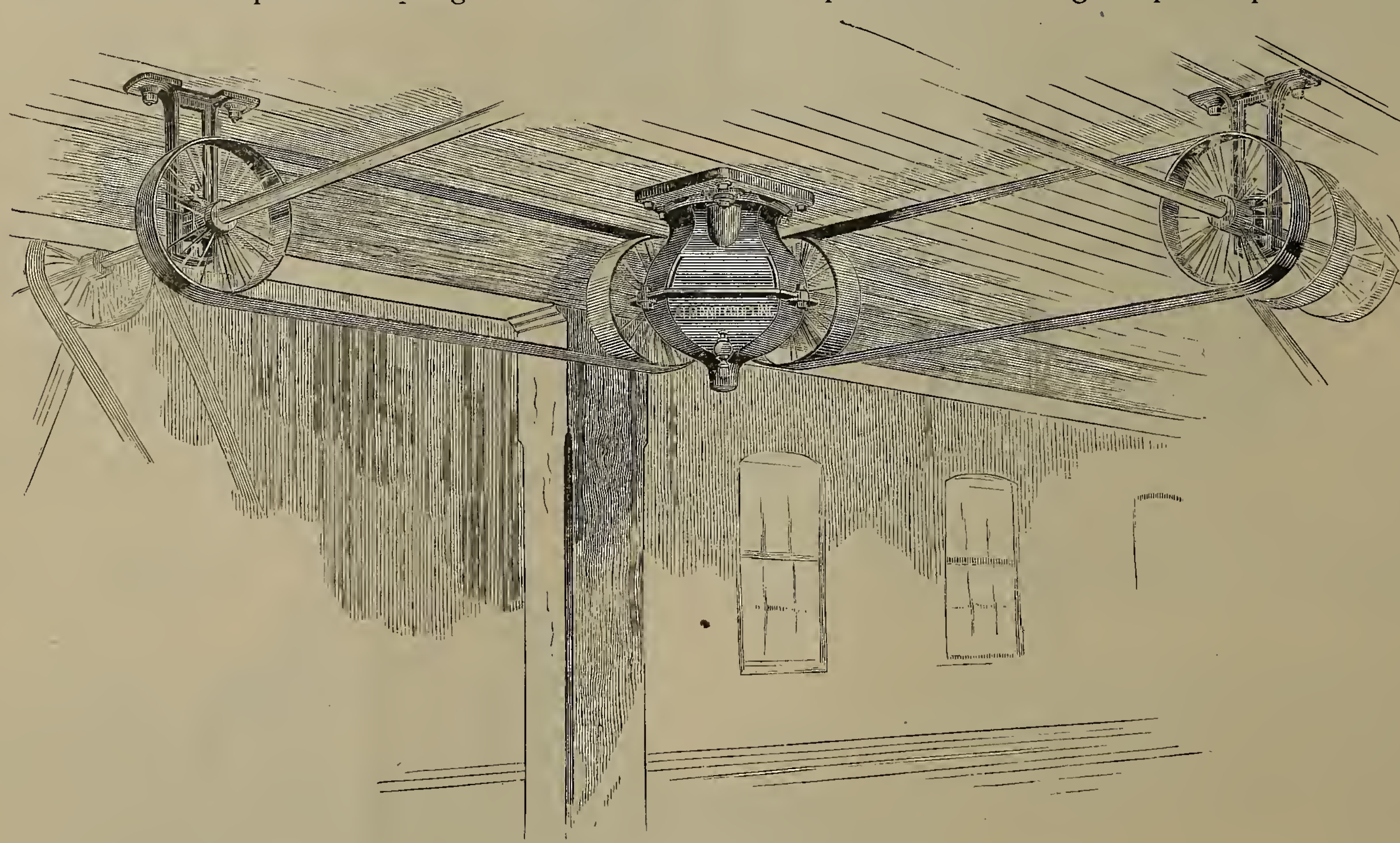
SECTIONAL VIEW OF JOHNSON-VAN VLECK CUT-OUT.

lutionized all this. It makes possible the spreading out of city growth; it enables a man to live four times as far from his business place as he could do under a horse-car system, and it enables him to get away from the polluted air and smoke and dirt of crowded streets, out where he can breathe fresh air untainted by city odors, where the smoke of factories and the dirt of streets that have been travelled for generations cannot mar the pleasures of life. Because of this, rapid transit creates va ues ; it makes what was farm property jump to city prices almost at a bound. The real-estate owner finds now that he can create wealth far more rapidly than the merchant or manufacturer could ever do. With an electric line touching his property and bringing it into quick communication with the centre of the city, he finds that his property is intrinsically worth more and immediately brings more per lot than it was worth per acre before. This value has been created. It is in no sense speculative or artificial. Conditions of city life changed when electricity propelled the first street car and a new era in urban development commenced.

Tables show that between January 1, 1893, and September 1, 1894, four hundred and thirty-nine miles of rapid-transit routes have been constructed in Southern cities and that 126 miles more are being constructed, or will be in a few months. When all the projected lines are completed, there will be a total mileage of electric and cable systems in the South of 1,611 miles.

RIGHT-ANGLE COUPLING FOR SHAFTS.

The problem of transmitting motion at right angles is at best a perplexing one, but Mr. T. R. Almond seems to have solved it in the patent coupling illustrated herewith. The illustration shows the coupling applied to ceiling countershafting. It is intended to be used in place of the quarter-turn belt and is positive in its motion.



ALMOND RIGHT-ANGLE COUPLING.

This coupling consumes less power than gears or the quarter-turn belt and takes care of itself, as regards lubrication, for several weeks, and is, besides, noiseless in operation. It has been thoroughly tested by many well-known manufacturing concerns during the past eight years and has given entire satisfaction.

The Almond coupling is made in three sizes, and any good machinist can hang it in position. It was awarded the John Scott Medal by the Franklin Institute, Philadelphia, in 1892

T. R. Almond, 83 and 85 Washington street, Brooklyn, N. Y., is the manufacturer of these couplings. In one factory as many as fourteen Almond couplings are in use.

THE BATE REFRIGERATING CASE BEFORE THE SUPREME COURT.

On November 15 argument was begun before the United States Supreme Court in the famous Bate refrigerating case.

This case is one of the most important that has been before the court for years, probably the most important in its history, in view of the vast extent and value of the interests that will be affected by the decision. The matter at issue is the construction of section 4,887, Revised Statues, relating to the life of a patent granted by the United States upon an invention for which a foreign government has also granted a patent, and the particular question to be decided is : Does the date of application for the patent or the date of issue of the patent in the United States determine whether or not the term of the patent is to be limited by the term of the foreign patent.

The Bate Company brought suit for infringement of its patent against Schwarzchild & Sulzberger in the Southern District of New York, and the bill was there dismissed upon defendants' plea that a patent had been issued in England upon the same invention between the dates of the application for and issue of the patents in the United States, and that therefore the latter patent had expired with the English patent prior to the bringing of the suit. The case went to the Court of Appeals, and that court has asked the Supreme Court of the United States to instruct it upon the question, in effect, "when did or when does the patent granted Bate in the United States expire?" The decision of the court will affect the life of many important and valuable patents, notably in connection with the telephone and electric lighting, and the case is being closely watched by the attorneys of the companies interested.

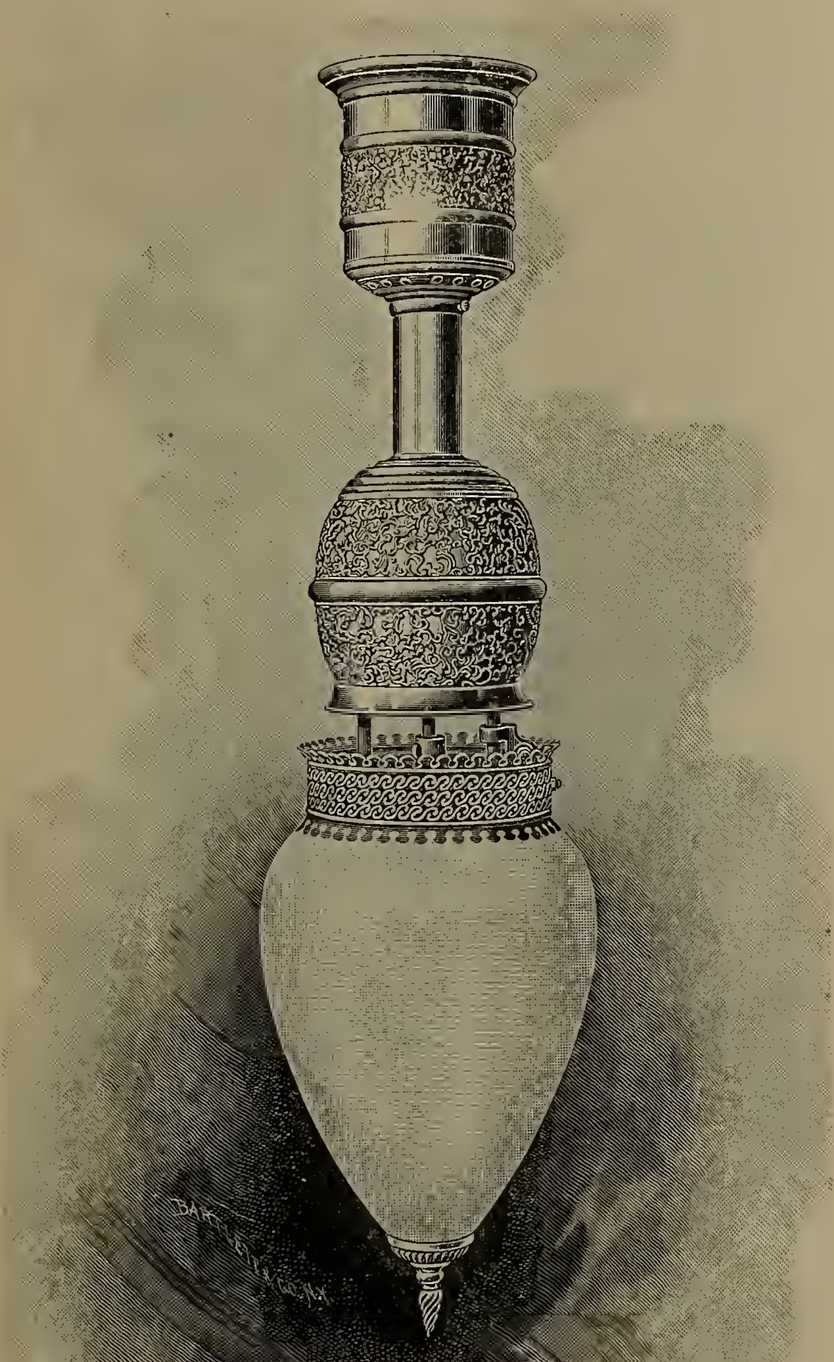
A GREAT TRUTH.—"If cable cars cannot go faster than the cable," said a little boy, reflectively, after his father had explained to him the different systems of propelling street cars, "I suppose electric cars cannot go any faster than the electricity."

DIRECT-CURRENT ARC LAMP.

The beautiful design of the lamp illustrated herewith is the first thing to attract attention. These lamps are made for use on direct-current circuits of any pressure above 60 volts, and are either single or "twin." In the mechanism of these lamps there are no dash-pots or clock-work to cause trouble; indeed, the works are so simple and consist of so few parts that there is little possibility of derangement.

The fact that thousands of lamps of the Electrical Construction and Supply Company's make are in daily use is positive proof that they possess merit.

For in-door use the ornamental arc lamps are of the most artistic design, the one shown in our illustration



DIRECT CURRENT ARC LAMP.

being one of the latest patterns. The company classes its lamps under the general heads, "plain" and "ornamental," the selection of either, of course, being determined mainly by the character of the surroundings amid which the lamps are to be placed.

In order to get the best of satisfaction from these lamps it is only necessary to keep the carbon racks clean; that a good quality of carbon be used and that a steady voltage be maintained. Under these conditions absolute satisfaction is positively guaranteed by the company.

The ornamental lamps are made in various designs and finish, the variety being almost as great as differences of taste. All the lamps made by this company burn economically and with remarkable steadiness, giving a soft, pure light. They are giving such satisfaction in practical use that the demand for them is rapidly increasing. Although there are so many tastes to suit, the Electrical Construction and Supply Company has the facilities available to produce lamps of any design on short notice. The standard lamps are made in a large variety of designs, samples of some of which can be seen in practical operation in the company's offices, 18 Cortlandt street, New York city.

ELECTRIC POWER ON SHIPS.

BY G. EMIL HESSE.

Electric power has been introduced in almost every branch of industry, and will, undoubtedly, in a few years occupy an even more important position. If it does not supersede steam it will at least considerably reduce the number of new steam plants.

There are certain places where the adoption of electricity as power on a large scale is out of the question—on board of large vessels, for instance. The reason for this is that we have not been able to produce the electric current direct in an economical manner, but as soon as this is accomplished it is certain that experiments on shipboard will be undertaken. What the result of such introduction would be on the world's commerce can only be conjectured, but the first effects will be a lowering of freight and passenger rates, both of which are factors of the utmost importance in the furthering of civilization and the extension of comfort and prosperity to all countries.

The steamship and the locomotive are probably the greatest levers of our present prosperity and higher education—greater than many other influences that claim the same distinction.

The application of electric power on land is easy of accomplishment, but at sea the case is quite different, mainly from the fact that the compass is affected when a strong electric current is present anywhere on board. Every electrical engineer who has installed an electric plant in a steamship appreciates the difficulties as they exist at the present time; and what will be the effect when 10 000 kilowatts or more have to be produced can easily be imagined. However, since so many difficulties have been overcome in the electrical field in the past, there is hardly any doubt that this problem will also be solved when the time is ripe.

No doubt it will be a very difficult problem, and the object of this article is to set inventors to thinking in this direction. I have personally found it very useful when a difficult problem is to be solved, to keep it in mind, without constantly thinking about it, which is necessary when one has to sit down and design or work out a similar task. It always takes time for fruit to ripen, and what is invention but the fruit of the brain?

ACCUMULATOR DECISION AFFIRMED.

A decision was rendered on November 15 in the U. S. Court of Appeals for the Second Circuit in the case of the Accumulator Company vs. The Electric Illuminating Co and The Electric Storage Battery Co., by Judge Wallace, affirming the decison of Judge Lacombe enjoining the Edison Electric Illuminating Company of New York from using the chloride battery, for the reason that it is an infringement of the Swan-Reissue patent.

ELECTRICITY ON SHIPBOARD.*

ITS PRESENT POSITION AND FUTURE DEVELOPMENT.

BY S. DANA GREENE.

On shipboard electricity has at last been recognized as the proper agency for lighting, and apparatus and methods of installation have been so improved and standardized that the electric ship plant can now be relied upon for continuous and economical service. Beyond this, it cannot be said that electricity has been introduced to any considerable extent in marine installations, although the future gives promise of many new applications. Inasmuch, however, as practically all other applications aboard ship are dependent upon the *lighting plant*, it is natural that the best engineering skill has been occupied in perfecting the latter. As a result there have been developed for marine work a special type of generating set (engine and dynamo), special appliances (switches, junction boxes, cut-outs, stuffing tubes, water-tight globes and lanterns, etc), special insulation for conductors, special methods of wiring, special forms of search lights, and special men who may properly be called "Marine Electricians." These apparatus and appliances differ materially from those in use on shore, and must be used under service conditions entirely dissimilar. Salt water, salt air, steam and the excessive heat of ship boiler and engine rooms, would play havoc in a very short time with the best modern shore installation.

It is wise for the Naval Architect in designing and installing a marine electric plant, whether it is for a man-of-war, merchantman, or yacht, to see that the material is ordered from manufacturers who have made a specialty of marine apparatus and to have it installed by practical marine electricians, who beside knowing something about electricity, know what a ship is and what the conditions are at sea. Finally, the plant should be put in charge of good practical dynamo-tenders, by which is meant men who are familiar with both steam and electrical machinery and their fittings.

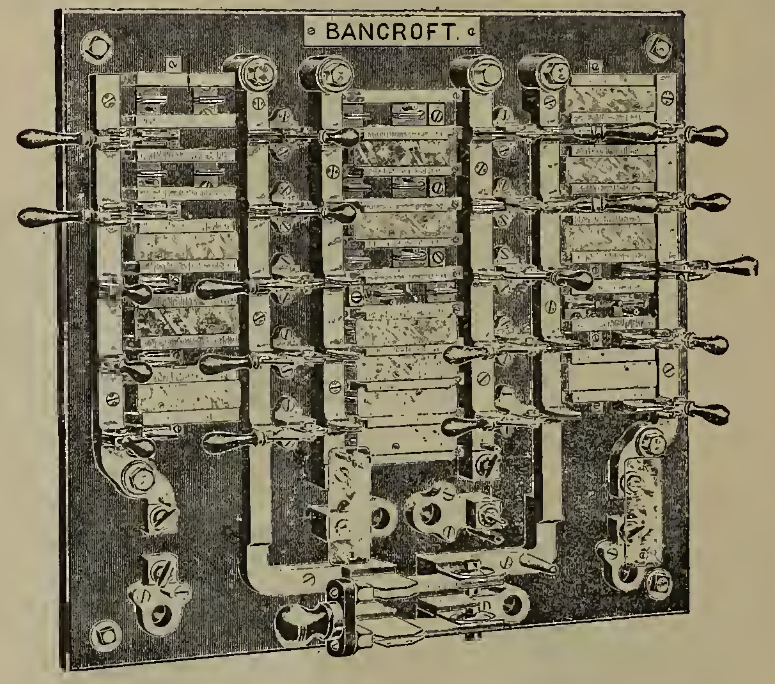
On war vessels the plant is properly considered as one of the vitals of the ship, and is always located below the protective deck, in a compartment by itself, near the boilers and as near the centre of the ship as possible. The nearer the plant is to the centre of the vessel, the less will be the cost of copper in the distributing circuits. With the earlier types of apparatus, care had to be exercised to locate the plant at a sufficient distance from the compasses, to prevent the influence of the magnetic field of the dynamo on the magnetic needle. The modern dynamo, however, with its closed magnetic circuit has no appreciable influence on a compass needle at a distance of 15 feet.

Engine and dynamo should always be direct coupled. The best practice is to provide a fixed coupling, readily accessible, between dynamo and engine. A reserve capacity should always be provided, if space allows. In the Navy, the present practice seems to provide a reserve of from 25% to 33⅓% of the full load duty of the plant, a separate unit furnishing the reserve. Thus, the full load service of the "New York" requires about 85 H. P. dynamo capacity, which is supplied by two (2) units, while a third, of 21 H. P., furnishes the reserve.

Engines should be of the open type, compact and strong, with rigid frames, large bearing surfaces and liberal clearance in the cylinders. Vertical engines occupy much less deck space than horizontal and are better adapted for ship service. Vertical engines, whether simple or compound, should have two cranks, to insure smooth and quiet operation. With the present size of marine plants, the consumption of steam is so small, as compared with the total amount used for other purposes, that it has not been thought necessary or advisable to complicate the plant by introducing compound engines; but as the users of electricity increase in number and variety (thus necessitating larger generating plants) it will probably be found economical to introduce the compound type. It is frequently used abroad at the present time.

The multipolar type of dynamo should be used, since it permits of slow armature speed, less weight, greater compactness and closed magnetic circuit. With the four-pole type, only two brushes are necessary, and this is a distinct advantage. The commutators (of bronze or hardened copper) should have ample bearing service and deep bars (1″ to 1½″), so as to admit of considerable wear without replacement.

Dynamos should be compound wound (insuring automatic regulation of the electromotive force with change of load), and should be provided with a field rheostat to compensate for the change in the resistance of the field winding, when hot or cold. Armature and fields should be most carefully insulated, and the insulation resistance of both should be carefully tested before the plant is accepted; it should not be less than one megohm. The maxmium rise in temperature above the surrounding air (measured immediately after a full load test of not less than four hours) allowed in any part of the dynamo must be small, for high internal heat is certain to impair or ruin the insulation in time, and then the plant is useless without extensive repairs. The naval specifications are very rigid in this respect, the maximum temperature rise being only 50° F. This makes the dynamos expensive, and a limit of 60° to 70° F. can be allowed with reasonable safety in the merchant marine, unless the location of plant is particularly unfavorable as to temperature and ventilation.



STANDARD SWITCHBOARD FOR NAVAL SHIPS.

Dynamos and engines should always be tested together, as a complete unit. The full load efficiency of the unit, as measured by the ratio

$$\frac{\text{Electrical Horse Power at dynamo terminals}}{\text{Indicated Horse Power of engine}}$$

should be not less than 80°; with the best types of marine sets it runs as high as 83% to 85%. This applies to a unit with simple engine.

The switchboard is an important accessory of the dynamo room and, in common with all other appli-

* Abstract of paper read at general meeting of the Society of Naval Architects and Marine Engineers, held in New York, November 15 and 16, 1894.

ances and devices used aboard ship, should be made of non-combustible material The body of the board should consist of slate or marble, and no wood is permissible in its construction. The instruments and connections on the board should be accessible and compactly arranged, and the positive and negative connections should be symmetrical. Any dynamo should be able to operate on any circuit, either single or in multiple with the other dynamos. Switches for different dynamos and circuits should be plainly marked, so that the operator cannot make a mistake in their manipulation.

The wiring of the vessel is the most difficult and expensive, as well as the most important part of the installation. With the wiring installed many of the circuits are very inaccessible, and should a fault occur it is difficult to locate and still more difficult and expensive to remedy. It is imperative, therefore, that only the very best material and skilled labor obtainable should be employed. Probably the best example of the highest grade wiring to be found is in our own naval ves-

STANDARD NAVAL FITTINGS.

sels, and the specifications of the navy department are very rigid and complete. The wiring should be divided in separate circuits, lights which are located in the same parts of the ship, and which are ordinarily used at the same time, being grouped on the same circuit. These several circuits are then carried back to the switchboard in the dynamo room, where they are so connected that they can be independently controlled. The number of these circuits depends entirely on the size of the vessel and the number of lights required. In large vessels the expense of running each circuit back to the switchboard becomes very heavy, and to reduce this "Feeders" are led to certain predetermined "centres of distribution," where they are connected by means of suitable junction boxes to the circuit mains, which in turn light a certain section of the ship. In our naval vessels circuits are classed as "battle circuits," including the lights needed in action, and "lighting circuits," which include the lights for ordinary illumination. At general quarters all lights on the lighting circuits are at once cut off at the dynamo room switchboard. In a merchant vessel lights in the engine and firerooms, cargo spaces, storerooms and quarters should be on separate circuits, the subdivision of circuits being varied to suit individual vessels. On all exposed decks, and in boiler and engine rooms, cargo spaces, storerooms and passengers' steerage, standard navy watertight mouldings and fittings (junction boxes, switches, etc.,) should be used. In the quarters of officers and cabin passengers, standard non-combustible fittings, such as are used on shore can be safely used.

The electro-motive force of all U. S. naval plans its 80 volts. This standard has been adopted in order to permit the use of search lights and incandescent lamps on the same dynamos without the interposition of too much dead resistance in the search-light circuit; and as the search lights are an important part of the military equipment of a naval vessel, the adoption of a non-commercial voltage for the plant may be justified. But in merchant vessels no such important reason exists, and the voltage should range from 100 to 120 volts, so that commercial incandescent lamps can be used.

All wiring fittings and fixtures should be of bronze, or composition with bronze finish, no iron being used.

The use of the electric motor is probably the most important development to be looked for aboard ship.

The advantages of the electric motor are now too well known to need repetition and with the improvement that has been made during the past two years in their durability and adaptability for special applications, there are many places aboard ship where they can replace the auxiliary steam engines with a saving of expense in first cost and operation and in space and weight. For military purposes, they can be used to advantage.

1. For ammunition hoists.
2. For handling the turrets of battle ships and monitors and also the heavy guns in these turrets.
3. For torpedo discharge apparatus.

Foreign navies have adopted electric motors for gun, turret and hoist work quite extensively, and a number of ammunition hoists have recently been ordered for our own ships; while the turrets of the new battle ships will, in all probability, be operated entirely by electric motors.

For general purposes electric motors can be used to advantage for—

1. Ventilating blowers.
2. Portable drills.
3. Portable pumps
4. Operating machinery in engineer's machine shop.
5. Deck hoists, which are located at some distance from the boilers.
6. Operating valve of steam steering engine, and thus doing away with the long and awkward mechanical connection between steering wheel and rudder.
7. Opening and closing of water-tight doors.
8. Driving ice machinery.

Such a general introduction of electric motors as here recommended necessitates an increase in the capacity of the generating plant of from 30 to 60-H. P. (the heavy turret turning machinery having its own plant), depending upon the number of motors used, but this increase can be provided for in the existing dynamo rooms of all larger vessels, and the advantages derived warrant the additional expense. A modern vessel is filled with steam and exhaust pipes running to the auxiliary engines; where they pass through living spaces they are a great discomfort; they are in constant need of repairs, and they are a menace to life in case of accidental bursting or breaking. Electric wires take up much less room, do not easily get out of order, and do not injure any one if they do get out of order. The electric motor is cleaner, quieter, lighter and more compact than any other form of motor.

PRINCIPLES OF DYNAMO DESIGN.

BY NEWTON HARRISON, E. E.

(*Continued from Page 272.*)

At the different areas per watt thus given as the best surfaces for radiation a series of diagrams may be constructed showing the relative depths of winding with such conditions imposed.

If a definite area at the core be arrived at as the best to prevent overheating of the inner layers, the calculation of the outer surface of the coil gives at once the depth to which the coil must be wound for a definite temperature rise,

at $1\frac{1}{2}$ sq. inches per watt at the core
and $2\frac{1}{2}$ " " at the

outer surface, the depth of winding will then bear a certain fixed ratio to the diameter of the core, if such a rule be adhered to.

By a simple formula

$$C : C' = D : D'$$

when the circumference and diameter of two coils are compared. But if a core be considered with respect to the outer surface of radiation as the above, both core and winding being of the same length, the ratio of their outer areas is the ratio of their respective diameters. Therefore as $1\frac{1}{2} : 2\frac{1}{2} = 3 : 5$, the diameter of the core to the outer surface of the coil bears the ratio of $3 : 5$. A table can be constructed giving these quantities in a tabulated form, as follows:

TABLE.

Per Watt.

F° at Core.	Core Surface.	Ratio of depth of winding to core diam.	Outer Coil Surface.	F° at Surface.	Ratio of core surface to coil surface.
90°	2.5 sq. in.	$\frac{1}{5}$	3.5 sq. in.	64°	5 : 7
112°.5	2 0 "	$\frac{1}{4}$	3 "	75°	2 : 3
150°	1.5 "	$\frac{1}{3}$	2 5 "	90°	3 : 5
225°	1.0 "	$\frac{1}{2}$	2.0 "	112°	1 : 2
450°	.5 "	$\frac{3}{2}$	2.0 "	112°	1 : 4

Upon the basis of 225° Fahr. rise in temperature per watt for each square inch allowed for radiation.

These figures may appear high for practice, but if the insulation between core and winding be somewhat thick, acting as a non-conductor to heat, and fibre or rubber flanges be used, then the accumulated heat will only escape from the outer surface at the above temperatures.

The temperature at the core may rise to even a higher point than that given in the table because of the rate of emission being less. The proper area must therefore be allowed or a dangerous rise will be inevitable. The more nearly the core diameter approaches the coil diameter, the less becomes the heating at the core and the more it tends to become uniform throughout the coil.

If the rule adopted be that three square inches of coil surface be allowed per watt of heat and two square inches at the core for the same purpose, then the depth of winding becomes by such a proportion one-quarter of the diameter of the core and the rise in temperature 75° Fahr.

With the $3 : 5$ ratio and 90° rise the depth of winding would be one-third of the diameter of the core, and with the $1 : 2$ ratio and 112° rise the depth of coil is one-half of the core diameter. It is common practice to use the $3 : 5$ ratio, though the fact was neglected that a proportion between the surface and heat energy must be observed. This disregard led to the construction of coils magnetically correct but exceedingly wasteful and inefficient.

It was deemed at one time sufficient to wind to a certain depth (a percentage of the core diameter), to obtain a certain magnetic output, and allow the heat question to take care of itself.

Wire insulation becomes gradually charred if persistently exposed to a moderately high temperature, which ultimately causes the ruination of the coil. It is therefore highly advisable to design the magnet coils so as to have copper sufficient for the distribution of the heat, otherwise the introduction of a machine with scanty field winding to the hot engine room may mean a great increase in the resistance of the coils, therefore a weaker field and lower voltage; so that, even though the immediate question be ignored, other disastrous results follow from a neglect of it.

It must be understood that in cases where the specific induction is low, the winding is less, and the depth of winding very much below the average; this would mean an increased surface for fewer watts and therefore less heating. Special cases arise in which, due to the limited coil space, a lower induction must be adopted. There is a great likelihood of magnetic unstability resulting from this practice; by an examination of the magnetization curve it may be seen that below 15,000 per sq. cm. such a likelihood exists as fluctuations or drop in E. M. F. of the armature may by merely a few volts difference cause a great change in the ampere turns and therefore in the resulting field.

The gradual recognition of the fact that increased coil surface reduced the copper which would otherwise be required, incited many manufacturers to increase the cross-section of the cores while keeping the specific induction constant; it being well-known that ampere turns are only considered per unit length with respect to the induction per unit area. The increased *length* of the ampere turn, the actual number being the same, supplies the magnetizing force for the additional iron area, but at the same time gives more radiating surface for the emission of heat.

S. P. Thompson gives a formula

$$X = a\,l\sqrt{D}$$

in which X = ampere turns,
l = length wire in inches,
D = depth of winding in inches,
a = constant having the values according to the diameter of the wire, as follows:

Diam. in mils.	*a*
40	522
120	542
200	570

that constant being dependent upon the size and insulation of the wire.

(*To be continued.*)

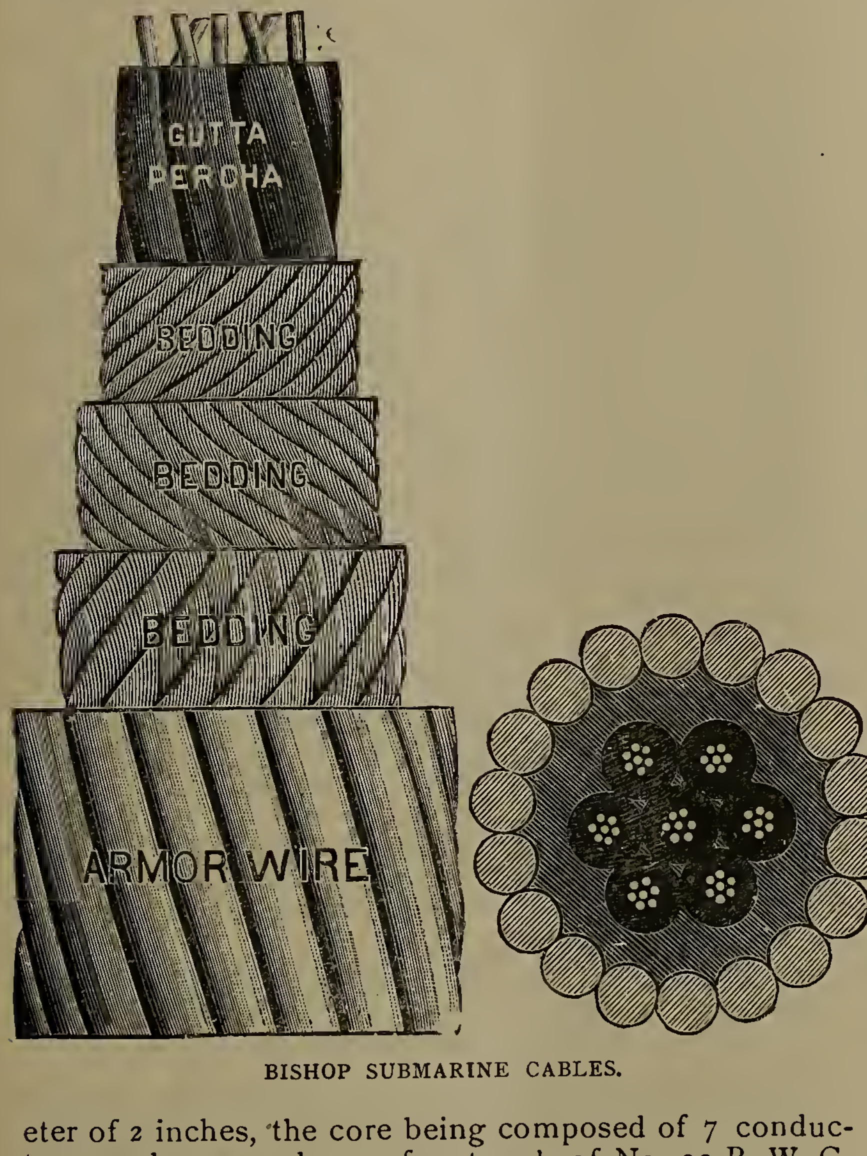
ALUMINUM BULLETS. — Mr. Charpentier Page made some experiments in France with aluminum bullets. He states they are preferable to lead bullets for quelling riots. They are no less effective at short range and lose much of their force at a distance of 150 yards. At 200 yards their force is entirely spent. Hence, it is argued, there would be less risk of killing innocent persons.

LARGE SUBMARINE CABLES.

Submarine cables of American manufacture are now generally recognized as equal in every respect to those of the best English make.

Among the American cable manufacturers none is better known than the Bishop Gutta Percha Company, 420–426 East 25th street, New York city. This company has the best of facilities for the manufacture of cables of any size and length, and has a good deal of the patronage of the United States government besides that of the largest private electrical concerns.

One of the most recent shipments of submarine cable was one of 3,000 teet in length to Algiers, La., for the Western Union Telegraph service at that point. It has a diameter of 2 inches, the core being composed of 7 conductors, each one made up of 7 strands of No. 22 B. W. G. copper wire, covered with Bishop's new rubber compound to 8/32 inches diameter, taped to 9/32 inches. Then seven of these conductors are stranded together, taped and jutted, and on top of this comes a protective armor of 18 No. 4 galvanized iron wires. This cable is similar to the celebrated Hooper's core cables; possesses the highest insulating qualities and stands warm climates better than gutta percha.



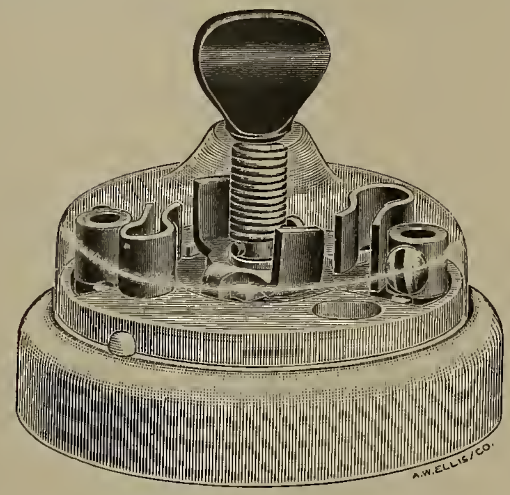
BISHOP SUBMARINE CABLES.

The Bishop Company's works are now running at the fullest capacity, and among the contracts in process of fulfilment are two similar cables for the Western Union Telegraph Company. They are also manufacturing six miles of single-conductor armored cable to be used in electrically lighting ten buoys off Sandy Hook. Six buoys are already in place and four more are to be added to render night navigation easier. The lights on these buoys are to be fed by alternating current, and the armor of the cable, which is to be used as the return, is composed of 18 No. 10 hard-drawn copper wires.

This cable was designed by Mr. Reed, manager of the Bishop Company, and if successful will be the first submarine cable to utilize the alternating current for heavy work.

NEW IONA SNAP SWITCH.

The new Iona snap switch herewith illustrated consists of the necessary number of contact springs (two in the single pole), somewhat in form like cotter pins, but shorter; one end being stationary and the other loose, the latter making the connecting points. This spring is punched out into a long strip with a piece attached to one side and end, which finally forms the base of the screw post upon which the post is mounted, and also the means of attaching the whole to the base. The spring made in this form is strong, also elastic, and makes a good, firm contact point.



IONA SNAP SWITCH.

The operating mechanism consists of a ratchet permanently attached to the base, a round disk, having a shaft hole off centre, with a projecting finger which stands against the ratchet teeth, a shaft carrying a small eccentric disk, fitted into the shaft hole in a large, round disk carrying the projecting finger, above which is the connecting bar, held down by a spiral spring, and in position by a second projecting finger of the disk coming up through a hole in its surface.

The spiral spring mentioned is attached permanently to the top of the shaft, its loose and lower end lying normally against a third finger on the round disk, and exerting sufficient pressure to hold the lower projecting finger of the round disk firmly against one of the ratchet teeth. In operating, the small eccentric disk throws the large, round disk outward, until the lower projecting finger is released from the ratchet tooth against which it has been resting, when the spring, that in the meantime has been creating a greater pressure on the round disk through the turning of the handle, tending to wind it up, throws the contact bar forward and makes or breaks circuit as the case may be.

The movement is quick and positive; the break is long and the contact large. All the parts are strong and made for wear. The spring is of special steel wire. The desire has been to overcome in it the faults to be found with most of the switches now on the market.

Another good point is that the position of the handles show whether current is on or off.

This switch has just been brought out by J. Jones & Son, 67 Cortlandt street, New York, agents of the Iona Manufacturing Co.

SUBWAY MANHOLES BLOW UP.

On the afternoon of November 14, three manholes over the subways of the Municipal Electric Light Company, Williamsburgh, N. Y., blew up with a loud report, injuring several persons. The shock was so great that many people in the vicinity thought it was caused by an earthquake, and many panes of glass were broken. A trolley wire broke and the end which fell into the street caused the ignition of gas which, it is supposed, filled the subways.

AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS.

The next meeting of the Institute will be held at 12 West 31st street, at 8 P. M., November 21. A paper will be presented by Prof. Geo. D. Shepardson, University of Minnesota, Minneapolis, entitled "Suggestions for an Index of Engineering Literature." An opportunity will also be offered for the discussion of the paper read by title at Philadelphia, by Mr. Charles P. Steinmetz, of Schenectady, and Dr. Frederick Bedell, of Ithaca, on "Reactance, and Its Definition." A meeting of Western members will be held on the same evening at Armour Institute, 33rd street and Armour avenue, Chicago.

NEW YORK ELECTRICAL SOCIETY.

The 163rd Meeting of the New York Electrical Society will be held at Columbia College, on Tuesday, November 27, at 8 P. M., when a most interesting lecture will be delivered on the subject of "Direct Current Motor and Dynamo Design," by Mr. Gano S. Dunn, electrical engineer of the Crocker-Wheeler Electric Company.

Among other points in this lecture, special reference will be made to rating and its effect on design; the newest forms of winding; such as two-circuit, double, etc.; sparking and armature reaction. A method of making the increase of potential in a compound-wound generator proportional to its load will be described, and many other hints and suggestions will be given, of the utmost value to students and young electricians.

NEW OFFICE OF THE AMERICAN INSTITUTE OF ELECRICAL ENGINEERS.

The office of the American Institute of Electrical Engineers, which has been at 12 West 31st street since May, 1890, has been removed to Rooms 1009 and 1010, Havemeyer Building, 26 Cortlandt street (10th floor), New York city.

This change has been decided upon by council after careful consideration during the past three months by a committee composed of Mr. James Hamblet, chairman; Prof. F. B. Crocker and Mr. H. A. Foster. The inconvenience of the uptown location has long been apparent to officers and members in the city, as well as visitors from a distance.

The choice of the Havemeyer Building was due to its central location in the electrical district, and its convenience to various lines of travel.

The Institute meetings will be held at 12 West 31st street, as heretofore, until further notice.

The office will be open from 9 A. M. to 5 P. M. It is equipped with a long-distance telephone and district messenger service. Over 100 electrical, mechanical and engineering periodicals will be found on file. The rooms front west and command a fine view of the Hudson River. Members visiting this city will find the rooms as convenient for their accommodation as were those at the World's Fair.

INCREASING BELL TELEPHONE CAPITAL.

The stockholders of the Bell Telephone Company, Boston, on November 15, voted to increase the capital stock of the company from $20 000,000 to $25,000,000. This action is in accordance with the bill recently passed by the Massachusetts legislature.

ENCOURAGEMENT TO SCIENTIFIC INVESTIGATION.

By the will of Robert Stanton Avery, who died in Washington recently, the Smithsonian Institution comes into possession of over $114,000, the income of which the testator directs shall be applied to the publication of "Lectures and Treatises Upon and Concerning Those Mechanical Laws Governing Etherial Mediums." He also suggests that prizes be given for essays on the phenomena of electricity, magnetism, light and heat.

NEW YORK NOTES.

Office of the Electrical Age,
World Building, New York,
November 19, 1894.

The Edison Electric Illuminating Co., of New York, reports gross earnings for October of $122,723, an increase of $18,375 as compared with the same month of last year, and net $60,527, an increase of $4,723. For the ten months ending October 31, the gross earnings were $1,090,112, an increase of $133,444 as compared with the corresponding period of last year, and net $563,491, an increase of $122,367.

At a meeting of the trustees of the Brooklyn Bridge, on November 15, it was decided not to carry out the proposed auxiliary storage battery system for lighting the bridge cars. Chief Engineer Martin reported that the new system, which is now being introduced, will serve the purpose.

Mr. A. H. Pease, of the Hart & Hegeman Co., Hartford, Ct., was in town last week.

Mr. F. M. Hawkins, agent of the Electrical Engineering and Supply Co., Syracuse, N. Y., has opened offices at 136 Liberty street, room 315, city.

J. P. Hall, electrical engineer and contractor, 143 Liberty street, city, has just begun the construction of an electric light plant on Ward's Island. Over sixteen hundred 16-c. p lamps will be used, for which current will be generated by four Edison dynamos. For the installation, Grimshaw wires will be used. Mr. Hall has recently completed several large contracts.

The Oakman Electric Co., 136 Liberty street, city, are pushing the New England safety switch to the front, also McNutt miniature decorative lamps, for holiday use. Two new and important additions to their long list of specialties are the Medbury overhead insulation and the Imperial insulating paint. This company feels assured of a good winter's business, judging from the manner in which orders are now coming in.

The Bishop Gutta Percha Company, of 420 E. 25th street, has been awarded the contract to supply the Weather Bureau, Washington, with wire, braided and with Okonite insulation.

W. R. Brixey, of 203 Broadway, has been awarded the contract to supply the Weather Bureau, Washington, with Kerite tape, copper wire and cables of various sizes.

W. T. H.

Increasing Business.—The Columbus Street Railroad reports gross earnings for October of $49,086, an increase of $4,032 as compared with the same month last year, and net $25,123, an increase of $5,384. For the ten months ending October 31, the gross earnings were $470,253, an increase of $18,642 as compared with the corresponding period of last year, and net $248,509, an increase of $77,750.

THE BEST METHOD OF TREATING ACCIDENTS.*

BY P. M. DYER.

Among the subjects coming to the attention of the general manager none is more replete with perplexity and difficulties than the disposition of personal injury claims. Expense of operation can be approximated; cost of construction estimated by the engineer or architect, but when and where accidents will happen, and what they will cost the company, can never be predicted. By the aid of modern inventions the cost of operation has been lessened; but this gain is threatened by the additional expense incident to the increased number of accidents on street railroads operated in the crowded thoroughfares of our large cities.

It is my purpose to explain to you in what manner the North and West Chicago Street Railway Companies attend to personal injury cases, commencing with the accident and following the theme to the final disposition of the claim. These two corporations carried 167,000,000 passengers during the year ending December 31, 1893, and upon the claim department devolves the duty of investigating all accidents and the making of settlements, or preparation of the defence, in all claims that spring from this great traffic. One claim department does this work for both roads.

The working force consists of a medical staff and a sufficient number of investigators, all under the direction of the chief adjuster, who reports to the general counsel of the two companies. For the purpose of this article the work of the claim department may be divided into three periods, each separate and distinct from the others, as follows: First, investigation; second, negotiation; third, litigation.

First, as to investigation. The work of this period begins immediately after the accident and continues until there has been secured a full and accurate account of the accident, with reliable information as to the nature and extent of the injuries to person. Employés have been instructed to notify the claim department of the occurrence of an accident on car or train, giving circumstances of the same, nature of injuries to and residence of the injured, and as far as possible to secure the names of the witnesses. When this has been accomplished and the injured one has been placed in the charge of a physician or the police, the car or train may continue its journey. In the meantime a representative of the claim department will proceed with all possible dispatch to the scene of the accident. If the injured person has not yet been removed, he must see that conveyance is provided to the hospital or to the home.

These companies usually bear the expense of temporary medical care and transportation, without regard to liability, believing such attention is appreciated by the injured and the community at large. In all cases of personal injuries, it is the duty of the medical staff to secure the privilege of an examination; the physician making the same to avoid any assumption of responsibility for the treatment, but to fully ascertain the nature and extent of the injuries, and to obtain, if possible, a concurrence in his report by the attending physician.

All employés witnessing accidents are required to make written statements of the circumstances of the same on printed forms provided for that purpose, attaching the names and places of residence of all witnesses. This report must be completed and given to the foreman before the employé finishes his day's duties. These reports are forwarded to the claim department without delay, and when received, circular letters containing printed interrogatories are sent to each witness. If the seriousness of the accident demands it, interviews are had with the witnesses. That the claim department may be kept fully advised from time to time as to the condition of persons injured on these roads, they are occasionally visited during the period of recovery by the investigators assigned to those cases. In Chicago, all hearings before the coroner are had immediately after the accident, and the verdict of the coroner's jury is usually rendered on the day following the death. It is the policy of these companies to secure the presence of their witnesses at the hearing before the coroner, and obtain stenographic minutes of the proceedings Thus, in a compartively short time, the claim department will have collected much information as to the condition of the injured and the circumstances of the accident. We may now consider the work of the first period completed.

The reports relating to an accident could now be filed away, perhaps forever, if it were not for the industry of some claim lawyer or other hustler who persuades the injured to make a demand on the company for compensation. The making of a claim leads us to a consideration of the second period, that of negotiation. Demand being made for compensation, it becomes the duty of the chief adjuster to place before the general manager or general counsel all facts within his knowledge bearing on the claim, for a decision as to liability, and the naming of the maximum sum to be paid, if a settlement is deemed advisable, the claimant being promptly informed of the decision. As to the negotiations preceding a settlement, I need say but little. They are usually conducted by the chief adjuster on the part of the company. If not successful the period of negotiation will end, usually to be followed by litigation, the third and last.

After the commencement of suit all witnesses are again located by the claim department, and thereafter located at stated intervals until the time of the trial, and if possible additional witnesses are found to strengthen the defense. Success in defending suits arising from personal injuries largely depends on the character of the work done during the period of investigation. The officers of these companies believe in the thorough investigation of all accidents; if possible, the settlement on a reasonable basis of all valid claims; in vigorously contesting fraudulent demands, and that prompt settlements are for the best interests of their companies.

In conclusion, I will say that the time is at hand when all railroad corporations must be prepared to resist claims in a large percentage of their accidents. To promptly prepare to do this is the part of wisdom, when considered from a financial standpoint, usually the determining consideration in corporate management.

An interesting discussion followed the reading of this paper. Mr. H. C. Payne stated that his company had practically the same system in use, and, speaking generally, asserted that the sooner a case was settled the better it was for the company. "It does not seem to make much difference," he continued, "what the merits of the case are; if we go before a jury we are almost sure a case will go against us. It is only in cases where the points of law are in our favor that we stand any chance of success."

The subject of street railway companies paying the expenses of taking care of people injured on their lines was considered in the course of the discussion. Many companies do this whether they are liable or not for the injuries, and in some cases their liberality is turned against them, as is shown in the case described by Mr. Payne.

"We had an experience in that direction," he said, "where the evidence seemed to point to the conclusion that the company was not liable. Our attorneys so

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* Committee Report read at the Thirteenth Annual Convention of the American Street Railway Association, Atlanta, Ga., October 17, 18 and 19, 1894.

advised us and friends of the injured party admitted that there was no liability, and upon their admissions and representations we sent the injured person to the hospital and cared for him for several months. I think we spent nearly a thousand dollars in the case. When we went to get a release and offered to throw in as a gratuity a few hundred dollars, they refused to settle with us. We litigated, because we were assured we had a perfect defense. Judgment was rendered against us for seven thousand eight hundred dollars, and the fact that we had done something to alleviate the distress of the injured person was used against us on the trial upon the ground that we must have believed that we were guilty of negligence, or we would not have expended so much money. That seems pretty hard—to help poor people out when they get injured and then have a jury render a verdict entirely against the weight of the evidence."

Mr. Connette, of Nashville, stated that his company takes the best of care of injured persons when the company is liable; but if it is not liable all expense in the case ceases. The lawyers cause the most trouble, he said. They will hunt up a case and institute suit immediately, without making any effort toward a compromise. In such cases he advised the settlement of the case outside of a lawyer. If a settlement cannot be effected, he thought the best thing to do was to keep the matter in court as long as possible, because the longer it is kept there the easier it is to effect a compromise.

NEW CORPORATIONS.

The Mount Jewett Electric Light and Power Company, Mount Jewett, Pa. Capital stock, $2,000.

People's Electric Light Company, Valparaiso, Ind. Capital stock, $30,000.

The Turnbull Electric Lamp Co., New Orleans, La. Capital stock, $300,000.

Norristown and Perkiomen Electric Railway Company, Norristown, Pa., by Thos. W. Reagan, Arthur W. De Pue, Paul W. Smith and others. Capital stock, $130,000.

The Archer & Pancoast Co., New York city, N. Y. The directors are Archer V. Pancoast, Chas. A. Cheever, Byron Traver, Wm. S. Fearing, John B Summerfield, and Samuel B. Lawrence, of New York city; Henry T. Bragg, of Yonkers, Gurdon S. Howe, Rasebank, Staten Island, and Edward Cornell of Central Valley. Capital stock, $100,000.

The Second Avenue Traction Co., Pittsburgh, Pa., by G. T. Hamilton, W. J. White, T. M. Dierker, H. J. Stern, W. T. Ford. Capital stock, $10,000.

The Philadelphia and Landsdale Railway Co., Harrisburg, Pa., by Robert A. Walshe, H. A. Mullen, John B. Moffit. Capital stock, $100,000.

Saginaw Consolidated Street Railway Co., Saginaw, Mich., by John M. Nicol, Frank E. Snow and Wm. A. Jackson. Capital stock, $150,000.

Mechanicsville and Boiling Springs Electric Railway Co., Harrisburg, Pa., by S. Rittet Ickes, Wm. K. Myers, Richard B. Ziegler, John B Skyles, J. E. Knapp. Capital stock, $100,000.

Painesville Telephone Co., Painesville, Ohio. Capital stock, $10,000.

Jasper County Electric Railway Co., St. Louis, Mo., by John W. Halliburton, Samuel Reynolds, Isaac Perkins and others. Capital Stock, $50,000.

The North American Interior Telephone Co., Baltimore, Md., by Messrs. Frederick W. Shultz, J. Kemp Bartlett, Jr., Seneca P. Broomal, Chas. C. Hughes and Thos. R. Brimmer. Capital stock, $60,000.

POSSIBLE CONTRACTS.

It is stated that the Hamilton Electric Radial Railway Co., Hamilton, N. Y., intends to build electric roads spreading out in all directions.

B. G. Underwood, Malden, Mass., and Arthur M. Bridgman, of Brockton, Mass., are interested in a project to build an electric railway in that section.

The Baltimore and Washington Electric Railway Company has advertised for bids for the construction of sixteen miles of double track between Washington and Laurel, Md.

The Toronto, Hamilton and Niagara Falls Electric Railway Company, Hamilton, Ontario, has applied for incorporation to construct an electric railway from Toronto to Hamilton and thence to or near Niagara Falls.

The Boston Electric Light Co., Boston, Mass., has petitioned the Gas and Electric Light Commission for permission to issue $900,000 additional bonds. This issue is said to be intended to cover the expenses of putting wires underground.

An electric railway will be built from Tower City, Pa., through Williams Valley to Williamstown and Lykens.

Max Joseph and R. J. Smith, of Brazil, Ind., have organized a company with a capital stock of $16,000, to build an electric railroad from Brazil to Terre Haute.

The Chicago Telephone Company, Chicago, Ill., will erect an exchange on 55th street, that city.

A company is being organized in Salisbury, Md., to build a telephone line in Wicomico County, to be operated in connection with the Salisbury Telephone Company.

L. M. Erb, of Leavenworth, Kansas, is at the head of a project to build an electric street railway in Salina, Kansas.

There is a movement on foot in Warren, O., looking to the construction of an electric railway between that place and Youngstown.

The Saginaw street-car line has been sold to the Union Street Railroad Company, of Saginaw, Mich., and will be equipped with electric power.

The City Council, of Rogers, Ark., is considering the proposition to build an electric light plant. The Mayor of that place can give further information.

C. F. Hopkins, St. Augustine, Fla., is endeavoring to establish a telephone exchange in that place.

An electric light plant is to be established in Bunker Hill, Mo. Address the Mayor for further particulars.

A street railway is to be built by the Clarksburg and Suburban Street Railway Company, Clarksburg, W. Va. Either electricity or steam will be used. Marcy McD. Price is chief engineer.

Syndicate.—A dispatch from Pittsburgh, Pa., on November 15, states that Brown Brothers, bankers, of New York city, are at the head of a syndicate to take control of all the small trolley lines between Pittsburgh, McKeesport, Homestead and Wilmerding.

TO CONTROL THE MARKET.

A structural iron company is building a million dollar plant nine miles north of Buffalo, to be operated by electricity and employ 2,500 men. By a new process the beam is worked simultaneously from all four sides directly from the billet, without intermediary heating. This method is accomplished by additional rolls and can be applied to beams of any size. Channels and angles can be made as rapidly and in such shapes as will lessen labor in built-up work. The president of the company says: "We will make such work at cost of billets, and built-up columns at half present cost. We shall command the market."

ELECTRICIAN'S DIRECTORY AND HANDBOOK.

"The Electrician" Electrical Trades' Directory and Handbook for 1895, published by the Electrician, London, is now in course of preparation. Great care is being taken in the compiling of this work, and next year's volume promises to be more valuable than ever. The American section will be very complete.

The *Landscape Architect* is the name of a handsomely gotten-up journal published monthly by the Vista Publishing Co., Rochester, N. Y. The first number is full of interesting matter pertaining to the title subject and includes an article on "Electricity as a Fertilizer." Mr. F. Tracy Nelson is the managing editor.

The Value of Advertising.—"A trade-mark name has, through the power of advertising, become a highly valuable property."—*Artemas Ward.*

TRADE NOTES.

Metropolitan Electric Co., 186 and 188 Fifth avenue, Chicago, have made arrangements with the patentee to handle the Allen soldering stick, and have a large stock on hand, and will be able to sell to the dealer or consumer at satisfactory prices. This little article is well-known to the trade and occupies its nitch in the gallery of specialties of the Metropolitan Company.

In our last issue, in the paragraph regarding the La-Roche Electrical Works, Philadelphia, Pa., the name of the New York agent was erroneously given as F. S. Meserole. F. D. Mersereau is what it should have been. Mr. Mersereau is so well known in the trade that the error was obvious to most of our readers.

SEALED PROPOSALS.

Sealed proposals are invited for the construction of a telephone exchange system in the Department of the Interior, Washington, D. C. Proposals will be opened December 18 next. W. H. Sims, acting secretary, may be addressed.

CHARACTERISTICS OF A POPULAR RAILROAD.

Travellers find unexcelled accommodations and supreme comfort on the cars of the New York Central Railroad. American railways are noted for the advantages which they afford the travelling public, and there are none that surpass this splendidly equipped road.—*Paper Trade Journal.*

Electrical and Street Railway Patents.

Issued November 13, 1894.

528,924. Radiating and Supply System for Thermo-Electric Generators. Harry B. Cox, Hartford, Conn. Filed Feb. 27, 1894.

528,925. Electrical Transformer. Frank S. Culver, Eau Claire, Wis. Filed Dec. 19, 1893.

528,949. Trolley. Benjamin F. Lare and Charles M. Greer, Philadelphia, Pa., assignors to the Ajax Metal Company, same place. Filed May 1, 1894.

528,959. Intersecting Electric-Railway Tracks. Mark Lowd, Salem, Mass. Filed Feb. 10, 1894.

528,560. Self-Winding Electric Clock. Adam Lungen, New York, N. Y., assignor of one-half to Robert Edwards, same place. Filed May 13, 1893.

528,963. Underground Conduit for Electric Roads. Ezra A. Mathers, Romeoville, Ill. Filed June 12, 1894.

528,972. Ore Washer or Concentrator. Charles F. Pike, Philadelphia, Pa. Filed Apr. 6, 1894.

529,000. Automatic Fire-Alarm System. Henry S. Tunnard, Rugby, and Arthur M. Keays, London, England. Filed Feb. 8, 1894. Patented in England, Dec. 21, 1893, No. 24,653.

529,011. Electric Railway-Switch. Rollin A. Baldwin, South Norwalk, Conn., assignor to the Fitch Excelsior Switch Company, of New Jersey. Filed Jan. 4, 1894.

529,041. Fender for Cars. John McCarthy, Newark, N. J. Filed June 2, 1894.

529,052. Fender for Cars. Friederick D. Weber, Brooklyn, N. Y., assignor of one-half to Henry C. Christgan, same place. Filed Feb. 23, 1894.

529,058. Trolley-Wire Hanger. Johan M. Andersen, Boston, Mass., assignor of one half to Albert Andersen, same place. Filed July 19, 1894.

529,059. Electrical Apparatus for Controlling Signals. Samuel S. Bogart, Schraalenburg, N. J., and Michael B. Leonard, Richmond, Va., assignors to the Electric Selector and Signal Company, of West Virginia. Filed Dec. 11, 1893.

529,080. Ore Washer or Concentrator. Charles F. Pike, Philadelphia, Pa. Filed Apr. 6, 1894.

529,085. Electro-magnetic Machine. Gordon J. Scott, Philadelphia, Pa., assignor of one-half to Albert H. Henderson, same place. Filed June 12, 1894.

529,095. Safety-Guard for Cars. Frederick Zorn, New York, N. Y. Filed June 21, 1894.

529,117. Regulator for Dynamo-Electric Machines. Jules Ferrand, Darnetal, France. Filed July 3, 1891. Patented in France, Dec. 29, 1890, No. 210,436; in Belgium, June 25, 1891, No. 95,420; in England, June 25, 1891, No. 10,843; in Italy, June 25, 1891, No. 29,979/499; in Switzerland, June 25, 1891, No. 3,699, and in Germany, June 26, 1891, No. 62,433.

529,127. Binding-Post for Electric Instruments. Ernest A. Lowe, New York, N. Y., assignor to himself and James Jones, Jr., same place. Filed Feb. 9, 1894.

529,144. Automatic Set-Back Annunciator. Henry C. Thomson and George J. Galbraith, Boston, Mass., assignors to the Electric Gas Lighting Company, of Maine. Filed July 2, 1894.

529,145. Dynamo-Electric Machine. René Thury, Geneva, Switzerland, assignor to the Compagnie de L'Industrie Electrique, same place. Filed Aug. 18, 1894.

529,152. Electrical Transformer. Fritz Zickermann, Berlin, Germany, assignor to Siemens & Halske, same place. Filed Dec. 9, 1892. Patented in Germany, Oct. 7, 1892, No. 73,200; in France, Oct. 31, 1892, No. 225,299; in Switzerland, Oct. 31, 1892, No. 5,934; in England, Nov. 3, 1892, No. 19,821; in Belgium, Nov. 7, 1892, No. 102,009, and in Italy, Apr. 28, 1893, No. 34,011.

529,158. Street-Car Heater. Menard K. Bowen, Chicago, Ill. Filed July 11, 1894.

529,164. Electric Switch for Railways. Charles M. Fitch, South Norwalk, Conn. Filed Nov. 18, 1893.

529,165. Train-Operated Signaling System. Johann H. Frischen, Berlin, Germany, assignor to Siemens & Halske, same place. Filed Nov. 28, 1893.

529,174. Magnetic Telephone. Oliver Higgins, Napoleon, Ohio. Filed July 16, 1894.

529,199. Method of and Apparatus for Circulating Liquid Electrolytes. Paul Schoop, Zurich, Switzerland. Filed Dec. 29, 1893.

529,203. Telephone. John Serdinko, San Antonio, Tex, assignor to the National Union Telephone Company, same place. Filed Apr. 28, 1894.

529,212. Automatic Electric Cut-Out. Daniel F. Sweet, Grand Rapids, Mich. Filed Apr 23, 1894.

529,213. Electrical Cut-Out. Daniel F. Sweet, Grand Rapids, Mich. Filed June 9, 1894.

529,215. Method of Sheathing Electrical Conductors. James Tatham, Philadelphia, Pa. Filed Jan. 2, 1894.

529,216. Conduit for Electric Conductors. James Tatham, Philadelphia, Pa. Filed Mar. 17, 1894.

529,240. Electric-Arc Lamp. James Brockie, London, England. Filed June 19, 1894. Patented in England, Jan. 19, 1893, No. 1,198.

529,260. Car-Fender. Elie B. Graff, Baltimore, Md. Filed June 25, 1894.

529,265. Means and Apparatus for Distributing Electricity. Haydn T. Harrison, London, England. Filed Jan. 19, 1894. Patented in England, Dec. 22, 1893, No. 23,674.

529,272. Alternating-Current Electrodynamic Machine. Maurice Hutin, Paris, and Maurice Leblanc, Le Raincy, assignors to the Société Anonyme pour la Transmission de la Force par l'Electricité, Paris, France. Filed Aug. 20, 1892. Patented in England, July 28, 1892, No. 13,765.

529,275. Street-Car Fender. Henry C. Kennedy and George W. Roletter, Philadelphia, Pa. Filed July 10, 1894.

529,284. Car-Truck. Benjamin F. Manier, Jr., Providence, R. I. Filed Apr. 11, 1894.

529,300. Autographic Telegraph. John O'Neil, New York, N. Y. Filed Nov. 27, 1893. Renewed Oct. 13, 1894.

529,313. Electric Gas-Lighter. Charles G Savage, Philadelphia, Pa., assignor of two-thirds to John L. Ricketts and Grant C. Osborne, same place. Filed June 13, 1894.

529,325. Electromagnet. Carl C. Gerlach, Cleveland, Ohio, assignor of one-half to Rudolph P. Gerlach, same place. Filed Dec. 9, 1893.

ELECTRICAL AGE

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NEW YORK, DECEMBER 1, 1894.

CONTENTS.

NATURE'S SECRET.

Our readers will find elsewhere in this issue an extremely interesting article entitled "The Enigmas of the Elements," which is a portion of the annual address delivered by the Marquis of Salisbury at the Oxford meeting of the British Association. After reading the article one cannot help reflecting on the meagreness of man's knowledge. The wonderful things he has accomplished depend upon facts about the nature of which he today knows but little more than he did centuries ago. The great enigma of the elements is practically no nearer a solution than it ever was, and man is still groping about in the dark in search of the answer. When he unlocks this secret he will know all. But will he ever unlock it?

PROBABLY AN AMERICAN IDEA.

An English genius—we do find a genius in England once in awhile—carries a full electrical protective equipment on his person. A valuable pin was stolen from him once, and that suggested the possibility of protecting the pockets and wearing apparel by electrical apparatus. He constructed a small accumulator, and had an electrical contact device attached to his scarf-pin. Should an attempt be made to relieve him of this treasure the fact is made known by an alarm on a tiny electric bell. His watch is guarded in a similar manner. When he attends spiritualistic *seances* or other entertainments where the lights are turned down, he can read his programme by the rays of a small electric lamp placed in a convenient location about his person, and when he desires to light his cigar our of doors he turns the current on into a small spiral coil of platinum wire which becomes white hot.

WHAT IS ELECTRICITY?

In our issue of November 17, we published an abstract of an article which appeared in the October number of *New Science Review*, entitled "What Electricity Is." The author sums up his argument by suggesting that electricity "is simply a form that energy may assume while undergoing transformation from the mechanical, or the chemical form, to the heat form, or the reverse." We doubt if he has succeeded to any great extent in throwing any light on the nature of electricity, as the title of his article would imply was his object. Every one who understands the laws of the conservation of energy knows that intimate relations exist between the forms of energy known as heat, light and electricity, but it does not seem that the author of the article has added anything to what was already known on the subject. He perhaps draws the line a little closer to the cause of electrical phenomena, but the proposition, "What Electricity Is," it seems to us, remains far from being satisfactorily proved. However, whether the author has succeeded in increasing existing knowledge of this great problem, or not, is not of so much importance as the fact that his efforts are stirring up other investigators and thinkers in this direction, and it is possible that the agitation he has so modestly brought about may result in an expansion of our knowledge of this most interesting phenomena. The fact that it is a profound problem, however, does not deter original thinkers and investigators from expressing their thoughts on the subject. Mr. J. M. Batchelor in his issue, on another page, expresses what he believes electricity to be. It is an interesting article, and the author advances some ideas that may be new to most people. Yet we are far from being satisfied in our craving to known "What Electricity Is."

THE NATIONAL ELECTRIC LIGHT ASSOCIATION.

CLEVELAND CONVENTION.

We are informed by Secretary Porter, of the National Electric Light Association, that the Hollenden Hotel, Cleveland, Ohio, has been selected as the headquarters of the Association during the Convention in that city on February 19, 20 and 21, next. The meetings will be held in the Army and Navy Hall, which is nearly opposite the hotel, on Superior street.

The Hollenden, it will be remembered, was the headquarters of the American Street Railway Association, when it held its convention in Cleveland, in October, 1892. It has the reputation of being one of the finest hotels in America, both as regards furnishings and cuisine. It fronts on Superior street, 133 feet, extending back 356 feet on Bond street. It is seven stories high, the first story being constructed of cream-colored sandstone and the other stories red brick with sandstone trimmings. It has 450 rooms, fitted with all the modern conveniences, and luxuriously furnished. The hotel is lighted by electricity.

The Army and Navy Hall, where the meetings are to be held, is large and well situated for such purposes and has ample capacity for a large number of delegates. With reference to the hotel, it is much more convenient than was the meeting hall of the American Street Railway Association Convention above referred to.

STORAGE BATTERIES FOR ELECTRIC TRACTION.

BY P. G. SALOM.

In an article on this subject, in *Cassier's Magazine* for November, the author considers, first, the question of the life of the battery in electric storage traction, and second, its weight, size of elements, etc. In traction work, he says, the only reliable method of determining the life of the battery is on the basis of car mileage, and then gives figures showing the cost of running 6,000 miles, with one set of accumulators, to be 3.85 cents per car mile.

Regarding the weight of the battery, he says that it is determined by the rate at which work is to be done and not by the total amount to be done. In view of these and other facts to which he gives attention it seems to him that the introduction of storage traction for surface roads in large cities is inevitable. The trolley may be introduced at the present time, pending the solution of the difficulties under which storage batteries have come into disrepute, but that it can obtain, in the long run, against the many and obvious advantages of the storage system is unlikely. Let the public once understand that there are no insurmountable difficulties connected with the storage system, beyond the fact that it costs a few more cents per car mile than the trolley, and the demand for its introduction will be irresistible.

The public are not interested in the cheapest and most objectionable method of transit, especially where they derive no benefit from the economies effected, but they are interested in and entitled to a safe, reliable and absolutely unquestionable method of transit, which is cheaper than horses at the present time, and which may, in a few years, from the further knowledge and experience gained by actual use, almost, if not quite, compete in cost with the trolley.

It is absolutely certain that all power houses for trolley lines will be compelled to introduce storage batteries for equalizing their loads. As at present operated, the power houses are called upon, without a moment's notice, to supply power from 50 to 500 horse power. This can be accomplished only by employing large units and the economic losses arising from operating large units at less than their maximum load are too well known to require comment. Storage batteries will gradually be introduced, first, for running night cars, which will permit of the power plant being shut down after 12 o'clock, and finally, on the day cars, as the efficiency of a large power plant operated with a constant load, day after day, charging batteries, and the saving in cost and maintenance of the line will more than counterbalance the cost of renewals of positive plates.

CLEVELAND HEADQUARTERS NATIONAL ELECTRIC LIGHT ASSOCIATION.

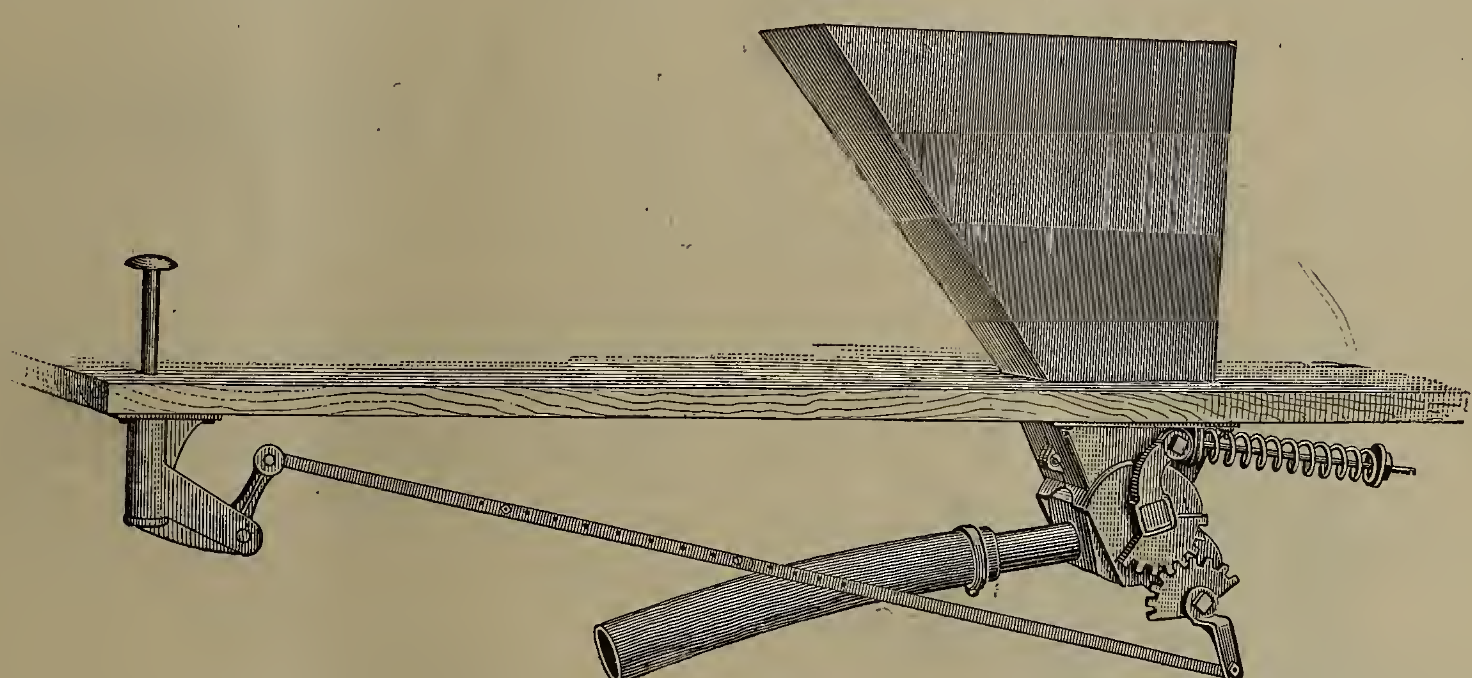
Credit to Whom it Belongs.—In the illustrated description in our issue of November 24, of the "Johnson-Van Vleck Service End Cut-out" we innocently committed the error of giving too much prominence to Mr. Johnson's name in connection with the device and not enough to Mr. Van Vleck's. Mr. Johnson himself calls our attention to this fact. He thinks Mr. Van Vleck is entitled to more credit for the invention, and we gladly make this explanation so that he may be accorded all the justice he is entitled to.

An electric railroad is to be built from Crisfield to Sterlingport, Md., for the purpose of carrying oysters.

STERLING SAND BOX.

"Sand" is an indispensable ingredient in the make-up of human nature. Without it we can not get a good grip on facts and opportunities, and are liable to slip past them with a useless waste of energy, and with possible disastrous results. With sand, however, we can always depend upon control, and go ahead at full speed in our multifarious enterprises with the full knowledge that we can check our progress or stop entirely, if need be, when danger threatens. So it is with street railway cars, especially those propelled by electricity or cable. Without a sand distributing appliance there is constant danger, particularly if the tracks are moist or wet. It is a common sight to see cars sliding along "on all fours," the wheels stopped, as far as their revolutions are concerned, but sliding along the track. The momentum of a heavy car under such circumstances is hard to control, and there is no doubt that many of the collisions and accidents of other kinds are due to this very cause.

Power brakes are no more effectual in cases of this sort than the ordinary hand brake; it is important, therefore, to provide means of sanding the track at such times.



STERLING SAND BOX.

The Sterling Sand Box shown in the accompanying illustration is about as simple and effective in operation as a device of this character can be made.

It is constructed with a minimum number of parts and of strong material. By depressing the pedal the circular valve is opened and the rubber tube is lowered so as to allow the sand to flow upon the rail. When the pressure of the foot is removed from the pedal the power of the retractile spring lifts the tube to a horizontal position and at the same time closes the valve and stops the flow of sand The supply of sand is kept in the triangular shaped box.

The Sterling Sand Box, which is manufactured by the Sterling Supply and Manufacturing Co., 97 Bank street, New York City, has been in satisfactory use for over a year on some of the largest street railways in the country, including the lines of the Brooklyn City Co., Brooklyn, N. Y., the Consolidated Traction Co., of New Jersey, and the Metropolitan Traction Co., of New York City.

A telephone system is to be constructed in Waynesville, N. C. For further information address J. E. Hellams.

"WHAT IS ELECTRICITY?" WHAT ELECTRICITY IS.

Editor Electrical Age.—The question started by the *New Science Review*, to ascertain what electricity is, which appeared in The Electrical Age of November 17, induces the writer to give the following explanation:

Electricity is a life element liberated from its imprisonment in things.

Electricity is of two kinds, organic and inorganic. The organic is the result of the life principle in activity in living things, intelligently or partly so, directed to produce it.

The inorganic is the blind result of scattered forms of life in one thing, or several things known in chemistry as inorganic, developed under the process of ordinary dissolution.

Electricity in the dynamo, the wheel, in the chemical battery and anywhere found that is not the direct action of a living plant, animal or man, is the harnessing of the force—named electricity—generated through the graduated dissolution of some form of inorganic matter or things.

The two common divisions of electricity known as negative and positive, are the female and male elements of all forms of organic matter after what is known as death has made them inorganic; and in the case of living or organic electricity, are the female and male characteristics of the one sex producing it, double characteristics which are associated with inheritance, or early fetal development.

The positive is the male and the negative the female parts of nature or life.

All known experiments in or instances of electricity support this explanation, although the text-books do not so interpret it. The text-books give an explanation of their own which many known facts neither prove nor sustain; nevertheless, because these text-books, at first putting their view as theoretical—that is, with no degree of confidence in their accuracy, but merely as the best theory they were then able to formulate—gradually, because of no contradictions, began to assume that their theory was fully proven; whereupon later works take for granted as a full and satisfactory analysis what was never originally put forward otherwise than as a tentative explanation.

All inorganic electricity that is known, which includes that by which industries are carried on, is directly traceable to the dissolution of inorganic matter under such stages of speed as enable the operator to harness it.

The reader can apply this explanation to any and all forms of electricity, and see for himself that it is substantiated in all particulars, by irrefragable proof in every instance known to the world.

In this—easy—verifiability, the explanation given is strictly scientific.

John M. Batchelor,
Hasbrouck Heights, N. J.

ELECTRIC PROJECTION LAMPS.

The use of the electric arc lamp for lantern projection has divested the old style lantern of many objectionable features. This light is the most convenient of all for projection, and is, besides, the most powerful, and with it results can be obtained that cannot be approached with any other form of light.

The application of electric light to this use has, however, not been a problem of easy solution. Many attempts have been made to master the difficulties, and many have failed. It can be said, however, that they have been entirely overcome by some makers with the result that a perfectly steady light and most satisfactory results are obtained.

To be successful in this work the electric light must

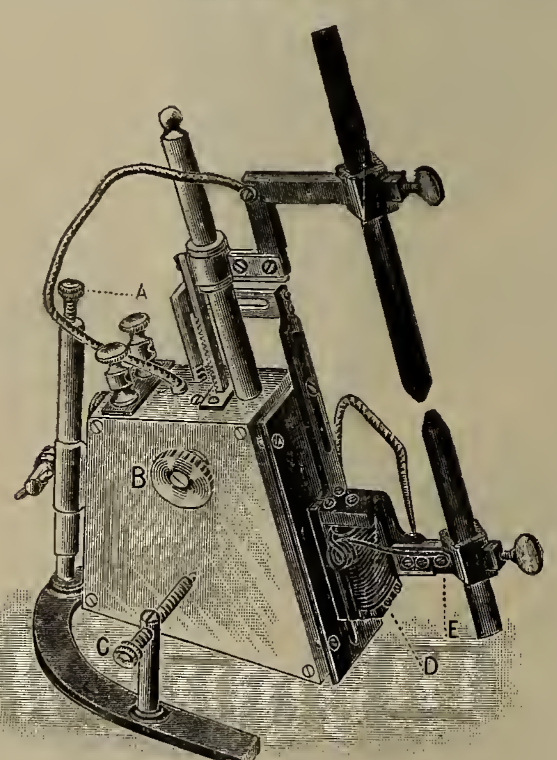


FIG. 1.

be steady in its illumination and steady with reference to the centre of the lenses. Variation in either blurs and distorts the figure, with unpleasant effect on the eyes.

The apparatus shown in the accompanying illustrations have a reputation for excellence of results in practical use. The automatic lamp (Fig. 1) is claimed to be the most compact in the market, the regulating mechanism being contained in a metal case two inches thick, three and one-quarter inches wide and four and one-half inches high The light is absolutely steady and noiseless in operation, and the carbons are self-centring. The carbons may be placed at any desired angle and their operation is not dependent upon gravity, but is entirely electro-mechanical. It can be used on any continuous circuit, either arc or incandescent, and as it is perfectly insulated it can be handled without danger of shock. Current from storage batteries may be used as well. and the same may be varied at will by means of an adjustable rheostat for the purpose of varying the illumination. By placing the carbons at an angle of about thirty degrees from the vertical line, the luminous spot on the negative carbon is obscured from the condenser, and the crater on the positive is presented in the most favorable way, the light being reflected into the condenser. The crater, it will be noticed, is produced a little in front of the central line of the carbons, by the slight displacement of the carbons from a straight line with reference to each other.

Fig. 2 shows the application of the electric lamp to

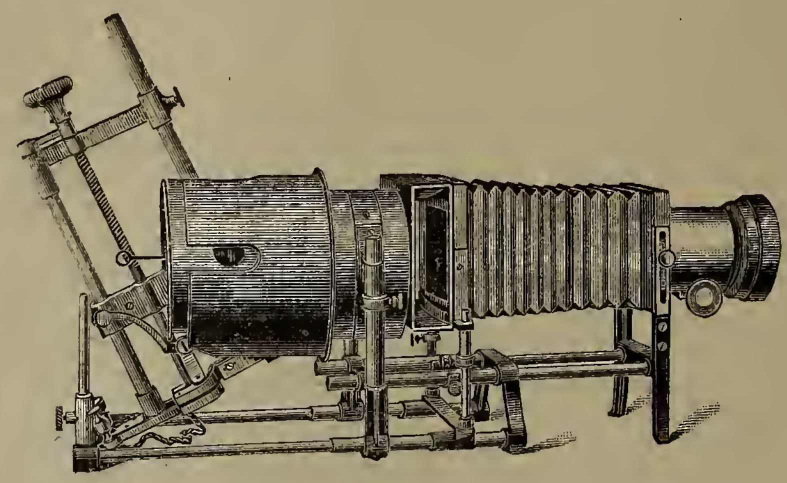


FIG. 2.

a lantern, and fig. 3 shows the same as applied to a stereopticon. In Fig. 2 the hand feed type of lamp is shown. The lower carbon is automatically fed to a given point, and the upper or positive carbon requires to be fed by turning, every few moments, the wooden handle at the top of the lamp, as the carbons are consumed.

The electric lantern can be used during the daytime as well as at night, and is far more economical than the oxy-hydrogen light; to say nothing of its greater convenience. These lamps are not confined to the use of the lantern alone but are meeting with ready sale to those interested in photo-micrography, art gallery and stage lighting, and in fact wherever steady and portable

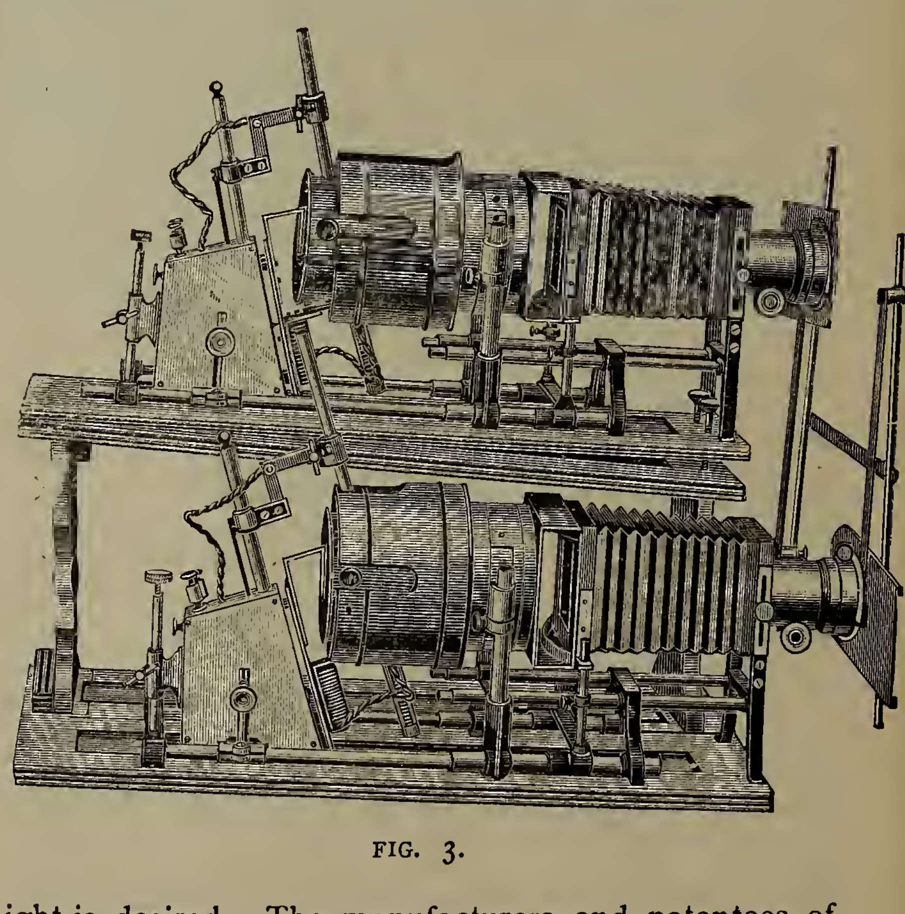


FIG. 3.

light is desired. The manufacturers and patentees of these lamps, Messrs. J. B. Colt & Co., 16 Beekman street, New York city, who are among the foremost manufacturers and dealers in the country of this class of goods, and the excellence of their lamps and other apparatus is well known and established.

MODEL DYNAMO.

The model dynamo-electric machine illustrated below is designed for the use of students and amateurs, and supplies a current equal to that given by three or four cells of battery. It is an excellent little machine for experimental work, and no end of instruction can be derived from its use. It generates enough current to drive small electric motors, charge magnets, decompose water, ring bells, etc., and can be driven by hand or by connection with the fly-wheel of a sewing machine.

Three or more small incandescent lamps can be lighted with this machine, the number depending upon the speed of the armature, which may reach 3,000 revolutions a minute with safety.

This dynamo is not a toy but is a practical machine, and with proper care will last for years. It is designed and constructed on correct principles, and is quite efficient for so small a machine. It is only 6x6 inches in size and three inches in height.

Fig. 1 shows a perspective view of the complete machine.

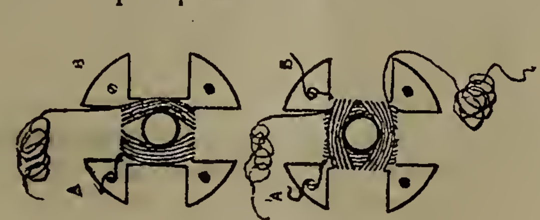


FIG. 3.

Fig. 2 shows the form and the method of winding the armature, and Fig. 3 a side elevation of the dynamo, showing the wire connections.

These machines can be obtained in rough castings, partly finished or complete, as desired. They are made by A. J. Weed & Co., 106 Liberty street, New York City.

CITY AND SUBURBAN ELECTRIC RAILWAYS.*

BY E. C. FOSTER.

A line to pay should be one that makes itself a necessity to the people, in offering them the best facilities for transportation in the particular direction. Competing

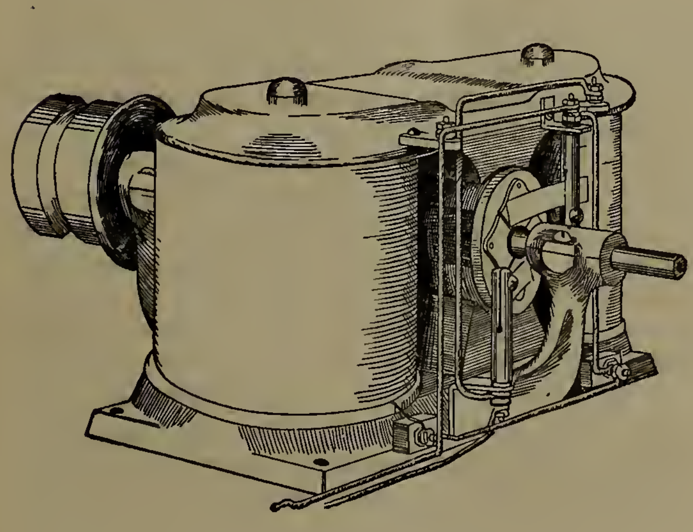


FIG. 1.

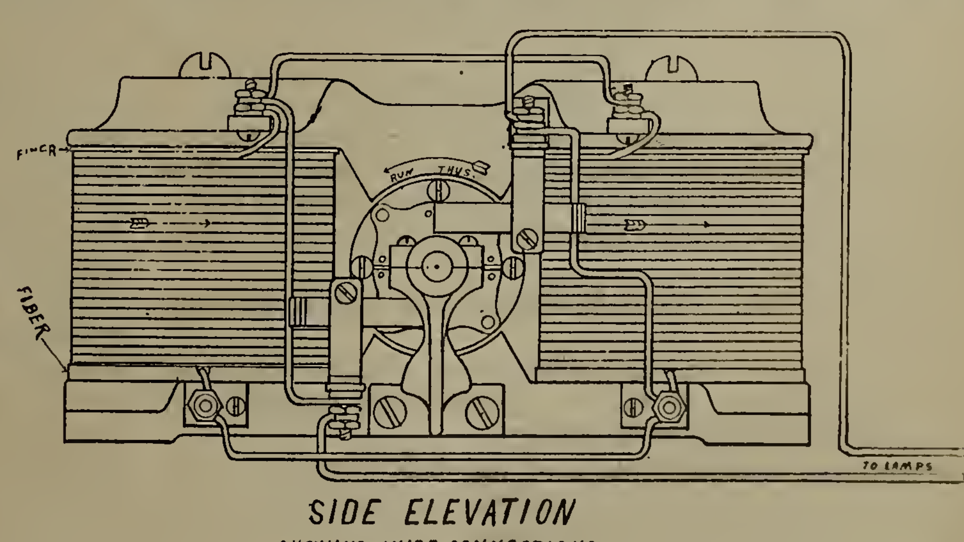


FIG. 2.

lines should be avoided, excepting where the volume of business is large enough to support both. Beside the assurance that the line is necessary to the people accommodated, it must be ascertained that the number of the latter is large enough to support the road on a paying basis, not only the first year, when the repairs are slight, but later, when reconstruction becomes necessary. I consider that there are very few cases where a company is warranted in investing its money in a line, on the strength alone of the future that may be expected from it. A road should be, at least, capable of earning its operating expenses from the start, and the evidence of a more prosperous time, later on, should be very strong, before it is constructed without immediate promise of good dividends. It is sometimes necessary for an established company to build on a location, merely to keep out competition. The only thing that warrants this is the knowledge that the opportunity exists for the proposed competing company to be self-supporting from the start, and ultimately a serious rival. Otherwise it is economy to allow them to build the road and buy them out at the foreclosure sale.

Mr. Foster then considers the subjects of track construction, overhead construction and car equipment. He believes that the longest car that can be operated successfully on four wheels is the most desirable for ordinary conditions.

Regarding the electrical equipment, he says, the modern multipolar, single reduction motors, with series-parallel controllers are the only ones a road can afford to use.

He believes in heating all cars in the North, but does not believe the electric method of heating can be depended upon. Our experience, he says, is that it takes from eight to twelve amperes to keep a twenty foot car comfortable, that is, forty degrees above the outside temperature. This means that it requires about as much current per hour as to propel a car four miles. This would make seventy-two car miles of power per day of eighteen hours, chargeable against the heaters. When it is considered that this extra power is often demanded when power is needed for other purposes, as in snow storms, it may be seen that, aside from the question of cost of coal, the consideration of the necessary increased capacity of the power station and feeder system is an important one. The stove, he thinks, will not be run out for the present.

It is not improbable that before long a telephone will be considered a necessary part of the equipment of each car operated on suburban lines, continued the report. It often happens that means of communication with the nearest car house, or with the starter, would save much delay, and even danger, in cases of cars disabled, or thrown off their schedule time by other causes. Either a telephone in each car, with means of plugging in on convenient poles, or 'phones, arranged at the turn-outs, in boxes, may be used. As a substitute for this arrangement, or in connection with it, a system of signals between turn-outs may be desirable, under certain conditions. By the use of lantern boxes, containing incandescent lamps, and the necessary hand

* Abstract of committee report read at the Convention of the American Street Railway Association, Atlanta, Ga., October 17, 18 and 19, 1894.

or automatic switches, a simple system of signals may be devised, by means of which cars running between turn-outs on single track lines will be protected from meeting other cars.

The adoption of a proper schedule of fares and transfers is a most important matter. Where lines are short enough to allow the use of the one standard fare throughout, this question is a simple one, but where routes are longer, and it becomes necessary to collect higher fares, complication commences. When this latter condition is aggravated by systems of transfers, the complexity increases. My experience has been that, in general, it is best to divide such a line into sections, collecting a single fare in each, and registering all as the standard fares. These sections are arbitrary, of course, but in our case are determined by town boundary lines.

I would say that there are instances where further restrictions need to be made. Cases have arisen where towns of large area have comparatively small centres of population a long distance apart. Single fares have been established as being good anywhere within the limits of either town. A line is then built connecting the two towns, and instead of ten cents, it is considered necessary to get fifteen cent fares The question then arises as to how the required three sections can be arranged. According to established precedent, the five cent fare sections include each whole town, although the line in question did not exist when this understanding was originated. In this case, however, it becomes necessary to establish the third section as including that part of the line between the boundaries of the more thickly populated portions of the towns, and including the intervening open country in both towns. As an exception to this method of paying fares "on the instalment plan," I would mention the case where there exists a very heavy through traffic on a line, compared with which the local traffic is slight. In this case I consider it best to collect the whole fare at once, issuing to the through passengers conductors' private checks. These latter are held by the passenger, as evidence that he has paid through fare, and surrendered to the conductor before the end of the trip.

The selection of the best rates of fares is a matter requiring the consideration of numerous conditions governing the particular case in question. It is safe to assume that the result to be worked for is the earning of the largest possible net revenue, considering, at the same time, the development of the business. Exactly the best way to accomplish this is the problem to solve.

I consider 1¼ cents per mile a minimum rate for the basis of a system of fares, no fare to be less than five cents, and would advise the establishing of higher rates, up to two cents, as the particular conditions would seem to recommend.

In certain cases I think it advisable to sell round trip tickets.

Transfers may be used within reasonable distances. The system must, of course, be carefully worked out, to avoid the possibility of abuse.

Regarding the elimination of the difference in power costs, now existing in favor of the city road, the indications are that the time is coming when it will be no longer necessary for the country road to maintain its numerous steam plants. I refer to the probable introduction of the alternating system of long distance electrical transmission into railway work. Suppose the case where it becomes necessary to distribute power for railway purposes over large areas, as on many suburban roads where several power stations are now used. With this system there need be but one main power station, which can be located at the point possessing the greatest advantages for cheap production of power. At various selected places rotary transformers may be placed, one for each section of road. These receive alternating current over long distance lines from the main station, and deliver it as direct current to the trolley wires, or possibly to such local feeders as may be necessary for the distribution throughout the particular section. These rotary transformers require only the same care as generators. Besides them, the only apparatus in the sub-station needing attention would be the circuit breakers. The latter would be arranged between the rotary transformers and the lines, in the same way that those in the present stations are. It will be seen, therefore, that one ordinary dynamo tender would be all the labor required in a sub-station. Further than this, the sub-station might often be in car houses, where one of the regular employés could care for the machinery, thus reducing the labor charge to a minimum. By this arrangement power could be distributed to cars operating over areas of from twenty-five to fifty miles radius from one station, at cost slightly above that for distribution within the ordinary distances of present practice. I am told that with such a system, using 6,000 volts, three-phase currents from a station located at the central point, we could supply power by the use of three No. 0 B. & S. wires to a road fifty miles in length, when fifty cars were being operated. The total efficiency of this transmission, neglecting the loss in the trolley wires, would be about 65 per cent. These fifty cars, on the fifty mile road, would give fifteen minute headway, with a speed of eight miles per hour. With the higher speed, that would more probably fit the conditions of such a road, the number of cars would be reduced, allowing a proportionate decrease in the size of the wires so long as the current allowance, 20 amperes per car, was sufficient. To accomplish these same results with the present system of 500 volts would require 600 No. 0 B. & S. wires, the use of which would, of course, be impracticable.

It will be evident that the adoption of a long distance transmission system will admit of the use of any suitable water power that may be located too far away to be available under the direct method of transmission.

THE ENIGMAS OF THE ELEMENTS.

In his annual address at the recent meeting in Oxford of the British Association, the president, the Marquis of Salisbury, made some remarks on scientific enigmas. This portion of his address, which is full of interest, is reproduced herewith.

"Of the scientific enigmas which still, at the end of the nineteenth century, defy solution, the nature and origin of what are called the elements is the most notable. It is not, perhaps, easy to give a precise logical reason for the feeling that the existence of our 65 elements is a strange anomaly and conceals some much simpler state of facts. But the conviction is irresistible. We cannot conceive, on any possible doctrine of cosmogony, how these 65 elements came into existence. A third of them form the substance of this planet. Another third are useful, but somewhat rare. The remaining third are curiosities scattered haphazard, but very scantily, over the globe; with no other apparent function but to provide occupation for the collector and the chemist. Some of them are so like each other that only a chemist can tell them apart; others differ immeasurably from each other in every conceivable particular. In cohesion, in weight, in conductivity, in melting point, in chemical proclivities, they vary in every degree. They seem to have as much relation to each other as the pebbles on a sea beach, or the contents of an ancient lumber room. Whether you believe that creation was the work of design or of inconscient law, it is equally difficult to imagine how this random collection of dissimilar materials came together. Many have been the attempts to solve this enigma; but up till now they have left it more impenetrable than before. A conviction that here was something to discover lay beneath the persistent belief in the possibility of the transmutation of other metals into gold, which brought the alchemy of the Middle Ages into being. When the immortal discovery of Dalton established that the atoms of each of these elements have a special weight of their own, and that consequently they combine in fixed ponderable proportions from which they never depart, it renewed the hope that some common origin of the elements was in sight. The theory was advanced that all these weights were multiples of the weight of hydrogen—in other words, that each elementary atom was only a greater or a smaller number of hydrogen atoms compacted by some strange machinery into one. The most elaborate analyses, conducted by chemists of the highest eminence—conspicuously by the illustrious Stas—were directed to the question whether there was any trace in fact of the theoretic idea that the atoms of each element consist of so many atoms or even of so many half atoms of hydrogen. But the reply of the laboratories has always been clear and certain—that there is not in the facts the faintest foundation for such a theory.

"Then came the discovery of the spectral analysis, and men thought that with an instrument of such inconceivable delicacy we should at last find out something as to the nature of the atom. The result has been wholly disappointing. Spectral analysis in the hands of Dr. Huggins and Mr. Lockyer and others has taught us things of which the world little expected to be told. We have been enabled to measure the speed with which clouds of blazing hydrogen course across the surface of the sun; we have learned the pace—the fabulous pace—at which the most familiar stars have been for ages approaching to or receding from our planet, without apparently affecting the proportions of the patterns which, as far as historical record goes back, they have always delineated on the evening sky. We have received some information about the elementary atoms themselves. We have learned that each sort of atom when heated strikes upon the ether a vibration, or set of vibrations, whose rate is all its own; and that no one atom or combination of atoms in producing its own spectrum encroaches even to the extent of a single line upon the spectrum that is peculiar to its neighbor. We have learned that the elements which exist in the stars, and specially in the sun, are mainly those with which we are familiar upon earth. There are few lines in excess to which we can give no terrestrial name; and there are some still more puzzling gaps in our list. It is a great aggravation of the mystery which besets the question of the elements that among the lines which are absent from the spectrum of the sun those of nitrogen and oxygen stand first. Oxygen constitutes the largest portion of the solid and liquid substance of our planet, so far as we know it; and nitrogen is very far the predominant constituent of our atmosphere. If the earth is a detached bit whirled off the mass of the sun, as cosmogonists love to tell us, how comes it that in leaving the sun we cleaned him out so completely of his nitrogen and oxygen that not a trace of these gases remains behind to be discovered even by the sensitive vision of the spectroscope? All these things the discovery of spectrum analysis has added to our knowledge; but it has left us as ignorant as ever as to the nature of the capricious differences which separate the atoms from each other, or the cause to which those differences are due.

"In the last few years the same enigma has been approached from another point of view by Professor Mendeléeff. The periodic law which he has discovered reflects on him all the honor that can be earned by ingenious, laborious and successful research. He has shown that this perplexing list of elements can be divided into families of about seven, speaking very roughly; that those families all resemble each other in this, that as to weight, volume, heat, and laws of combination the members of each family are ranked among themselves in obedience to the same rule. Each family differs from the others; but each internally is constructed upon the same plan. It was a strange discovery—strangest of all in its manifest defects. For in the plan of his families there were blanks left; places not filled up because the properly constituted elements required according to his theory had not been found to fill them. For the moment their absence seemed a weakness in the professor's idea, and gave an arbitrary aspect to his scheme. But the weakness was turned into strength when, to the astonishment of the scientific world, three of the elements which were missing made their appearance in answer to his call. He had described beforehand the qualities they ought to have; and gallium, germanium, and scandium, when they were discovered shortly after the publication of his theory, were found to be duly clothed with the qualities he required in each. This remarkable confirmation has left Mendeléeff's periodic law in an unassailable position. But it has rather thickened than dissipated the mystery which hangs over the elements.

"The discovery of these co-ordinate families dimly points to some identical origin, without suggesting the method of their genesis or the nature of their common parentage. If they were organic beings all our difficulties would be solved by muttering the comfortable word 'evolution'—one of those indefinite words from time to time vouchsafed to humanity, which have the gift of alleviating so many perplexities and masking so many gaps in our knowledge. But the families of elementary atoms do not breed; and we cannot therefore ascribe their ordered difference to accidental variations perpetuated by heredity under the influence of natural selection. The rarity of iodine, and the abundance of its sister chlorine, cannot be attributed to the survival of the fittest in the struggle for existence. We cannot account for the minute difference which persistently distinguishes nickel from cobalt by ascribing it to the recent inheritance by one of them of an advantageous variation from the parent stock.

"The upshot is, that all these successive triumphs of research, Dalton's, Kirchoff's, Mendeléeff's, greatly as they have added to our store of knowledge, have gone but little way to solve the problems which the elementary atoms have for centuries presented to mankind. What the atom of each element is, whether it is a movement, or a thing, or a vortex, or a point having inertia, whether there is any limit to its divisibility, and, if so, how that limit is imposed, whether the long list of elements is final, or whether any of them have any common origin—all these questions remain surrounded by a darkness as profound as ever. The dream which lured the alchemists to their tedious labors, and which may be said to have called chemistry into being, has assuredly not been realized, but it has not yet been refuted. The boundary of our knowledge in this direction remains where it was many centuries ago.

"The next discussion to which I should look in order to find unsolved riddles which have hitherto defied the scrutiny of science would be the question of what is called the ether. The ether occupies a highly anomalous position in the world of science. It may be described as a half-discovered entity. I dare not use any less pedantic word than entity to designate it, for it would be a great exaggeration of our knowledge if I were to speak of it as a body or even as a substance. When, nearly a century ago, Young and Fresnel discovered that the motions of an incandescent particle were conveyed to our eyes by undulation, it followed that between our eyes and the particle there must be something to undulate. In order to furnish that something the notion of the ether was conceived, and for more than two generations the main, if not the only, function of the word 'ether' has been to furnish a nominative case to the verb 'to undulate.' Lately our conception of this entity has received a notable extension. One of the most brilliant of the services which Professor Maxwell has rendered to science has been the discovery that the figure which expressed the velocity of light also expressed the multiplier required to change the measure of static or passive electricity into that of dynamic or active electricity. The interpretation reasonably affixed to this discovery is that, as light and the electric impulse move approximately at the same rate through space, it is probable that the undulations which convey them are undulations of the same medium. And as induced electricity penetrates through everything, or nearly everything, it follows that the ether through which its undulations are propagated must pervade all space, whether empty or full, whether occupied by opaque matter or transparent matter, or by no matter at all. The attractive experiments by which the late Professor Herz illustrated the electric vibrations of the ether will only be alluded to by me, in order that I may express the regret deeply and generally felt that death should have terminated prematurely the scientific career which had begun with such brilliant promise and such fruitful achievements. But the mystery of the ether, though it has been made more fascinating by these discoveries, remains even more inscrutable than before. Of this all-pervading entity we know absolutely nothing except this one fact, that it can be made to undulate. Whether, outside the influence of matter on the motion of its waves, ether has any effect on matter or matter upon it, is absolutely unknown. And even its solitary function of undulating, ether performs in an abnormal fashion which has caused infinite perplexity All fluids that we know transmit any blow they have received by waves which undulate backward and forward in the path of their own advance. The ether undulates athwart the path of the wave's advance. The genius of Lord Kelvin has recently discovered what he terms a labile state of equilibrium, in which a fluid that is infinite in its extent may exist, and may undulate in this eccentric fashion without outraging the laws of mathematics. I am no mathematician, and I cannot judge whether this reconciliation of the action of the ether with mechanical law is to be looked upon as a permanent solution of the question, or is only what diplomatists call a *modus vivendi* In any case it leaves our knowledge of the ether in a very rudimentary condition. It has no known qualities except one, and that quality is in the highest degree anomalous and inscrutable. The extended conception which enables us to recognize ethereal waves in the vibrations of electricity has added infinite attraction to the study of those waves, but it carries its own difficulties with it. It is not easy to fit in the theory of electrical ether waves with the phenomena of positive and negative electricity, and as to the true significance and cause of those counteracting and complementary forces, to which we give the provisional names of negative and positive, we know about as much now as Franklin knew a century and a half ago."

PERSONAL.—At a meeting of the Superior Water, Light and Power Co., West Superior, Wis., held a few days ago, ex-governor W. R Merriam was elected president, to fill the vacancy caused by the death of A. H. Wilder.

THE RANGE OR POSITION FINDER.*

An instrument which will indicate quickly and with reasonable accuracy the distance of objects within the range of vision at sea, is obviously of great advantage, both on account of its military value to a war vessel and as an aid to navigation in coasting or making land. Several range finders have been devised both here and abroad, but by far the most complete apparatus is that invented by Lieutenant Bradley A. Fiske, U S. Navy.

This beautiful instrument, after tests extending over a period of five years, has just been officially approved and adopted by the Navy Department, and it has been adopted by several foreign governments as well. The following extracts from an official report of the commanding officer of the "San Francisco" show what it will do in actual service:

"In January last, when at Pernambuco, Brazil, I sent to the Department a tabulated record of the errors of the Range Finder as determined in the various parts where the true distances could be gotten from the charts. The average error of all the observations was

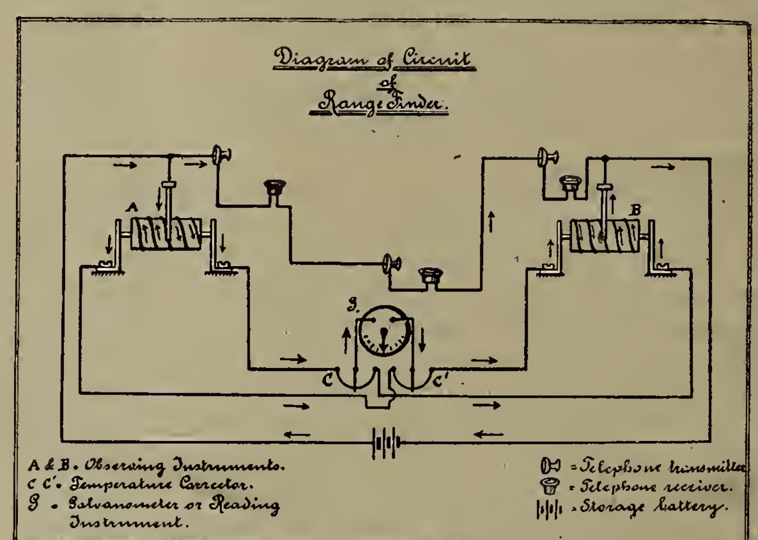


DIAGRAM OF RANGE FINDER CIRCUIT.

about six-tenths of one per cent. per thousand yards. Since that time I have always made use of the Range Finder at target practice, and in going into and out of port and in coasting. The Range Finder is thoroughly adapted to ship use, as is shown by the fact that its whole care and service are in the hands of three apprentice boys. These boys keep it in order, and go to it as their station at general quarters, getting under way and anchoring, and whenever the word is passed, 'Man the Range Finder.'

"The Range Finders keep in order with almost no care whatever. There is a transmitter in the conning tower—one reading instrument in the starboard gangway—another reading instrument on the poop. The quiet and orderliness of target practice would be much increased if two reading instruments were added—one for the port gangway and one for the forecastle."

This report shows that the instrument is accurate and easily kept in order. In its construction, the principle of the well-known Wheatstone bridge is applied very cleverly. Two standards are firmly secured to the deck, at the ends of a base line of known length. The standards are connected to each other and to a central point (usually the conning tower) by proper wires, there being also a telephonic connection between all these stations. Each standard carries a telescope, fitted with an electric contact and pivoted so as to travel over a graduated metallic arc. The diagram shows the usual connections. The galvanometer in the circuit is located at one of the standards. As the telescopes are directed on the same object, (communi-

* Abstract of paper read by S. Dana Greene before the Society of Naval Architects and Marine Engineers, New York, November 15 and 16, 1894.

cation being constantly maintained between the two stations by telephone) they take different positions on the arcs, and a deflection is produced on the galvanometer, which deflection is proportional to the distance of the object. By trigonometry, the distances are determined for different angular positions of the telescopes and the galvanometer is then graduated to read the distance direct in yards

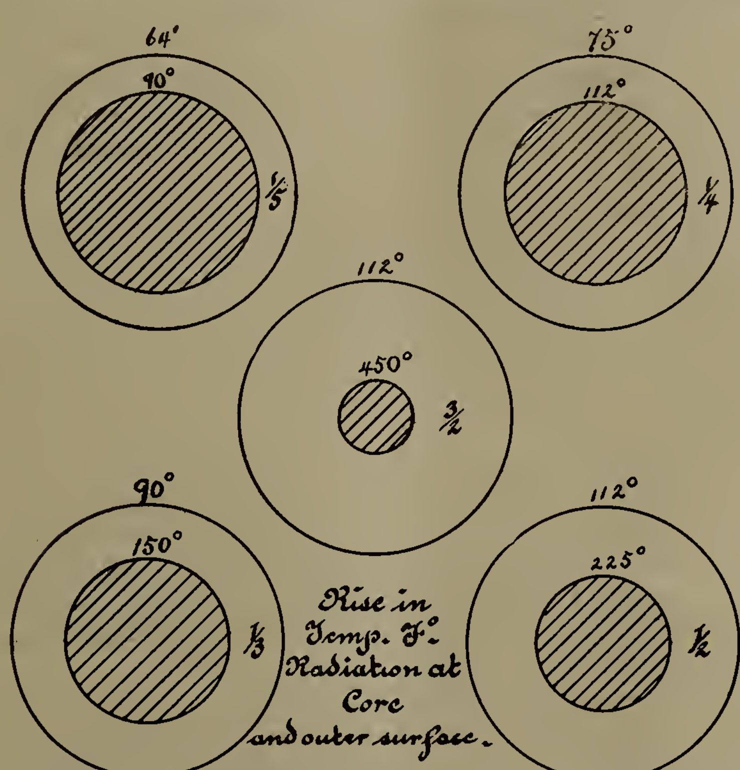
This distance is reported from the principal observing station to the conning tower by telephone and is then telegraphed to indicators placed conveniently about the decks. In future naval engagements, the range finder will play an important part and it may be a controlling factor in determining a victory; while in the field of navigation, its use will be steadily extended.

PRINCIPLES OF DYNAMO DESIGN.

BY NEWTON HARRISON, E. E.

(*Continued from Page 290.*)

The graphical representation of the coil proportions advocated in the table appeals more to certain minds than would the written values. The illustration clearly shows the limiting depth which with a certain fixed loss in watts may be increased if desired, though economy would forbid a further use of copper. The situation is merely this; that with a given number of watts dissipated as heat, the greater the volume of copper they raise in temperature the less the specific temperature or heat evolved per square inch of the coil. The sketch below may immediately act as a definite guide to the



Windings = 1/5, 1/4, 1/3, 1/2, 3/2 Diameter of Core at 225° rise per watt per Sq. inch

proper coil design, as follows: Determine the watt loss per square inch at core and outer surface by selecting any proportion on the diagram. By this it is inferred that the C^2R is known; such being the case the dimensions are arrived at by the above system, that is to say, the length of core and depth of winding.

The next determination to be made is the size of wire which will have the proper resistance and cross-section for the E. M. F. and current to be sent into it. This selection necessitates the filling in of the coil space with a certain resistance of copper wire; the ampere turns being known by previous methods. The size of wire may at once be determined from the large table already given, remembering to divide the heat as represented there by the number expressing the ratio between 225° and the heat calculated for on the surface of the coil. If, for instance, the rise of temperature of the coil be 56°, the depth of winding given in that table will be 225° with one square inch per watt, but with two or three square inches per watt the temperature will be only one-half or one-third of 225°. The 56° is calculated for on this basis; that is to say, a coil with four square inches per watt for radiation will only rise to 56°, or one-quarter of the heat as given in the table at the depth specified.

The diagram is merely given as an assistance to the designer for the prevention of heavy windings and lack of proportion between core surface and energy dissipated. It also immediately determines the volume of winding with a given C^2R. A formula can be given for the approximate determination of the size of wire when the volume and resistance of the coil is known. But the variable factor will be the percentage to allow for insulation in different sizes of wire, smaller sizes having more depth of covering than the larger in proportion to their circular mils. From 15 to 20 mils extra allowance must be made over the bare wire for sizes ranging from No. 25 to No. 10 B and S. The formula is then applicable in the following form:

$$D^2\, d^2 = \frac{V}{R} \times 960{,}000.$$

D = mils diameter covered.
d = " " bare.
V = volume in cubic inches.
R = resistance in ohms.

In which $D = d + 15$ mils within the sizes above mentioned. As an illustration of its applicability take a coil whose temperature is to be within 75° F. If its diameter of core is eight inches, with winding it will be twelve inches, using the proportions given in the diagram. The length if ten inches will give a volume for wire of $10 \times (.8\,\delta^2 - .8\,\delta_1^2) = V = 640$ cubic inches.

$$\delta = 12 \text{ inches.}$$
$$\delta_1 = 8 \text{ ''}$$

At an E. M. F. of 100 volts the resistance = 80 ohms and the current 1.26 amperes, then

$$D^2\, d^2 = \frac{640}{80} \times 960{,}000.$$

$$= 7{,}680{,}000.$$

$$\text{or } D\, d = \sqrt{7{,}680{,}000} = 2{,}771$$

but $D = d + 15$, therefore $D\, d = d^2 + 15\, d = 2{,}771$

by the binomial theorem $(d + 7\frac{1}{2})^2 = d^2 + 15\, d + 56\frac{1}{4}$

$$d + 7\tfrac{1}{2} = \sqrt{2{,}771 - 56\tfrac{1}{4}} = 52$$

therefore $d = 52 - 7.5 = 44\frac{1}{2}$ mils or No. 17 B & S gauge.

The heat would be, for a coil 3.3 inches deep, 225° according to the table usually referred to. This would mean a rise of only $\frac{2}{3} \times 225°$ for a winding two inches deep or 150° Fahr.; but this will be still further reduced to one-third by the larger area at the surface of the coil, hence the temperature rise will be $\frac{1}{3} \times 150°$ or 50° Fahr. As the table of coil proportions calls for a 75° rise, a finer wire may be used and less current consumed in the coil; the adjustment being made as suggested by economical considerations. The ampere turns, it being understood, having been found by previous methods, the current is determined by reference to the table of percentages of energy allowed for field coils according to the size of machine in kilowatts. This fact at once fixes the current for the coils if the watts thus allowed be divided by the E. M. F. to be applied to them. From this we are enabled to calculate the resistance of the coils by the simple rule $C \times R = E$, therefore $R = \frac{E}{C}$.

The coil space or volume of wire, the current, resistance and temperature limit being known, the size of wire is obtained and tested. The heat necessarily affecting its resistance .2 of an ohm each degree Fahrenheit, thus leading to the necessity of a larger wire for very accurate design, otherwise the ampere turns would decrease with the heating of the coils and somewhat weaken the field, though the armature may be more effective in this respect when fully loaded than the coils, because of its lower E. M F.

Should coil space be limited however, the smaller areas will be best as a basis for calculation, though a machine whose design is such that certain parts are cramped and compressed needs but one remedy for an efficient cure, and that is—to redesign it.

(*To be Continued.*)

TELEPHONE NOTES.

The Mason Telephone Company, Sumter, S. C., will enlarge its plant.

A telephone exchange is to be established in Austin, Minn., by W. S. Willis.

A telephone line is being erected along the Ohio River, Wheeling, W. Va.

J. E. Helema, Waynesville, N. C., is talking about constructing a telephone system.

The telephone wires in the streets of Lockport, N. Y., must come down, so says the common council.

A long distance telephone line is to be erected between Manistee and Ludington, Mich. The poles are now being set.

The telephone was very extensively used in Chicago in disseminating election returns and news during the recent "political revolution."

The National Telephone Company, and the Anthony Telephone Co, Austin, Tex., have been granted franchises by the council of that city.

The American District Telegraph and Telephone Company, of West Superior, Wis., has been incorporated. A. J. Graham is president.

The Nebraska Telephone Exchange, Council Bluffs, Ia., is making some important changes in its service and otherwise improving the same.

A company has been organized in Dayton, Ohio, and will install the D'Unger telephone. The promoters are securing many subscribers, so it is reported.

Winona, Minn., will have a new telephone system if sufficient interest can be developed among the citizens by the projectors, who are Minneapolis men.

All the telephone trunk lines in Wilkesbarre, Pa., are being placed under ground. The new exchange will be ready for occupancy about February 1, next.

A Chicago daily paper states that the Harrison Telephone Company has decided to invade the territory of the Chicago Telephone Company, and make things lively for the older concern.

The North American Interior Telephone Company has been incorporated in Baltimore, Md., with a capital stock of $60,000. For further particulars address Frederick W. Schultz, Baltimore.

Commissioner of Corporations Endicott, Boston, Mass., has decided that the new issue of Bell Telephone stock may be sold at $190 per share. Five thousand shares of the new stock will be issued.

The telephone lines suffered severe injury during the recent sleet and snow storm in the Eastern states. The damage, it is stated, has never before been equalled, and this at the beginning of the winter season.

The negotiations looking to the establishing telephonic connection between Dubuque and Bankston, Iowa, has fallen through on account, it is said, of the high price asked by the Bell Company for line construction.

The Minnesota Harrison Telephone Company has been incorporated with a capital of $250,000. The officers are Chas. H. Macy, president; W. A. Edwards, vice-president; B. U. Taylor, secretary, and Thos. F. Hurley, treasurer.

A new telephone company has been organized in Rahway, N. J, for the purpose of establishing in that place low-priced telephone service. The incorporators are Chas. Oliver, H. B. Rollinson, William Howard, William Chamberlain, Ferdinand Thompson and W. J. Lansley.

Herbert Laws Webb's new "Telephone Hand Book" is selling "like hot cakes." It is the best telephone book published and deals with the subject from a to z. Those interested are not slow to show their appreciation of this comprehensive and reliable work on the telephone.

The American Telephone and Telegraph Company is distributing among its patrons a directory of its subscribers in the various cities and towns throughout the country. It is a most valuable publication and it is worth becoming a subscriber to the company's excellent service in order to get a copy of the "Long Distance Telephone Directory."

Telephone manufacturers are all doing a nice business and they seem to be the happiest mortals alive. Some excellent instruments are made outside of the monopoly's sphere. This sphere is gradually contracting, and the "independents" are increasing in number at a rapid rate. The Bell Company is not travelling on an easy road nowadays.

If the United States Supreme Court decides the Bate Refrigerating Case in favor of the Bate interests, then the Bell Telephone monopoly may be extended until 1909; if against, then the monopoly is ended. The Bell Company, it is stated, is backing the Bate Company in the fight and has the heaviest interest at stake. Among the concerns represented on the other side is the Harrison International Telephone Company.

In his annual report General A. W. Greely, Chief of the Signal Service, lays special stress upon the value and importance of captive balloons, provided with telephonic apparatus, for use in the event of popular disturbances where the services of troops are necessary. A telephone connection between the balloon and the commanding officer would enable the latter to keep fully informed as to the movements of hostile rioters and keep the law-breakers under such surveillance that would insure prompt and effective action.

ELECTRIC TRANSMISSION OF POWER FOR MINING PURPOSES.*

One of the most interesting cases of the electrical transmission of power for coal mining purposes in Europe has been completed and set in operation at the Decize Collieries in the Nièvre Department of France, and which are owned by MM. Schneider & Co. This installation is remarkable from the fact that diphase alternating currents are employed for the transmission, and diphase alternating current motors are used for reconverting the electrical energy into mechanical power at the different pits. In designing this plant the problem to be solved was to erect a central generating station for the distribution of electrical energy at the different pits where it could be utilized in electro-motors for operating ventilating fans, hauling machinery, pumps and for lighting purposes. A general idea of what had to be accomplished is shown in the annexed table :

Site.	Distance from generating station. Yards.	Electrical machinery or lamps receiving the current transmitted.
1.—West.		
Puits des Chagnats	5,090	30-H. P. electric motor.*
Fendue des Lacets	3,466	" " *
Puits des Coupes	2,058	" " *
Puits des Zagots	1,084	Elec. hauling machine of 15 H.P.†
2.—Generating Station.		
Various installations	—	Six arc and 100 incandes. lamps.‡
3.—East.		
Fendue des Marizy	1,300	30-H. P. electric motor and 24 arc lamps.§
Sorting and washing shops of the Pré-Charpin	2,490	500 Incandes. lamps of 16-C. P.‡
Champvert	3,250	12 H. P. electric motor.‖

* Used for ventilating fan. † Inclined plane. ‡ Lighting. § Ventilating fan and lighting. ‖ Pumping.

The generating station is situated respectively at distances of from 3.1 miles and 1.86 miles from the extreme points which have to be supplied with current. It contains a battery of six boilers and two units (steam engines and dynamos), each of a capacity of 100 kilowatts ; a further unit will shortly be laid down. The two units may be worked singly or in parallel. The engines are of the horizontal non-condensing type, running at 200 revolutions per minute, and driving the diphase alternators by means of belting. A notable feature in this connection is the fact that each electrical unit comprises a twin alternator, or in reality two machines, placed one at each end of the shaft, the driving pulley carrying the engine belt being arranged in the middle of the shaft. Of course, in a case like the present, where current is employed both for lighting and for power purposes, one of the circuits may become more loaded than another, and in this event the equilibrium must be established by varying the ratio of the electromotive forces. The arrangement adopted in the Decize installation allows of this being accomplished, as each of the two circuits having a distinct field, it is only necessary to vary the exciting current by means of rheostats to get the desired effect. The generators introduced are Zipernowsky 10-pole alternators, with revolving field-magnets. The 10-field magnets are connected together in series, and the exciting current is led to them by means of two metallic rings carried on an extension of the driving shaft on the opposite side to that of the driving pulley—that is to say, on an outer extension of the shaft. Two ordinary brass brushes press upon these rings, to which the exciting current is furnished by a direct current dynamo. This latter machine is operated by a belt from the shaft of the alternator. At 900 revolutions a minute this direct current dynamo supplies the exciting current for the twin alternator, being between 25 and 30 amperes at 110 volts.

* *Colliery Guardian.*

The fixed armature of the alternators is formed of 10 coils, any one of which can be withdrawn and replaced with little trouble.

After passing through the switchboard the current is transmitted mainly by means of overhead wires to the points of utilization, the only portion laid underground being towards the end of the principal line leading to the Chagnats Pit. The wires forming the overhead line are of silicon-bronze, and are carried on porcelain insulators attached to poles 24 feet high. The diameter of the wires constituting the principal line to the western part of the district is 6 mm., and 4 mm. in the case of the remainder of the line. It is noteworthy that the same poles carrying the transmission wires also support telephone wires, the latter being arranged 12 feet from the ground. In order to counteract the effects of induction in the telephone wires, the line conductors are crossed at distances averaging 540 yards, and by this means the difficulty of understanding conversation along the telephone wires which use the earth as return, has been overcome. The small portion of underground line forms a lead-covered cable, laid in a wooden conduit, as also does the telephone line for the same distance. Suitable lightning conductors are provided at the generating and distributing sub-stations and at intervals along the line. The electromotors at the sub-stations, where the current is utilized for the different purposes mentioned in the table given above, are of the same type as the generators. These diphase motors are easily set in operation, and are to all intents and purposes left to themselves for several hours together. The only attention they receive is the visit of an employé every six or eight hours to ascertain whether the motors are working properly. The sub-stations are situated in the forest, and the facility of working on this system as compared with the erection in each place of a boiler, steam engine and ventilating fan, is considered to be remarkable, apart from the question of the cost of transporting fuel.

AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS.

At the meeting of Council held at 26 Cortlandt street, November 21, the following associate members were elected :

Appleton, Joseph, electrical engineer, The Electrical Storage Battery Co. ; residence, 706 South Washington Square, Philadelphia, Pa.

Archer, Geo. F., student in electrical engineering, Columbia College ; residence, Garden City, L. I.

Ashley, Frank M., master mechanic, Ashley Engineering Works, Hawthorne, N. J., 136 Liberty street, N. Y.

Blizard, Charles, general sales agent, Electric Storage Battery Co., 45 Broadway ; residence, 76 Madison ave., N. Y. city.

Davenport, C. G., expert and agent General Electric Co., 44 Broad street, N. Y. city.

Hadaway, W. S., Jr., electrician, Central Electric Heating Co., 26 Cortlandt street, New York city.

Hedenberg, Wm. L., draughtsman, W. R. Fleming & Co. ; residence, 83 Clinton place, N. Y. city.

Munns, Chas. K., electrician, Strowger Autom.-Tel. Exchange, Chicago, Ill. ; residence, 1002 W. Monroe street, Chicago, Ill.

Ridley, A. E. Brooke, agent, electrical engineer, Siemens & Halske Electric Co., 508 California street, San Francisco, Cal.

Robinson, Francis G., foreman, Bushwick and Union Avenue Depots, Brooklyn Heights R. R. Co. ; residence, 156 Macon street, Brooklyn, N. Y.

Varney, William Wesley, attorney-at-law, electrical expert, 118 East Lexington street; residence, 1001 Harlem avenue, Baltimore, Md.

The following associate members were transferred to full membership:

Sands, H. S., consulting and contracting electrical engineer, Wheeling, W. Va.

Ross, Norman N., district engineer, Canadian General Electric Co., Winnipeg, Man.

Cheney, W. C., superintendent and electrical engineer, General Electric Co., Portland, Ore.

Bowman, Fred. A., superintendent New Glasgow Electric Co., New Glasgow, N. S.

Tischendoerfer, F. W., electrical engineer, Schückert & Co., Nuremberg, Germany.

At the institute meeting held at 12 West 31st street in the evening, President Houston in the chair, a paper was presented by Professor Geo. D. Shephardson of the University of Minnesota, entitled "Suggestions for an Index of Engineering Literature." In the absence of the author, Mr. T. C. Martin read the paper and opened the discussion, which was participated in by Messrs. Crocker, Caldwell, the president and the secretary. Written discussions were also communicated by Messrs. Carl Hering, J. Stanford Brown, M. Osterberg and Professor Goldsborough. Professor H. J. Ryan also sent in a communication upon the subject of "Reactance" in discussion of the paper read at the Philadelphia meeting.

POSSIBLE CONTRACTS.

The Electric Messenger Company, Pittsburgh, Pa., has been granted the right by the Select Council, of Allegheny, to lay and maintain its wires, cables, etc., through and under the streets in the suburban districts.

Efforts are being made by three companies to secure a franchise for an electric railroad from Niles to Girard, Ohio. The County Commissioners, Warren, O., will consider the applications on the first Wednesday in December.

F. A. Sieberling, representing an Akron syndicate, has been granted a franchise, by the County Commissioners, Cleveland, to build and operate an electric railroad along the improved Bedford road.

The Athens Telephone Exchange, Athens, Ga., contemplates the construction of a telephone line from Athens to Atlanta. Mr. H. C. Conway, manager of the Atlanta Exchange, can give further information.

The Raleigh Electric Company, Raleigh, N. C., will put in an incandescent light plant. Alfred A. Thompson is president.

The Washington, Arlington and Falls Church Electric Railway Co. has secured right of way for its proposed lines.

An electric light plant is to be established in Woodbine, N. J.

The Bellevue Electric Light Company, The Avalon Electric Light Company and The Benavon Electric Light Company, Pittsburgh, Pa., will apply for charters early in December.

John R. Bond, Jas. A. Brewer and John Clinton, of Brownsville, Tenn., have been granted a franchise for the erection and operation of an electric light plant in that place.

The Security Storage & Trust Company, Baltimore, Md., of which Henry S. King is president, contemplates the erection of a building to cost about $125,000.

The Graham Storage Warehouse Company, Baltimore, Md., contemplates the extension of one of its buildings at a cost of $200,000. Jas. McEvoy is general manager of the company.

Greeley, Rollins & Morgan, Jacksonville, Fla., can probably give particulars regarding the proposed erection of a hotel by English capitalists at a cost of $500,000.

The Hotel Belvedere, Washington, D. C., is to be extended according to plans prepared by A. P. Clark, jr.

The Chattanooga Railroad Company, Chattanooga, Tenn., is contemplating the extension of its lines to East Chattanooga.

W. B. Henry, Clerk of Council, Elberton, Ga., can give information regarding the proposed construction of an electric light plant by the city.

The St. Charles & New Orleans Street Railroad Companies are talking about constructing a new power plant.

A petition will be presented to the next Mississippi Legislature for authority to construct an electric light or gas plant in the town of Quincy, that State.

W. S. Cook, Mayor of Fayetteville, N. C., can give information regarding the proposition to improve the lighting system in that place.

NEW CORPORATIONS.

The Mound City Electric Light & Power Company, Mound City, Ill., by A. J. Dougherty, E. G. Bruckman and S. E. Bruckman. Capital stock, $50,000.

Dearborn Electric Company, Chicago, Ill., by T. C. Rafferty, Chas. Messer and J. P. Rafferty. Capital stock, $25,000.

North American Interior Telephone Company, Baltimore, Md., by Frederick W. Shultz and others. Capital stock, $60,000.

Second Avenue Traction Company, Pittsburgh, Pa. Directors: G. T. Hamilton, Edgewood, H. J. Stern, Avalon, W. J White and others. Capital stock, $10,000

The Whittingham Electric Car & Heating Company, Baltimore, Md., by Percy B. McLaram, Henry W. Williams, Frank Della Torre, G. H. Whittingham and Alex. Brown.

The Citizens' Telephone Company, Akron, Ohio, has been organized with a capital stock of $100,000.

Paragould Electric Light Company, Paragould, Kansas, by T. H. Wyse, D. A. Bertig and others. Capital stock $5,500.

Carthage, Webb City, Joplin and Galena Electric Co., St Louis, Mo., by John N. Bofinger, J. J. Taussig, David R. Powell, C. C. Carroll and Jas. P. Dawson. Capital stock $175,000.

The Raleigh Electric Co., Raleigh, N. C., by Alf. A. Thompson, president; F. H. Briggs, secretary-treasurer, and A. B. Andrews, J. H. McAden, of Charlotte, Julian S. Carr, J. A. Jones and others, directors.

The Traders' Annex Co., Clarksburg, W. Va., by T. M. Jackson, D. R. Morgan and W. B. Maxwell. Capital stock $1,000,000.

The Moore Electrical Company, New York City; directors, Joseph Livingston, Leopold Wallach, Daniel McFarlan Moore of New York City, and Edward J. Wessels, of East Orange, N. J. Capital stock $50,000.

The Clarksburg & Suburban Street Railway Company, Clarksburg, W. Va., by R. S. Gardner, J. H. Horner and others.

The Union Electric Co., of Hallstead, Pa., by J Gardner Cassatt, Thomas A. Biddle, Robert Mitchell, L. B. Huff, Thomas Donohue, William F. Lloyd and John Lloyd. Capital stock, $150,000.

The Traders' Annex Company, of Clarksburg, W. Va., by T. H Jackson, D. R. Morgan and W. B. Maxwell. Capital stock $1,000,000.

NEW YORK NOTES.

Office of the Electrical Age,
First Floor, World Building,
New York, November 26, 1894.

The State Railroad Commissioners have granted permission to the Nassau Electric Railroad Company, of Brooklyn, to use the overhead trolley system in New York avenue from Fulton street to Atlantic avenue. It is stated that there will be opposition from the residents.

An injunction was served on November 20 on the Board of Aldermen to restrain them from giving their consent to the Metropolitan Traction Company to build a street railroad on St. Nicholas avenue and the Kingsbridge road.

To Mayor Schieren of Brooklyn is probably due the credit for conceiving the idea of lighting the bridge cars by electricity. It seems to have been his idea, too, to carry the current to the cars by an overhead wire. The matter was considered by the Bridge Trustees last March when Superintendent Martin favored the Pintsch gas system of lighting. He did not think electricity could be used. Mayor Schieren thought otherwise, and suggested that as the road was so short that an overhead wire could be used to carry the current.

On November 21 Mayor Gilroy appointed as Commissioners of the Board of Electrical Control, Jacob Hess, Amos J. Cummings and Henry S. Kearney. Hess is a reappointment and the others are new.

The firm of Bloomer Bros. & Co., 26 Cortlandt street, has assigned.

STREET RAILWAY INTERESTS.

The Allegheny Traction Company's barns, on Spring Garden Avenue, Pittsburgh, Pa., were burned on November 23, together with forty-nine horses seven horse cars, seven electric motor cars. Loss $75,000.

TRADE NOTES.

H. J. Jaeger, 168 William street, manufacturer of glass mercury pumps for incandescent lamp work, does all kinds of glass blowing for electrical work and inventors. Among his novelties are glass pens for advertising purposes. They are very neat and useful.

The Phœnix Telephone Co., Produce Exchange, New York City, are doing a good business in magneto telephones. They have one of the simplest, most compact and efficient instruments in the trade. Responsible parties may secure territory without cost for the exploitation of this telephone.

Noll & Sibley, Postal Telegraph Building, New York City, now having a telephone in their office can take your order by telephone for anything you may need, from a lamp socket to a central station outfit. They represent some of the best producers of lamps, sockets, switches, cut-outs, etc.

J B Phillips, electrical engineer and contractor, 30 Cortlandt street, New York City, is an old Brush and United States Electric Light Company man, of twelve years' experience in the installation of lighting and power plants He is now installing a direct connected Sturtevant engine and Wenstrom dynamo for the wrecking boat, "W. E. Chapman," and is also installing a plant for the Standard Steel Company, Phillipsburg, N. J. This plant will include a 500-light Wenstrom dynamo. Among other contracts he has under way are the wiring of 200 lamps in the private residence of Benjamin Sterns, New York City; the wiring of Troop A Armory, 94th and 95th streets and Madison Avenue, New York, for 1,000 lamps, using therefor Grimshaw wires and brass armored interior tubing. Associated with Mr. Phillips is Oscar Weiderhold, an electrical engineer of long experience, and formerly connected with the Elektron Manufacturing Company. Mr. Weiderhold is interested in the installation of the plants and other work mentioned above.

Neftel, O'Connor & Company, Inc., engineers and contractors of electric railway, light, power and steam plants, 126 Liberty street. New York City, are building the Carbondale and Forest Electric Railway, Carbondale, Pa, using the General Electric Company's system, the motors, however, being of the Westinghouse Company's make. This line is 16 miles in length.

The Crescent Electric Machine Company, 647 Kent avenue, Brooklyn, which was organized January last, has been very successful in business. This company manufactures the Churchward Perry system of electrical apparatus and has now on hand orders for $15,000 worth. The company was incorporated with a capital of $20,000, which has since been increased to $70,000. Of this amount $30,000 have been paid in. The officers of the company are M T. Davidson, president; Wm. A. Drewett, superintendent; Geo. F. Simpson, treasurer; James S. Simpson, secretary, and Alexander Churchward, electrician.
W. T. H.

LATEST TRADE CATALOGUES.

We have received from J. H. Bunnell & Co., 76 Cortlandt street, New York City, an advance copy of the latest edition of their general catalogue of telegraph, telephone, railway and electric lighting supplies, as well as of phonographs, graphophones, etc. The catalogue has 225 pages and is neatly gotten up.

Electrical and Street Railway Patents.

Issued November 20, 1894.

529,354. Contact Device for Overhead Electric Railways. Josiah L. Blackwell, New York, N. Y., assignor to the Thomson-Houston Electric Company, of Connecticut. Filed Sept. 15, 1888.

529,357. Street-Car Fender. Alphonso F. Boardman, Brooklyn, N. Y. Filed Feb. 17, 1894.

529,363. Electric Switch or Cut-Out. John C. Cassidy, East Orange, N. J. Filed Aug. 11, 1894.

529,370. Car-Fender. Wm. F. Duncker, Steelton Pa., assignor to Jacob Shaar, same place. Filed Mar. 6, 1894.

529,373. Electromagnetic Apparatus. Stephen D. Field, Stockbridge, assignor to the American Bell Telephone Company, Boston, Mass. Filed July 24, 1894.

529,385. Electric-Fan Motor. Frank X. Hofbauer, Newark, N. J., assignor, by mesne assignments, to the Armature Bell Company, same place. Filed Aug. 1, 1894.

529,398. Audible Synchronism-indicator. Ralph D. Mershon, Pittsburgh, Pa. Filed Apr. 27, 1894.

529,406. Underground Electric Railway. Henry B. Nichols and Frederick H. Lincoln, Philadelphia, Pa. Filed June 13, 1894.

529,411. Manufacture of Electric Conductors. John Robinson, Philadelphia, Pa , assignor of one-half to Wm. J. Chaninel, same place. Filed Feb. 16, 1894.

529,412. Insulated Electric Conductor. John Robinson, Philadelphia, Pa., assignor of one-half to Wm. J. Chaninel, same place. Filed Feb. 17, 1894.

529,413. Manufacture of Electric Conductors. John Robinson, Philadelphia, Pa., assignor of one-half to Wm. J. Chaninel, same place. Filed Mar. 6, 1894.

529,421. Multiple Switchboard System. Charles E. Scribner, Chicago, Ill., assignor to the Western Electric Company, same place. Filed May 1, 1890.

529,429. Electric Incandescent Lamp. Elihu Thomson, Swampscott, and Edwin W. Rice, Jr., Lynn, Mass., assignors to the Thomson-Houston Electric Company, of Connecticut. Filed Feb. 8, 1892.

529,433. Electrical Measuring Instrument for Switchboards. John Van Vleck, New York, N. Y. Filed Apr. 14, 1894.

529,434. Electrical Measuring Instrument. Edward Weston, Newark, N. J. Filed Oct. 3, 1892.

529,435. Electrical Measuring Instrument. Edward Weston, Newark, N. J. Filed June 21, 1894.

529,437. Armature-Core. James J. Wood, Fort Wayne, Ind. Filed Aug. 21, 1894.

529,451. Combination Gas and Electric Light Fixture. Gustav A. Loeben, Philadelphia, Pa., assignor of two-thirds to Charles Falkenstein and George Falkenstein, same place. Filed June 7, 1894.

529,460. Car-Fender. George W. Oakley, Manchester, N. J. Filed May 4, 1894.

529,465. Telephone System. John I. Sabin, San Francisco, Cal. Filed Apr. 14, 1894.

529,552. Trolley-Stand. Frank N. Kelsey, New Haven, Conn., assignor of one-half to Charles L. Wright, same place. Filed Aug. 29, 1894.

529,559. Electric Circuit. Joseph W. Marsh, Pittsburgh, Pa. Filed Apr. 10, 1894.

529,563. Apparatus for Generating Electricity for Lighting Railway Cars. Thos. A. Murray, Boston, Mass. Filed May 3, 1894.

529,578. Switch. Francis B. Badt, Chicago, Ill. Filed Oct. 14, 1892.

529,595. Electric Switch and Cut-Out. John C. Cassidy, East Orange, N. J. Filed Sept. 24, 1894.

529,609. Antiseptic Mouthpiece for Telephones. Rial N. Denison and Frank M. Geary, Brooklyn, N. Y. Filed Apr. 25, 1894.

529,616. Section-Insulator. Albert Hennefeld, Christ. Dehner, and Charles H. Van Ness, Colorado Springs, Col. Filed Apr. 19, 1894.

529,646. Street Railway-Switch. Cornelius Coughlin, Cincinnati, Ohio. Filed Feb. 15, 1894.

529,650. Continuous-Current Dynamo-Electric Machine. Maurice Hutin and Maurice Leblanc, Paris, France, assignors to the Société Anonyme pour la Transmission de la Force par l'Électricité, same place. Filed Feb. 12, 1894. Patented in France June 21, 1893, No. 231,027, and in England Dec. 4, 1893, No. 23,309.

529,654. Electric-Light Fixture. John R. Konetshny, Brooklyn, assignor to the E. P. Gleason Manufacturing Company, New York, N. Y. Filed Feb. 21, 1894.

529,657. Life Guard for Street-Cars. Martin W. Lydon, North Andover, Mass. Filed Dec. 4, 1893. Renewed Oct. 24, 1894.

529,666. Electrical Releasing Device for Target Traps. Charles H. North, Cleveland, Ohio, assignor to Paul North, same place. Filed Aug. 16, 1894.

529,671. Gearless Electric Locomotive. Charles J. Van Depoele, Lynn, Mass. ; C. A. Coffin and Al ert Wahl, administrators of said Van Depoele, deceased, assignors to the Thomson-Houston Electric Company, Boston, Mass. Filed June 3, 1891. Renewed Sept. 17, 1894.

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CONTENTS.

PEACEFUL MISSION OF THE TELEPHONE.

The German and Austrian emperors conversed with each other on December 1 over the new telephone line between Berlin and Vienna. It is often stated that the civilizing influence the telegraph has had over the world is inestimable, but there is a promise of greater power for good in the telephone. In the future the telephone may be a positive war preventive and a valuable adjunct in the preservation of peace among warlike nations. In the event of international disturbances what is to prevent the rulers of the pugnacious countries from meeting each other at the 'phone in an endeavor to settle their differences, without intrusting the solution of the delicate problem to diplomatic channels, which most always add to the complication of the situation?

RATS!

According to a Baltimore dispatch a rat was the cause of the demoralization of the Brush electric light service in that city on Thanksgiving night. In prowling around the switchboard it very indiscreetly began monkeying with the connections. Just what happened will probably always remain a mystery, as the rodent did not live long enough to give any evidence. However, all the lights went out and stayed out, causing darkness to reign supreme throughout that section of the city served by the Brush Company, and a good deal of damage and annoyance. The short circuit set the switchboard afire, so states the dispatch. Judging from the manner in which the story is written the death of the rat seems to have been of greater importance than the damage to the station; little is said of the latter and much of the former. This experience introduces a new element of danger in electric lighting practice, and tends to prove that many of the fires of the past that have been charged to electric wires were, after all, caused by mice or rats.

CHEAP ENERGY.

To the casual observer it is strikingly evident that a great deal of natural energy goes to waste, while the engineer, fully appreciating the fact, turns his thoughts to devising ways and means of utilizing some of the power thus lost. The most prominent examples of waste energy are water-falls, water currents and air currents. Water-falls have, for centuries, been used to a very limited degree for the purpose of producing mechanical energy, and air currents have been used in like manner and to a like limited degree, but not until the advent of the electrical age have these methods of producing power received any great attention. The exquisite engineering refinements of the day have of necessity brought the possibilities of water-power prominently to the front, and the utilization of the power of air currents for the production of electrical energy has in late years received a great deal of attention. The latter method of obtaining power has been a very difficult problem to solve, but according to an article from Lieut. I. N. Lewis, in the *Engineering Magazine* for December—an abstract of which we print on another page in this issue—the difficulties that stood in the way of a solution have been practically overcome. An immense field is thus opened up for development; there has been "a long-felt want" for small electric plants for suburban uses, which would require a minimum amount of attention and be cheap to maintain. Fortunately, nature does not tax us for the winds that blow over the surface of the earth, and anyone who has the necessary translating apparatus can have electric light and electric power, the energy for the production of which costs nothing.

PRINCIPLES OF DYNAMO DESIGN.

BY NEWTON HARRISON, E. E.

(*Continued from Page 304.*)

MAGNETIC LEAKAGE.

The production of different types of machines on the market, each possessing peculiar characteristics and having a quantity of copper wound upon them due to certain notable differences, is worthy of close consideration. Iron, when magnetized, becomes polarized; each small particle arranges itself in a definite manner with respect to the next particle. This being the tendency it necessarily follows that iron possessing grain will assume this condition more easily than metal of irregular molecular structure. Therefore, one of the first points to notice is the character of the metal used as a frame-work for the dynamo. It has already been shown that cast iron has a lower specific induction than wrought iron. It is also true that in proportion to its dimensions it has a greater factor of magnetic leakage. Cast iron frames were commonly used until a recent date; then makers who used wrought iron cores and cast iron frames gradually turned their attention to cast steel as a substitute for cast iron. The superior permeability of steel made its value magnetically, as compared with cast iron, two to one.

Leaving this subject of material for a while, it is instructive to turn the attention to the more direct causes of leakage and the percentage or coefficient of leakage for different field frames.

In one of the previous illustrations the leakage from corners, curved surfaces and points is very graphically represented. Corners and points act as if they condensed the lines of force and allowed a streaming effect to take place. It therefore follows that in the design of a type of machine it is the best practice to avoid as far as possible such irregularities. Another point of interest well worthy of attention is the necessity for as great a distance as possible between points of opposite polarity for obvious reasons.

It is surprising to note the large value which the coefficient of leakage assumes for certain types of frame, especially when the above points are disregarded. In small frames the leakage is greater than for larger frames of the small type, because, if the same specific induction be observed in the cores of their respective magnets, the parts of the smaller framework are nearer together for a given magnetic density than those of the larger; therefore the leakage between any two given points is greater. Another point to be noted is the fact that in the air gap of a smaller frame, the space between the armature core and the polar face is greater in proportion to its size than it would be for a larger frame. The leakage becomes greater as the magnetic induction passes a certain point, due to the fact that the permeability approaches that of air as the specific induction increases; therefore the likelihood for greater leakage increases and the lines of force thread the air in greater numbers.

Hopkinson investigated the subject and remarks the difference that occurs between the characteristic calculated for and the curve obtained. These differences were virtually due to the leakage and certain unexpected areas supplying lines of force to the armature core.

The characteristic curve of a dynamo expresses the relation between the current and E. M. F. that it develops.

It can be shown that the E. M. F. and I are mutually related. By establishing such a relation we can delineate graphically the resulting curve obtained by plotting current and magnetizing force.

The two elements composing the curves will individually contain the E. M. F. in the case of the ordinate, and the current in the abscissa, of course, along with other quantities whose values do not change.

$$E = \omega f I$$

and $I = \dfrac{E}{\omega f}$ by transposition;

but $e = \varphi(I) \therefore e = \varphi\left(\dfrac{E}{\omega f}\right)$

in the above $\varphi(I)$ = function of I,
e = potential difference,
ω = angular velocity,
f = constant.

Showing the permissibility of plotting I as the ordinate of the curve to obtain the characteristic instead of E. M. F.

In like manner the M. M. F. $4 \pi n C$ contains the element of current C along with other relatively constant quantities $4 \pi n$ thus making in total the necessary constitutents of the curve.

The equation of the characteristic curve is therefore

$$4 \pi n C = l_1 f\left(\frac{I}{A_1}\right) + 2 l_2 \frac{I}{A_2} + l_3 f\left(\frac{I}{A_3}\right)$$

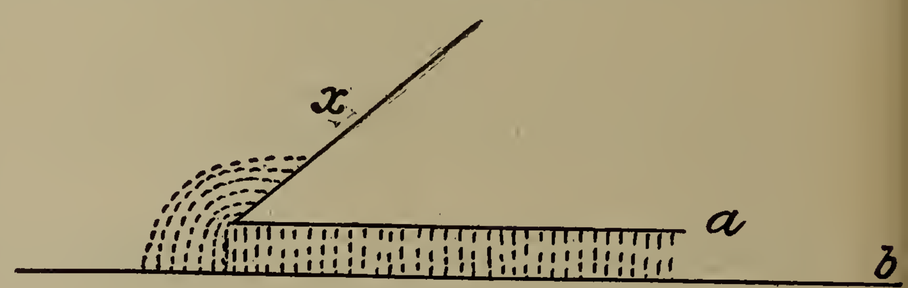


FIG. 15.

By the above formula it is possible to plot the characteristic with a surprising degree of accuracy. This method of predetermining the characteristic of a machine would be exact were it not for the fact that the magnetic leakage modifies the general result, so that when we compare the calculated and the actual characteristic we will find two facts of importance.

(1) The characteristic does not rise with sufficient rapidity at first.

(2) It attains a higher maximum than is actually realized.

(A). The reason for the first is because of the fact that the area of pole-pieces supplying lines of force is greater than that included within the arc.

If a (Fig. 15) represents the pole-piece and b the armature core, the lines of force pass to b not only from a, where it is parallel to b, but from x to b, thus making a larger path or area supplying lines of force.

(B). The second reason is because of the leakage not being taken into account; all the lines of force of the cores do not go into the armature, but many leak away. Therefore we have, instead of $f\left(\dfrac{I}{A_3}\right)$ a greater value or $f\left(\dfrac{vI}{A_3}\right)$, where v is a constant greater than I, expressing the ratio of the total induction through the magnets to the induction in the armature.

The treatment at once assumes an accurate character and the formula benefitted by the following additions becomes more complete.

l_4 = the mean length of lines of force in the wrought iron yoke.

A_4 = the area of the yoke.

l_5 = the mean length of the poles.

A_5 = the area of the pole-pieces.

These last two are introduced to determine the forces required to magnetize the yoke and two pole pieces. In total we have:

$$4 \pi n c = l f \left(\frac{I}{A_1}\right) + 2\, l_2 \frac{I}{A_2} + l_3 f \left(\frac{I}{A_3}\right) + l_4 f \left(\frac{I}{A_4}\right) + 2\, l_5 f \left(\frac{I}{A_5}\right)$$

The curve is now reconstructed and a more correct characteristic obtained.

(*To be continued.*)

BLESSINGS OF ELECTRIC RAILWAYS.

Electric street railways, especially in large cities, are very common and convenient subjects for popular abuse, if newspapers may be relied upon as reflecting popular feeling in such matters. It is rarely that electric railway companies get any credit for anything they do, although they spend thousands and sometimes millions of dollars for improvements in their service. To be sure, this money is spent with the expectation of getting something in return for it; no sane man for a moment supposes that capitalists spend their money just for the fun they get out of it. Yet, disregarding the fact that railroad companies are doing business to make money, the people directly concerned get benefits and advantages through these improvements that they would not otherwise get.

One important service rendered to the people by electric railways was clearly brought out by Mr. E. C. Foster in his paper read at the recent convention in Atlanta, Ga, of the American Street Railway Association. The title of his paper was "City and Suburban Electric Railways."

The function of nearly all city roads, said he, is largely to convey the people from the residential districts, mainly in the suburbs, to the business sections, and likewise, from the latter to the former. In the improvements it has made in this class of transportation lie the greatest benefits of the application of electricity to street-car propulsion. The growth of our great cities has resulted in the appreciation of value of all real estate near the business sections, to a point where the only residence a working man can afford in these districts is a tenement house. These tenements are invariably crowded to a degree that is unhealthful. That the electric railway has done much for humanity in enabling the working population to leave these homes in the congested districts, and procure more comfortable and respectable ones in the suburbs, goes without saying.

Next to this most important use of the electric railways comes their use in furnishing recreation for the masses of the people. Nothing accomplishes so much in the elevation of our population as frequent opportunity to cultivate acquaintance with nature. Optimism is the natural and healthy condition of the mind, and nothing encourages one to look on the bright side of life as does a ride or ramble through the country. The combination of fresh air and pretty scenery makes the only tonic that tones. The two necessary considerations in the accomplishment of the scheme of country air for the masses are, first, the public parks, and second, the means of transportation to them. It is only within the past year that, in the state of Massachusetts, a State Public Park Commission has been created for the purpose of purchasing large tracts of land and opening them to the public, that they may enjoy the beauties of nature without trespassing upon private property. On a portion of the Blue Hills, only ten miles distant from the heart of the city of Boston, over 1,200 acres have been secured to be preserved forever for the benefit of the people. Also, in Arlington, a like distance in another direction, a large reservation is made; Middlesex Falls in another, and the Commission is now turning its attention to the shores of Revere Beach, immediately north of the city, one of the grandest beaches of this continent. It is needless to add that the street railway companies are doing their share in the matter of providing the necessary transportation. While their motives are not purely philanthropic, the results accomplished are of almost as substantial benefit as though the people only were considered. While this fact is very greatly appreciated, there seems to exist a growing feeling on the part of some, that the street-railway companies get everything and give nothing. Certainly the very evident benefits the people have secured, coupled with the fact that few companies have earned more than moderate dividends, and many none, should be enough to convince the most skeptical that the stockholder's experience is not always a profitable one.

NEW YORK ELECTRICAL SOCIETY.

The 163d meeting of this society was held at Columbia College, New York, on the night of November 27. Mr. Gano S. Dunn, electrical engineer of the Crocker-Wheeler Electric Company, delivered a lecture on the subject of "Direct Current Motor and Dynamo Design." Mr. Dunn described the method of rating, designing and the newest forms of winding; sparking and armature reaction received especial consideration, and a method of making the increase of potential in a compound-wound generator proportional to its load was described.

There was a notable attendance, including Nikola Tesla.

The society's programme for the season of 1894–5 includes the following lectures and other forms of instruction:

Lecture on "Some Leading Phenomena and Principles of the Alternating Current," by Mr. C. S. Bradley.

Lecture on "The Production of the Higher Forms of Carbon (such as Carborundum, Diamonds, etc.) by Electricity," by Mr. E. G. Acheson.

Visit to the Metropolitan Art Gallery and Museum, with a lecture on "Interior Lighting," by Mr. Luther Stieringer.

"Niagara on Tap; A Lecture on the Details of the Water-Power of Niagara," by Mr. T. C. Martin. The lecture will be illustrated by lantern slides made from photographs taken specially for the lecture.

Lecture on "The Doctrine of Unity in Electricity," by Dr. Michael I. Pupin.

Visit to an electric lighting station.

Talk on "Street Railway Practice in the United States," by Mr. C. B. Fairchild. The lecture will be based on personal observation in a trip across the country and through the South, and profusely illustrated by lantern slides.

Lecture on the "Use of the Electric Light in Lantern Projections," by Mr. E L. Hopkins. In this lecture the incandescent light and the arc light will be shown on the screen under varying conditions, and the voltmeter and the ammeter will also be visible, so that their readings can be followed with all the changes in the power of the light.

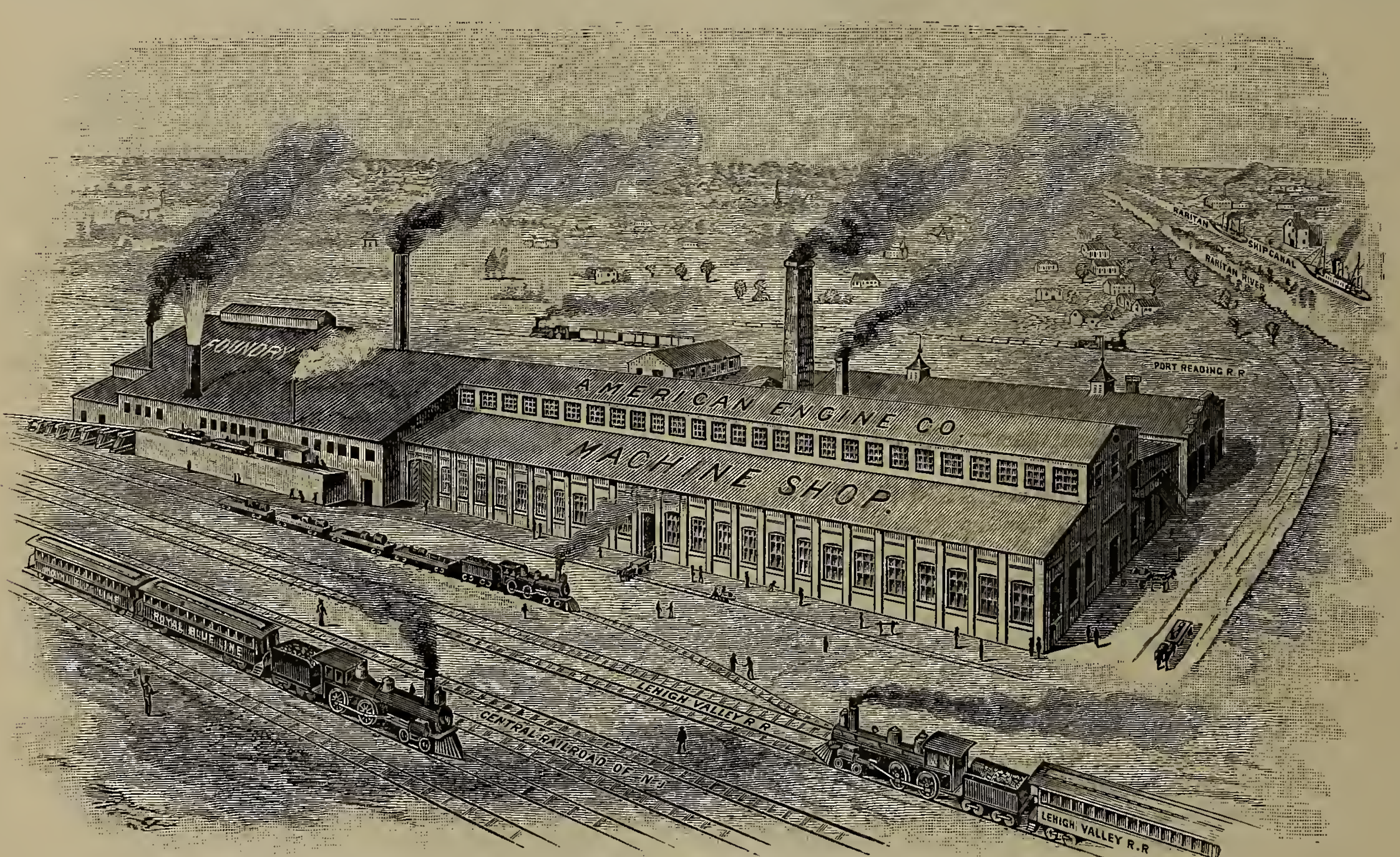
Lecture on "The Static Machine and Its Use and Office in Electrotherapy, by Dr. W. J. Morton.

The membership now numbers 350 and is rapidly increasing. The scope of the society has been extended by supplementing the regular course of lectures and papers with a series of "visiting meetings," at which the members are enabled to see practical illustrations of work in the leading branches of electrical application. These meetings have been highly successful, and will in future form a regular feature of the season's arrangements.

IMPROVED ENGINE OF THE AMERICAN ENGINE CO.

This engine, which is attracting a great deal of attention among engine users, has some unique and ingenious features that are worth careful consideration.

Before describing the engine itself, however, we will give our readers a few words regarding the plant where it is manufactured. The accompanying illustration gives an excellent view of the company's works in Bound Brook, N. J. As will be seen, they are excellently located with reference to shipping facilities. Two railroads run close by on one side, while in front are the Raritan river and Raritan canal. The works are fitted up with machinery of the most modern design, and in every respect the plant is a model of its kind.



WORKS OF THE AMERICAN ENGINE CO., BOUND BROOK, N. J.

The machine shop is 300x75 feet and is lighted by between 250 and 300 sixteen candle-power lamps and six arc lamps. The current is supplied by one slow-speed Loomis generator, which was recently put in, displacing two old type machines. The new dynamo occupies less space than did one of the old ones, and besides furnishing current for lighting purposes it runs two overhead travelling cranes, one in the foundry and one in the machine shop.

Bound Brook is 31 miles from New York city, and with the excellent facilities enjoyed in the matter of shipping, the American Engine Company is extremely fortunate in securing a plant in so favorable a locality.

We now come to the main subject of our article—the engine built by the American Engine Company.

The manufacturers claim as the main features of their engine a valve that possesses the simplicity of the single valve and the steam distribution of Corliss and similar valves, thereby giving the highest attainable steam economy. This valve is the invention of Mr. E. F. Spaulding, manager of the company, and the engines equipped with it are said to be giving excellent satisfaction. A large number of these engines have been sold to electric light stations, where, as is well-known, only the best engines made can obtain an entrance.

The construction of this engine is said to be as simple as that of any single-valve engine, and the number of parts that enter into its make-up as few. The steam economy is equal to that of the Corliss engine. The two greatest claims of the company for its engine are great simplicity and high economy in steam consumption.

(*To be continued.*)

ACTINIC FORCE.

In a paper read by M. Ch. Maréchal, at the meeting on November 7, of the Société Internationale des Electriciens, Paris, that gentleman showed experimentally, by means of an electro-chemical actinometer, that luminous energy is transformed into electrical energy mechanically — available even at long distances — not through the calorific or chemical power of the light, but by virtue of a third force, which the writer calls actinic force.

This transformation is effected in all the divisions of the spectrum, but depends on the coloring matter employed for sensitizing the plates of the actinometer, the sensitiveness of which is so great that the light of a candle at a distance of some metres produces effects that are as clear as they are instantaneous.

After discussing certain applications to telegraphy and photography, M. Maréchal in an hypothesis which, though bold, is based on facts ascertained by observation and experiment, shows once more the close connection between electrical and luminous phenomena; then he showed the intimate relations existing between solar light and the great natural phenomena, such as terrestrial magnetism, the different variations of the magnetic needle, the aurora borealis, earth currents, etc.

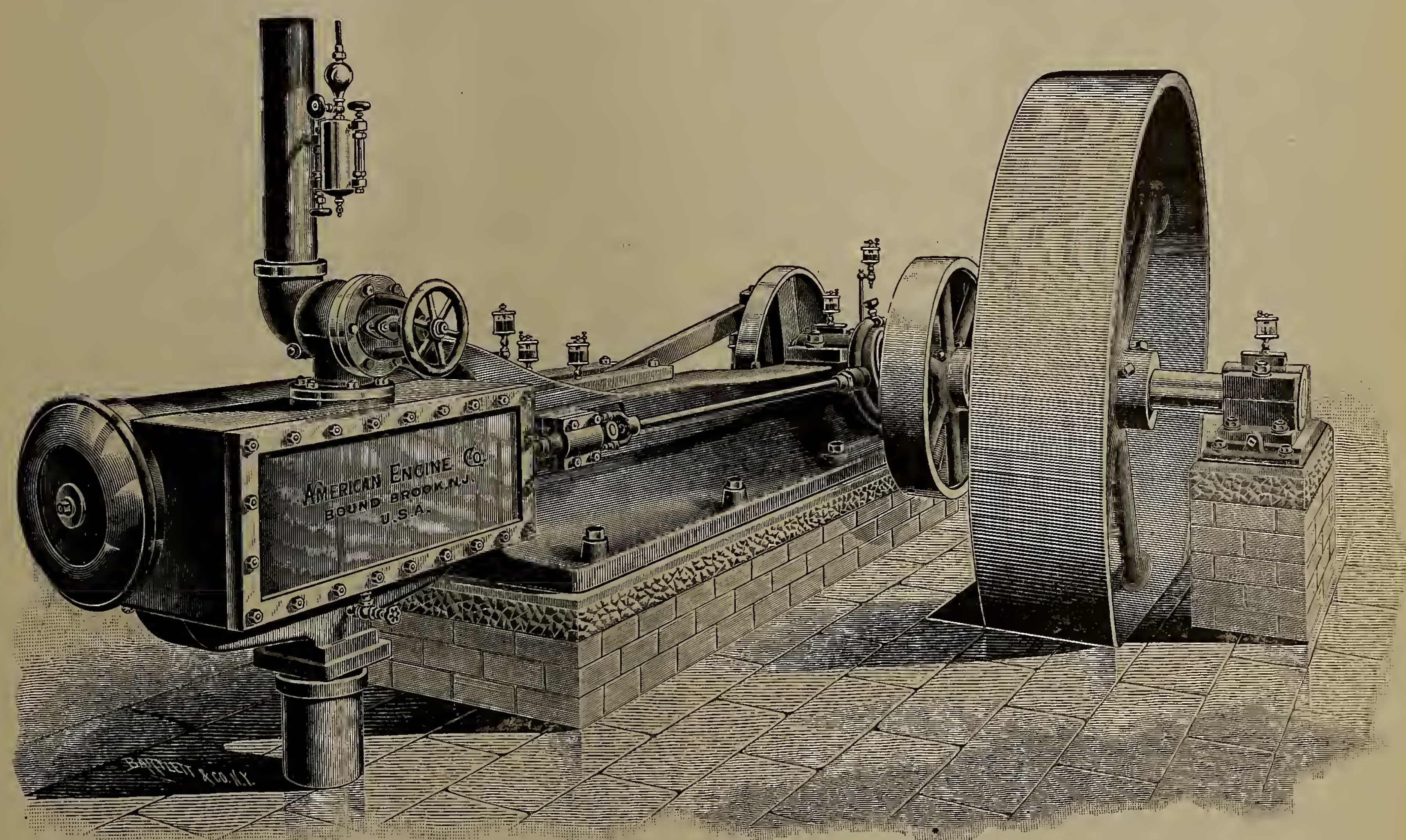
MAIL SERVICE ON ELECTRIC RAILWAYS.

The increasing use of electric street railways for the collection and distribution of mail matter in cities has frequently been referred to in these columns.

The service is so satisfactory that the second assistant Postmaster-General in his annual report recommended its extension, and it is not at all unlikely that mail cars will before long be run over electric lines in all important cities.

In this connection a description of the mail car service in St. Louis will be of interest. The St. Louis and Suburban Railway Co. was among the first, if not the first, to introduce the mail car, and similar service has been adopted in other large cities.

The St. Louis and Suburban Railway begins in the business part of the city and runs through the choicest residence and suburban settlements of the town of Florrissant, sixteen miles from the centre of the city. After leaving the city limits, the line penetrates the beautiful Florrissant valley, thickly dotted with pleasure resorts, country clubs, summer homes and suburban villas. The down-town portion of the road was formerly a cable, and the suburban part a narrow gauge steam line, but with the onward march of progress, the grip and the locomotive have gone to join the mule car, and the road is now electric throughout its entire length. The mail car makes three trips each day, two through to Florrissant and one as far as the city limits. The railroad company furnishes a conductor and motorman, while the post-office department supplies the mail clerks. The car, which was built especially for this purpose, is equipped with its own motors and is furnished with the necessary desks, cases, racks for mail bags, etc. At a schedule time it is run up in front of the post-office and receives the mail put up in pouches from a wagon there to meet it. The mail clerk receives a bag for each station outside the city limits, and for each carrier along the route a bag designated by his number. He also receives all mail which has come in too late for assortment, which is distributed on the car to the proper bags before reaching the first station. Letters are received, cancelled and distributed on this car, just as in the ordinary steam railway mail car. The first stop is at a point about one and a half miles from the post-office. At this point six carriers meet the car and each carrier receives from the mail clerk the pouch bearing his number. Another stop is made about two miles out, another two and a half, another three, and another four miles from the post-office. Any mail for the suburbs is handed to the mail clerk by the carriers and dropped into the proper bag by him. After the city limits are passed, bags are exchanged at each station just as on a steam railroad. On the return trip the same system is followed until the city limits are reached. Within the city, the post office department has placed letter-boxes at the principal corners along the line. Each carrier brings the mail collected in his district to the nearest box on the line of the railroad. Stops being made at each box, the mail clerk removes the mail, and assorts it before arriving at the next station. The letters thus canceled and assorted are delivered at the main post-office, tied up in bundles ready for shipment. The mail car makes no stops for passengers, and for this reason can easily keep out of the way of the passenger cars A light freight business is also done on the car. Provisions, light furniture, milk, trunks, etc., are carried and the charges collected by the conductor. The mail service has now been in operation three years. New features are constantly



AMERICAN ENGINE, MADE BY THE AMERICAN ENGINE CO., BOUND BROOK, N. J.

being added to it, and aside from the accommodation afforded the residents of the territory through which the road runs, it is a source of profit to the railroad company.

The system just described seems the best that has yet been devised for the handling of a large mail business.

DISTRIBUTION OF LIGHT FROM ARC LAMPS.

BY RANKIN KENNEDY.

The light is thrown out from the arc in a continuous current circuit, principally in the form of a cone having its apex at the arc and its base resting on the ground; this is a favorable circumstance and is taken advantage of to the fullest extent in street lighting by arc lamps.

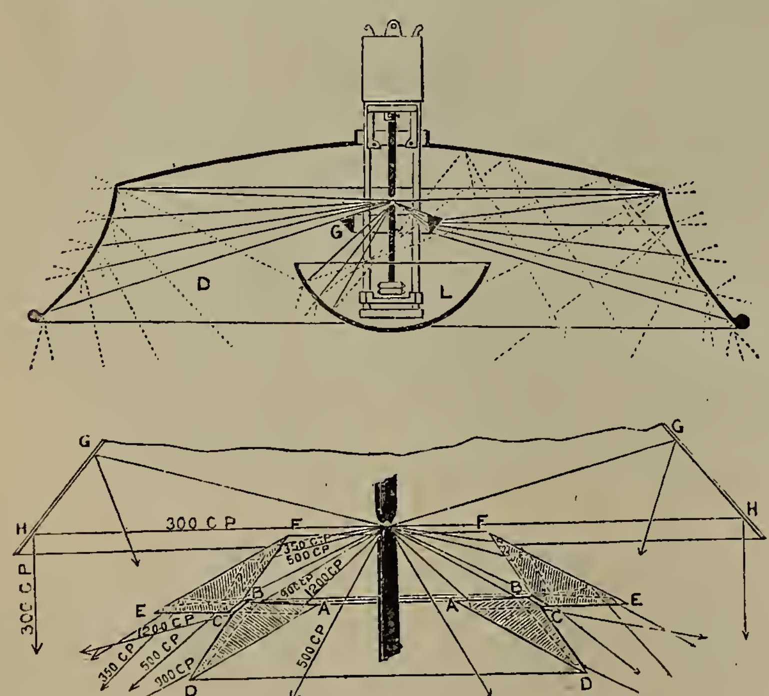
For interior illumination the lower carbon is sometimes made the positive carbon, and the cone of light thrown up onto a white ceiling, or a white disk above the lamp, a method first used at the 1880 Paris Exhibition by Jasper, in lighting the art gallery.

An arrangement by Siemens & Halske, for the same purpose, consists of a diffuser hung over an ordinary lamp. This diffuser is like a reflector in shape, and is about three feet six inches or four feet in diameter at the mouth, and is painted white inside (D, Fig. 1).

A bowl-shaped deflector, or, in other words, a common enameled iron bowl, white inside, L, is hung below the lamp and serves the double purpose of reflecting the light up into the diffuser and receiving any ash or carbon falling from the arc.

Such an arrangement is so far quite old, and is used in photographic electric lamps by Gwynne.

But a new and interesting addition for street lighting



FIGS. 1 AND 2.

is shown at G, a ring of polished glass of triangular section. This ring receives the most intense cone of light from the arc, and deflects it on to the white surface of the diffuser, as shown by the divergent lines; with this arrangement a beautifully uniform illumination is produced. The lamp, of course, must be a focussing lamp; the glass ring is best built up of four or six segments of glass held in a light metal frame; the diffuser is umbrella shaped and made of canvas on a wire frame, and painted inside with lead white. The whole arrangement is light and cheap and easily applied to any focussing lamp.

An arrangement like this is far more rational, and superior to the insane practice of using semi-opaque globes over arcs in street lighting; these simply cut off from 30 to 60 per cent. of the light produced, and do not in any way assist the diffusion or distribution of the light. It can never be accepted as good sense to generate at great expense a powerful light of, say, 600-candle-power, and then to carefully cut off 200 candle-power of it in absolute waste, yet that is what is done in every arc lamp with a semi-opaque globe on it.

In this arrangement (fig. 1) the arc is about eight or nine inches from the upper surface of the diffuser, which is, altogether, about 18 inches deep.

Prof. Anthony, who is a prominent authority on arc

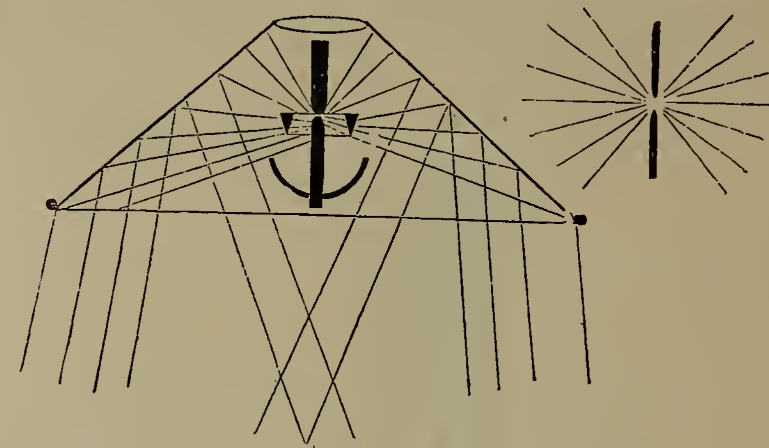


FIG. 3.

lighting in America, proposes another scheme for distributing light from arcs.

Fig. 2 illustrates his method: two rings of glass, A B C, D E F, of cross section, shown fixed with the arc on the level of the upper edge, H, G. H, G is a reflector above the arc, which receives the upward thrown light and sends it to light up the space immediately below the arc. By means of the prisms the strongest rays are sent furthest off, as will be seen by following the path of the 1,200 c.-p. ray in fig. 2.

This is rather an elaborate arrangement, but still as it would give at least four times more light, evenly distributed, compared with the semi-opaque globe, it may be cheaper in the end to use it.

The idea is not to waste about half of the light in an endeavor to soften it, but to screen off the actual light and diffuse or reflect it from a large white surface.

An alternating current arc requires a very different form of rings of glass, and also a different form of diffusing surface. A plain cone is best for this purpose, as the light is thrown from the alternating arc in a diverging ring as in Fig. 3.

The usual arrangements of large diffusers are very hideous looking affairs, but where arc lighting is to be adopted on any large scale it is easy enough to make them both effective and artistic with the aid of the architect.

E. PLURIBUS UNUM.

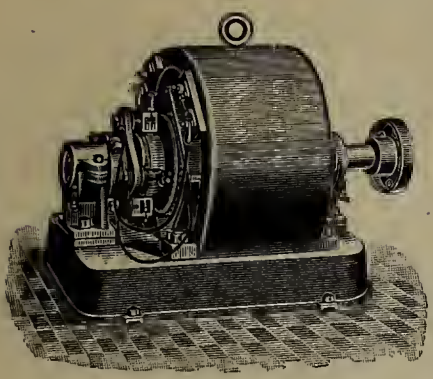
Let him who imagines he is overburdened with work contemplate the case referred to below. In order to obtain data regarding street railway service circulars were sent out to all the street railway companies in the country requesting the necessary information. One concern (?) down in North Carolina replied as follows: "This here road is owned, directed, managed, superintended and driven by

Yours truly,"

———————.

It is queer combination to be capitalist, director and mule driver all in one. But this is a country of queer things.

THE LOOMIS GENERATOR.



On September 1, last, a new generator of merit made its *debut*. Bound Brook, N. J., is its home and Mr. Osborn P. Loomis its maker.

Mr. Loomis began the business of manufacturing dynamos in 1885, starting in Lynn, Mass. His original machines were of different design to the new type, but they were efficient and are in constant use today in many cities throughout the country and are giving great satisfaction.

The new machines are of the slow-speed, multi-polar type, with circular iron magnet frames cast in one piece, without joint. They regulate automatically from zero to full load, and run without sparking. They are designed for lighting and power purposes and are compound wound unless otherwise ordered.

Since September 1, Mr. Loomis has disposed of a large number of his new machines varying in capacity from 250 to 750 lights. They can be constructed up to 5,000 lights capacity and of any voltage. The machines are self-oiling and require a minimum amount of attention.

Among recent shipments may be mentioned a direct-connected plant for the Mathieson Alkali Works, Saltville, Va., of 400 lights capacity; and Loomis machines are in use in Providence, R. I., Southbridge, Mass., and other places, installed by Messrs. Drake, Payson & Whittier, of Providence, R. I., and others installed by J. E. Duval, constructing engineer, of Charlotte, N. C., at Cowpens, S. C., Lincolnton, N. C, and Burlington, N. C.

Mr Loomis also manufactures motors of the same general design as his generators.

THE MILLION BATTERY.

A bronze medal has been awarded by the jury of the Lyons Exhibition to the Million battery, which is a modification of the bichromate battery. According to the *Bulletin International de l'Electricité*, the battery consists of a porous annular vase containing a solution of sulphuric acid, in which is placed an amalgamated zinc plate forming the negative pole. Around this vase are arranged carbon rods connected together at the top and bottom by means of two lead crowns, to which they are soldered, and constituting a large depolarizing surface and the positive pole. The central part of the porous vase is occupied by a small crown of carbon rods connected to the external crown, and allowing of the zinc being worked on both sides. The whole is contained in an external vessel of glass, enamelled iron or lead according to circumstances, which serves as a receptacle for a depolarizing solution of bichromate of soda in acidulated water. A cell of this kind is said to have a capacity of from 160 to 180 ampere-hours, the discharge being varied at will. Moreover, it is claimed by the separation of the liquids that polarization is overcome. The E.M.F. of the cell is given as follows:

2.1 volts on open circuit.
1.9 " with a discharge of 5 amperes.
1.8 " " 10 "
1.7 " " 15 "
1.6 " " 20 "
1.5 " " 25 "

It is mentioned that this type of battery has been employed for a variety of purposes.

GENERATING ELECTRICITY BY WINDMILLS.*

BY LIEUT. I. M. LEWIS.

In the United States, the history of windmill electric generation would be practically all included in a history of the single elaborate plant erected by Mr. Chas. F. Brush, at his city home, Cleveland, Ohio, in 1887, and which is still in entirely successful operation.

* * *

From a commercial standpoint of view the only criticism to be made in connection with Mr. Brush's plant is the great first cost which the complex construction necessarily involves. However much they may appreciate the convenience and desirability of possessing such a home luxury, there are comparatively few householders that can afford the expense. The question naturally arises, therefore, cannot the same results be secured without the expense?

It was in the effort to answer this question in the affirmative that the writer, some two years ago, undertook a series of experiments which have already yielded such promising practical results that he is encouraged to believe the answer complete.

The three obstacles which, in the past, have stood in the way of commercial success in this particular line of electrical development, viz.: expensive and inefficient windmills, the need of a dynamo especially designed for variable driving speeds, and costly as well as unreliable storage batteries - are no longer formidable.

Since Sir William Thompson first called attention to the subject in 1881, there have been many improvements in windmill construction, all of which have tended to increase its efficiency, while decreasing the cost of manufacture. Steel is taking the place of wood as a material, both in tower and wheel, with less dead weight in the moving parts, and correspondingly greater speed. The power lost through friction is therefore diminished. Another feature is the rapidly increasing number of "geared" mills, manufactured each year; the reciprocating or "pumping" mill not being suited to the work of driving machinery.

The *useful efficiency* of the best types of geared mill now on the market compares most favorably with that of the best simple steam engines, when the total amount of energy available in each case is considered, and the difference in first cost is not so great as is popularly supposed. The windmill costs nothing for either fuel or attendance, while the allowance for depreciation is less than half that allowed for the engine.

* * *

Next to the windmill, the most important factor in the problem is the dynamo. The service conditions here are so radically different from any found in ordinary practice, that a special machine is a necessity. The speed is never for a moment constant, and the variations are both sudden and great, with corresponding fluctuations in the current produced.

Heretofore the effort has been to regulate for changes in speed, by some form of resistance device placed in the field circuit and operated either by a centrifugal governor or an electro-magnet, the brushes being shifted automatically as the load changed. Such a construction is objectionable for two reasons, viz.: it adds to the number of delicate parts, and hence to the chances of a break-down, and it also greatly increases the cost of manufacture.

I have found that it is possible to secure the most satisfactory regulation by simple, differential winding of the field. The dynamo is compound wound, with

* *Engineering Magazine*, December, 1894.

the compound or series coil reversed. The field is therefore strongest when no current passes through this coil—(i. e., when the line circuit is open) and it becomes weaker as the current output increases; thus reversing the usual practice.

With the proper number of turns of wire in the compound coil it is possible to operate this machine safely between any given speed limits, but since the regulation must necessarily be secured at the expense of efficiency, it is not wise to make these limits too great. On the score of economy, it is well to so adjust the mill itself that the maximum speed of the dynamo is never more than double the average working speed. With carbon brushes of good size, and a properly designed armature and commutator, there is no necessity for any movement of the rocker arm under the most violent fluctuations of load.

This method of regulation is as effective as it is simple. It is peculiarly well adapted to windmill service since the working or charging circuit must always contain a storage battery, and the resistance of the line is necessarily small. A slight rise in the voltage, therefore, produces a very considerable increase in the regulating current, and hence the lamps are never subjected to extremes of pressure, however much the speed may vary.

The automatic cut-out used between the dynamo and the battery is simple and inexpensive and never fails to do its work. It closes the charging circuit when the voltage of the dynamo equals or exceeds that of the battery, and opens the instant these conditions are reversed.

The third essential element in our generating plant is the storage battery. Experience shows that a wind velocity of at least six miles per hour is necessary to drive a windmill. Consequently, there are hours, and even days, at a time when it cannot be depended upon to do effective work. The storage supply must therefore be sufficient to tide over such periods of calm.

Where windmills are used to pump water, it is the general practice to have the storage tank large enough to contain from three to five days' supply. The same rule should hold in determining the storage capacity for the electric plant. Much, however, will depend upon the location of the mill. Along the seacoast, or on the prairies of the West, where the wind blows almost constantly, a three days' supply is ample, but in many other parts of the country, a full week's reserve may be occasionally needed.

There is a constantly growing demand for small, isolated lighting and power plants, which can be installed at a moderate cost, and cheaply maintained. The demand is naturally greater in the suburban and near-by country districts, particularly those surrounding our larger cities, where the luxury of electric light is fully appreciated and would be secured if the expense were not prohibitive.

It is in this field that the windmill, as a source of cheap power, must find its greatest usefulness. It is admirably adapted to the work, and in the opinion of the writer, such an electric plant will be found to be more economical than any other, where the number of lights supplied is not too great. The cost of operation is practically limited to the two items of depreciation and interest on money invested, since no attendance beyond occasional inspection is necessary.

Suit.—It is stated that John E. Ridall has brought suit in the United States Circuit Court, in Pittsburgh, against the McKeesport Electric Light Company and the Brush Electric Company, Cleveland, O., to recover over $100,000 in commissions.

TELEPHONE NOTES.

On November 29 the long distance telephone line between Berlin and Vienna was practically tested by a party of journalists in both cities, and conversation was successfully maintained. The distance between the two cities is about 450 miles. The line was opened for public use on December 1.

J. W. Hills and S. W. Williams, Harriman, Tenn., have applied for a telephone franchise in that place.

The long distance telephone line between Atlanta and Macon, Ga., was formally opened on November 24. Governor Atkinson, at Atlanta, and Mayor Horne, of Macon, exchanged greetings on the occasion. The distance between the two cities is about 100 miles.

It is reported that a new telephone company is to be incorporated in St. Louis, Mo., with a capital stock of $1,000,000. The company will operate under the system of the Chicago Interior Telephone Co. The object of the company is to lessen the cost of telephone service to its subscribers. It is stated that the charge will be $2 per month. The telephone instrument will have a nickel-in-the-slot device.

TELEPHONE PATENTS ISSUED NOVEMBER 27.

Telephone.—Alfred Stromberg and Androv Carlson, Chicago. (No. 529,818).

Telephone Switch.—Edgar S. Combs, Rochester, N. Y. (No. 529,826).

Signalling Apparatus for Telephone Exchange Systems. —James H. Cary, Malden, Mass. (No. 529,894).

Switchboard (Telephone).—Louis A. Berthon, Paris, France. (No. 529,999).

For further details see patent record on last reading page.

STREET RAILWAY INTERESTS.

It is reported that the employés of the Brooklyn trolley roads will demand an increase of wages when the time comes for the signing of new contracts, which will be early next year. All the railroad employés are included in District Assembly 75 of Knights of Labor. A sharp controversy in the matter is looked for, so it is stated.

Noah Redford, who owns property on Bath Road, Newport, R. I., has brought suit against the City of Newport, claiming that the street railroad on the street named has caused a depreciation of the value of his property.

Four miles of track of the Pikesville, Reisterstown & Emery Grove Electric Railway, Pikesville, Md., are now completed. The line will be finished by January 1.

Work has begun on the construction of the Baltimore, Middle River and Sparrows Point Electric Railway. Chas. D. McLane is chief engineer.

The gripmen on the New York City cable cars say the car has "skipped the rope," when the cable is "lost."

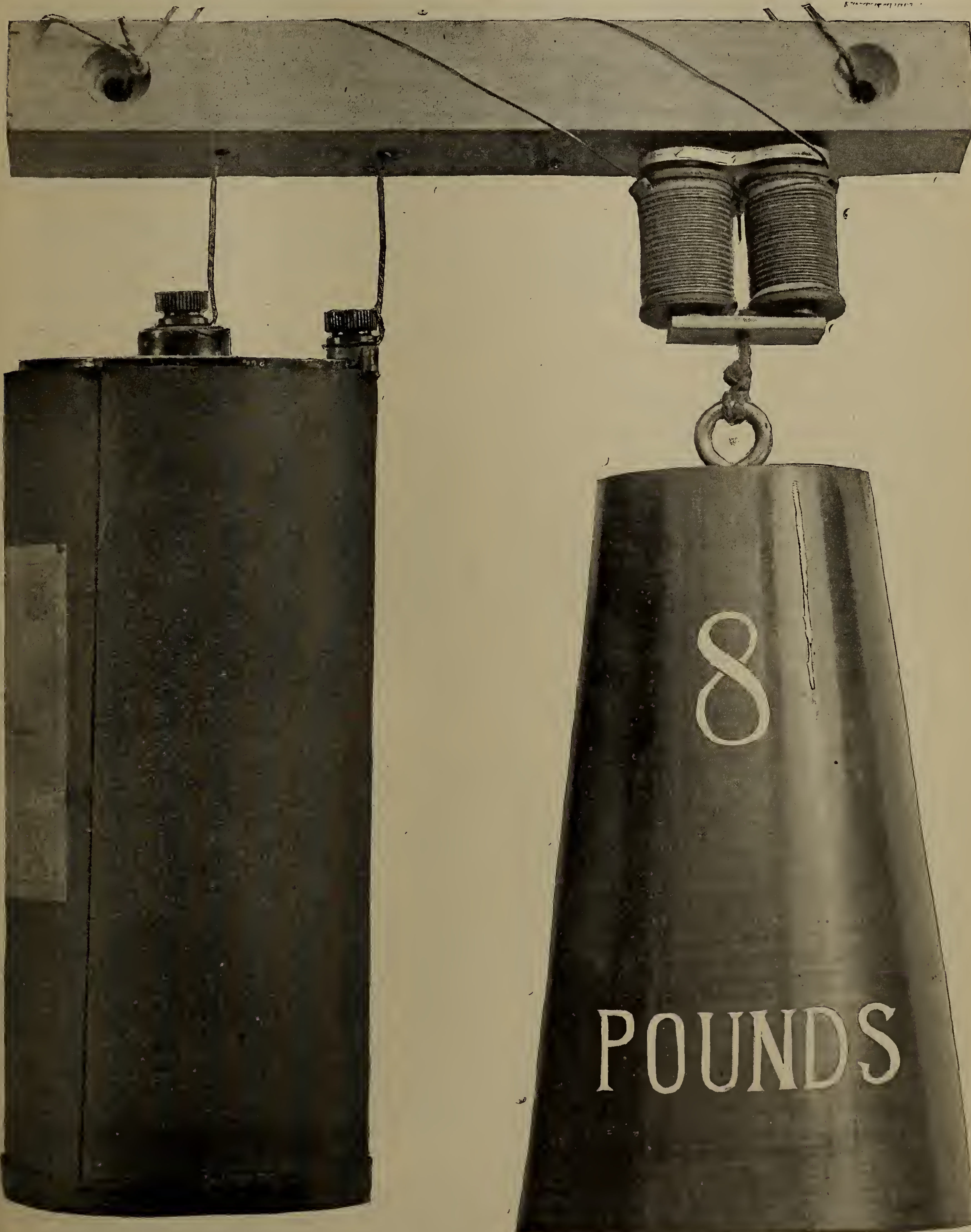
Reported Sale.—It is reported that the Milwaukee Arc Light Company has sold its plant to four of the directors. It is understood that the amount paid was about $86,500. The original capital of the company was $150,000.

—Alexander Graham Bell's patents on the telephone are not only on the instrument but also on the method of transmission.

LITTLE GIANT VARLEY MAGNETS.

The accompanying illustration shows an interesting test of a pair of Varley duplex bell magnets. It is so plain that it tells its own story, and any extended description would seem superfluous.

These magnets are giants of power, the pair shown lifting forty-eight times their own weight, with the cur-



PAIR OF VARLEY BELL MAGNETS SUSTAINING FORTY-EIGHT TIMES THEIR OWN WEIGHT.

rent supplied by one cell of dry battery.

Some doubts were expressed regarding the power of these magnets to lift and sustain such a weight, so with characteristic enterprise the Varley Duplex Magnet Co., the manufacturers, had the combination photographed and a cut made from the photo. Photographs are like figures; they don't like.

The duplex magnets vary from 20 to 40 per cent. stronger than ordinary magnets with the same current. They get the name duplex from the winding of the wire. Two wires are wound on the core at the same time, one being bare and the other insulated. After the winding is finished the wire ends are connected up in proper combination. On account of one of the wires being bare considerable more copper can be placed in a given space than by the ordinary method, and herein lies the secret of the magnet's power.

This method of winding is the invention of Mr. Richard Varley, Jr., and on account of the great economy effected by the use of these magnets the company has naturally found a very ready market for their goods.

The company's offices are at 64 Cortlandt street, New York City.

ELECTRIC TRACTION IN GERMANY.

In a book gotten out by the Allgemeine Elektricitals Gesellschaft, Berlin, is given a description of ten important electric railroads in Germany equipped by this company. These ten roads, built in the past four years, have an aggregate length of 90 miles of track, operate 392 cars, and employ 4,395 steam I. H. P. Seven more lines are under equipment by the company, the contracts for which call for the construction of 31 miles of elevated conductors, and the supply of 101 motor cars.

On all these lines a pressure of 500 volts is used, following the standard American practice. With the sole exception of Great Britain there is no country which does not now allow of the employment of this, or a higher voltage.

The ten roads have been electrically equipped at an expenditure of £600,000.

The oldest installation is that at Halle, opened as an electric line in 1891. The working costs of this line are given as follows:

Number of motor cars	36
" " trail cars	13
Total miles of track	10
Maximum gradient	1 in 20
I. H. P of engines at power house	400
Passengers carried in 1893	3,150,000
Car miles run from June, 1892, to June, 1893	695,005
Total receipts for financial year 1892-93	£13,552
" expenses " " "	£7,990
Depreciation	£1,500
Sinking fund	£650
Operating expenses per car mile	2.79d.
Total cost per car mile	3.51d.
" receipts per car mile	4.64d.

The working expenses were subdivided as follows:

Transportation expenses per car mile	1.23d.
Motive power	0.79d.
Maintenance	0.19d.
General expenses	0.58d.
Total operating expenses per car mile	2.79d.
Ratio of operating expenses to receipts	59%

Statistics are given to show that while the horse tramways of Berlin record one accident to the person for every 41,625 car miles run, the Halle line has had but one accident for every 88,638 car miles.

Attention is called to the fact that in Halle, the monthly receipts of the electric cars have shown a steady increase, while the horse-car lines show a steadily decreasing business.

The Gera tramway (6½ track miles, 34 cars), which is also described, is especially interesting from the fact that although in its permanent way construction the metre gauge was employed, the ordinary railway freight wagons are carried over the tram-lines by the use of specially designed trucks, and delivered directly on sidings running into the factories of the town, thus greatly aiding in handling goods.

At Gera, the electric tramway power-plant is utilized to light the town electrically. The dynamos used have a pressure of 275 volts. For railway work, two are placed in series, and for lighting, one of these dynamos is in parallel with a battery of 132 accumulator cells, from the centre of which the third conductor is taken, the lighting being done on the three-wire system. The following figures are given for 1892 and 1893:

	1892.	1893.
Car miles run	379,335	381,857
Working expenses per car mile	2.97d.	2.80d.

The electric line at Kiew (8¾ track miles, 32 cars), the first Russian installation of electric traction, is noticeable on account of the heavy grades operated, 1 in 10 being of frequent occurrence.

At Breslau (16¾ track miles, 80 cars), where the line is fairly level, the maximum grade being 1 in 40, the coal consumption per car mile is 4.63 lbs.

In the old town of Lubeck 44 electric cars are operated over 8½ miles of track.

At Essen, 13½ track miles and 41 cars are in operation. The tramway threads its way through the streets, which are but 11 feet 8 inches wide from curb to curb, and only 13 feet 4 inches wide between house fronts. The other lines described as in operation and using the Allgemeine Company's plant are:

Chemnitz	13 miles of track,	48 cars.
Christiania	4¾ " "	18 "
Dortmund	7 " "	46 "

The following are under construction:

Plauen i., V	3½ track miles,	9 cars.
Spandau	7¼ " "	24 "
Altenburg	2¾ " "	7 "
Genoa	12 " "	45 "
Konigsberg, i. R	3½ " "	8 "
Christiania extension	— " "	4 "
Dortmund "	1½ " "	4 "

The permanent way corresponds closely to the best English practice; grooved rails and a concrete or broken stone bed being employed.

Silicon-bronze trolley wire is used instead of the hard-drawn copper wire universally adopted by American lines.

In the design of motor-trucks, American practice has been closely followed. One or two, 15 or 25 H. P., single-reduction, armor-clad motors are carried by each truck. Speed regulation is effected by the use of the series-parallel system, now universally adopted as the best modern practice.

Denial. —The Ordnance Department, Washington, D. C., denies the statement to the effect that several electrical firms had been invited to submit designs on the electrical apparatus for the operation of turrets and guns on board naval ships.

WHERE P. & B. GOODS ARE MADE.

The manufacturing plant of the Standard Paint Co., ot New York, makers of the celebrated P. & B. paints, insulating compounds, etc., is located at Bound Brook, N. J., and it is about as conveniently located with reference to ease of shipment of goods as it would be if it were right in the heart of New York City. It is close to the tracks to two railroads and on the banks of the canal, where goods can be transported directly from the factory to boats on a track. The company has its own freight house, in which goods awaiting shipment can be stored.

The plant covers over four acres of ground, the main buildings being 350 feet long, 50 feet wide at one end and a hundred feet at the other. These buildings contain all the machinery and apparatus used in the manufacture of insulating paper and tape. Two buildings, 50x100 each in dimensions, are used in the manufacture of compounds. In one of the buildings is made the celebrated Rubberoid, which is an excellent imitation of hard rubber, and possesses all of the pliability and in-

FACTORY OF THE STANDARD PAINT CO.

sulating qualities of rubber. The Rubberoid goes through about the same process of manufacture as does rubber, being ground and mixed, however, by a process that is a trade secret. It afterwards goes into presses and comes out an excellent imitation of hard rubber.

The electrical compound is prepared under special processes of boiling and mixing, and is turned out in barrels of 500 pounds weight each.

The insulated paper and tape are made by machinery designed especially for this work. The paper is extra strong in fibre and the electrical compound is thoroughly incorporated throughout its substance. The tape is made of cloth specially woven for this purpose and thoroughly saturated with P. & B. electrical compound. It is adhesive, and is not affected by heat, cold, water, acids, etc., and is a perfect insulator.

Mr. Wm. Griscom, Jr., is superintendent of the factory, and he has a large force of men constantly employed in producing P. & B. goods.

Mr. Ralph L. Shainwald is president of the Standard Paint Co., and Mr. Frank S. DeRonde general sales agent.

Literary.—The *Buletin des Sommaires* is a fortnightly review published at Rue Beaunier 44, Paris, France, giving résumés of principal articles on all topics published in periodicals. The publisher can supply copies of any article so published.

FIRE AND ELECTRICAL WIRES.

In an article under the head of "Fire Outbreaks from Electric Equipment," in the *American Exchange and Review* for December, various fires which are supposed to have originated by defective insulation are specifically referred to. The article concludes as follows :

While electricity has for the time increased the burning of gas by reason of the propensity of people to indulge in extra illumination from being accustomed to the brilliancy of the incandescent lamp, there is every reason to believe that the future will see a specific reduction of the fire hazard from the adoption of electric lighting, if there be increase from other causes. Accidents, like breaking wires falling on trolleys and lightning invasions are unavoidable, but serious loss may be averted by good systems of wiring. Incidentally lightning is accountable for very little damage in electric fires, f r although it may injure delicate apparatus through sudden burning out i's instantaneousness will cause only a momentary incandescence, whereas arc or trolley wires entering a building, and completing circuit by a ground connection with pipes or constructive metal-work will keep up a continual flow until the part which is affected by the most resistance takes fire. Whether on overloaded series, defective switchboards, or short circuits, fire is the result of heat, and heat is electrically the product of resistance. Heat and electricity are convertible forces. Heat may develop electricity, electricity may develop heat. As a theory, we may say electricity is molecular motion, flame atomic motion. Resistance seems to transfer the electric action of the integrant molecule to the atomic components; hence flame. Electricity and chemistry meet in electrolysis. They separate when heat is a phenomenon ot dissociation

Since the *American Exchange and Review* is an insurance journal, these utterances are suggestive.

FORETELLING EARTHQUAKES WITH THE TELEPHONE.

Señor Francisco Estrada, professor of physics in the state college of San Luis Potosi, has submitted an original plan to the government for foretelling earthquakes in the volcanic zone of Mexico, by means of the telephone. In the course of his report the author says :

"With the telephone and the microphone, and with daily simultaneous observations taken in the volcanic zone, which comprises Vera Cruz, Pueblo, Mexico and Guadalajara, I believe it possible to definitely prognosticate earthquakes and volcanic eruptions, as the result of the great interior changes of the earth, which change the geological construction of our land. The noises that trouble long-distance telephones that use the earth to complete the circuits, noises hitherto unexplained, I believe, from my repeated observations, are originated from two principal causes—atmospheric electricity and underground electrical currents, which come from depths more or less great. In case the first they are easily distinguished by exterior signs, such as storms, thunder, lightning, etc., but there are times when the air being perfectly still, singular noises like murmurings, sand storms, blows or the rubbing of a rough body upon the instrument are heard at the telephone. As this instrument is the most sensitive known, I judge it is suitable for the recognition of the approaching seismological phenomena, which cause such great terror to the inhabitants of volcanic zones. I propose the rational study of those phenomena by the following plan :

"Construction of various telephone lines; let one connect the central government meteorological observatory with the base of the volcano, Popocatapetl, being grounded in one of the deepest cracks or crevasses, selecting among them one containing a thermal spring, connecting the other end of the line at the observatory with the metallic tube of one of the deepest artesian wells in the city. Another line should run from Pueblo to the same mountain and then connect Guadalajara with the volcano of Colima, and later lines should be run to the peak of Orizaba, the Cofre de Perote, and the Jorutle volcano. I would place at least two telephones and one vertical galvanometer at some convenient spot midway in the telegraph lines from Vera Cruz to Pueblo, from Pueblo to Mexico City, to Guadalajara, and Guadalajara to San Blas or some other Pacific port that has a telegraph office to take daily observations with the telephone. In each one of these branches or sections, and with all the lines connected as often as possible without interfering with this service of the wires, the placing in the observatories at Mexico, Pueblo and Guadalajara of a simple microphone composed of a carbon pendulum suspended on a thin spiral wire, so arranged that it will close an electric circuit at the slightest motion, and set an electric bell to ringing, in order to record the slightest movement of the earth.

"If properly handled, by these means the eruptions of any volcano and earthquake might be foretold many days in advance."

POSSIBLE CONTRACTS.

The Queen City Electric Light Company, Gadsden, Ala , intends to increase the capacity of its plant.

The American Car Company, St. Louis, Mo., contemplates large improvements in its works.

George F. Barber & Co., Knoxville, Tenn., are the architects of a hotel to be built in Siloam Springs, Mo., by H. D. Mackay, to cost $50,000.

The Thomas M. Holt Mfg. Co., Haw River, N. C., has let a contract to light its cotton mill by electricity.

The Raleigh Electric Company, Raleigh, N. C., will issue $25,000 first mortgage bonds for the installation of its electric light plant and enlargement of its Railway plant.

W. N. Louque, president of the Jefferson Avenue Railway Company, New Orleans, La., can give information regarding the line to be built by that company. His address is 835 Canal street.

Two companies have applied to the Portsmouth, Va., City Council for franchises to build an electric road in that city.

The Mid-Suburban Railway Company, St. Louis, Mo., will build an electric road from Maplewood Park to connect with the Lindell railroad system.

A company has been organized in Houston, Tex., to build a $30,000 natatorium. C. H. Milby and A. Dow are interested.

The Commercial Club, Kansas City, Mo., proposes to erect a $100,000 convention hall.

Work on the American University, in Washington, D. C., under the supervision of the Methodist Church, will soon be commenced, it is stated.

Dr. Thomas M. Haskins, Wheeling, W. Va., will erect a hospital equipped with all the modern improvements.

The Mayor of Apalachicola, Fla., can give information regarding the proposed electric light plant in that place.

The Appleton Edison Electric Co., Appleton, Wis., intends to build and operate an electric road from Kau kauna to Neenah.

The Chicago City Railway Co., Chicago, Ill., is building a power house that will cost $350,000. Victor Falkenau & Brother, are the contractors.

An electric light plant is to be established in Bremen, Ind.

The electric light station at Sault Ste. Marie, Ont., was recently damaged by fire.

The power house of the Electric Street Railway, Terre Haute, Ind., is to be enlarged for the use of the Citizen's Electric Light and Power Company for street illuminating purposes.

The Lynchburg Electric Light Co., Lynchburg, Va., has secured the contract to light the city streets by electricity for five years; also the franchise to erect and maintain poles and wires in the streets for thirty years.

NEW CORPORATIONS.

Chicago-Electro-Therapy Co., Chicago, Ill., by Chas. S. Wood, Sarah V. Westrup, and L. J. H. Wells. Capital stock, $50,000.

The Mt. Vernon and Walhonding Electric Railway, Mt. Vernon, Ohio, by F. T. Botgarn and others. Capital stock, $50,000.

Mt. Carroll Electric Light Co., Mt. Carroll, Ill., by O. P. Miles and others. Capital stock, $42,800.

Sedalia & Brown Springs Electric Railway Company, Sedalia, Mo.

The Potomac Light and Power Company, Georgetown, D. C., by A. H. Wilder and V. M. Watkins, of St. Paul, Minn.; G. A. King and W. E. Harvey, of Washington, D. C. Capital stock, $35,000.

The Luling Electric Light and Power Company, Luling, Tex., by W. R. Johnson, Davis Gregg, W. W. Lipscomb, C. Bellinge, F. R. Starre, Jr., J. Van Gasker, R. H. Walker and H. Keinsmith. Capital stock, $20,000.

Sedalia and Brown Springs Electric Co., Sedalia, Mo., by D. C. Mesker, W. E. Sterne and others.

The Mount Washington Electric Railway Company, Baltimore, Md., by G. R. and W. G. Hatter. Capital stock, $150,000.

The Van Wert Telephone Company, Van Wert, Ohio. Capital stock, $10,000.

Waterloo, Seneca Falls and Cayuga Lake Railway Company, Albany, N. Y. Capital stock, $150.000.

The Raton Gas and Railway Company, Sante Fe, New Mexico, by Frederick Mitchell, J. Leahy, Alva L. Dobbs, Perry H. Smith and Leslie St. John.

FINANCIAL.

The North Side Electric Street Railway Co., Chicago, Ill., has increased its capital stock from $500,000 to $1,500,000.

A judgment for $31,955 has been entered against the Eastern Electric Co., New Brunswick, Can., and John F. Zebley, of New York City.

—In 1837 Prof. Page discovered that a piece of iron would give out sounds when rapidly magnetized and demagnetized. This is the principle of the speaking telephone of today.

LEGAL.

On November 9, Judge Taft of the United States Circuit Court for the Northern District of Ohio, Eastern Division, affirmed the former decision in the case of the Pittsburgh Reduction Company vs. the Cowles Electric Smelting and Aluminum Company. The decree in this case sustained the patent issued on April 2, 1889, to Chas. M. Hall, for a process of reducing aluminum. The bill was to enjoin the infringement of a patent for a process of making aluminum by electrolysis and to recover damages. It was found that the defendant had infringed it and the question of damages was referred to a special master. The defendant made a motion to reopen the case for leave to introduce new evidence and for a rehearing. The opinion on the merits was filed and a decree entered in accordance therewith. The defendant then took the bill to the Circuit Court of Appeals, which was dismissed by the appellant. The motion for rehearing was denied by Judge Taft, as above stated.

NEW YORK NOTES.

Office of the Electrical Age,
World Building, New York,
December 3, 1894.

Justice Gaynor, of the Supreme Court, Brooklyn, granted a mandamus prohibiting the Brooklyn Subway Commission from interfering with the operations of the New York and Eastern Telegraph and Telephone Co., which recently received a franchise from the Brooklyn Aldermen.

A judgment of $22,500 against the Brooklyn City Railroad Co. in favor of Annie Tholan, also one of $3,000 against the company in favor of Annie's father, have been affirmed by the General Term. Annie Tholan, the 8-year old daughter of John S. Tholan, was run over by a Third Avenue trolley car, both her legs being cut off. The suit was brought in the City Court. Her father brought suit for $3,000 for loss of his daughter's service.

The Commercial Cable Company is distributing in the trade a little card calling attention to the remarkable bursts of speed accomplished by that company in the matter of transmitting dispatches across the ocean. In December, 1884, a communication was sent from New York to London over the Commercial cables, and an answer received in forty-five seconds. This feat, however, was eclipsed by that in October, 1894, when a similar test of speed was made over the company's third cable, recently laid. On that occasion a reply was returned in five seconds. W. T. H.

NOTES OF GENERAL INTEREST.

Fire damaged the Western Union Telegraph office, 109 State street, Boston, on the night of November 27. Communication by telegraph was completely destroyed and great inconvenience resulted, especially to the newspapers. There were 40 operators in the operating room at the time, but they all escaped without injury.

Electricity and Water Power.—We have received from the author a copy of a pamphlet on the subject of Electricity and Water Power, by Mark A. Replogle, Cedar Falls, Iowa. This pamphlet is designed to help the business man, the mechanic and the student to form reliable conceptions as to the fundamental principles of electricity and water power, and their inter-relations. The price is 25 cents per copy.

Receiver.—The Neptune Electric Company, of Asbury Park, N. J., has gone into the hands of a receiver. The liabilities of the company are said to be $67,000.

TRADE NOTES.

Barnard & Hoopes, 916 Arch St., Philadelphia, Pa., have closed a contract with the Salisbury Telephone Company, Salisbury, Md., for one hundred telephones and a one-hundred point switchboard. Any prospective purchasers of telephone apparatus will find this firm in a position to contract for an exchange, furnish instruments and give a first-class guarantee that the instruments will give perfect satisfaction and are non-infringing in every respect. Barnard & Hoopes have sold a fifty light arc machine to the Edison Electric Illuminating Company, of West Chester, Pa., to be installed on or before January 1, 1895. The machine to be furnished is that manufactured by the Great Western Manufacturing Company, of Chicago, of whom Barnard & Hoopes are the eastern agents.

The Columbia Telephone Co., 138 Front street, New York City, have received orders for hundreds of phones from Philadelphia, Boston, Chicago, New York, Newark, Trenton, Providence and many other places. The factory is kept busy.

J. W. Parker & Co., 30 Cortlandt street, New York City, have taken a contract to furnish one 175 H. P. tandem-compound engine for the Hackensack, N. J., Edison electric light station, which was recently burned. This firm has also taken an order for one 60 H. P. engine for export for the Thomson-Houston International Electric Company. This engine is to go to Mexico. They are also sending one 60 H. P. to Guantanama, Cuba. These orders were all taken last week. The firm is now installing two Cross compound 500 H. P. vertical engines for the Camden, N. J., Railroad Company.

W. R Fleming & Co., 203 Broadway, New York City, contractor for the installation of complete steam plants and general eastern agent of the Ide Engine Company, has sold sixty seven engines of a total of 7,000 H. P. since May last. This is a greater amount of business than was done during the same period in 1893.

WOVEN WIRE BRUSHES.

The Belknap Motor Co., of Portland, Maine, are the patentees and manufacturers of the best woven wire commutator brush on the market.

NOTICE.

To the stockholders of the Broderick Supply Company of the City of New York.

Notice is hereby given that a meeting of the stockholders of the said corporation will be held pursuant to law, at 44 Rose street, in the City of New York, on the 20th day of December, 1894, at 10 o'clock in the forenoon, for the purpose of increasing the capital stock of said corporation to the sum of $10,000, pursuant to the provisions of Section 5 of chapter 567 of the Laws of 1890, passed June 7, 1890, and known as a Business Corporation Law, as amended by Section 4 of chapter 691 of laws of New York of 1892, and for the transaction of such other business as may properly come before said meeting.

P. C. Nielson, Secretary.
Fred Becker. Treasurer, a
majority of the directors of said corporation.

Dated November 30, 1894.

ELECTRICAL and STREET RAILWAY PATENTS

Issued November 27, 1894.

529,688. Means for Supporting Motors in Electric Locomotives. Walter S. Adams, Philadelphia, Pa., assignor to John A. Brill, same place. Filed Nov. 9, 1893.

529,704. Closed-Conduit Electric Railway. Charles G. Burke, Brooklyn, N. Y. Filed Feb. 10, 1894.

529,710. Sectional Thermo-Electric Generator. Harry B. Cox, Hartford, Conn. Filed Jan. 31, 1894.

529,711. Thermo-Electric Generator. Harry B. Cox, Hartford, Conn. Filed Jan. 31, 1894.

529,726. Street Car Fender. Henry Grieser, St. Louis, Mo., assignor of two-thirds to Charles L. Hood and Charles B. Tomlinson, same place. Filed Apr. 4, 1894.

529,759 Electric Signal for Railway-Crossings. Daniel W. Smith, St. Louis, Mo., assignor, by direct and mesne assignments, of two-thirds to Alfred Bevis and Charles H. Longstreth, same place. Filed Sept. 10, 1894.

529,784. Commutator-Brush for Dynamos. George Forbes, London, England. Filed Aug. 8. 1892. Renewed Apr. 14, 1894.

529,797. Closed Conduit for Electric Railways. Frederick L. King, Chicago, Ill. Filed Jan. 15, 1894.

529,818. Telephone. Alfred Stromberg and Androv Carlson, Chicago, Ill. Filed Oct. 9, 1894.

529,826. Telephone-Switch. Edgar S. Combs, Rochester, N. Y, assignor of one-half to Irving Paine, same place. Filed Oct. 9, 1894.

529,829. Trolley-Wheel. Frederick Lepper and William Wighton, Toronto, Canada. Filed Sept. 22, 1893.

529,836. Conduit Electric Railway. Leonidas C. Pressley, San Francisco, Cal. Filed Feb. 6, 1894.

529,894. Signaling Apparatus for Telephone Exchange Systems James H. Carey, Malden, assignor of one-half to Luther P. Bryant, Northampton, Mass. Filed Mar. 17, 1894.

529,898. Rotatable Electric Contactor. John W. Curry, Cairo, Ill. Filed July 9, 1894.

529,903 Trolley-Wire Support and Coupling. Aaron P. Gould, Canton, Ohio. Filed Mar. 7, 1894.

529,918. Alternating-Current Generator. John F. Kelly, Pittsfield, Mass., assignor to the Stanley Laboratory Company, same place. Filed Aug. 18, 1894.

529,938. Electrical Recording Device for Safes. Robert A. Newlyn, Cincinnati, Ohio, assignor of one-half to George W. Hart and Agnes H. Boylan, same place. Filed Apr. 28, 1894.

529,949. Electrical Danger-Signaling System. William A. Phillips, U. S. Army. Filed May 29, 1893.

529,984. Electric Signal Apparatus. Horace E. Walter, Richfield Springs, N. Y. Filed Jan. 9, 1893.

529,985. Electric Signaling Apparatus. Horace E. Walter, Richfield Springs, N. Y. Filed Mar. 26, 1894.

529 986. Electric Signaling Apparatus. Horace E. Walter, Richfield Springs, N. Y. Filed Apr. 26, 1894.

529,999. Switchboard. Louis A. Berthon, Paris, France, assignor to Société Générale des Téléphones, (Réseaux Téléphoniques et Constructions Électriques), same place. Filed Oct. 17, 1893. Patented in France, Jan. 31, 1893, No. 227,557.

530,004. Electrical Contact Mechanism. John F. Blake, New Haven, Conn. Filed June 21, 1894.

530,021. Method of Electrically Heating Metal. Chas. L. Coffin, Detroit, Mich. Filed July 10, 1894.

530,032. Electric Elevator-Motor. Wendell C. Fletcher, St. Louis, Mo., assignor of one-half to Edward W. Moon, same place. Filed June 14, 1894.

530,033. Supply System for Electric Railways. Zebulon Foster, Chicago, Ill. Filed Mar. 7, 1894.

530,053. Electric Robe, Towel, etc., for Heating. Henry G. O'Neill, Boston, Mass., assignor of one-half to Edward Jewell, same place. Filed Apr. 9, 1894.

530,066. Plug and Receptacle for Electrical Purposes. David J. Cartwright, Boston, Mass. Filed Jan. 24, 1894.

530,067. Street-Car Register. Ephron Catlin and Gustavus Rein, St. Louis, Mo., assignor to the St. Louis Register Company, same place. Filed Dec. 14, 1893.

ELECTRICAL AGE

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NEW YORK, DECEMBER 15, 1894.

CONTENTS.

CULM HEAPS.

Every one who has passed through coal regions has noticed the immense number and size of culm heaps. Culm is small particles of coal, much coarser than dust but too fine to use for fuel under existing methods of combustion. For practical purposes these piles of culm represent so much waste energy, because there is, as yet, no practical method of utilizing their substance for heat generating purposes. There are thousands upon thousands of tons of culm scattered throughout the coal regions of Pennsylvania and elsewhere, and it is a serious problem with the mine operators as to how it shall be gotten rid of. All recognize its value as a heat generating substance, as it is rich in carbon, but as there is no way to consume it it is so much dead and inert matter occupying valuable land. It will not pay to transport it anywhere as it is practically valueless. Many inventors, recognizing the fortune that awaits the one who succeeds in discovering a practical method of consuming culm, have attacked the problem, and while many things have been promised and claimed for certain methods of utilization, nothing of any practical value seems to have yet been evolved. It is reported that a company has been started in the Pennsylvania coal regions to utilize the culm heaps in the neighborhood in the production of electricity, which is to be transmitted to Philadelphia, New York and other cities. This news, however, we think, is too sudden to be true. The realization of this object has been the dream of inventors for years, and, no doubt, the result will be attained some day, but as far as we can learn there is yet nothing practical visible along the horizon of invention.

THE TROLLEY IN PHILADELPHIA.

A remarkable showing is made in the annual report of the Philadelphia Traction Company of operations during the year ended June 30, last. The report emphasizes, as many others have done, the popular appreciation of improvements in methods of street travel. The street railroad companies, especially those in large cities, come in for a very large share of abuse, through the newspapers, when they make an effort to introduce a change. If the newspapers reflect public sentiment, then the public must be very inconsistent, for it generously supports the enterprise of the street railway companies. Philadelphia is no exception to the rule. When the subject of the trolley was first broached the staid Philadelphians stood aghast at the mere thought of it, let alone the reality. Then the railroad companies were turned on for their audacious aggressiveness. Enterprise and determination in a good cause, however, overcame the obstacles set in the path of progress, and Philadelphia eventually got her trolley lines. There are a few horse car lines yet to be equipped, and the people show their detestation of this antiquated system by going several blocks out of their way in order to ride on the trolley cars. The effect of the introduction of the trolley in Philadelphia is best seen in the figures revealed by the report. Since the opening of the trolley lines the company's revenues have increased on an average of $50,000 a month, and it is stated that the November business will show an increase of $75,000 as compared with November of last year. During the year 10,692,794 more passengers were carried over the lines than during the year previous. Such a report must be very gratifying to the stockholders, and the fact that the people have in this case generously backed the railroad companies in their enterprise proves once more that the public always hails with satisfaction any improvement made for their benefit, newspaper reports to the contrary notwithstanding.

PRODUCING ELECTRICITY BY MEANS OF CHEMICAL ENERGY.

Dr. W. Borchers recently read a paper before the Deutsche Electro-chemische Gesellschaft, in which he described some interesting experiments he had been making on the direct production of electricity from coal and combustible gases.

The following account of the experiments and illustrations are taken from the London *Electrical Review.* Dr. Borchers' experiments were made with carbonic oxide gas, but he also succeeded in producing an electric current by the combustion of hydrogen, hydrocarbon gases, and even from pulverized coal. His great invention, however, is the use of cuprous chloride as the electrolyte in his battery. It is well known that cuprous chloride is a good absorbent for both carbonic oxide and oxygen. It appears natural, therefore, to suppose that it will form a suitable electrolyte to promote chemical combination in a gas battery, with carbonic oxide and oxygen as its elements.

The first apparatus was made of any glass or stoneware vessel to hand, which could conveniently be divided into two compartments, communicating at the bottom. The vessel was partly filled with an ammoniacal or acid solution of cuprous chloride, air was supplied to one compartment and carbonic oxide to the other. When the carbon poles, with which the compartments were furnished, were connected, a weak electric current was obtained. By placing pieces of coke in the cells and thus increasing the surface of contact between the gas and the liquid, a considerable increase in the strength of the current was obtained. The results of this first experiment, if not exactly discouraging, were far from being up to expectation. Platinum poles would probably have given a better effect than

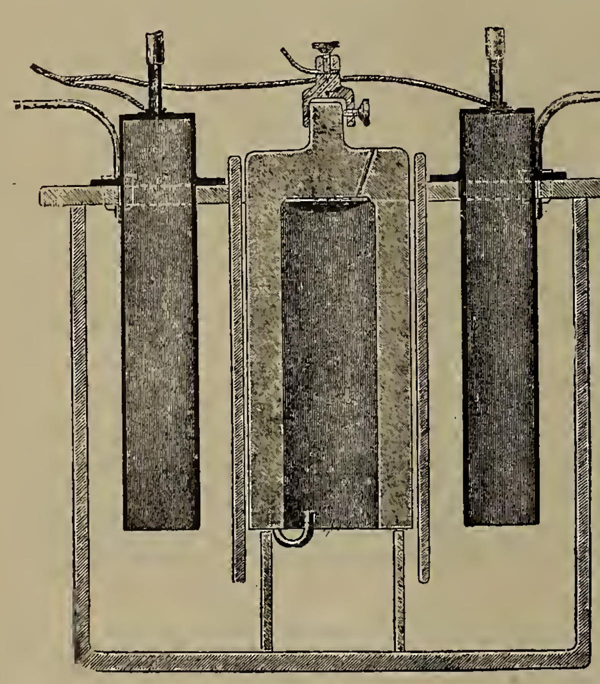
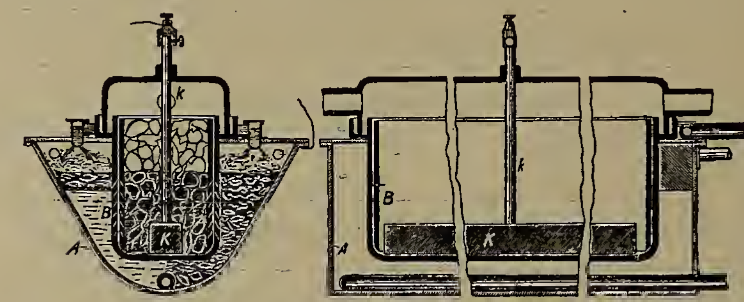


FIG. I.

carbon, but the use of this metal was forbidden by its price. It then occurred to the author that copper might be safely used as a pole in the carbonic oxide cell, the probability being that it would not be dissolved, since carbonic oxide precipitates copper from cuprous salts. This supposition was found by experiment to be correct, and it thus became practicable to make the vessel containing the electrolyte of copper, and to connect to it one of the terminals of the external circuit.

The preliminary apparatus by which these points were established is shown in fig. 1. A glass vessel was divided into three compartments by two glass plates which did not reach quite to the bottom. In both the exterior compartments copper tubes were suspended for the introduction of the carbonic oxide gas. In the middle compartment, a carbon bell dipped, for the introduction of air. A solution of cuprous chloride was used as the electrolyte. The copper tubes were weighed. The carbonic oxide cells were protected against the entrance of air by lids. The carbonic oxide, which was used in the first experiments, was afterwards, for convenience, replaced by coal gas, which contained at least five per cent. of the former. No decrease in the weight of the copper was at any time ascertained; on the contrary on one occasion a slight increase was observed.

Acid solutions of cuprous chloride gave better results



FIGS. 2 AND 3.

than alkaline solutions. Table I gives the results of measurements made when carbonic oxide strongly contaminated with carbonic acid, an acid solution of cuprous chloride, and air, were used in the battery.

TABLE I.

External resistance in ohms.	E.M.F. in volts.	Current strength in amperes
0.1	0.05	0.5
1	0.20	0.20
2	0.23	0.13
3	0.25	0.10
4	0.275	0.075
5	....	0.060
7	....	0.050
10	0.300	0.040
15	....	0.028
20	0.400	0.020
25	....	0.015
30	....	0.012
40	....	0.010
50	0.400	0.008

To facilitate the absorption of carbonic oxide by exposing a greater surface of contact the external cells were filled with copper clippings. By using at the same time a gas corresponding in composition to generator gas, a current of as much as 0.64 ampere was obtained on short circuit, while by gradually increasing the external resistance a maximum value for the E.M.F. of 0.56 volt was reached. This result, to be sure, is not to be chracterized as in every respect favorable, since the E.M.F. calculated from the chemical combination of carbonic oxide and oxygen alone is 1.47 volts. From the results of the experiments given above as compared with the maximum theoretical voltage, at least 27 per cent. of the energy of the fuel is converted into electricity. By the use of a gas among whose combustible constituents are, besides carbonic oxide, hydrogen and hydrocarbons, the effect appears to be still more favorable. According as the lowest or the highest values of these combustibles are taken, the electric energy produced is 38 per cent., or 26 per cent. of the energy of chemical combination. If, therefore, in a comparatively incomplete apparatus one-quarter to one-third of the chemical energy of the fuel can be converted into electricity, this success may well give encouragement to further efforts.

It is well-known that a solution of cuprous chloride also dissolves hydrocarbons. It may not therefore be necessary to convert the fuel into carbonic oxide. Powdered coal was tried in the above apparatus instead of carbonic oxide, and the strength of current and E. M. F. obtained were not far behind those obtained with gaseous fuel. A maximum E. M. F. of 0.3 volts, and a maximum current of 0.4 amperes was obtained.

The oxidation of carbon corresponds to a theoretical voltage of 2 volts; thus 0.3 volt corresponds to an efficiency of 15 per cent. Even with considerable motion in the liquid a falling off in the current soon takes place with coal dust, and this has never been observed with the use of carbonic oxide, or coal gas. The gradual pollution of the liquid with the use of coal would forbid its use even with a more favorable efficiency. The author considers that the use of the gas element is the only way by which success is likely to be attained.

The most recent design of the gaseous fuel element elaborated by the author after the trial of many forms is shown in figs. 2 and 3. The external vessel, A, is of copper and contains the cuprous chloride electrolyte. The inner vessel B, is of earthenware with double sides which are perforated, and contains the space for the cathode. The space between the double sides may be filled with a porous material if necessary. The vessel, A, is furnished with a lid having two holes for the inlet and outlet of the gas, and an aperture in the centre through which a carbon rod, *k*, passes down to the carbon plate, K. The space above the carbon plate may be filled with broken coke to increase the surface of contact. For the same reason, the outer vessel is filled with clippings of copper. The cuprous chloride is supplied by channels running along the lid of the external vessel, A, and drawn off by a pipe at the bottom of the vessel. The gas and the electrolyte can thus be circulated through a series of cells in a large battery. Pipes are also fitted to circulate air in the upper part of the copper vessel. The author also describes a form of cell adapted for the combustion of powdered coal. The latest form of the gas element described above has not yet been tested, being still in the course of construction.

PRINCIPLES OF DYNAMO DESIGN.

BY

Newton Harrison E.E.

(*Continued from Page 311.*)

The value of the coefficient *v* is naturally of a changeable quantity for every different type of machine.

It represents the ratio between the lines of force in the magnet limb and the lines of force passing through the armature.

A great deal has been said about the calculation of leakage before an actual test has been made; but it is best to depend upon the data at hand as being more satisfactory in the generality of cases.

The general principles upon which calculations are based for predetermination of leakage is that of considering the relative reluctances of the different paths which the lines of force are likely to follow, and by this means the leakage from point to point or from area to area can, by careful calculation, be approximately determined. The issue of lines of force from points or from parallel surfaces will be a matter of easy consideration; but the more complex situation, the estimate of the number of lines of force passing from two areas in the same plane or a curved surface and a plane, is a more difficult case to correctly determine.

As all these conditions in detail represent in the concrete the sum total of the results so repeatedly obtained from numerous tests, a slight resumé of the subject will be both interesting and instructive.

There is much data published respecting the different frames by the earliest investigators in this subject, and amongst those first accepted with any degree of confidence are the tabulated results of Esson.

STRAY FIELD IN DIFFERENT DYNAMOS.

	Field,	Armature.	Leakage coefficient.	
Edison-Hopkinson	Single mag. 2 pole	drum	1.32	Poles next to bed plate
Siemens	" "	"	1.30	Yoke next to bed plate
Phœnix	" "	cylinder	1.32	Yoke next to bed plate
"	double mag. 2 pole	"	1.40	Horizontal
Manchester	" "	"	1.49	Bed and one pole cast together
Victoria	" 4 pole	Ring	1.40	Ordinary pattern
Ferranti	" multipolar	Coreless disk	2.00	Alternating

These tables, however, are somewhat antiquated and therefore need not be looked upon as anything but a list possessing the interest which priority gives in all such cases.

The means by which the factor can be found by direct experiment is worthy of explanation.

A deflection is obtained in a ballistic galvanometer by connecting it to a temporary coil surrounding the magnet coil; this is divided by the deflection obtained by having the coil then surround the armature core; the quotient obtained will be the coefficient of leakage. If the first kick of the galvanometer when the circuit is closed be 200° and the kick due to the lines of force in the armature be 160°, then the ratio observed will be expressed by $\frac{200}{160} = 1.25$; which means that for every 125 lines of force produced in the field coils 25 of them will leak away before they reach the armature core. Therefore, if our calculation for electromotive force necessitates the passage of 100 lines of force in the armature, the leakage factor immediately comes into use for the determination of the number of lines of force that must be generated in the magnet cores equal to $100 \times 1.25 = 125$.

By a casual examination of the different types of frames they may in general be reduced to a few forms, from which all others may be considered as mere elaborations. The names of these special types may be called sucessively the horseshoe, the Manchester and the ironclad type. One of the first that appeared in the history and practice of electrical engineering was the horseshoe frame, consisting merely of two magnet-limbs or cores having a common keeper at one end and a cylindrical cavity at the other extremities for the insertion and necessary rotation of the armature. This type has been used in the inverted form, that is to say, the keeper has been a casting so designed as to allow of its use as base or foundation for the machine.

Rising upward from an extension of the keeper are two bearings upon which the shaft rotated, thus making a most solid, substantial and convenient form of dynamo frame. Under the heading of this last-mentioned type were constructed a great variety of commercially successful machines.

The Edison and other companies manufactured this single horseshoe type, but let it rest upon its pole-pieces, thus having the armature nearer to the ground than in the other method of suspension.

By this method of using this particular type of frame, it becomes absolutely necessary to have a non-magnetic metal interposed between the pole-pieces and bed-plate of the machine, and in fact it is the practice of the Edison Co. today to use a casting of zinc in the above-mentioned manner. The magnetic leakage between the pole-pieces and the bed-plate would entirely depend upon the thickness of the intervening unmagnetizable plate.

(*To be Continued.*)

A Wilkesbarre, Pa., despatch states that capitalists in that city and Scranton propose to utilize the culm piles with which that region abounds for boiler fuel in the generation of electricity. The current will be transmitted to New York, Philadelphia, and other places, at a cost to the consumer of less than $7 per horse-power per year.

IMPROVED ENGINE OF THE AMERICAN ENGINE COMPANY.

(*Continued from Page 312*).

The Spaulding valve, as constructed for horizontal engines (see figure 1), consists of a flat-face slide valve bearing upon a flat seat, against which it is held by the steam pressure. The valve travel is invariable, hence the wear upon its seat is uniform, and therefore the valve always remains tight. This valve controls the admission, release and compression, maintaining them constant; while the cut-off is variably controlled by a small cylinder valve within the slide valve, as shown in Fig. 3. This valve is provided with longitudinal ports, and corresponding longitudinal ports are cast through the shell of the slide valve surrounding it; and the cutting off of the steam is accomplished by twisting or rotating the valve, which opens and closes the longitudinal ports.

The valve gear or operating mechanism consists of an ordinary eccentric fixed to the engine shaft, which gives to the valves a reciprocating motion. Mounted upon the eccentric is a loose sleeve having a diagonal V-shaped groove turned in its periphery, as shown in Fig. 2, to which is fitted the eccentric strap. This sleeve is connected to the governor weights by links in the usual way of connecting eccentrics.

As the sleeve revolves with the eccentric, being carried around by the governor weights, a twisting motion is imparted to the eccentric strap and through the eccentric rod and valve rod to the cylinder valve within the slide valve.

From the foregoing description it will be seen the slide valve which controls the admission, release and compression, has an invariable reciprocating motion, which makes those events constant, while the cylinder cut-off valve within has a twisting motion which is invariable in degree, but variable relative to the reciprocating motion.

This variation is accomplished by advancing or retarding the sleeve, mounted upon the eccentric, whenever the governor weights change their position as a result of a change in speed.

The exhaust steam passes directly to an exhaust pipe cast on the under side of the steam chest, the ends only being joined to the steam chest so that the exhaust does not come into contact with any live steam surfaces except the ends of the main valve. The live steam is conveyed by a pipe into the steam chest through the top at the centre, and is prevented from passing the ends of the valve to the exhaust by packing strips, one bearing against the steam chest cover, the other against the top of the steam chest, being kept in contact with these surfaces by the steam or by small springs when the steam is turned off. A corner-piece is so constructed as to effectually close the joint where the packing strips meet at the corner. These strips are made of the same material as the valve, and are secured from moving away from the valve seat proper by a pin, but are free to move out of the groove in the valve (as wear may occur) against their bearing surfaces.

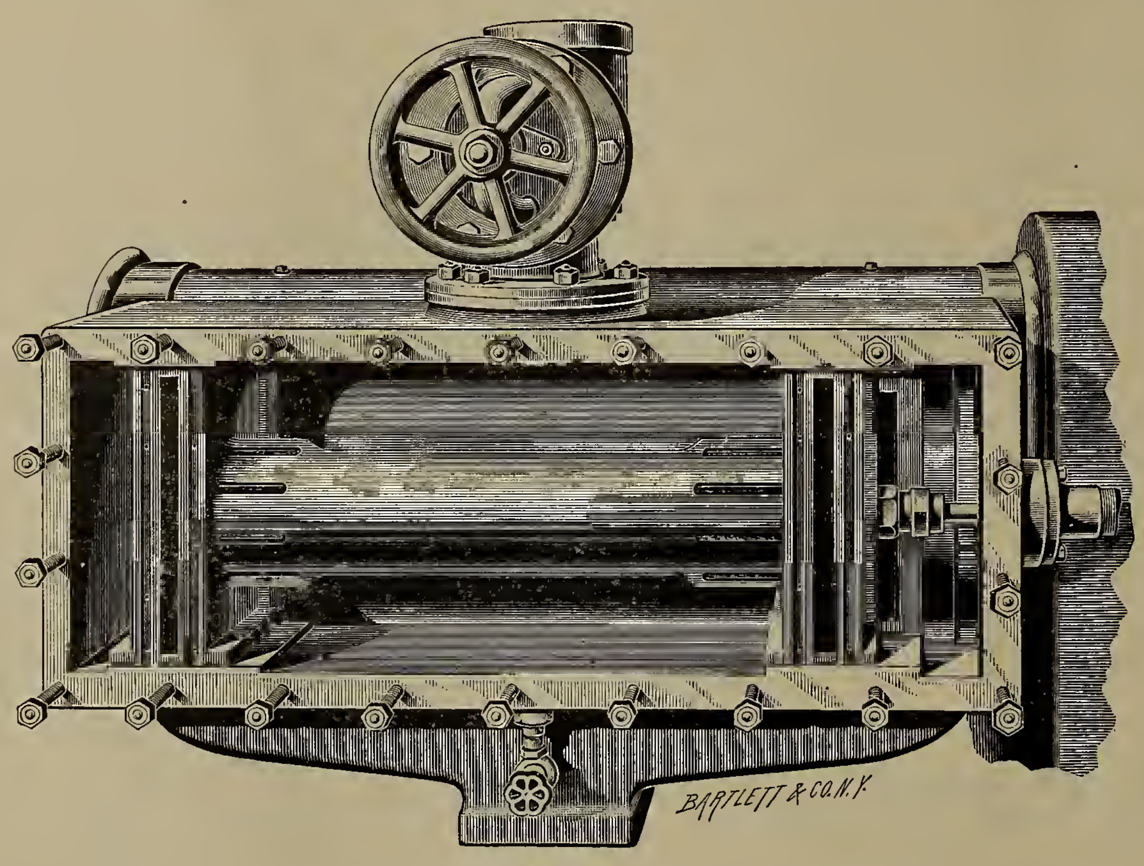


FIG. 1.

Fig. 3 shows a sectional view through the centre of the cylinder and through one end of the valve. The arrows at the right hand of the illustration show the course of the steam as it passes out of the cylinder and into the exhaust chest, and those at the left show its course in passing into the cylinder from the steam chest.

The clearance space of an engine has much to do with its steam economy, and in the case of the engine under consideration there is but one port at each end of the cylinder for the induction and eduction of steam, as shown in fig. 3. If proportioned to the same rotative speed a smaller percentage of clearance for a given horse-power is obtained than in the Corliss engine.

The new gear is positive in its action and admits of running engines equipped with it at any desirable speed within the limits of safety.

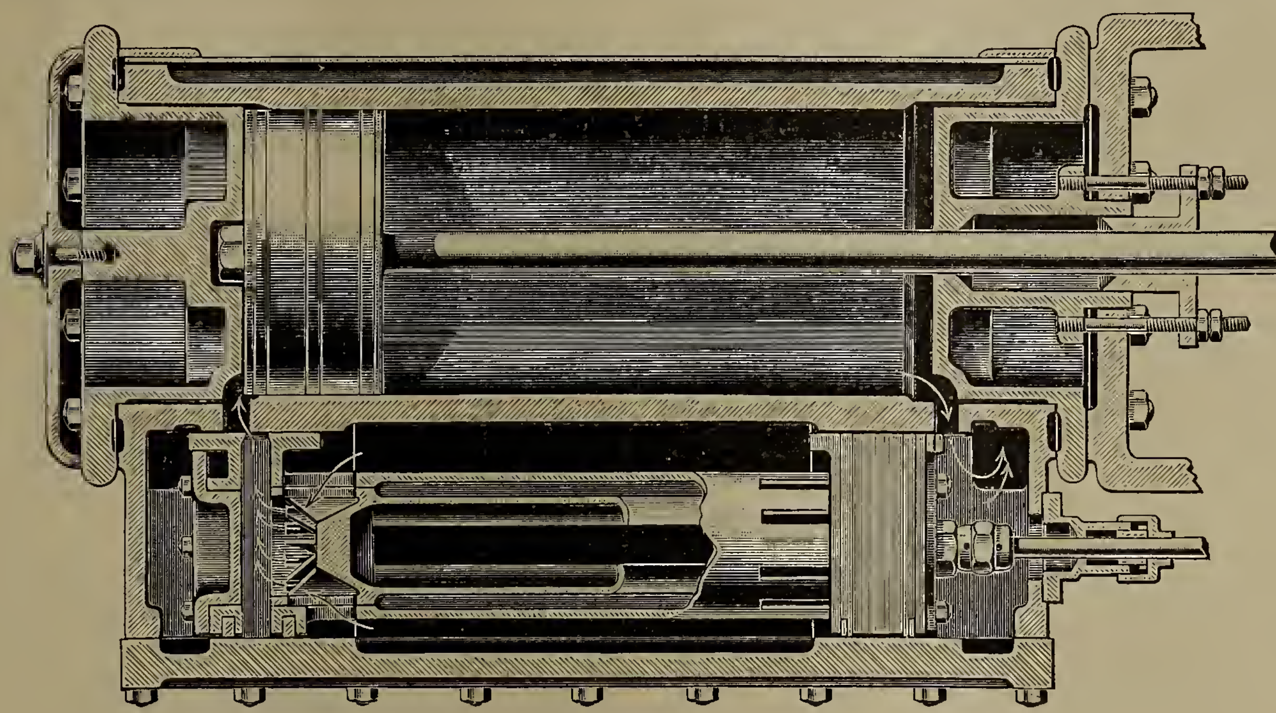


FIG. 3.

The American Engine Company claims for its new gear the highest attainable steam economy with but a single valve and the most simple actuating mechanisms known; positive in its action, which, with its extreme

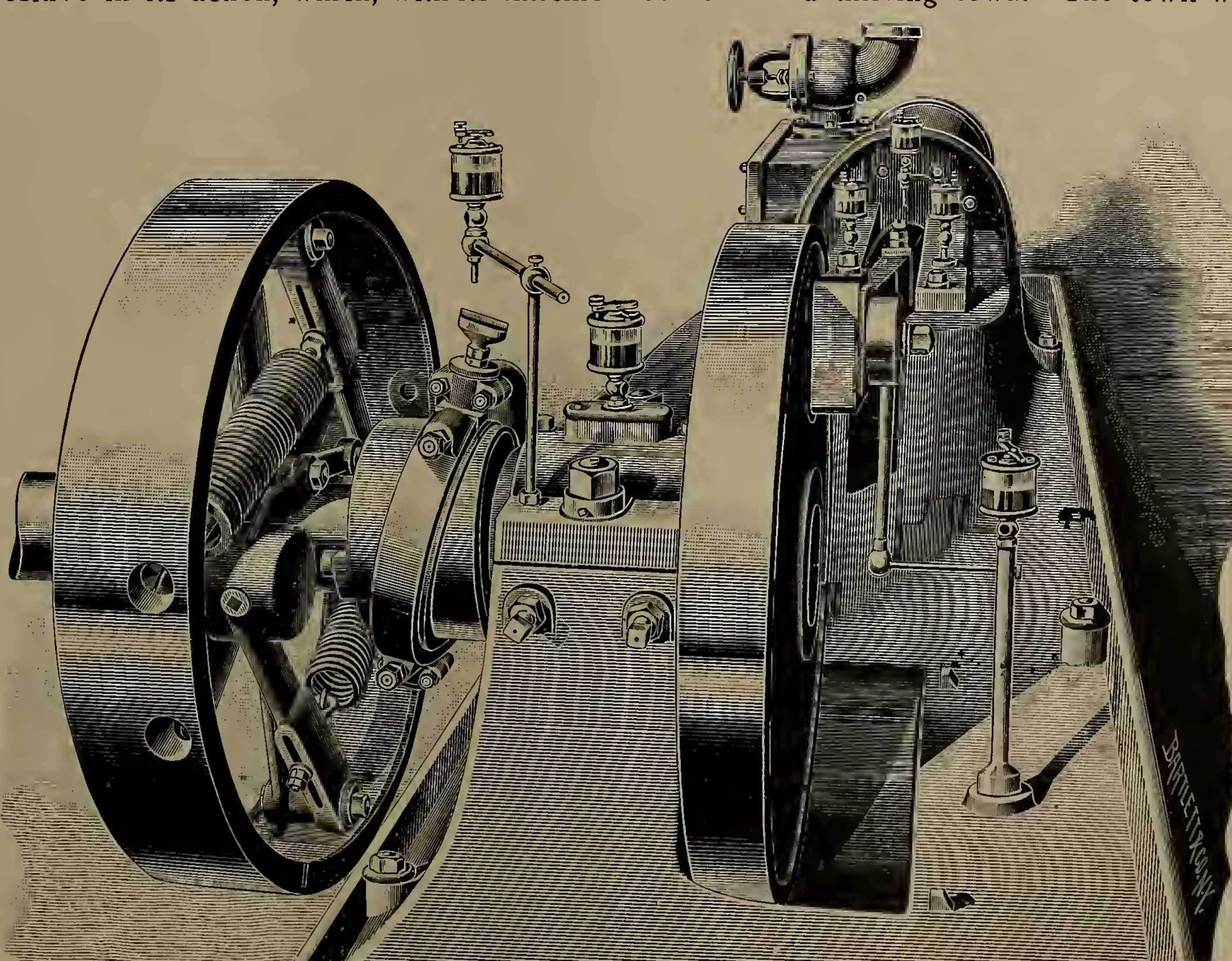


FIG. 2.

simplicity, makes it capable of the highest attainable speed.

In a future article we will illustrate one of the vertical engines built by this company in which a single valve accomplishes the same results, i. e., a constant admission, constant release and constant compression, with an automatically variable cut-off.

Incidentally, a few words about New Bound Brook, where the American Engine Company's shops are located, will not be devoid of interest.

New Bound Brook adjoins the borough of Bound Brook, and covers a very large acreage. The property was purchased by Hon. Ray V. Pierce, president of the American Engine Company, and transformed into a beautiful and thriving town. The town was planned with great care, and it possesses all the modern conveniences, including electric lights, well-paved streets and water, which is of excellent quality. Fine houses are constantly being erected, and a large hotel with every modern convenience is projected. The New Jersey

Central Railroad Company has completed plans for the erection of an elegant station at the place. In every way New Bound Brook is a most desirable place for residence, and it offers special advantages for manufacturing industries.

Against the W. J. Johnston Company.—The appeal from the judgment of the referee in the case of the W. J. Johnston Company, Ltd., against T. C. Martin, has been decided by Judge Pryor in the New York Court of Common Pleas, general term, in favor of Mr. Martin. The question at issue concerned the repurchase by the W. J. Johnston Company of 20 shares of stock of that company, held by Mr. Martin, and the price to be paid for the same. Judge Pryor affirms the judgment of the referee.

Personal.—Mr. James W. Godfrey, general manager of the New York Insulated Wire Company, of New York, severed his connection with that company on the 8th instant.

Death of Mr. Degenhardt.—Mr. Fred. E. Degenhardt, the Chicago representative of the Standard Underground Cable Company, of Pittsburgh, died at his home last week, of typhoid-pneumonia. Mr. Degenhardt was one of the most genial of men, and he had a host of friends in the electrical trade who will deeply regret to learn of his death.

ALUMINUM, THE SUPERABUNDANT METAL.

In an article under this head in the *Engineering Magazine* for December, Henry Wurtz, Ph. D., gives many interesting facts regarding the production and properties of aluminum. Regarding the method of getting aluminum he says:

The Cowles process (American, 1885) produces alloys only, mainly aluminum bronzes or copper alloys. An arc between very large carbon electrodes is diffused throughout alumina, corundum, or other ore, mixed with granulated copper and carbon. It is in part an adaptation of the first electric furnace of the British patent granted January 31, 1862 (to E. C. H. Monckton), specifying the application of electric currents to "the reduction and fusion of ores and metals that are otherwise intractable, by intensifying the heat of ordinary furnaces, as for example, the reduction of aluminum." The alumina melts, and is deoxidized by the carbon, the aluminum being even converted partly into vapor by the heat of the arc Such vapor is absorbed by the copper to the amount of 30 per cent. or more. This rich alloy is subsequently melted with more copper to bring the aluminum to the proportion desired. The Hall process (American, filed in 1886), operated by the Pittsburgh Reduction Company, is to employ also at Niagara 6,500 electrical horse-power. This company now monopolizes the American trade in pure and "commercially pure" aluminum. The process is the electrolysis of fused cryolite (or other fluorides) kept saturated with pure alumina dissolved at intervals. Fusion is maintained by resistance of the cryolite, which is a poor electrolyte, and can therefore be regulated by more or less alumina, which decreases the resistance. If the fluoride bath be pure, the metal obtained should also be pure; but as native Greenland cryolite is used, for economy, its contaminations, silicon and iron, are introduced. Nevertheless the Pittsburgh Company now advertise metal of 99.6 per cent. at special rates; ingots over 98 per cent. for 58 cents per pound by the ton; 60 cents for 100 pounds, and for less 63 cents. Also 94 per cent. ingots (for siderurgical uses, at 50, 53 and 55 cents respectively. The baths are in cast-iron pots lined with carbon as cathodes, with carbon anodes, which are gradually consumed by the oxygen of the decomposing alumina and require renewals. If bronze is made the anodes are copper. The temperature is below that of fusion of copper. The aluminum realized is 94½ per cent. of that added as alumina. Each bath yields one pound of aluminum per hour, with a consumption of 18.1 electrical horse-power hours, and of one pound of carbon anode. The Heroult process (French, 1887), when making pure aluminum, appears practically similar to that of Hall. but without solvent for the alumina fed in, this being kept in fusion by the arc, as in the Cowles apparatus. The carbon anodes of course are consumed. For bronzes the fused alumina rests upon melted copper, which becomes highly charged with aluminum. It has been operated since 1888 by water-power on a great scale at Neuhausen, Switzerland, at the Falls of the Rhine, by the Industrie Actien-Gesellschaft, who advertise aluminum (grades not stated) for 45 cents per pound. It is operated also at Froges, in France, by water power.

POSSIBILITIES OF THE STORAGE BATTERY.*

BY PEDRO G. SALOM.

One of the most important applications for storage batteries is found in connection with electric lighting. Electric lighting with such batteries may be divided into isolated lighting and central station lighting. All isolated installations that are now being run night and day can advantageously and economically be improved by the addition of a storage battery, and the continuous operation of a dynamo thus be dispensed with, as well as the services of an extra engineer. When plants are run night and day, owing to the great expense which it is impossible to avoid in operating a few lamps before and after the hours of maximum load, it is necessary to use gas or other source of illumination. This is a ridiculous and unnecessary humiliation to the owners of a costly installation, when a few storage batteries only are required in addition to the plant which they already possess to make it available day or night.

When lamps are supplied direct, the machinery must have a power capacity equal to the maximum number of lamps, and since the lamps are usually needed only a few hours a day, the plant will remain idle the rest of the time. Moreover, the engine and dynamo must be of the best construction and design, steady and quick regulating, to prevent flickering or variation in candle-power. But with storage batteries the generator is not limited as to the time or manner of working, and can prepare its supply slowly, ahead of time during the day, in the many hours at its disposal; and, in addition to its requiring only a dynamo of very much smaller size, the machinery may be of much simpler and cheaper construction, for with the battery, irregularities in movement can exist without in any way affecting the quality of the light. The current from the accumulators is always uniform and regular, even while the charging current is subject to marked fluctuations. The storage battery is, in fact, an equalizer and regulator to the dynamo, besides acting as a reservoir in case of accident, liable to happen with the best of machinery.

In all cases, a direct lighting plant can be made complete and perfectly reliable by the addition of storage batteries, as the surplus energy which can be stored while the dynamo is running under light load can be utilized during the remaining hours of the day or night. With

* Abstract from *Cassier's Magazine* for December, 1894.

water or gas, we cannot expect a reliable supply without providing facilities for storage. In the profitable and practical application of electricity, we must also have a means of storing to insure an absolutely steady and uniform current, so necessary with incandescent lighting, and also to provide against any possibility of the extinguishing of the lights by failure of the generating plant.

The problem of domestic lighting has been solved by the introduction of storage batteries. Heretofore, electric light was only obtainable in localities adjacent to a central station, but by the application of accumulators almost any power can be made available.

In places where an arc circuit is already installed, the introduction of the incandescent light becomes a comparatively simple and inexpensive matter. The arc dynamos can be used in the daytime to charge the batteries, and at night to supply the arc lamps, while the stored, electrical energy is used to supply the incandescent lamps.

As an accessory to direct lighting in mills, or other manufacturing establishments, hotels, office buildings, schools, institutions and public buildings, the advantages of the use of storage batteries are too apparent to admit of argument. They furnish light when the power is shut down (which is usually at six o'clock), for office work, watchmen, storerooms and warehouses, for preparing and rearranging machinery, boilers, engines, shafting, etc., which in many cases has to be done at night. They will also furnish power for running electric motors, when other sources of power are stopped, as at night, or on Sundays or holidays.

The advantages to be derived from the use of storage batteries in an isolated electric light installation, when once fully recognized and appreciated by electrical engineers, will render their introduction well nigh universal. They may be summed up as follows: light and power on tap at all hours of the day or night; the ability to add incandescent lighting to an arc system already installed; increase in life of lamps due to perfect regulation of the current, thus effecting a great saving in lamp renewals; as an auxiliary to direct incandescent lighting, where it is not possible or practical to keep the generating machinery in continuous operation; ease of manipulation and freedom from annoying breakdowns and other mechanical irregularities; the battery may be charged from either arc or incandescent circuits by the introduction of proper automatic safety switches and rheostats; the utilization of the current for many household conveniences, such as the running of fans, sewing machines, clocks, electric bells, pumps, etc.; economy obtained by dispensing with an extra engineer for night work, and by obviating the necessity of running a large engine and dynamo for lighting a few lamps during the day or night, or before and after the time of maximum load.

* * *

The advantages of using storage batteries in central station lighting may be briefly summed up as follows: They effect a substantial saving in operating expenses; they increase the factor of safety; they permit of a material extension of distribution without increasing the size of the power plant Since the question of economy is largely the determining factor in considering the advisability of introducing a battery, let us examine more at length the means by which economy may be effected: 1. By taking care of a sudden and excessive load when all the generating machinery is taxed to its utmost extent. 2. By dispensing with one shift of labor in taking care of the entire minimum load. 3. By permitting the operation of large units exclusively. 4. By operating all the units at their maximum load and, hence, their maximum efficiency.

Owing to the peculiar nature of electric lighting it frequently happens that the number of units generated at the maximum load is not more than a few per cent. of that of the total average load, and the total load is only a few per cent in summer, and rarely above forty per cent. in winter, of the total possible output of the plant.

Tbe first requisite in determining whether a battery can be advantageously introduced in any given central station, and if so, what its size or capacity shall be, is to have diagrams of the load curves. The next important factor is the number and size of the units employed at the station. From these data can be determined what has very appropriately been called the load factor, and then it is simple to calculate the size of the battery required to give the most economical operating results. Once the size of the battery determined we can calculate the saving effected: *a.* By dispensing with a night shift; *b.* By diminishing the consumption of coal for a given output; *c.* By the saving effected by operating a few large units of one size instead of a number of small units of various sizes; *d.* By the saving effected in operating each unit at its maximum efficiency, and *e.* By the additional revenues from increase of total output taken from battery at time of maximum load.

UNDERGROUND PIPES AS ELECTRICAL CONDUCTORS.

The first annual meeting of the American Society of Municipal Improvements was held in Buffalo, September 19, last. During a discussion attention was directed to the electrolytic action of electric railway return currents on water pipes. In this connection Mr. Geo. H. Benzenberg, of Milwaukee, said:

The subject of returning the current back to the generator is not a difficult one. There is nothing in the world easier than to remove the corrosive action of the current upon the pipe, by making a careful connection between the water pipe and the generator at the power house, at the nearest point to the negative pole of the generator, at the power house. The current itself does not destroy the iron. The destruction is caused by electrolysis. The salts contained in the earth are nitrates, chlorides, and sulphites. The current will act upon the salts of chlorides, producing hydrochloric acid. It is this that affects the water-pipe. Now if the pipe is kept negative—has less current upon it than it can convey—there is no inducement for the current to leave the pipe for some other conductor, and it makes no difference how much current is passing through the pipe if you have the facilities to carry it directly to the generator. The water-work's men should satisfy themselves that at no place is the pipe positive to another conductor. When it is, and the earth contains certain salts, of course this corrosive action is constantly going on, even though there be but the smallest fraction of a volt of current passing from the pipe, and the result is the corrosion of the water-pipe. If these salts were not in the ea'th, any amount of that current would pass through the pipe without harmful results.

In Milwaukee we conduct a very large proportion of the return current, in fact 31 per cent. of the entire output of the electric power station is sent back through the water pipes without the least observable action upon the pipe.

For the purpose of making a good metallic connection between the generator and the pipe, the pipe was filed on its surface, and the current, we found, after passing through the pipe for fifteen months, left the fine ridge-marks of the file as clear and distinct as they were on the day the connection was put in. This matter forces itself upon us; we found an eight-inch pipe corroded to the thinness of a knife blade, and the metal at the break was as soft as a sponge. Investigations were made and it was determined that it was caused by the electric current acting upon the pipe, through the salts contained in the earth, and as I say, since the connection was made with the pipe and the generator, no corrosion has taken place. Continuous observations are being made by the department, by applying a volt meter to determine whether the current is positive to any other conductor.

If this copper connection is made between the rail and the pipe, the result is that the surplus current, which is forced to leave the pipe, to some other conductor, is conducted back through the copper wire to the trolley, and no injury occurs to the pipe.

In order to overcome any resistance on account of the imperfect work in bonding, the four rails should be connected at every one hundred or one hundred and twenty feet. The size of the bond depends upon the size of the rail. In the outlying districts, where there is little current passing through the rail and but three or four cars on the district at a time, No. 00 copper wire would be sufficient for bonding; but as you approach your power house, where you have a great number of electric cars passing over the lines continuously, not less than No. 0000 copper wire should be used, and the bonding should be done by a process of welding, so as to make the connections as perfect as possible.

LOSSES IN BOILER PRACTICE AND SOME OF THEIR CAUSES.*

BY DANIEL ASWORTH, M. E.

In city buildings, especially where space is necessarily limited, and frequently unavoidably, closer attention should be given to space and accessibility in the boiler department to the various points connected therewith. Many a connection has been allowed to waste for an unreasonable period of time. Many destructive corrosions have taken place by continued leaks and droppings by reason of the difficulty and great inconvenience of access to reach these points, which would have been entirely prevented by giving a little more room, which, in itself, would have begotten a promptness of action to prevent all this. There has been a line of argument adduced in opposition to these views that we would have to pay higher wages in order to have more intelligence in these departments. Conversely stated, then, it would be more profitable to have ignorance and its attended waste surrounding us on every hand. If proprietors and progressive superintendents are willing, and I believe they all are, in general, to adopt mechanical devices when it is clearly demonstrated to them that their operation is such as to be conducive to economy, when they cheerfully place upon their plants automatic dampers, shaking grates, water alarms, and such appliances, does it not seem to be a gross inconsistency that they halt, or hesitate, at least upon the question of a little investment for more brains and intelligence? And does it not seem to be a still greater incongruity that when all these appliances, no matter how excellent they are, from the gauge cock to the complete stoker, can be rendered almost useless as far as economy is concerned, and indeed, very frequently, far more wasteful, when improperly used than when in their primitive condition. It is a well-known fact, and I think every inventor will bear me out in this, that the very best appliances which would have become almost universally adopted, have been eternally damned by being left to the entire control and indifference of an ignorant operator.

When these plain unvarnished facts are recognized by interested parties, then we will make rapid strides in economy, which I believe will far exceed the expectations of the most sanguine. When we have arrived at that stage, we shall feel somewhat emboldened and encouraged, if you please, to talk to some degree of confidence that we will produce some results upon the chemistry of combustion and circulation and calorimetry, and with some feeling of assurance that these, in addition to what has already been accomplished, if it will not make us feel that we have arrived at a condition of ultima thule, we shall have accomplished a revolution which will form an important epoch in the history of steam making. If the plain facts as herein expressed will, either through the medium of discussions, exchange of thought or otherwise, set the wheels of thought into motion in this direction, which ultimately will produce a reformation in boiler departments, for which we so earnestly plead, we will have the satisfaction of knowing that, no matter how crude the efforts may be, they have not been in vain.

* Abstract of paper read before the Engineers' Society of Western Pennsylvania, November 15, 1894.

REPORTED CONSOLIDATION OF STORAGE BATTERY INTERESTS.

A despatch from Philadelphia, December 4, states that the Electric Storage Battery Company of that city has acquired all the rights and patents of the Consolidated Electric Storage Company, the battery patents and rights of the Brush Electric Company, of Cleveland, the battery patents and all interests in connection with batteries and the good-will of that branch of the business of the General Electric Company; all the property, rights, and patents of the General Electric Launch Company and the Electric Launch and Navigation Company, and the rights, licenses, and patents of the Accumulator Company.

These purchases virtually place in control of the Electric Storage Battery Company all its former competitors in the business of supplying storage batteries, and put an end to all litigation over patent rights.

ELECTRICITY IN BRIDGE BUILDING.

A bridge is in process of construction over the canal near Kiel, at an elevation of 145 feet above the level of the water, to carry the railway from Eckemforde to that town. Four cranes, two of the locomotive and two of the pivoting type, are employed, instead of the usual hoisting appliances, and are all worked by electricity. According to the *Electrotechnische Zeitschrift*, loads of 10 tons are raised in 20 minutes, and smaller loads at a much quicker rate. At 850 revolutions per minute, the cranes develop seven H. P., and the electromotive force of the current does not exceed 220 volts, with a yield of 84 per cent. Two compound dynamos, disposed in parallel, act as generators, driven by a steam engine of 25 H. P. Both dynamos and electromotors are of the four-pole type. As the consumption of the motive power in the cranes was of a very variable character, variable resistances, composed of spirals of nickeline attached to slabs of slate, are interposed as required by an automatic appliance. The electric circuit comprises three parallel wires $\frac{1}{4}$-inch in diameter, with a total length in both directions of three-quarters of a mile. In order to work the cranes, which have a dead weight of their own of 33 tons, at a speed of six inches per second, the electromotor requires 40 amperes and 210 volts.

FOREIGN ELECTRIC RAILROADS.

The following table, taken from the report of Mr. Paul von Vloten to the Permanent International Tramway Union, regarding electric railroads in European countries and England, shows the length of road in operation and length under construction in the various countries named at the end of 1893:

	In operation.	In construction.	Total.
Belgium	3.2	18.5	21.7
Germany	102.0	66.1	168.1
England	71.4	21.4	92.8
France	41.4	29.0	70.4
Italy	13.0	—	13.0
Holland	4.9	—	4.9
Austria-Hungary	33.4	—	33.4
Roumania	—	5.5	5.5
Russia	3.0	7.0	10 0
Sweden and Norway	—	6.5	6.5
Switzerland	23.6	10.6	34.2
Servia	—	10.0	10.0
Spain	14.0	—	14.0
Total	309.9	174.6	484.5

AN EXCELLENT STORAGE BATTERY RECORD.

The Electric-Power Storage Company, of New York, lately installed a plant of storage batteries in Hudnut's pharmacy, in the old Herald Building, at the corner of Broadway and Ann street, where it is doing most excellent work in lighting service and giving unqualified satisfaction. The batteries manufactured by this company are of the pure Planté type, with the true Planté "formation," and withstand the severest treatment with perfect impunity. The plant referred to is composed entirely of cells that had been in use in the company's factory in this city for more than a year before they were installed in their present locality. These batteries are 280 ampere-hour cells, and during their actual every-day use in the company's factory, for a period of sixteen months, they were treated with special severity for the express purpose of discovering their weak points, if they had any, and with a view to breaking them down, if severe work could do so.

To this end, these cells were charged day after day with currents, varying from 60 to 100 amperes, and day after day during these many months, were discharged on one hundred 50-volt lamps (their normal discharge rate being for 28 such lamps), and at the same time were frequently required to furnish current to run a one-horse motor in addition to the 100 lamps, thus being required to furnish a discharge current of from 110 to 125 amperes, and this not occasionally, but daily; while many times the discharge was increased to 150 and 175 amperes. Yet, notwithstanding this continual severe treatment for so many months, not a single plate in any cell is or at any time has been sulphated, and not a plate is bent, warped, "buckled" or injured in any way, nor was any deposit from disintegration found in the cells.

Plants of these batteries are soon to be installed in Chicago and Minneapolis for light and power service, and we are informed that negotiations are in progress looking to their adoption for traction purposes on an extensive scale, and also for use in the propulsion of electric launches.

These batteries are especially suited to such service by reason of their ability to yield excessive discharge rates without injury to their plates.

The company is receiving many calls for estimates on plants of large capacity for central station service, and in several cases for plants as power-house adjuncts.

STREET RAILWAY INTERESTS.

An electric railway will probably be constructed between Llanfair-pwllgwyngyl and Beaumaris, Anglesea, England. All aboard Llanfairpwllgwyngyl!

The Wellston Belt & Street Railway Company, Wellston, O., has changed its name to Wellston & Jackson Belt Railroad Company.

The Consolidated Traction Company, of Newark and Jersey City, has been indicted by the Grand Jury for running its cars through the city at a high rate of speed.

The Metropolitan Street Railway Company on Dec. 8 opened its Columbus Ave. Cable road. This road connects with the Broadway Cable line and runs from the junction with this line on 53d street through Columbus avenue to 98th street. For the present passengers will be required to transfer at the corner of Seventh avenue and 53d street to the Broadway cars. As soon, however, as the very complicated machinery underground at that point shall be perfected, the cars will run through to the Battery. They will be distinguished from the cars running up Seventh avenue to Central Park by blue signs on the ends and sides of the roof, and at night by blue lights conspicuously displayed.

The report of the Philadelphia Traction Co. for the year ending June 30, last, shows receipts $5,194,990.52; expenses $4,702,416.70; net profit $492,573.82. During the year 136,327,329 passengers were carried, an increase of 10,692,794 over the previous year. The president's report says that since the introduction of the trolley system the increase in revenue has averaged about $50,000 a month, and the figures for November will show an increase of about $75,000 over the preceding November. "In the light of the past," says President Widener, "I don't think that there is any property in the country that has a brighter prospect than this property."

THE SUBURBAN TRACTION CO.'S DIFFICULTIES.

Watson Whittlesey of Orange, N. J., has been appointed receiver of the Suburban Traction Co., of Orange, upon the application of the American Loan & Trust Company, of Boston. The appointment was made upon the representation that the company is in an insolvent condition, and that if the receiver should not be appointed at once the mortgagee and the bondholders would suffer greatly because of sheriff's sales and judgments.

The petition of the American Loan and Trust Company says that twenty suits have been begun against the Traction Company, some of them for injuries, and others to recover on loans, the claims amounting to $170,000. The petition also states that the Suburban Traction Company owes $44,498 outside of its mortgage to the Boston Company. The total indebtedness is placed at $104,954 outside of the mortgage, and the assets are rated at about $500,000.

The company has been in an embarrassed financial condition for some time. Last June it decided to issue $1,500,000 worth of bonds so as to tide over difficulties. The issue was made, and the American Loan and Trust Company agreed to take the entire issue in consideration of a first mortgage on all of the property. The property of the concern consists of ten miles of track, six and a half miles of which are equipped with electric power.

A large number of the company's bonds are held in Orange, seventy of them being in the possession of the Orange National Bank. The interest on the bonds for the last year and the taxes for the last two years have not been paid.

TELEPHONE NOTES.

The Central Union Telephone Co., Massillon, O., has been charged with violating its franchise.

The Rocky Mountain Telephone Co. is extending its lines throughout Montana and is at present at work on the construction of a metallic circuit to Maryville, a distance of 32 miles from Salt Lake City.

It is proposed to establish a telephone line between England and Holland. The London Chamber of Commerce and the Netherland Chamber of Commerce are considering the matter. They are trying to ascertain if the time is yet ripe for the undertaking.

Every one engaged in the telephone business should understand the telephone itself. Send to the Electrical Age for list of telephone books and prices.

The Bell Telephone Company is making telephones of special design for use on shipboard. This special type is known as the marine telephone.

Subways for telephone wires are now being constructed in Pawtucket, R. I.

The Central Union Telephone Company will not allow the Harrison Telephone people to put in their in-instruments in Findlay, Ohio. A suit is probable.

One hundred and seventy-two pound wire is to be substituted for 104 pound conductors now used as trunk lines by the Southern New England Telephone Co. The breaking stress of the new wire is 533 pounds and of the old 342.

The Home Telephone Company, Plain City, Ohio, has been incorporated by W. C. Bollinger, W. H. Schierer, Chas. Dun, J. C. Thompson, J. A. Kile, A. Lee Seeley, G. W. Gardner, Albert Hauer and N. F. Matoon. Capital stock, $5,000.

The Citizens' Mutual Telephone Company, Lockport, N. Y., incorporated by Jos. A. Ward, William V. Trevor and others. Capital stock, $15,000.

The Southwestern Telegraph & Telephone Co., Austin, Tex., will enlarge and otherwise improve its plant.

The Valparaiso Telephone Exchange, Valparaiso., Ind., has been incorporated with a capital stock of $5,000.

The National Telephone Company has just completed the work of putting in an exchange in Marshfield, Wis.

TELEPHONE PATENTS ISSUED DECEMBER 4.

Telephone Transmitter.—Miles A. Morehouse, Weverton, N. Y. (No. 530,115.)

Telephone Switch.—Alfred Stromberg and Androv Carlson, Chicago.—(No. 530,208.)

Telephone Transmitter.—John T. Williams, Brooklyn, N. Y. (No. 530,315.)

Telephone Exchange System.—Romaine Callender, Brantford, Canada. (No. 530,324.)

Telephone Switch.—Romaine Callender, Brantford, Canada. (No. 530,325.)

Telephone Transmitter.—John Goodman and Henry M. Goodman, Louisville, Ky. (No. 530,412.)

Queen & Co., of Philadelphia, have been sued by the Weston Electrical Instrument Co., of Newark, N. J., for alleged infringement of electrical measuring instruments and galvanic batteries.

Personal.—Mr. W. H. McKinlock, president of the Metropolitan Electric Company, Chicago, is in the East on business.

NEW CORPORATIONS.

The Baum Street Railway Co., Harrisburg, Pa. Capital stock, $10,000.

The Power Development Co., San Francisco, Cal., by C. W. Howard and others. Capital stock, $500,000.

The Universal Electric Constructing Co., Detroit, Mich., by J. H. Talbot and others. Capital stock, $5,500.

The Stockton Gas & Electric Co., San Francisco, Cal., by August Muenter, W. B. Kollmeyer, Chas. E. Green, Ed. Barry, F. W. Longee, Robt. M. Welch and others. Capital stock, $1,000,000.

The Liberty Traction Co., Harrisburg, Pa., by John F. Scott, president, Geo. S. Davidson, P. Rhoades Baker, W. F. Bickell and others. Capital stock, $70,000.

The Garfield Water, Gas & Electric Light & Power Company, Colorado Springs, Col., by P. J. Freidrich, Alois Kock and John L. Frazer. Capital stock, $1,000,000.

The Nutting Electric Company, Chicago, Ill., by Jas. W. Hedenberg, Carl K. McFadden and Frank A. Smith. Capital stock, $50,000.

The Madison Square Light Company, New York, N. Y., by Geo. W. Maslin, Arthur Freeland, Richard Lanford, William Townsend, Edmund Merrill, I. S. Lewis and Partick Nolan. Capital stock, $1,000.

Sprockett Car Wheel Company, Boston, Mass., by L. W. Price, president; A. W. Bridgham, treasurer, and Louis E. Walkins. Capital stock, $1,200.

The American Gas Engine Electric Company, Chicago, Ill., by T. M. Carlton and others, with a capital stock of $250,000.

The Dearborn Electric Company, Chicago, Ill., by Chas. Messer and others. Capital stock, $100,000.

The Mutual Gas & Electric Company, Brooklyn, N. Y., by Aquilla Wanamaker of Jersey City, N. J., and others. Capital stock, $100,000.

The Traverse City, Peninsula & Mission Electric Railway Company, Lansing, Mich. Capital stock, $160,000.

The Ravenna Electric Street Railway & Power Company, Ravenna, Ohio, by Geo. H. Worthingham, Wm. J. Akers, Geo. W. Gardner, John H. Evans and R. B. Carnahan. Capital stock, $50,000.

White Hall Electric Railway, White Hall, Ill., by Gilbert S. Vasseller, Orlando F. Griswold and Henry W. Hand. Capital stock, $10,000.

The Chatham Electric Light & Power Company, Savannah, Ga., by Geo. Parsons, Jas. H. Johnston, John N. Harriman, Ed. J. Thompson and others. Capital stock, $25,000.

The Mahoning Valley Electric Railway Company, Niles, O., by C. F. Clapp, R. G. Skyes, Arthur A. Anderson, G. E. Herrick, Andrew Squire and John E. McVey. Capital stock, $150,000.

Cambridge District Messenger Co., Cambridge, Mass., by J. O. Shaw and others. Capital stock, $10,000.

The Paducah Electric Co., Paducah, Ky., Elbridge Palmer, R. Rowland, J. L. Friedland, J. W. Kellar, W. A. Gardener, F. M. Fisher and A. A. Einstein. Capital stock, $40,000.

Gloucester & Rockport Street Railway Company, Gloucester, Mass., by W. B. Ferguson, A. D. Bosson and D. S. Presson. Capital stock, $40,000..

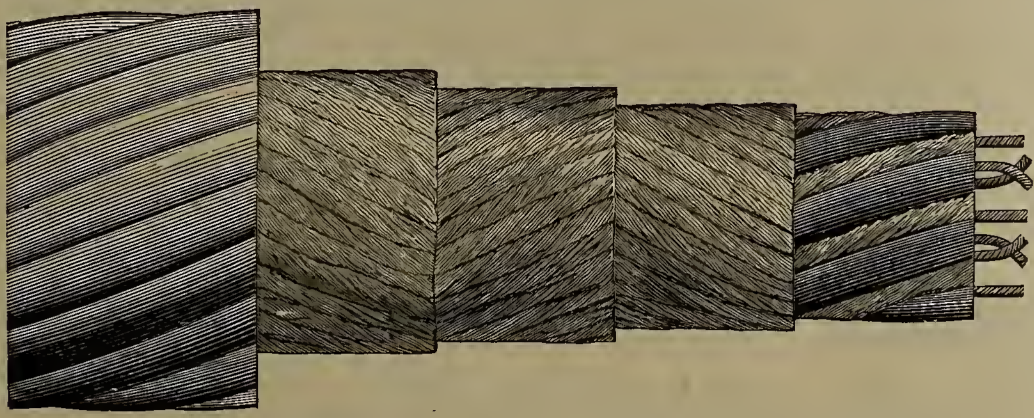
KERITE SUBMARINE CABLES.

W. R. Brixey has completed the manufacture and laying of a four-mile length of submarine telegraph cable having two conductors. The conductors are stranded, 14 B.W.G. wires insulated with Kerite; taped and bedded in jute, the whole being protected with an armor of No. 6 galvanized iron wires. Mr. Brixey has also on the machines and ready for submersion several lengths of 20-conductor submarine telephone cables; also seven-conductor and ten-conductor telegraph cables. Besides these he has also ready submarine cables for street railway feeders. The unusual demand for Kerite cables is an evidence of the esteem and reputation so long held by the public for Kerite goods.

The accompanying illustration shows the construction of the cable first mentioned—the conductors, their insulation, taping, jute bedding and armor all being plainly shown.

Kerite cables are second to none in the quality of material used and care taken in their manufacture, and the long experience of the company in the manufacture of cables of all kinds is a guarantee of the reliability of the same.

The special feature of Kerite cables is, of course, the Kerite insulation. This substance is one of the very few that is perfectly adapted to electric insulating purposes.



KERITE SUBMARINE CABLE.

Mr. Brixey, as is well known, does not confine his work to the manufacture of submarine cables alone. He also manufactures wires and cables for telephone, telegraph, electric light and general signal uses. Kerite wires and cables are met with everywhere and they seem to be highly thought of by users.

Mr. J. E. Ham, general agent for W. R. Brixey, 203 Broadway, New York, reports a good and increasing demand for Kerite wires and cables generally, especially for the electric light and power purposes.

MISS CLAPROSS IN A HOLE.

The Consolidated Traction Company of Jersey City, N. J., on December 4, met with very determined opposition in its efforts to change the motive power on one of its branch lines from horse to electricity. The company's men had started to dig holes along Johnson avenue and Pine streets, when some objecting property owners appeared on the scene. One man set a chair over a hole that had been started; sat in the chair himself and defied the workmen to touch him. He was left in full possession of the hole. A few feet further on the men began digging another hole. After getting well down into the bowels of the earth, a Miss Minnie Clapross, property owner, jumped in and was almost entirely swallowed up, only her head and shoulders being above the surface. On striking bottom and getting a foothold, Miss Clapross exclaimed to the workmen: "Now, let's see you put that pole up here!" It is needless to say that the pole did not go up, and the workmen withdrew from the scene. The holes were afterwards filled up by the irate property owners, and as the latter are determined, it is stated that the company is inclined now to go slower with the improvements along those particular thoroughfares. The fight, it appears, is not against the trolley particularly, but against a street car line of any sort. The old horse car line was objected to.

ELECTRIC LIGHT AND POWER RULES.

At a meeting of the New York Board of Fire Underwriters, at 32 Nassau street, on November 27, 1894, the following amendment to the rules and requirements of the Board for the installation of electric light and power was adopted:

INTERIOR CONDUITS—

Rule 22.

e. Add to clause—

"Unless the said two separate conductors or twin conductor having an approved insulation, are enclosed in a complete, fully insulated, continuous iron conduit, and are in circuits installed as per table of Capacity of Wires (see Section 25), for currents not to exceed 100 amperes.

RULE AS AMENDED.

Rule 22.

e. Must not be supplied with a twin conductor or two separate conductors, in a single tube, unless the said two separate conductors or twin conductor having an approved insulation, are enclosed in a complete, fully insulated, continuous iron conduit, and are in circuits installed as per table of Capacity of Wires (see Section 25), for currents not to exceed 100 amperes.

BIG WATER-POWER PLANT.

A corps of engineers is now engaged on the work of damming the Susquehanna River, about two miles north of Conowingo, Md. It is claimed that 25,000 H. P. can be obtained, which will be used for the generation of electricity for use in Baltimore city. Power sufficient to light the city, and operate all the trolley lines, factories, etc., will be generated at this point. It is also stated that Philadelphia will be supplied with some of the electric power. There is a probability that Conowingo will become one of the greatest electrical centres in the United States.

HOW TO MANAGE DYNAMOS AND MOTORS.

Everyone having charge of a dynamo or motor should know how to manage these machines properly. Trouble is liable to occur at any time, and to be able to determine the cause by the symptoms and how to apply the remedy is a knowledge that every operator should possess. The book entitled "Practical Management of Dynamos and Motors," and written by the well-known electrical authorities, Prof. F. B. Crocker and Dr. S. S. Wheeler, gives plain directions for the management of these machines. It costs but $1.00 a copy, and can be purchased at the office of THE ELECTRICAL AGE, New York.

POSSIBLE CONTRACTS.

The Northampton Electric Railway Co., Northampton, Mass., will extend its lines to East Hampton.

J. H. Roberts, Grand Rapids, Mich., is interested in a project to build an electric railway around Mackinac Island and establish an electric light plant in the same connection.

James H. Elmore and Frank Van Derzee have been granted a franchise by the De Pere (Wis.) City Council to build an electric street railway to connect with the Green Bay system.

Mayor S. W. Cook, of Fayetteville, N C., can give information regarding the lighting of the streets of that place by electricity.

C. E. Loss & Co., Crawfordville, Ind., has been awarded the contract to construct the Anderson & Muncie electric railway. The cost will be $525,000.

NEW YORK NOTES.

Office of the Electrical Age,
World Building, New York,
December 10, 1894.

After doing business for 12 years without a franchise the Special Fire Alarm Signal Company of this city has come to the conclusion that it would be better to possess such an instrument, and has applied to the Board of Electrical Control for one.

C. I. Hills, manager of the New York office of the Columbia Incandescent Lamp Co., of St. Louis, is doing a fine business with his company's excellent lamps. They are claimed to be the best in the world.

During the past year, according to President Howell's report, the Brooklyn Bridge railway earned $1,111,-815 and carried 41,714,235 passengers. The bridge rentals for telegraph and telephone wires amounted to $22,071.60. Since the opening of the bridge, 11 years ago, 346,589,521 passengers have been carried across on the cars, not one of which received mortal injury.

W. T. H.

THE POETRY OF MOTION.

REPRESENTED BY THE NEW YORK CENTRAL.

Speed and comfort are two conditions demanded by modern travelers; but the perfect combination is a rare one. On most American railroads high speed is only possible at the expense of danger and discomfort. To combine comfort and safety with the greatest speed, perfect equipment and absence of sharp curves are necessary. The most perfect roadbed and the most excellent rolling-stock will not secure comfort on a railroad that winds sharply among hills, for passengers must inevitably be shaken and jolted about by the sudden changes of direction.

There is only one railroad in America that combines all the conditions essential to the highest speed and the greatest comfort. That is the New York Central & Hudson River R. R. It holds the world's championship for long-distance fast trains, won by recent improvements in equipment and locomotive building that fairly mark an epoch in railroading; and its hundred-ton engines, borne on massive rails weighing 120 pounds per yard, now skim with perfect safety around curves at the rate of 90 miles an hour. The solidest of roadbeds is needed to withstand this marvelous speed, and to bear the enormous locomotives and trains; and the New York Central stands alone in the speed of trains, because what it does with safety is impossible to other railroads of inferior equipment.

But ordinary travelers do not wish exceptional speed when it entails great discomfort; nor is it desirable to court the fatigue and soreness inseparable from a long journey on a jerky train. A journey on the New York Central is the perfection of luxury. It entails neither fatigue nor soreness, for it has practically no sharp curves, and its trains move at the highest speed without the slightest shock. Its trains are superb in their furnishings, every detail of modern luxury is provided, the service is ideal. To travel on the New York Central is the poetry of motion.—*The Dry Goods Chronicle.*

THE GREAT WESTERN M'F'G CO'S AFFAIRS.

The Great Western Manufacturing Co., of Chicago, which failed a few days ago, had an indebtedness of about $300,000 and the assets are said to amount to $700,000. The First National Bank of Chicago is supposed to be the largest creditor, having a claim of $115,000. The company was organized January 13, 1893, with a capital stock of $1,500,000 and was formed by the consolidation of several other electrical concerns, including the old Great Western Supply Co., of Chicago, and the Phœnix Manufacturing Co., of Duluth, Minn. For several months it has been known that the company was financially involved.

ODDS AND ENDS.

The secret has got abroad that Mr. Edison's front door electric bell does not work.

BUSINESS NOTES.

The Rae Electrical Manufacturing Co. has been organized in Detroit, Mich., by Frank B. Rae, F. H. Date and J. H. and B. H. Scranton.

BUSINESS REVERSES.

The Greenfield Electric Light and Power Company, Greenfield, Ind., it is reported, has asked for the appointment of a receiver.

The Great Western Mfg. Co., Chicago, Ill. has, confessed judgment in the United States Court for $15,000.

The Brockport Electric Co., Brockport, N. Y., has been dissolved.

John Balch, of Boston, has been appointed receiver for the Dubuque Light & Traction Co., Dubuque, Ia.

TRADE NOTES.

The Metropolitan Electric Company, Chicago, have taken the general Western agency for the Large and Twinning station and line switches and are getting in a large stock of all sizes. They are sending out a little booklet describing the Ideal Lightning arrester, for which they are the general agents.

Mr. J E. Duval, contractor and construction engineer, formerly of New York, having headquarters at Charlotte, N. C., has been unusually successful in this fall's business. During the last sixty days he has installed three of the new Loomis slow speed generators —two 250 lights and one 350 light. Besides this he has installed three smaller size dynamos. Trade is booming among the cotton mills in the South, and Mr. Duval seems to be getting his share of the lighting business.

The Manhattan Electrical Supply Co, 32 Cortlandt street, New York city, has just issued the second edition of its descriptive pamphlet of electric telephones and electrical supplies.

Hatzel & Buhler, electrical contractors, 114 Fifth avenue, New York, are installing an electric light plant in the new Hoffman House, New York. The engine plant consists of three Ball & Wood engines—two of 75-H. P., and one of 120 H. P.—all direct connected to two 50-K. W., and one 75-K. W. dynamos. The wiring is for 4,000 incandescent lamps. They are also installing the electric call and telephone systems. The firm has just been awarded the contract for the complete electric installation of George W. Vanderbilt's new house in Biltmore, N. C. This plant includes all the wiring for 3,000 lamps, electric call system and telephone circuits. They have just completed the installation of a fine plant for the American Express Company, 65 Broadway, New York city, consisting of the wiring for 2,000 lamps, one 50-K. W. Siemens & Halske dynamo, direct connected to a 75-H. P. McIntosh & Seymour engine. They have also just successfully completed the installation of an electric railway for the Franklin Street Railroad Co., Franklin, Pa. The firm has 80 men in its employ and has all the business it can conveniently attend to.

Zimdars & Hunt, electrical contractors, 127 Fifth avenue, New York city, have just installed 20 telephone stations in the new Criminal Court building, using the Zimdars & Hunt system. All the offices of the Health Department are thus connected with one switchboard, which is controlled by an operator. The design of the switchboard is a very simple and practical one and the operation of the board is extremely easy; only one plug is used, in connection with a sliding switch on the front of the board. Zimdars & Hunt are very busy in telephone work. They are installing a number of electric light plants, among them being the Marie Antoinette Hotel, 1473 Broadway, New York city, for 2,200 lights, two Siemens & Halske dynamos, electric elevators, motors, pumps, etc., and the wiring for 500 lamps.

WOVEN WIRE BRUSHES.

NOTICE.

To the stockholders of the Broderick Supply Company of the City of New York.

Notice is hereby given that a meeting of the stockholders of the said corporation will be held pursuant to law, at 44 Rose street, in the City of New York, on the 20th day of December, 1894, at 10 o'clock in the forenoon, for the purpose of increasing the capital stock of said corporation to the sum of $10,000, pursuant to the provisions of Section 5 of chapter 567 of the Laws of 1890, passed June 7, 1890, and known as a Business Corporation Law, as amended by Section 4 of chapter 691 of laws of New York of 1892, and for the transaction of such other business as may properly come before said meeting.

P. C. Nielson, Secretary.
Fred Becker, Treasurer, a
majority of the directors of said corporation

Dated November 30, 1894.

Electrical and Street Railway Patents.

Issued December 4, 1894.

530,082. Telegraph-Key. Louis D. Bliss, Washington, D. C , assignor to Charles W. Needham, same place. Filed Mar. 7, 1894.

530,088. Brush for Dynamo-Electric Machines. Pierre J. C. Carron, Pont-de-Claix-Isère, France. Filed Feb. 10, 1894. Patented in France, Apr. 22, 1893, No. 229,554, and in England, Jan. 16, 1894, No. 993.

530,093. Electric Railway Signaling. William Daves, Jersey City, N. J , assignor to the Hall Signal Company, of Maine. Filed May 24, 1894.

530,114. Method of and Means for Operating and Controlling Electromotors. Carl Moderegger, Vienna, Austria-Hungary, assignor to Siemens & Halske, Berlin, Germany. Filed Dec. 16, 1893. Patented in Germany, Sept. 6, 1891, No. 68,722, in Austria-Hungary, Jan. 29, 1892, No. 42,613 and No. 76,773; in Belgium, Nov. 11, 1892, No. 102,331 ; in France, Nov. 22, 1892, No. 225,853; in Switzerland, Nov. 24, 1892, No. 6,232; in Italy, Dec. 1, 1892, No. 33,076, and in England, Mar. 3, 1893, No. 4,976.

530,115. Telephone-Transmitter. Miles A. Morehouse, Wevertown, N. Y. Filed Mar. 28, 1894.

530,122. Signal Apparatus. Charles E. Ongley, New York, N. Y., assignor to George J. Schoeffel, same place. Filed Feb. 17, 1894.

530,140. Car-Fender. Edgar B. Towne and Franklin S. Towne, Kingston, N. Y. Filed June 13, 1894.

530,141. Service End, Cut-Out and Switch-Box for Electric-Lighting Circuits. John Van Vleck, New York, N. Y. Filed May 28, 1894.

530,145. Electrometer. Edward Weston, Newark, N. J. Filed Apr. 26, 1893.

530,150. Car-Starter. Thomas C. Wright, Chicago, Ill. Filed Mar. 19, 1894.

530,174. Safety-Guard for Street-Cars. Daniel A. Freeman, Boston, Mass. Filed Nov. 23, 1893.

530,176. Alternating-Current Motor and Method of Operating Same. Ludwig Gutmann, Pittsburgh, Pa. Filed Oct. 30, 1889.

530,177. Alternating Electric Motor. Ludwig Gutmann, Pittsburgh, Pa. Filed Dec 3, 1891.

530,178. Electric Conversion System. Lugwig Gutmann, Pittsburgh, Pa. Filed Dec. 23, 1891.

530,184. Circuit-Closer. Herbert V. Keeson, London, England. Filed Sept. 17, 1894.

530,185. Brake for Railway-Cars George H. Kinter and George D. Teller, Buffalo, N. Y., assignors of one-third to George Tait, same place. Filed Mar. 2, 1894

530,192. Electric-Railway System. David Mason, New York, N. Y. Filed Feb. 16, 1894.

530,201. Tongue-Switch. Henry O'Shea, Johnstown, Pa., assignor to the Johnson Company, same place. Filed May 11, 1893.

530,208. Telephone-Switch. Alfred Stromberg and Androv Carlson, Chicago, Ill. Filed Oct. 9, 1894.

530,223. Fender for Trolley-Cars. Charles F. Haug, Brooklyn, N. Y. Filed Apr. 5, 1894.

530,235. Magneto-Electric Machine. Joseph N. McLeod, Brooklyn, N. Y. Filed Apr. 2, 1894.

530,236. Signaling Apparatus. Bernice J. Noyes, Boston, Mass., assignor to George W. Gregory, same place. Filed Feb. 18, 1890.

530,253. Electric Bell. Edward G. Worley, New York, N. Y. Filed June 13, 1894.

530,260. Primary Battery. Charles W. De Mott, New York, N. Y. Filed Dec. 7, 1893.

530,276. Trolley-Catcher. William F. Kendt, Buffalo, N. Y., assignor of two-thirds to George M. Mitchell and Rod McLeod, same place. Filed May 26, 1894.

530,283. Conduit for Electric Railways. Michael I. Marlin, Chicago, Ill. Filed Feb. 7, 1894.

530,286. Electric Tramway. Heinrich Schwieger, Berlin, Germany, assignor to Siemens & Halske, same place. Filed Dec. 22, 1891. Patented in Germany, Dec. 30, 1885, No. 37,255; in Austria-Hungary, Aug. 7, 1886, No 31,294/36, and No. 2,759 and No. 63,587, XX, 2,733, and in England, Aug. 20, 1886, No. 11,003.

530,293. Electric Switch. Ike W. Ullman, Birmingham, Ala. Filed Sept. 28, 1894.

530,302. Switch-Operating Device for Tram-Cars. Augustin C. L. Engstfeld, Cleveland, Ohio, assignor of one-half to Lawrence Lamb, Memphis, Tenn. Filed Jan. 22, 1894.

530,315. Telephone-Transmitter. John T. Williams, Brooklyn, N. Y. Filed Aug. 8, 1894.

530,324. Telephone-Exchange System. Romaine Callender, Brantford, Canada. Original application filed Aug. 13, 1892. Divided and this application filed Dec. 18, 1893. Patented in England, Jan. 2, 1894, No. 139; in Austria Jan. 2, 1894, No. 2,347; in France Jan. 2, 1894, No. 235,225, and in Belgium Jan. 2, 1894, No. 107,937.

530,325. Telephone-Switch. Romaine Callender, Brantford, Canada. Filed Sept. 15. 1894.

530,343. Electric-Light Fixture. Herman Horn, Philadelphia, Pa, assignor to the Horn & Brannen Manufacturing Company, of Pennsylvania. Filed May 24, 1894.

530,344. Electric Dental Engine. Joseph A. Jeffery and Benjamin A. Jeffery, San Francisco, Cal. Filed Apr. 5, 1894.

530,351. Electric Meter. Gustave A. Scheeffer, Peoria, Ill., assignor to the Diamond Electric Company, same place. Filed July 17, 1894.

530,359. Car Attachment. Charles K. Sherwood, Brooklyn, N. Y. Filed Aug. 18, 1894.

530,399. Insulator for Electric Conductors. John H. Croskey and Joseph Locke, Pittsburgh, Pa. Filed Sept. 28, 1894.

530,401. Battery Connection. Walter S. Doe, Brooklyn, N. Y., assignor of one-half to Henry Thompson, same place. Filed Aug. 27, 1894.

530,411. Burglar-Alarm for Safes. James W. Gilstrap, Rol a, and William D. Gilstrap, Racine, assignors of one-third to Austin L. McRae, Rolla, Mo. Filed Apr. 24, 1894.

530,412. Telephone Transmitter. John Goodman and Henry M. Goodman, Louisville, Ky. Filed July 3, 1894.

530,430. Thermal Circuit-Breaker. Henry Klein, Janesville, Wis. Filed May 19, 1894.

530,432. System of Electrical Distribution With Storage Batteries. Emil Kuchenmeister, Berlin, Germany, assignor to Siemens & Halske, same place. Filed Nov. 25, 1892. Patented in Germany, Mar. 18, 1890, No. 56,525; in Switzerland Nov. 22, 1890, No. 3,146; in Austria Nov. 24, 1890, No. 52,749. XLI, 742; in Hungary Nov. 24, 1890, No. 6,439, XXV, 678; in Italy Nov. 26, 1890, No. 28,645; in Belgium Nov. 26, 1890, No. 92,878, and in France Nov. 21, 1890, No. 209,833.

530,433. Indicator for Steam-Engines. Frederick Lane, Brookline, assignor to the Crosby Steam Gage and Valve Company, Boston. Mass. Filed Dec. 1, 1893.

530 434. Burglar-Alarm. John H. Lowe, Neosho, assignor of one-half to Arthur H. Waite, Joplin, Mo. Filed July 20, 1894.

530,465. Dynamo-Regulator. John Van Vleck, New York, N. Y. Filed Oct. 8, 1894.

530,472. Electric Switch. John M. Cronin, Cambridge, assignor to James L. Wesson, Boston, Mass. Filed Sept. 22, 1894.

530,482. Electric-Railway Supply System. John J. Green, Boonton, N. J., assignor to the Universal Electric Company of the City of New York. Filed Aug. 21, 1893.

530,485. Primary Battery. Charles J. Hubbell, New York, N. Y., assignor to J. J. Darlington, trustee, Washington, D. C. Filed Apr 30, 1894.

ELECTRICAL AGE

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CONTENTS.

A MERRY CHRISTMAS.

The present being the issue immediately preceding the most significant and joyous of Christian holidays—Christmas—we take this opportunity to wish all of our readers and friends a Merry Christmas.

THE BELL TELEPHONE COMPANY DEFEATED.

The important suit brought against the American Bell Telephone Company by the United States for the annulment of the famous Berliner patent has been decided against the Bell interests. On December 18, Judge Carpenter, of the United States Circuit Court, Boston, rendered his decision in the case and decreed that patent No. 463,569, issued November 17, 1891, to Emile Berliner, be declared void and delivered up to be cancelled. We give on another page in this issue the full text of the judge's decision. The announcement of the decision came with awful suddenness, and Bell stock on the Boston Exchange took a decidedly heavy tumble, partially recovering later in the day, however. It is stated that the Bell Company will appeal. The decision will undoubtedly be hailed with joy in the electrical trade at large, as the feeling was very strong over the Berliner patent matter and against the Bell Company. The company will have a hard time to prove that it was not instrumental in delaying the issuing of the Berliner patent. It has had a monopoly as long as the law contemplated anyone should have.

UNDERGROUND CONDUIT RAILWAY IN NEW YORK.

On one of the finest avenues uptown, in New York City, is being constructed an underground electric conduit railway, and from what we learn the fate of the underground conduit problem seems to hinge largely upon the result of this work. In a lecture a few weeks ago, before the New York Electrical Society, Mr. Joseph Sachs gave it as his opinion that a successful underground conduit road could be built, provided sufficient capital was expended on the work; cheap construction would not do. The Metropolitan Traction Company, who owns the line now being built, have afforded every facility to demonstrate the truth of this proposition, and the work is now being carried forward—we hope to a successful issue. On another page we give a general description of the electrical features of this road, and an illustration giving a cross-sectional view of the conduit. Further details are not obtainable at present, as the contractors are inclined to say as little as possible until their work has been subjected to a practical test. Should the experiment be successful—and we do not see why it should not be—it may mean the substitution of electricity for cables on all the cable lines in this city. The cables too frequently cause trouble and delay, and the people of this town would hail with delight the introduction of any other system that would not be subject to these exasperating interruptions.

OUR CHRISTMAS COVER.

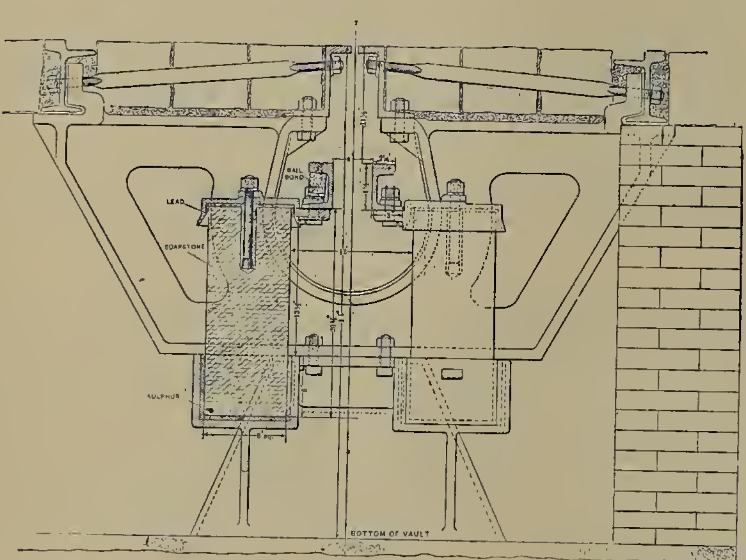
Fifty issues of the ELECTRICAL AGE during this year have been under a blue cover. In this issue, the 51st, we have departed from our time-honored color, and substituted therefor a bright and pleasing pink, using a handsome blue ink in the printing. This pink cover, however, is not to be a permanency—it is merely a holiday diversion.

UNDERGROUND CONDUIT ELECTRIC RAILWAY IN NEW YORK.

At the upper end of New York City, on Lenox avenue, a street railway is being built which possesses a great degree of interest to electric railway people. It will be the pioneer underground conduit railway in New York City and it is already attracting a great deal of attention.

The Metropolitan Traction Company of New York City, is extending its lines from Ninth avenue, through 116th street, up Lenox avenue to 145th street and the Harlem River. This section of the road is to be operated by electric power. Regular cable road construction is being carried out, the idea being that in the event of the failure of the electric system a cable can be substituted and the road operated by this means. The officials look upon the electric system in the light of an experiment, but the contractors—the General Electric Company—have had the benefit of the best electrical engineering skill available in planning this road, and naturally feel sanguine as to the results.

It is generally admitted by electrical engineers that a practical and reliable underground system *can* be built, providing sufficient means are expended to insure first-class work. In the Lenox Avenue construction the very best of engineering skill and the best of materials enter, and it will be seen, therefore, that the solution of a very important problem hinges on the success of this undertaking.



SECTIONAL VIEW OF LENOX AVENUE CONDUIT.

As already stated, the construction of this road is precisely the same as if it were the intention of the Traction Company to put in a cable at the start. The work is now approaching completion, and a brief description of the electrical features will be of interest at this time. The first public reference to this work was made by Mr. Joseph Sachs, in a recent lecture before the New York Electrical Society.

The conduit is of sheet iron, such as is generally used for cable lines, and the yokes are of cast iron. On the ends of the yokes are laid the rails, seven-inch girders.

Every thirty feet along the line manholes are located, and at each of these points insulators, properly supported, are attached to the yokes. The insulators are rectangular in form (as seen in the accompanying illustration, which gives a cross-sectional view of the conduit) and are supported in cups and embedded in sulphur. The insulators themselves are made of soapstone, and at the top is fastened an iron arm to which is attached the channel iron contact conductor. The feeders will be carried in pipes laid between the tracks. Two conductors will be used, which will obviate the necessity of using a structural return.

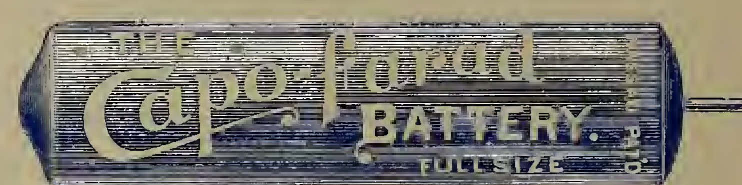
The insulators will be readily and easily accessible at all times, being located in the manholes.

It is intended to use a current of about 250 to 300 volts.

THE CAPO-FARAD BATTERY.

In looking along the lines of electrical progress that makes this year conspicuous, we find one branch that seems to have arrived at a point of perfection sufficiently distinguished to make it not only first of its class, but a copy-head for other departments to emulate.

The problem of maximum power and efficiency combined with minimum weight and dimensions, places the Capo Farad battery an easy first in the whole field of its wet and dry competitors. Some four years ago the Nassau Electrical Co. incorporated under a New York charter, and proceeded to manufacture and supply a capsule sealed battery for which they held the patent and which they believed would revolutionize the existing consumption. They subsequently found, however, that although the E. M. F. of their battery was fully up to expectation, its deficiency in lasting qualities prohibited a guarantee and debarred its sale. At this stage arrangements were made with Mr. Jas. J. Pearson to take over the entire management of the concern, and finally, after exhaustive experiment and by dint of patient labor, Mr. Pearson's "Cartridge Shell" battery has been developed into the Capo-Farad sealed battery, which we illustrate herewith by full-sized cut.



CAPO-FARAD BATTERY.

In appearance it is a zinc cylinder $\frac{1}{16}$ inches diameter by 2¾ inches long, stoppered with a hard-rubber plug-cap, through which the silver electrode extends. The elements are silver chloride and zinc, the latter being both an element and the containing cell. Its E. M. F. is one and one-quarter (1.25) volts and one and nine-tenths (1.9) amperes, while its weight of little over one ounce enables it to be mailed under a two cent stamp to any part of this country, and, in fact, to any country in the postal union. It works in any position; never polarizes; is not affected by climate or rough usage; needs no preparation or attention, and its strength remains constant up to the moment of its final exhaustion. It will ring a door-bell for 28 continuous hours (equal to about one year and a half in ordinary use), work a faradic coil from 52 to 100 continuous hours, and two cells on a sparking coil in a gas lighter will give nearly 360,000 ignitions. For testing and blasting sets its convenience and efficiency cannot be overrated, with a four-foot fuse, No. 14 copper wire, of ordinary make.

1	cell fires	1	fuse	through	130	feet of	lead wire.
2	"	1	"	"	670	"	"
2	"	2	"	"	500	"	"
3	"	1	"	"	1200	"	"
3	"	2	"	"	1000	"	"
3	"	3	"	"	850	"	"
3	"	4	"	"	650	"	"
4	"	5	"	"	1000	"	"
4	"	7	"	"	600	"	"

Having regard to the cumbersome apparatus in present use for electrical blast firing, as compared to the Capo-Farad blasting battery (see cut), which will stow in a watch-pocket or work under water, we cannot but congratulate the Nassau Electrical Co. and their energetic manager on the distinguished success they have achieved, and heartily recommend their *multum in parvo* Capo-Farad battery for any and all purposes where a battery can be used.

AUTOMATIC CONTROL OF TEMPERATURE.

Most people enjoy listening to the stories told by very old folks of the early days of their lives and how people used to live in those days. The common feature of these tales is that our ancestors had very few comforts, as we know them, and when we are told how the people used to stand before the great log fires in the winter time and roast in front and freeze behind, we are inclined to thank our lucky stars that we live in the present day, when we have so many comforts at our beck and call. There is no excuse nowadays for roasting one side of our bodies while the other is freezing, when there are so many electrical and mechanical appliances available to keep the air of our homes, stores, offices, etc., at an even temperature during the cold season.

Through the agency of electricity—the most faithful servant man ever had—we can keep the temperature of our homes, places of business, green-houses and all buildings heated by furnaces, steam or hot-water heaters, at any given point desired.

MAGNET THERMOSTAT

The Magnet Thermostat, illustrated herewith, is an instrument that automatically controls the draft of the heating apparatus, and consequently the temperature. In its action it causes the draft to be turned on or off the moment the temperature of the air rises or falls one degree from the point or degree of heat desired to be maintained.

The Magnet Thermostat consists of a bar of two dissimilar metals, rigidly suspended between two magnets. The magnets are adjustable with reference to the bar by means of a pointer, the latter being set at the degree at which it is desired to maintain the heat. A rise or fall of one degree in the temperature of the air causes the closing of an electric circuit by the expansion or contraction of the bar. The closing of the circuit sends the current through the electric motor, which mechanically controls the draft apparatus, the draft being opened or closed according to the direction of the motion of the motor.

The Thermostat is connected with the motor by means of a small three-wire cable. The motor can be applied to the control of dampers or valves, as desired, and requires no special attention. The thermostat acts on these instantly and positively the moment the thermostatic blade first touches the magnet.

This is said to be the only magnet thermostat made, and is broadly covered by patents which are owned by the Compton Electric Service Company, 253 Broadway, New York.

The draft controller equipment consists of a magnet thermostat (highly polished) motor, section of pipe with Compton damper, bracket to hold motor in position, crank and disk to operate damper, 75 feet of 3-conductor cable, 25 feet office wire and five cells of battery to run the motor. The valve regulator for radiators consists of the same except that a balance valve and motor combination is substituted for the section of pipe and damper.

The company has a large number of contracts to install their electric service system in Washington, Baltimore, New York and other large cities. The system is rapidly growing in favor.

Mr. M. D. Compton, the inventor of this system, is a genius of the first order. He is the inventor also of a system for reproducing base-ball games at a distant point, by electricity, which met with great popular favor in Baltimore during the past season. The reproduction is made in a hall or theatre. Pictures of players are painted upon a stage scene at the respective positions occupied by the side that is in the field; beneath these pictures are round openings in the scene about five inches in diameter. Behind these openings appears the color, "white" when one club is in the field and "green" when the other is in the field. Numerous other openings are in the scene, behind which electric motors will bring to view pictures and figures, which instantly indicate a "ball," "strike," "foul," "error," and by whom made, "base hits," the number of inning being played and the score of each respective side. The man at the bat is instantly indicated, so that the moment a player steps to the bat, the audience immediately knows his name, and each and every decision of the umpire as to "fouls," "balls," "strikes," etc. After he advances from the plate, after making a "hit," the audience sees him appear at first, second and third base, and so on, until he scores or is put out, and is instantly informed the moment he scores

MR. M. D. COMPTON.

or is put out. The whole system is controlled by a key board which is located in the orchestra in front of the scene, where a telegraph operator sits at his instrument with a direct wire to the ball ground, and as the plays are flashed to him over the wire, he simply presses the proper button and the "play" is reproduced before the audience within five seconds, just as it takes place at the scene of action.

Mr. Compton was warmly congratulated for the successful work he accomplished in Baltimore and Washington with this system during the final struggles for victory on the diamond, in which the Baltimore club won the championship pennant.

ITS TENTH BIRTHDAY.—*Power*, of this city, commemorates its tenth birthday by appearing in its best clothes. As a ten-year old it has every indication of being well fed and nourished. It is the leader in its particular field, and a *power* in influence as well as in name. We congratulate our neighbor on its successful career.

IMPROVED ENGINE OF THE AMERICAN ENGINE CO.

(*Continued from Page 328.*)

The accompanying illustration gives a view of E. F. Spalding's patent valve and valve-gear, which is the

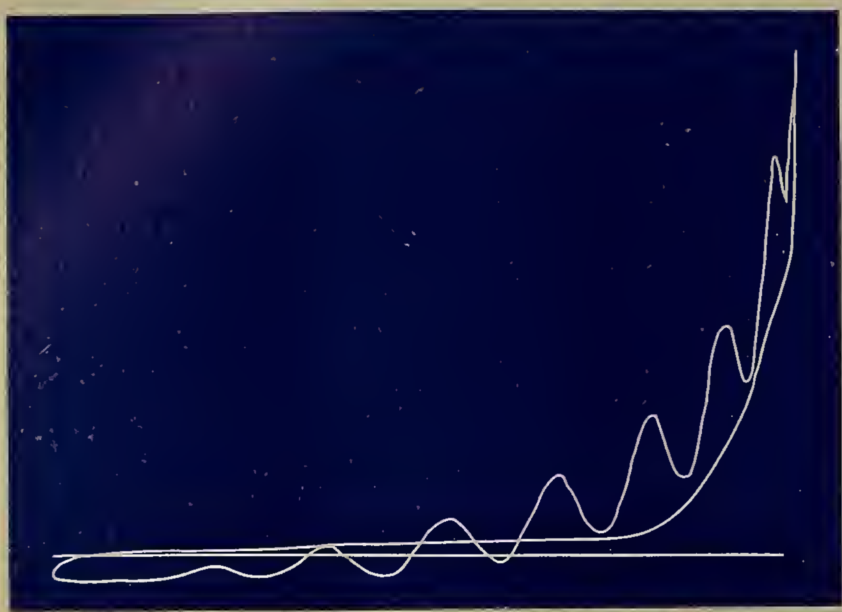


FIG. 5.

main feature of the American Engine Company's engines. The cut shows, besides the valve itself, the

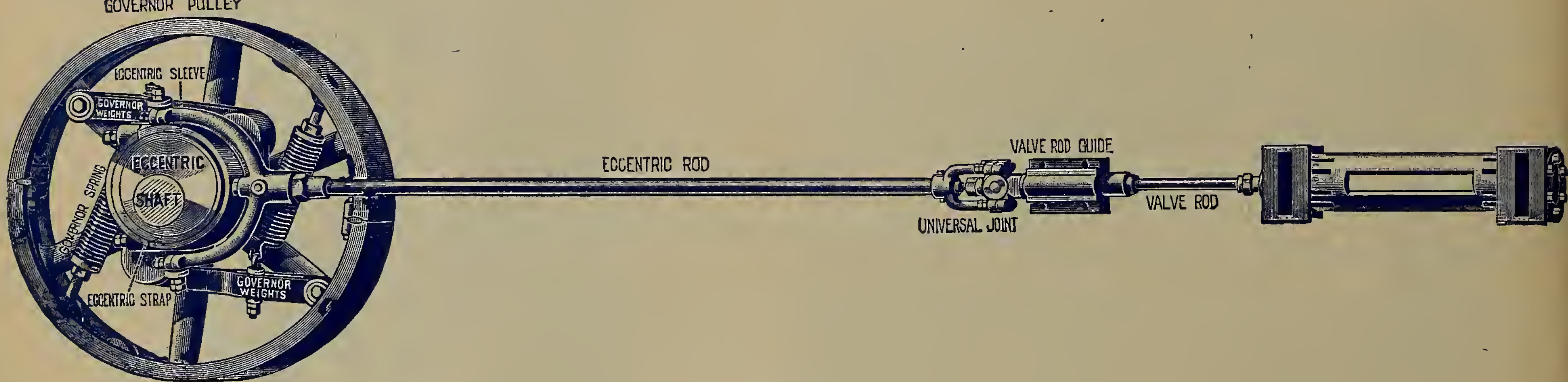


FIG. 4.

various connections between it and the relative parts. Being a side view the peculiar action of the eccentric

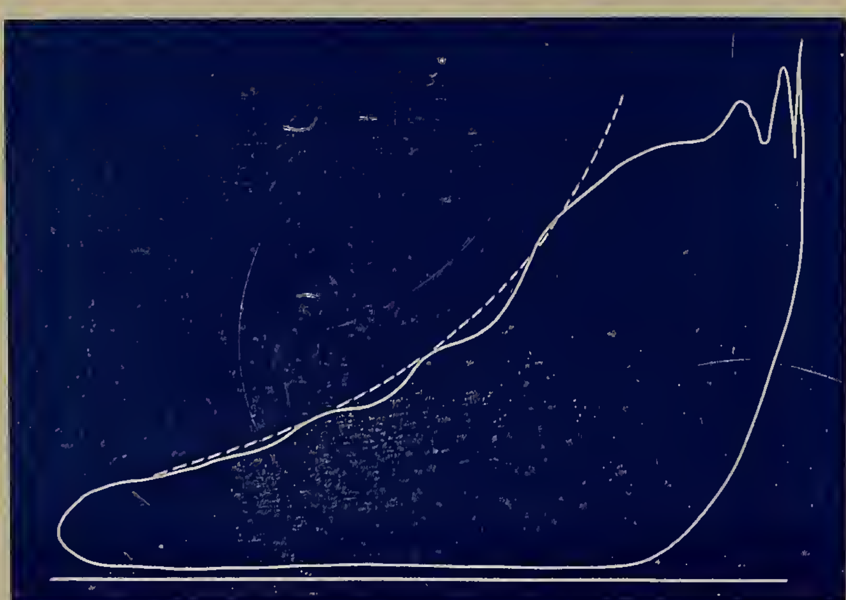


FIG. 6.

and valve combination is not readily apparent. Fig. 2 in our previous issue, however, renders the action more comprehensible to the mind. In that illustration the eccentric strap is shown standing diagonally across the face of what appears to be the eccentric, but in reality is a sleeve mounted loosely upon the eccentric and connected with the governor weights, as described in our previous issue. It is evident on a moment's thought that the effect of this arrangement will be to give a twisting motion to the eccentric rod and, consequently, to the valve itself.

The universal joint shown in Fig. 4, herewith, trans-

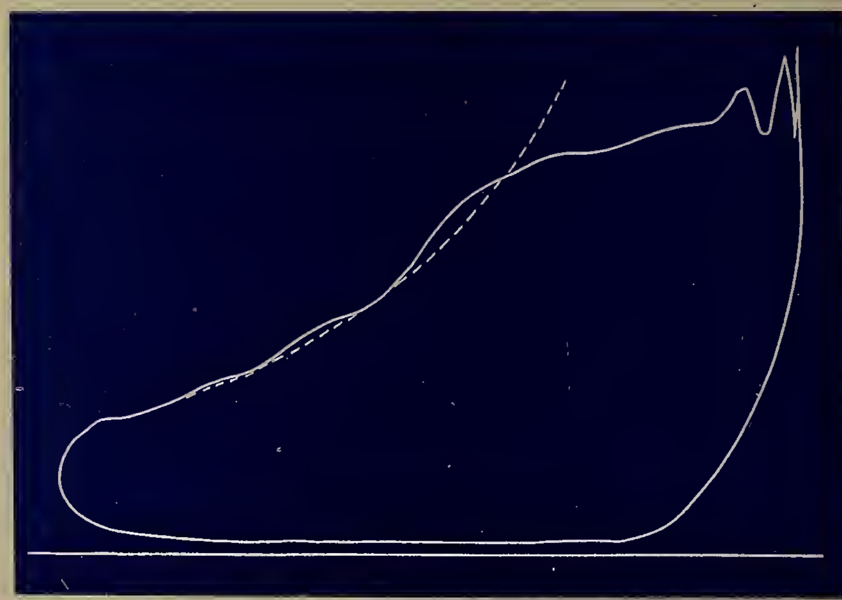


FIG. 7.

mits the various motions of the eccentric rod to the valve along a straight line. The ports of the valve are well shown. This valve automatically varies the cut-off, as explained in our previous article, and maintains a constant admission, release and compression.

The performance of this type of engine is best shown,

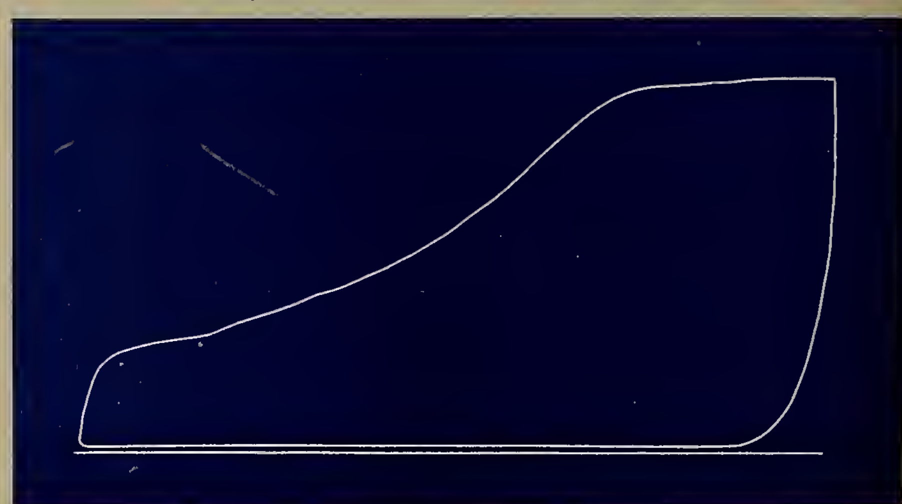


FIG. 8.

however, by means of indicator cards. Figs. 5, 6 and 7 are diagrams taken from a 13 × 12 inches single friction valve as applied to vertical engines running 300 revolutions per minute. They show the steam distribution with Spalding's patent single valve automatic cut-off. Figs. 8 and 9 are diagrams from a 13 × 24 inches horizontal engine, as illustrated in a previous issue, showing steam distribution with Spalding's automatic cut-off valve gear and slide valve, the engine running at a speed of 150 revolutions per minute.

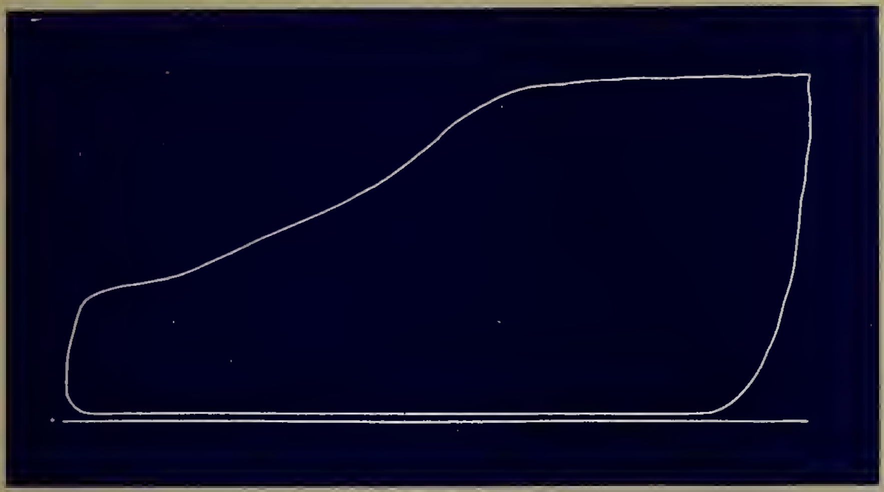


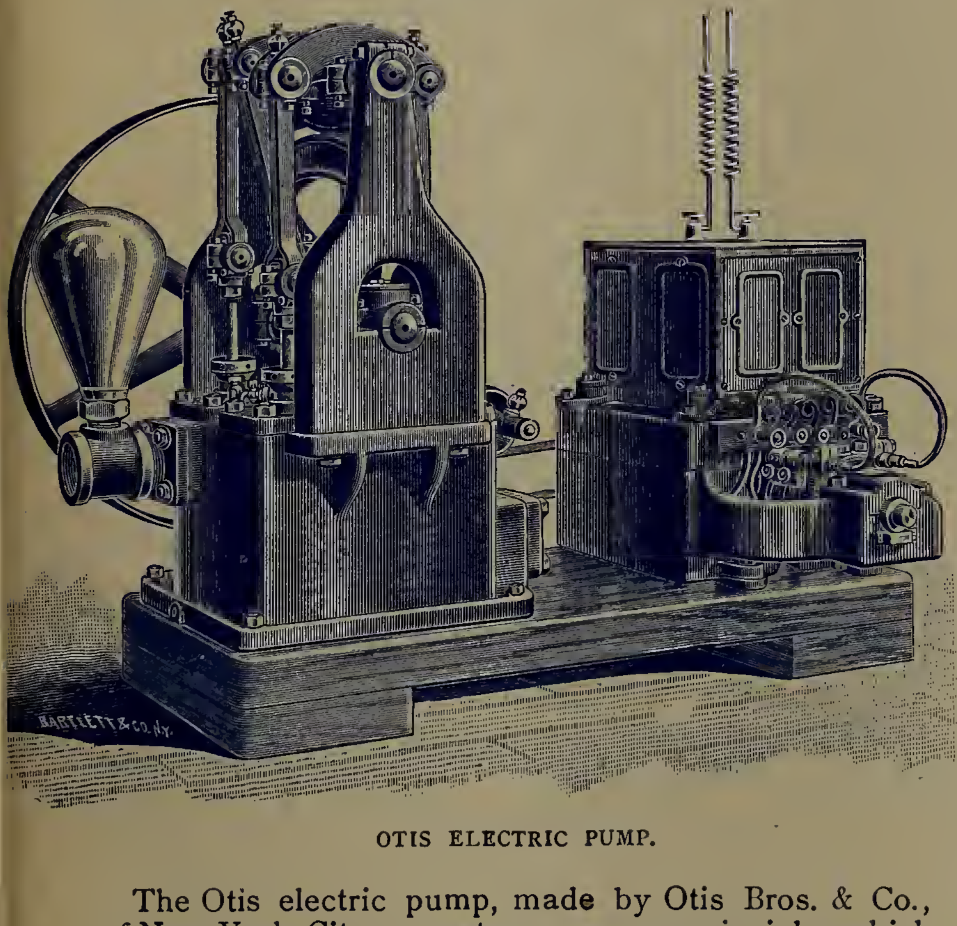
FIG. 9.

These diagrams tell their own story and show the high efficiency of engines fitted with the Spalding valve and gear.

THE RECORD OF 1894.

As the year of Our Lord one thousand, eight hundred and ninety-four is rapidly drawing to a close, it will be of interest to look back and see what has been done in the electrical industries during the past year, as chronicled in the pages of The Electrical Age. Many new things have been brought out in the past twelvemonth —dynamos, switches, lamps, motors, and all sorts of minor appliances—all of practical utility and value.

We take pleasure in re-illustrating some of the most important productions of the year, and noting briefly their most prominent features.



OTIS ELECTRIC PUMP.

The Otis electric pump, made by Otis Bros. & Co., of New York City, operates on a new principle, which secures a steady and uniform flow of water. It is free from jar or water hammer, and the work is evenly distributed at all points of the revolution. This latter feature prevents injury to the electric motor. The pump is automatic in its action, being controlled by the high and low levels of the water in the tank.

At the Washington meeting of the National Electric Light Association, last March, the Kester alternating current arc lamp attracted much attention. This lamp is designed for 50 and 52-volt circuits and is made in a first class manner. These lamps run perfectly steady, and when taking nine amperes of current they consume 252 watts, the low voltage being attained by the use of an "economy coil." These lamps are made by the F. P. Little Construction Co., of Buffalo, N. Y.

In our issue of May 12 we described and illustrated the Johnson-Lundell electric railway system. This system was experimentally tested in New York City, and gave excellent results. Between the rails lies a

KESTER A. C. ARC LAMP.

conducting bar or strip of metal, which is divided up into insulated sections. In boxes placed underneath the street surface near the track are substantial electro-magnetic devices which deliver current to each section as a car comes along. The car carries a brush, which provides contact with the conducting strip, and the current is thus carried to the motor. Each car carries a storage battery of sufficient capacity to carry it over emergencies. The batteries are used also to "pick up the circuit" and light the car.

The new Riker multipolar dynamo, made by the Riker Electric Motor Co., of 45 York street, Brooklyn, is a very compact and efficient machine. The field magnet is made of cast steel, with the salient points projecting inwardly, and the armature is of the drum type. The armature coils are all cross-connected in parallel grouping to maintain a perfect electrical balance. The commutator is heavily built and well insulated. The ma-

(*Continued on Page 343.*)

PRINCIPLES OF DYNAMO DESIGN.

BY

Newton Harrison E.E.

(*Continued from Page 326.*)

The actual value of the leakage in a type of single horseshoe frame has been estimated by test and otherwise to be between fifteen and one hundred per cent., according to the size of the machine. It has already been stated that the leakage between two points of opposite polarity depends entirely upon the permeability and reluctance of the medium between them.

The greater the permeability of the frame and the greater the reluctance of the space through which leakage may occur, the less we will actually realize. Therefore, in large types of machines in which these quantities approach their minimum and maximum values, it is easily seen that the percentage of leakage is at its least if due attention has been paid during design to the fact that points, corners and any projections whatsoever, are features that tend to cause excessive leakage. When a frame is cast with projections from the pole-pieces, between which the bearing is constructed, it is usual to find great magnetic leakage in such cases. Therefore it seems inevitable to have leakage whenever there is a quantity of projecting iron in the neighborhood of the polar extremities.

Perhaps leakage is least in those types of iron-clad machines in which care is taken to have a great distance between the pole-pieces and iron frame-work; that is to say, the inside core surface and the inside opposite and parallel frame surface. It must be understood that in all these cases the nearer the armature core is to the source of magneto-motive force, the sooner the lines of force will pass directly into the armature, and consequently reduce the chance for radiation of lines of force before it is reached.

Parallel magnet cores are one of the causes which tend to increase the leakage. Were the magnet cores of the single horseshoe type made to diverge, the leakage would be reduced in the proportion of seven to six, showing a decrease in leakage of sixteen per cent., with frames of one-tenth horse-power size. Though this proportion rapidly decreases when we examine into the leakage, resulting from type frames of twenty-five to one hundred horse-power or over; due to the fact that the distance between points of opposite polarity has increased. The Manchester or consequent pole type is in reality the coalescence of two separate magnetic circuits into one. One pole-piece being the common junction of one pair of polar extremities and the other being likewise constructed so that between these two polar faces the armature may be revolved. By passing a plane through this type of frame so as to make a longitudinal section of the armature, we immediately obtain the type of single magnet frame which, by examination, seems to be practically the single horseshoe type minus its keeper. The consequent pole type of machines, under which is included the iron-clad type, derive their names merely from the relative position of their field windings upon that type of continuous iron frame. The Manchester type has its field windings upon that part of the frame which in the iron-clad type gives to it its characteristic name. Extend the pole-pieces of the Manchester type, place upon one or both of the pole-pieces the field windings, lengthen the machine in the direction of its armature shaft, and we have at once the iron-clad type. By dividing the winding into four parts and winding near the corners of that part of the casting which makes it iron-clad, and we arrive at a type of machine invented by Weston, and utilized today by the United States Co. This type is called the double horseshoe type. By taking two single horseshoe frames and using but one pair of pole-pieces having the keepers extended downward to serve as supports, we arrive at exactly the same design. The Manchester type of field, which by an extended application has been shown to cover so many other types of frame, is one of very popular use. Its leakage in small sizes of a few horse-power, or less, is very high, because of the nearness in most cases of the pole-pieces to the magnet core with a high specific induction in the iron. This objection can be entirely removed by stretching out the machine at right angles to the armature shaft; that is to say, by separating the magnet cores from each other and from the pole-pieces. It is not an exaggeration to place the leakage of this type at one hundred per cent. in small sizes, of one horse-power or less, and at an average of sixty per cent. for sizes within twenty horse-power, these figures decreasing, as remarked before, with the increased size of frame. It is a usual practice to extend the lower pole-piece of this machine into a support for two bearings, one on each side of the lower pole-piece; the pole-piece base plate and bearings then being of one polarity. This is a most substantial type of machine from a mechanical standpoint. It being cast in two pieces, the upper portion connecting the two magnet cores and containing the pole-piece, forming one casting; the lower part, including the base plate, pole-piece and magnet cores composing the other casting. In some cases, though the practice seems to have been discontinued, one bearing would be cast with the base plate and the rest. It becomes a simple matter with such a design, to slip the field windings over the cores and then bolt the upper portion in place. We might consider in this type the winding to be upon the respective keepers of the two halves composing the total magnetic circuit. If it were not for the fact that a false impression might be conveyed to the reader, leading him to consider magnetism in the same light as electricity, as having a flow, it would be a good guide to include all types under two general headings, the *series* and the *multiple field* type. Magnetic circuits as a rule are of the latter type, and in the styles of dynamos called multipolar machines, there are always four or more multiplicate magnetic circuits, two forming respectively one pair of poles, and two another. Many of the present types of alternating current dynamos also use a form of field identical with the multipolar.

The third type of field frame is the iron-clad type. This has the advantage of being a thorough shield to the magnetism within. It is a form of frame that is compact and self contained, and possesses the additional qualification of mechanical strength and stability. The field coils can be completely enclosed, bearing upon the armature and exercising their immediate influence upon it.

It may be remarked now that in all frames in which there is not a perfect magnetic balance above and below a horizontal plane passing through the axis of the armature core, there will be heating at the bearings, due to the fact that there is either an upward or downward pull on the armature, caused by the uneven distribution of the lines of force in the pole-pieces. Single horseshoe types, which have not the proper cross section of iron at that portion of the pole-piece furthest from the keeper, suffer from a pull on the bearings toward the keeper because of the lines of force being crowded toward the two inner horns of the polar extremities. In the Edison type the claim is made that the weight of the armature balances this upward pull. Therefore it is easily seen that a symmetrical field is a necessary object in design.

It is possessed in common by all types of consequent pole machines. In the true iron-clad type of machine, the leakage is less than would be supposed. The shorter the pole-pieces, the less in area become the parallel faces between which leakage occurs, the shorter becomes the magnetic circuit and the more compact the machine. Leakage varies in this type of bipolar iron-clad machines from thirty to fifty per cent. for small sizes of frames and diminishing to an average of about twenty per cent. for larger types approaching seventy-five to one hundred and fifty horse-power.

(*To be continued.*)

THE RECORD OF 1894.

(*Continued from Page 341*).

chine is designed to facilitate installation and at the same time preserve an artistic appearance.

The new mutlipolar generator of the Belknap Motor Co., of Portland, Me., is an excellent machine. The frame is made in several parts, the field-magnet frame consisting of two semicircular sections. There are four magnets, square in form. The armature is of the toothed hollow-drum type, and every wire is accessible. Belknap woven wire and graphite brushes are used. The fields are compound wound and in every respect the machine is well designed.

A high resistance bell was brought out about the middle of the year by the Electric Bell and Resistance Company, 46 Lawrence street, Newark, N. J. These bells are for use on circuits with a pressure of from 50 to 500 volts, either direct or alternating current. They are made in all sizes from 2½ to 12 inches, and for all purposes.

Among the new isolated plants installed during the year is that of the Cotton Exchange, New York. The plant includes two Claus dynamos, each of 600 lights capacity and driven by a 50-H. P. straight-line engine. The switchboard was installed by P. Claus and is a fine example. The main feeders are No. 0 Habirshaw flexible cables, which run through interior brass-armored tubing. Schieren perforated belts are used in driving the dynamos.

The Kennelly combination galvanic and faradic adapter is designed to be used with the Edison 110 or 120 volt direct current for all the varied forms of electro-therapeutic treatment. It is capable of graduation and control within the finest limits, and accurately measures the strength of the current employed. It is provided with all the necessary regulating and measuring apparatus, and is made in a first-class manner. These instruments are made by the Edison Electric Manufacturing Co., 110 East 23d street, New York.

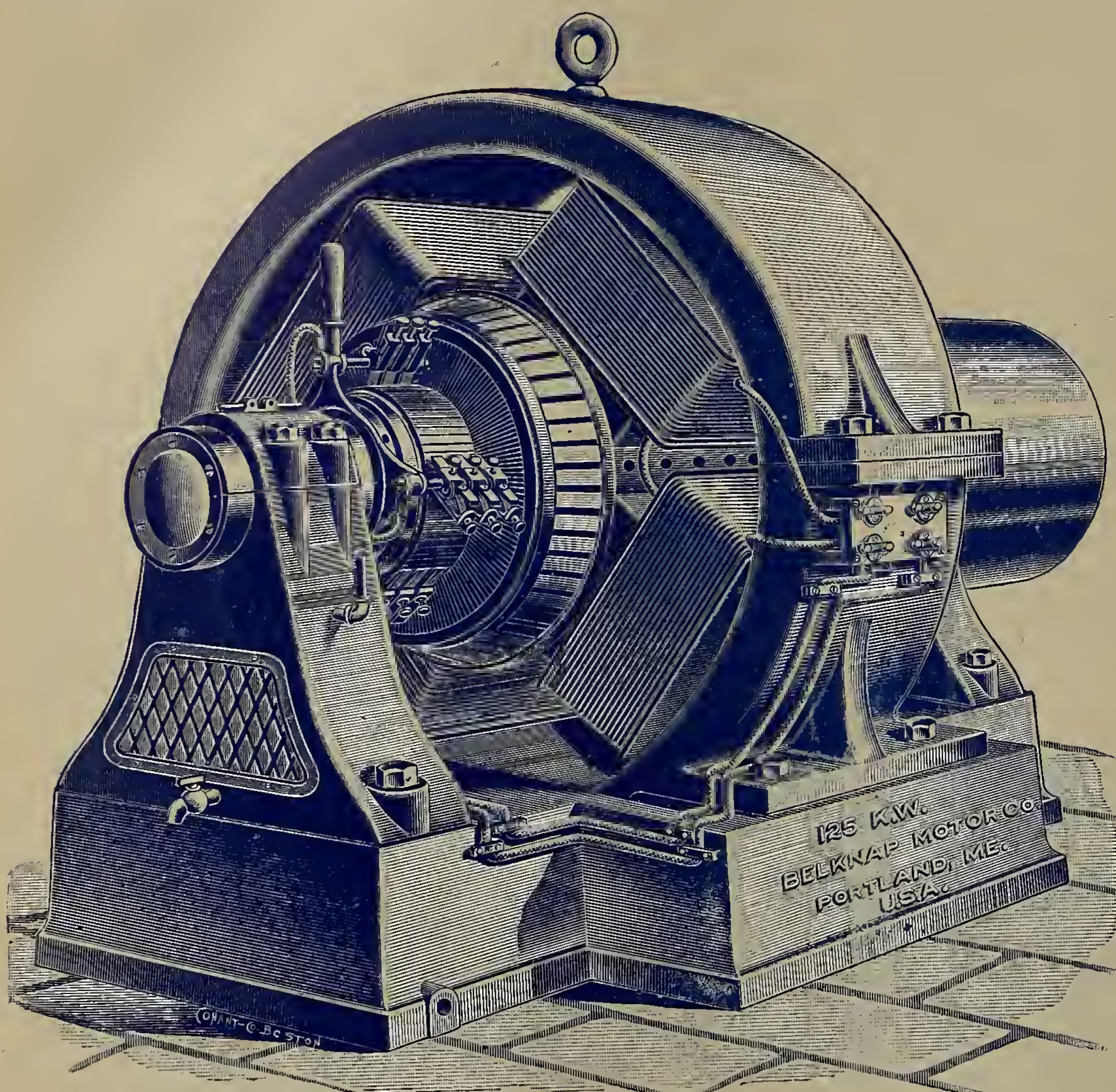
The General Electric Co.'s. alternating current fan motor appeared in good season, just when people were sweltering. This machine is compact in construction and designed for alternating currents of 52 or 104 volts. The armature is a solid metal wheel hung on one bearing; it has no wires, brushes, commutators, or collecting rings. The current enters a number of stationary field spools which cannot burn out.

Last summer the Walker Manufacturing Co., of Cleveland, began the construction of electric railway generators and motors. The motors embody several new features, the method of suspension being particularly ingenious. They are very accessible for examination and repair. The field magnets are of the four-pole type and are made of cast steel. The armature is of the toothed-drum type, the coils being interchangeable. The motors are practically noiseless in operation.

(*To be Continued.*)

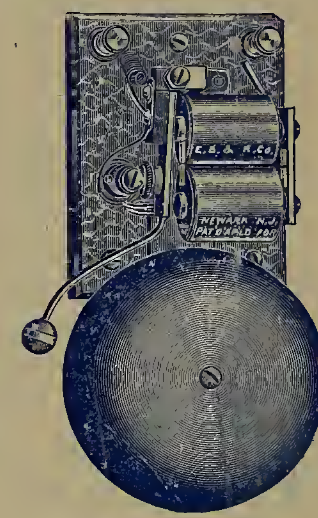
JOHNSON-LUNDELL ELECTRIC RAILWAY.

The Old Falls of the Mousam river at Sanford, Me., have been purchased by C. A. Bodwell, superintendent of the Mousam River Electric Railroad. Mr. Bodwell intends to form a stock company in the spring and erect a plant at the falls for the purpose of generating electricity, for manufacturing purposes, in Sanford. The company will also supply light and heat by the same means. It is stated that there are from 800 to 1,000 horse-power available.



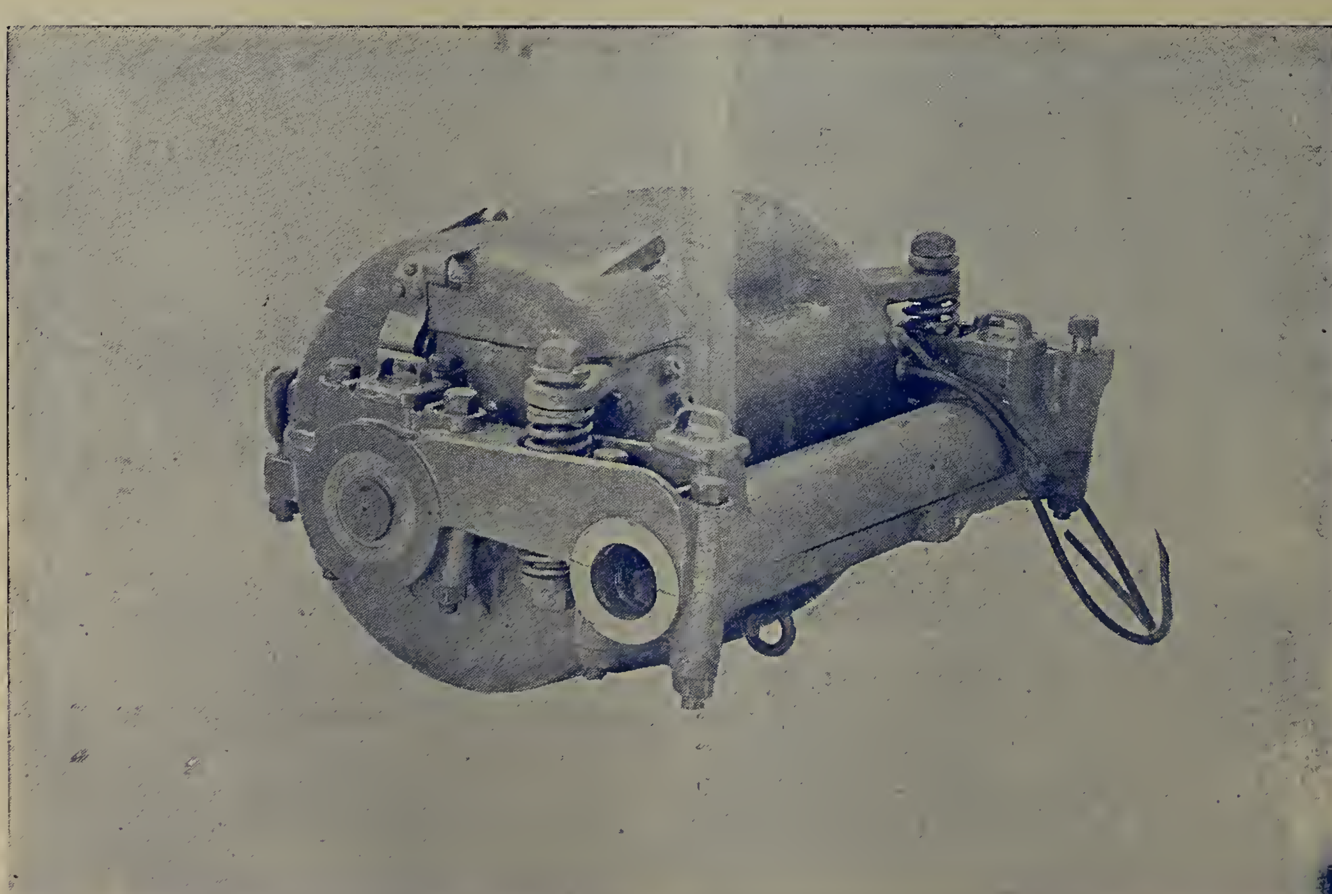
BELKNAP MOTOR CO'S NEW GENERATOR.

C. S. Bernsee, Vanderbilt Building, city, of Eco-magneto Clock fame, is having an excellent trade with these valuable devices. The Eco-magneto Clock is a reliable watchman's recorder. It does not run down on account of the batteries becoming exhausted, because there are no batteries. The clock works by magnetism, which is an infallible power. These clocks are very extensively used in factories, electric light stations and similar places where night watchmen are employed. The Eco-magneto Clock tells whether a watchman attends to his duty or not, and cannot be bribed or influenced against the employer's interests.



HIGH RESISTANCE BELL.

The cruiser "Cincinnati," of the United States Navy, will be the first ship in the service to be fitted with electrical firing attachments to the guns. The new device is now being applied. A dry cell is bolted to the inside of the gun carriage. This supplies the necessary current to fire the gun, which act is performed by pressing a button — the spark does the rest. It is claimed that this method of firing will greatly reduce the error due to the change of relative positions of ship and target which is caused by the unavoidable shifting of the ship's position, however slight.



WALKER STREET CAR MOTOR.

THE NEWEST ELECTRICAL BOOKS.

Electric Railway Motors, Their Construction, Operation and Maintenance, by Nelson W. Perry, E. M. Street Railway Gazette Company, New York, 238 pages, with numerous illustrations. Price, $1.00

GENERAL ELECTRIC'S A. C. FAN MOTOR.

The object of this book is to provide for motormen an intelligent elementary exposition of the principles upon which are founded the apparatus they are required to handle. The author has avoided the use of all technical terms as far as possible in the early stages of the work, gradually introducing them in their proper places as the mind of the student becomes prepared for an intelligent understanding of them.

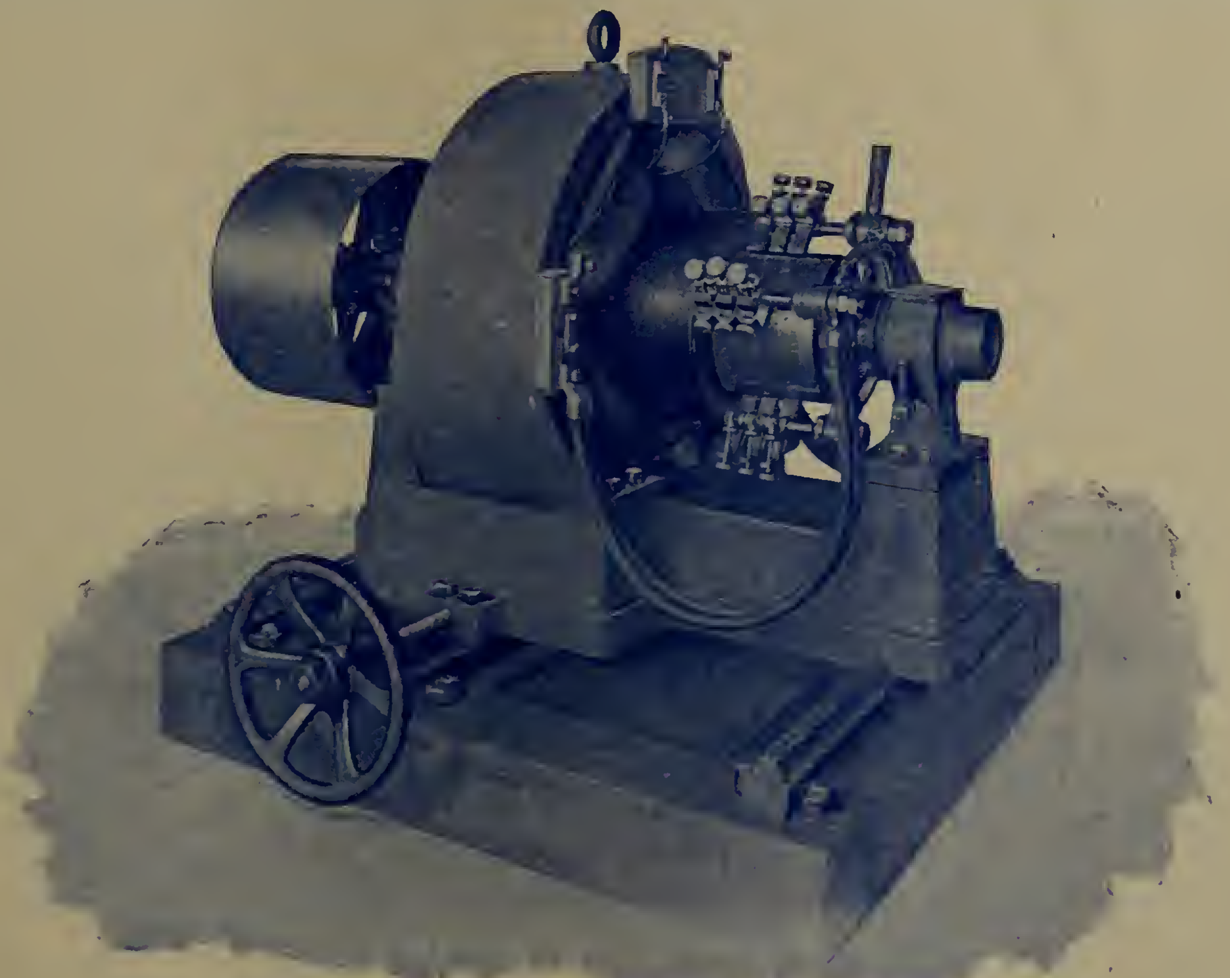
The language used in this work is very clear and well chosen, and it would seem that the mission of the book is to be a successful one. The motorman who knows the least about electricity and electric railways will certainly find this work worth his careful study. The plain manner in which things are explained will surprise him and he will, after carefully studying the contents, find himself quite a master of the situation. Even those who are expert in the business will find it refreshing to peruse its pages, for it will bring them back to first principles, from which they are inclined to wander when trying to solve some apparently difficult problem.

The book is divided into 25 chapters, which cover very fully the subjects named in the title, which is a very comprehensive one. A set of rules and instructions for motormen is given, which in itself is very valuable and will help the motorman out of many a difficulty when its provisions are intelligently applied.

In short this book is just what has been wanted for a long time. The men who have to handle electric railway apparatus are the ones who have, heretofore, known the least about it. They should at least understand the principles involved and know what to do in case of emergency. This book is designed to aid in this direction, and if the motormen do not buy it themselves the companies should buy it for them and require them to study its contents. It will pay the companies to encourage the men to do this, and at the same time the men will be making themselves more valuable to their employers and benefitting themselves.

ELECTRICITY AT THE WORLD'S FAIR.

One of the most interesting books published is that of J. P. Barrett, entitled "Electricity at the World's Columbian Exposition." It gives a history of this wonderful department of the wonderful show; also describes the exhibits in considerable detail, and is full of elegant illustrations. Everyone interested in electricity should have a copy for reference. It is an invaluable work of this character. Send $2.50 to the Electrical Age, New York, and get a copy of the book by return mail.



RIKER'S NEW GENERATOR.

THE BERLINER PATENT VOID.

IMPORTANT DECISION AGAINST THE BELL TELEPHONE COMPANY.

On December 18, Judge Carpenter, in the United States Circuit Court, Boston, rendered a decision in the suit of the United States against the American Bell Telephone Company, decreeing that letters-patent No. 463,569, issued November 17, 1891, to Emile Berliner be declared void and delivered up to be cancelled.

The government's case rested on two grounds. 1st. That the patent is void because patent No. 233,169 issued to Berliner on Nov. 2, 1880, covered substantially the same claims, and, 2nd, that the issue of the patent was unlawfully delayed through the fault of the respondents. The text of Judge Carpenter's decision follows:

The first ground of the bill to which I shall refer is that the patent is void, as being beyond the power of the commissioner to issue in view of the issue of a former patent, No. 233,969, issued Nov. 2, 1880, to Emile Berliner, for electric telephone.

The patent of 1891 is for a transmitter for a speaking telephone. The fourth claim of the patent of 1880 is as follows:

"A system of two or more telephone instruments in electrical connection with each other, each consisting of two or more poles of an electrical circuit in contact one with the other, either or both poles of each instrument being connected with a vibratory plate, so that any vibration which is made at one contact is reproduced at the other, substantially as set forth."

This patent is therefore for the "system" or combination of a transmitter and a receiver for a speaking telephone. The whole apparatus is shown in the drawings of both patents and is identically the same in both. The transmitter and the receiver are identical in form and differ in function according as they are placed at the transmitting or at the receiving end of the telephone wire. It therefore appears that one of the functions of the device shown in the patent of 1880, namely, the function of transmitting articulate speech, is identical with the sole object or function of the device covered by the patent of 1891, and that the device for affecting the transmission is identical in both patents. The patent, therefore, seems to me to be void and beyond the power of the Commissioner to issue. "Miller vs. Eagle M'f'g. Co., 151 U. S., 186."

The second ground of the bill is that the issue of the patent was unlawfully delayed through the fault of the respondents. The respondent company were the owners of a patent previously granted to Alexander Graham Bell, which covered the art of electrical transmission of articulate speech. The device of Berliner, as both parties in this case agree, covers the only commercially practicable and useful method at present known for effecting such transmission. In this state of facts the claim of the complainant under this bill is fully and briefly stated by counsel in the following words:

The proposition is that the Bell Telephone Company intentionally delayed the prosecution of the Berliner application and the issue of the Berliner patent for the purpose and with the result of prolonging their control of the art of telephoning, which would cease with the expiration of the Bell patents in 1893, and that they did this by submitting to delays on the part of the officers of the Patent Office, which delays they, the Bell Company, had it in their power to prevent, and refrained from preventing for an unlawful purpose. This conduct is alleged to constitute a fraud practiced on the public through the Commissioner of Patents and his assistants, and it is claimed that the patent so obtained by such fraud may and should be annulled by the decree of the court on the authority of the United States vs. American Bell Telephone Company, because there is no substantial difference between a fraud practiced upon the Commissioner as an agent of the public and a fraud practiced upon the public with the Commissioner's connivance or acquiescence. The application for the patent was filed June 4, 1877, and the patent was issued Nov. 17, 1891. The patent of Bell expired in March, 1893.

The device covered by the patent in suit had been in public use by the respondent corporation since the year 1878. The respondent corporation was in ample means to prosecute the application. The result of any delay which might take place in the issue of the Berliner patent would evidently be to continue so much longer the practical monopoly of the art of electrical transmission of speech.

Under these circumstances, I think it clear that the duty of the respondent corporation was to use the greatest degree of diligence in prosecuting the application to an early issue. There should have been at least as great diligence as their own interests would have called for had their business been unprotected by patent rights.

Thus there is no dispute between the parties here. It is admitted that the greatest diligence was incumbent in the respondent corporation, and that if there be unlawful delay and that if there be bad faith and an intention to delay on the part of the applicant, then the patent may be here held to be void. From the filing of the application, June 2, 1882, it is not contended that there was any delay on which a decree here should be founded. There were delays in prosecuting the application, but they are said to be no greater than is usual in the Patent Office. On the date last given, the solicitor in charge of the application was notified by the examiner, as at present advised, it is believed, that the claims presented may be allowed, but final action in this case must be suspended, in view of probable interferences with other pending applications. In October, 1883, the solicitor wrote to the office asking that the case might receive attention, to which it was replied that the apprehended interferences had not yet been declared; and the correspondence was continued in the same sense until March, 1888, when the application was suspended until May, 1888, on the ground of the expected interference, and also for the purpose of awaiting the determination of the telephone case in the Supreme Court.

The application with which an interference was anticipated was that filed July 26, 1880, by Daniel Drawbaugh, in which he claimed to be the original and first inventor of the telephone. His claims were rejected on the ground that the instrument which he claimed to have invented had been in public use and was on sale for more than two years before the filing of his application. He had filed an affidavit in which he denied that there had been such public use with his consent and allowance. There was abundant evidence on file in the Patent Office by which was shown the fact of public use as early as July 26, 1878. It had been declared in Manning vs. Cape Ann Isinglass Glue Company that the statute then in force did not allow the issue when the invention had been in public use for more than two years prior to the application either with or without the consent or allowance of the inventor.

The case was then pending of the Bell Company against the People's Telephone Company, owners of the alleged telephone inventions of Drawbaugh, in which was involved the question whether Drawbaugh had in fact invented the telephone at the early day claimed by him, or whether, on the other hand, his claim was entirely false. Under these circumstances there was set on foot a general understanding, as it is called, on the part of the examiner and the respective counsel for Drawbaugh and for the Bell Company that the decision for the application for the Berliner patent should await the decision of the pending suit. There seems on the testimony no doubt that the Bell Company fully acquiesced in this general understanding, and I think that in so doing it failed in its duty and committed a wrong against the public.

It was evident that in no case could Drawbaugh be entitled to a patent. He was clearly barred by the prior use of his invention. On the other hand, it is to be observed that the action versus the People's Telephone Company might not be finally decided for many years, and that when decided it would not necessarily throw any light on the question then pending in the Patent Office—namely, whether Berliner or Drawbaugh was the first inventor of the microphone transmitter. The suit was for infringement of two of the early patents issued to Bell, the first for electrical transmission of sound, and the second for a receiver.

The answer denied the validity of the patents, alleged anticipations and further averred generally that Drawbaugh was the first inventor of the speaking telephone. The invention of the microphone, a particular form of the speaking telephone, was therefore not in issue. The case made by the People's Telephone Company, as was well known, was that Drawbaugh had invented the whole telephone system as it was then known, including the microphone, long before Bell's invention. If this were found to be the fact, then, of course, it would follow that it had anticipated Berliner as well as Bell. But if this were found to be the fact, that finding would throw no light on the question whether Drawbaugh had or had not invented the microphone subsequent to Bell and prior to Berliner. It could never appear in the Patent Office that Drawbaugh was entitled to a patent, and only in one aspect of the telephone case could it be decided that Berliner was not entitled to a patent.

The plain duty of the respondent corporation was, it seems to me, to prove these claims on the Patent Office, and insist on its rights to a patent at once, leaving the question, which was pending in the courts to be settled whenever a final decision should be reached, and leaving the decision of that case to have whatsoever effect it lawfully might on the validity of the patent. The Commissioner on such an application might properly have been asked to take proofs on notice to Drawbaugh, so as to ascertain *prima facie*, and with sufficient certainty for the purpose of an administrative decision, by whom the first invention of the microphone had been made. It would well have been urged on him that it was his duty to make such an investigation of a question which was not in issue in the pending suit, and which the decision of that suit might furnish no guide in determining.

It is objected that there was no established practice in the Patent Office, by which the question of priority of invention could be ascertained, and that for other reasons such an application to the Commissioner had no prospect of success. It seems to me clear that the duty of the respondent corporation was to test these questions rather than to consent that they must be decided against them, for an acquiescence in the delays seems to me to be no less than a consent that unfavorable result could come from the application.

That the unwarranted delay thus caused was intended by the respondent corporation I have no doubt. In matters of this consequence, involving the whole business of a company of so large capital, and engaged in so large affairs, I cannot doubt that they were fully advised both as to the facts and as to the law, and I think that their acts were so gross as to forbid any inference except that they dishonestly delayed the issue of the patent, taking advantage for that purpose of the perhaps excusable willingness of the officials of the Patent Office to postpone the decision of a sharply debated question in which a large public interest was involved, on a chance that a decision of the Supreme Court might supersede the necessity for a decision on their part.

In March, 1888, a final decision was rendered by the Supreme Court in the action against The People's Telephone Company, and the claim of Drawbaugh to the invention of the telephone was held to be unfounded. In June, 1886, the Examiners-in-Chief of the Patent Office had decided that Drawbaugh's application was barred by reason of two years' public use of the invention, and the time for an appeal from this decision expired in June, 1888.

The Commissioner then set on foot a proceeding to determine whether in fact there had been a public use of Drawbaugh's invention for two years before the date of his application, and the Berliner application was still suspended to await the result of an interference which might be declared in case Drawbaugh should prevail in the public-use proceeding, the rule of the Patent Office being that no interference could be declared unless in cases where the interfering applicant, if successful in the interference proceeding, would be entitled to a patent.

The public-use proceeding, the purpose of which is to permit the applicant to be heard on the question of public use when that question has been raised by the office, was strenuously objected to by Drawbaugh, who took no evidence in the proceeding. In October, 1891, the proceeding came to an end by a final decision of the Commissioner, to the effect that Drawbaugh was barred by the prior use of his invention.

On the next day the Berliner patent was ordered to issue, "largely because well-settled principles of public policy forbid us to give any further opportunity for holding this application in the office."

There was no effort, as far as I can see, in the evidence on the part of the respondent corporation, to prevent this further delay. There was ample evidence before the Commissioner of the fact of prior use. The applicant, Drawbaugh, declined to take evidence in contradiction, and it seems to me clear that the respondent corporation should have urged upon the Patent Office a decision on the *prima facie* case which it had made.

I am persuaded that the delay thus caused, as well as the delay previous to the decision of the Supreme Court, was voluntarily acquiesced in by the respondent corporation. This seems to me the only conclusion from a consideration of the whole evidence. It is in proof that, during the whole time from 1882 to the issue of the patent, and perhaps earlier, the solicitors of the Bell Company were urgently insisting to the officials of the Patent Office that prompt action should be taken in the application. Even while the general understanding was in force to the effect that the application should await the decision of the Drawbaugh case in the courts, the evidence shows that these urgent applications were made to the Patent Office officials. I cannot think that it was by any one expected that such oral applications should have any effect, unless, at least, they were made in support of formal applications made on the record, and, if formal, arguments and representation made in support of such application. The officers of the company also testify that at all times they were urgent in pressing for the issue of the patent. As to their state of mind and their actual intention at the time, I am free to say that I place less reliance on their statements now made than on a single statement made at the time. In February, 1886, while the general understanding was in force, Mr. Swan, one of the solicitors for the application, wrote as follows to the president of the Bell Company :

"I am working the Edison and Berliner cases along quietly, and think they will be granted by the Examiner without interference or appeal, so that we can take them out by paying the final fees. We have six months to do that in."

This is but a single paragraph out of many hundreds of pages, but I think it shows clearly what was the purpose of the respondent corporation consciously formed by their officers and perfectly understood by their agents at the Patent Office. The application was to be "worked along quietly," although apparently pushed with great energy. There would be delay, but no substantial obstacle to the grant of the patent; and even after the patent should be ordered to issue there might be a further delay within the limits of the law and without imperiling the patent. If this latter does not mean this, I am at a loss to know what it does mean.

My conclusion, therefore, is that the complainant has made out the case, and that there should be a decree that the patent in question is void and shall be delivered up to be cancelled.

The case was argued June 14, 15, 16, 18, 19 and 20 before Judge Carpenter. The government's special counsel were Causten Brown, of Boston, and Robert S. Taylor, of Fort Wayne, Ind. The telephone company's counsel were Chauncey Smith, J. J. Storrow, F. P. Fish and C. H. Swan.

The telephone company will have to pay the costs of the suit.

HELMHOLTZ MEMORIAL.

A memorial celebration in honor of the life and works of the late Professor Hermann Helmholtz was held in Berlin, on December 14. The German Emperor and Empress and many other distinguished persons were present. An eulogistic address was delivered by Professor Bezold.

LARGE CONTRACT.

The Westinghouse Electric and Mfg. Co., Pittsburgh, Pa., has been awarded the contract for a large consignment of electrical apparatus by the West End Street Railroad Company, Boston. This is the third order that has been received from this company within the past year.

STRIKE.

At four o'clock in the afternoon of December 14, the conductors and drivers of the Metropolitan Street Railroad Company, Washington, D. C., struck work. This action was caused by the notification to the employés that their wages would be reduced from $2.03 per day to $1.68. The strike continued until the next morning, a conference between the strikers and the railroad officials having been held in the meantime. At this meeting a compromise was effected on $1.75 per day of twelve hours. All the strikers were taken back.

Safety Insulated Wire.—The Boston Electric Light Company, Boston, has placed a second order for Safety insulated wire. The order calls for 15 miles of solid stranded conductors. This is a good record for safety. The Safety Insulated Wire and Cable Company, of New York, the manufacturers of Safety wire, has furnished all the cables used in the Boston parks and the Boston Common.

HISTORY OF THE TELEGRAPH.

The Telegraph Historical Society of North America was organized in Washington, D. C., on December 5. Alonzo B. Cornell, of Ithaca, N. Y., was elected president. The object of the society is the collection, publication and preservation of historical data concerning the birth and progress of the telegraph. About 250 members were enrolled; they represent all sections of the country.

ELECTRIC RAILROAD IN AND ABOUT BALTIMORE.

Baltimore has entered another period of activity in electric-railway building, says the *Manufacturers' Record*, and by April 1, 1895, companies organized in this city will probably have built more street, suburban and interurban electric roads than around any other city in this country within a period of three years.

At present fully 164 miles of road for electric motors are either under construction or planned by combinations of responsible parties to traverse the country near Baltimore and within the city limits. Here is a list of the enterprise in detail :

Electric system from Baltimore to Gettysburg. This is planned by the Baltimore Traction Co., and will be formed by a combination of lines built via Pikesville, Emory Grove and Westminster, Md., to Gettysburg. About twelve miles are completed, leaving fifty-one to be built. Companies have been formed covering the entire route.

Baltimore & Washington Boulevard Co. This line is via Laurel, Md., and is about thirty-two miles long. It will be double track, rock ballasted and operated by 100 horse-power motors, estimated to cost $1,000,000. David M. Newbold is president.

Edmondson Avenue, Catonsville & Ellicott City, ten miles. John Hubner, of Catonsville, is back of this project. This line will probably be double track, with at least one power-house. The trolley system will be used

Baltimore Traction Co., changing of Gilmor street and Druid Hill avenue cable lines to trolley systems. Will require the electrical equipment of about nine miles of double-track line, also wire and poles. Hon. Frank Brown is president. The traction company has also planned the following extensions : To Clifton Park by way of Waverly, to Mount Washington from its Pikesville section, and to Westport with its Ridgely street division. An extension of its Curtis Bay division of 2000 feet is in progress.

City & Suburban Railway Co., extension to Clifton Park from its York road division; also equipment of its Catonsville line, six miles, with the trolley system. Nelson Perin is president.

City Passenger Railway Co., extension of its Homestead trolley system. Joseph H. Rieman is acting president.

Mount Washington Electric Railway Co., to build two miles of trolley road into Mount Washington to connect with the Baltimore Traction lines. Geo. R. Webb and Wm. G. Hatter are interested.

Clifton Park Electric Railway Co. W. J. Taylor and Eben B. Hunting are among the principal promoters. The line is to be between three and four miles long, extending east from a point near Roland avenue, north of the city line to Clifton Park. It will be a double-track trolley road, and may have its own power station.

Baltimore, Middle River and Sparrow's Point Co., proposed line of 15 miles between the points named. Grading has begun on this road, which will be equipped with the trolley system and may generate its own power. Geo. R. Willis, F. W. Trimble and Charles B. McLane are actively interested.

Baltimore, Severn Park and Annapolis Co., to build a trolley road 28 miles long, with one power station. It is to extend from South Baltimore to Annapolis by way of Severn Park. The company is to be capitalized at $250,000. Bready Bros., contractors; G. Howard White, a real-estate operator, and D. S. Collett, another contractor, are interested in forming the company.

To summarize the various construction projects, they comprise the following:

	Miles.
Baltimore-Washington	32
Baltimore-Gettysburg	51
Baltimore-Ellicott City	10
Changes cable to trolley in the city	9
Extension to Mount Washington and Clifton Park	5½
Extension to Curtis Bay and Westport	2
Mount Washington independent line	2
Clifton Park Company	3½
Baltimore Sparrow's Point	15
Baltimore-Annapolis	28
City and Suburban, Catonsville line	6
Total	164

Estimating the expense, including three power stations for the Washington-Baltimore line, two for the Gettysburg, one for the Ellicott City road and one each for Sparrow's Point and Annapolis roads, a total of $3,245,000 will be spent on this work. This is calculated on experts' figures. The additional rolling stock (included in the cost of construction) will be 124 motor cars from 40 to 100 horse-power each.

STREET RAILWAY NOTES.

There is a small war in Bridgeport, Conn., between the Bridgeport Traction Company and the New York, New Haven & Hartford Railroad Company. At Fairfield avenue, trolley wires of the street railroad company are attached to and run under the bridge of the New York, New Haven & Hartford Railroad Company. Early on the morning of Dec. 10 the railroad company sent an engine to the bridge, and in an instant the vicinity swarmed with Italians, who were under orders. The result was the wires of the Traction Company were cut. As soon as this was done, the workmen boarded the engine and were off again. Some time ago there was a pitched battle betwen the men representing the two belligerents at the Main street crossing.

Judge Truax refused to make permanent the injunction obtained by Mrs. Martha N. Wysong, restraining the Thirty-fourth Street Railroad Company from completing its line through Thirty-fourth street, between Fifth and Madison avenues, New York City.

A. F. Gerald, general manager of the Waterville & Fairfield Electric Railroad, Waterville, Me., has resigned and is succeeded by I. C. Libby.

TELEPHONE NOTES.

Samuel Regester, Richmond, Va., has applied to the City Council for a telephone franchise.

Telephonic communication has been established between Madrid and Barcelona, Spain.

A telegram from Brussels, Belgium, states that it has been decided to connect that city with The Hague, Rotterdam, Amsterdam and Flushing by telephone. It is also proposed to establish similar communication between Brussels and Hamburg and Copenhagen.

The Metropolitan Telephone and Telegraph Co., New York City, is now putting in its improved exchange service, metallic circuit lines and long-distance equipment for $80. per year for combination line, and $120. per year for direct line, and upwards, according to use. It makes no extra charge for installation

Beaver & Gladwin Telephone Company, Gladwin, Mich., incorporated by Eugene Foster, J. M. Schaffer, S. S. Townsend and others. Capital stock $250.

The Harrison Telephone Campany, Grand Rapids, Mich., has applied to Council for franchise to build lines in Detroit.

TELEPHONE PATENTS ISSUED DECEMBER 11.

Suppression of Self-Inductive Obstruction in Electro-magnetic Apparatus—Stephen D. Field, Stockbridge, Mass. (No. 530, 516).

Telephone Transmitter—Arthur F. Boardman, Somerville, Mass. (No. 530, 575).

Telephone System.—Wilhelm Oesterreich, Berlin, Germany. (No. 530, 598).

NEW CORPORATIONS.

The Trenton Traction Company, Trenton, N. J., by E. J. Moore, of Philadelphia; Thomas C. Barr, of Newark; Francis M. Eppley, of Orange, and others. Capital stock, $500,000.

The Staten Island & Electric Railroad Company, Albany, N. Y., by George B. H. Harvey, Milton L. Bouden, John A. Hilton, John J. Walsh, William H. Hurst, John W. Mills, Eugene R. Leland, A. J. Hummell, and Henry Haggerty, of New York City. Capital stock, $1,250,000.

The Phoenix Electric Supply Co., Warren, O., by Warren B. Swager, Warren T. Swager, William F. Corbin, Herbert H. Miller and David W. Campbell. Capital stock, $1,000.

The Sidney Electric Company, Sidney, O., by Chas. Timeus, John Laughlin, J. H. Frederick, William Piper and John H. Wagner. Capital stock, $100,000.

Bellevue Electric Light Company, Bellevue, Pa. Capital stock, $500.

The Ben Avon Electric Light Company, Ben Avon, Pa. Capital stock, $500.

POSSIBLE CONTRACTS.

It is reported that a new electric railroad is to be built in Allegheny City, Pa. H. W. Ahlers and others are connected with the company.

The Gas Belt Electric Street Railway Company, Anderson, Ind., has awarded the contract for the construction and equipment of its electric road to a Chicago concern.

A company proposes to construct an electric railroad between Rensselaerville and Ravenna, N. Y., a distance of twenty miles.

The Anderson Electric Light & Power Company, Anderson, S. C., has purchased water power at High Shoals, and will remove its plant to that place.

An electric light plant is to be established in Hempstead, Texas.

The Baltimore, Severn Park & Annapolis Electric Railway Company will locate its plant at Severn Park, Md.

A company is being organized to build an electric railroad between De Leon Springs, De Land and Orange City, Fla.

The Edison Electric Light Company, Philadelphia, is making preparations for the erection of a large power house on Pine street, that city.

The City Clerk, Clintonville, Wis., can give information regarding the establishment of an electric light plant in that place.

John E. McVey, Warren, O., has been granted a franchise for the construction and operation of an electric road from Niles, O., to the southern line of the county.

John H. Davidson and Remur McIntyre have purchased the electric light plant in Thomasville, Ga.

It is reported that the Cataract Electric Co., Niagara Falls, N. Y., will build a trolley line from New York to Tonawanda early in the spring.

The Mayor of Eufaula, Ala., can give information regarding the project of buying and operating an electric light plant in that place.

Efforts are being made in Frederick, Md., looking to the construction of a fire-alarm system. The Junior Fire Company can give further information.

Owen Ford, of St. Louis, Mo., has obtained a franchise for the erection of an electric light plant in Neosho, Mo.

The Athens Roller Mills, Athens, Tenn., will put in an electric light plant.

The Regents of the University of Texas, Austin, Tex., contemplate the enlargement of the electrical plant.

The Georgia Legislature has been asked for an appropriation of $50,000 for the Georgia Normal School and Industrial College.

Plans for the Maryland Horse Show Association Buildings have been completed by Henry Brauns, Baltimore. Mr. Robert Hough is secretary of the association.

Crutche & Starks, Louisville, Ky., will erect a new building to cost $100,000.

The J. Brown Storage Co., St. Louis, Mo., intends to build a storage house.

Hon. Frank Brown, president of the Baltimore Traction Company, can give information regarding the extension of that company's line to Clifton Park by way of its Waverly line. This latter line is to be equipped on the electric system.

Efforts are being made in Grafton, W. Va., to form a company to build an electric railroad between Grafton and Pruntytown.

The Jackson Suburban Street Railroad Company, Jackson, Tenn , will likely introduce the trolley system on its line. The general manager of the company is J. L. Wisdom, who can give information.

Several of the large towns in Preston County, W. Va., will be connected by an electric road. Action with this object in view is being taken in Kingwood, W. Va.

The Knoxville & Fountain Head Suburban Railroad, Knoxville, Tenn., it is stated, will be changed to the trolley system.

A company is being formed in Valdosta, Ga., to build an electric railway in that place.

The Columbia Railway Co. of Washington, D. C., has asked permission from Congress to extend its cable road to the Potomac River. For further information, W. C. Battler, superintendent, should be addressed.

A summary of electric lines projected in and around the city shows the following: Baltimore-Washington Boulevard Co. will build thirty-two miles double track with 80-pound steel rails, block system, rock ballast; will need three $60,000 power stations to generate 1,000 horse-power each and twenty 100 horse-power motor cars; for this line about 3,000 poles will be used; address David M. Newbold (contracts partly let). Baltimore-Gettysburg electric line will have fifty-one miles of 70 to 80-pound steel rails, rock ballasted; will need two power houses capable of generating 2,500 horse-power each, and 4,500 iron or wooden trolley poles; about 30 motor cars will be needed; Hon. Frank Brown may be addressed. Edmondson Avenue, Catonsville and Ellicott City, 10 miles 60 to 80-pound steel rails, double track, rock ballasted, with one 1,000 horse-power generating station; will need 900 poles and 15 to 20 motor cars; address John Hubner, Catonsville, Md. Baltimore Traction Co., changing nine miles of cable road to the trolley system; will need about 600 iron poles, feed and trolley wires and electric rail connections; also may increase generating power at stations and add 15 to 20 motor cars; address Hon. Frank Brown. Mount Washington electric road, two miles of 60 to 80-pound steel rails, double track, rock ballast, with 200 wooden poles and five 50 to 75 horse-power motor cars; address Geo. R. Webb, Clifton Park Electric Co., three and a half miles double track, rock ballasted, 70 to 80-pound steel rails, 300 wooden poles, one 800 to 1,000 horse-power station and five to ten motor cars; address Winfield J. Taylor or Eben B. Hunting. Baltimore, Middle River and Sparrow's Point, 15 miles 60 to 80-pound steel rails, stone ballast, one 1,000 horse-power station 25 to 30 motor cars, about 1,400 wooden poles; address Geo. R. Willis (contracts partly let). Baltimore, Severn Park and Annapolis, 28 miles single track, 60-pound steel rails, one 1,200 horse-power generating station, 2,500 wooden poles, with trolley and feed wire, 40 to 50 motor cars; address Bready Bros. or D. S. Collett.—*Manufacturers' Record.*

NEW YORK NOTES.

Office of the Electrical Age,
World Building, New York,
December 17, 1894.

The Gas Commission, on Dec. 10, awarded contracts for the lighting of the city during the coming year by gas and electricity. The total cost will be $935,000. The contracts for electric lighting were awarded as follows: The Brush Electric Light Company, 295 lamps at 40 cents a night, and 92 lamps at 45 cents a night; the United States Illuminating Company, 411 lamps at 40 cents a night; the Mount Morris Electric Company, 344 lamps at 40 cents a night; the Madison Square Electric Company, 299 lamps at 40 cents a night, and 10 lamps at 50 cents a night; the Harlem Light Company, 210 lamps at 40 cents a night, and 19 lamps at 50 cents a night; the Manhattan Electric Light Company, 163 lamps at 40 cents a night; the Edison Electric Illuminating Company, 107 lamps at 50 cents a night; the North River Electric Light Company, 827 lamps at 45 cents a night.

The Edison Electric Illuminating Company, of Brooklyn, in its report for November, shows gross earnings of $50,018, which is an increase of $13,098 as compared with the same month last year. The net earnings are $25,109, an increase of $5,617.

The Oakman Electric Company, 136 Liberty street, has made arrangements to handle the lightning arrester for railroads and electric light circuits, of a well-known inventor. The arrester is already on the market and is said to be the best of its kind. The Oakman Company will control the entire output of this device. One Chicago company has guaranteed a sale of 800 a year. The Oakman Company reports that the lamp business is good.

Edwards & Co., 144th street and 4th avenue, and 5 Dey street, city, are doing a general electric light and power business. They are at the present time wiring five different churches in New York city and vicinity for over 2,000 lamps, and just completing their work on the Scotch Presbyterian Church, 96th street and Central Park, west. W. H. Hume & Company are the architects.

Bids were opened on December 17, at the Mayor's office, for alterations in the rifle range of the Seventh Regiment Armory, New York city, of which Clinton & Russell are the architects. W. T. H.

NEW CATALOGUES, ETC.

The Niles Tools' Works Company, of Hamilton, Ohio, has just issued a neat little pamphlet regarding street railway equipment manufactured by that company. The apparatus described in the pamphlet includes engine lathes, car-wheel borer, drill press, hydrostatic car-wheel press and gear cutter.

The Electric Storage Power Company, of Philadelphia, has just issued an illustrated catalogue of its chloride accumulators.

TRADE NOTES.

The American Electric Supply Co., of Buffalo, N. Y., have severed their agency relations with the Interior Conduit and Insulation Co., of New York. The American Electric Supply Co. is one of the oldest agents of the Conduit Co., and the relations between the two companies have always been of the pleasantest character. The Conduit Company, however, have found that their interests are antagonized when represented by a construction house, and have consequently changed their policy, and in the future will be represented by supply houses not engaged or financially interested in the construction business. The American Electric Supply Co. could not afford to give up the large construction business they enjoy, and hence followed a friendly termination of their agency relations with the Interior Conduit and Insulation Co.

Mr. J. L. Somoff, 11 Park Row, New York city, calls our attention to the mistake in the prices of his miniature incandescent lamps, as advertised. The figures should be $39 and $48 per 100, not $30 and $38.

WOVEN WIRE BRUSHES.

The Belknap Motor Co., of Portland, Maine, are the patentees and manufacturers of the best woven wire commutator brush on the market.

NOTICE.

To the stockholders of the Broderick Supply Company of the City of New York.

Notice is hereby given that a meeting of the stockholders of the said corporation will be held pursuant to law, at 44 Rose street, in the City of New York, on the 20th day of December, 1894, at 10 o'clock in the forenoon, for the purpose of increasing the capital stock of said corporation to the sum of $10,000, pursuant to the provisions of Section 5 of chapter 567 of the Laws of 1890, passed June 7, 1890, and known as a Business Corporation Law, as amended by Section 4 of chapter 691 of laws of New York of 1892, and for the transaction of such other business as may properly come before said meeting.

John J. Canavan, President,
P. C. Nielson, Secretary.
Fred Becker, Treasurer, a
majority of the directors of said corporation

Dated November 30, 1894.

THE NESTOR OF FAST PASSENGER SERVICE.

The New York Central system was the nestor of fast passenger service in the United States. Away back in 1878 that road was running "flyers." The "White Mail" was put on in 1876, and ran between New York and Chicago in nearly as fast time as is now made between these cities. This train, however, did not carry passengers, though there was, even at that time, a fast passenger service in operation over these roads. The train was called the "Lightning Express," and made the trip from New York to Chicago in about twenty-six hours. The "White Mail," as it was called, was the admiration of the whole country. Four snow-white mail cars made up the train and the farmers used to stop work when it passed. Indeed, there was a rumor to the effect that this train only hit in high places. Soon after this the New York and Chicago Limited was put on. This was the first all-sleeper train ever run, and some doubt as to patronage was indulged in by the officials. But this question settled itself. The train paid from the beginning, and it was soon followed by other fast all-sleeper trains. But the other roads have always waited on the Central, and we owe the comfortable train service throughout the country to the enterprise and pluck of the New York Central System. —"*Dixie.*"

Electrical and Street Railway Patents.

Issued December 11, 1894.

530,497. Street-Sign. Halsey H. Baker, Plainfield, N. J. Filed Jan. 22, 1894.

530,498. Insulator for Electric Overhead Construction. Henry P. Ball, Bridgeport, Conn., assignor to the General Electric Company, Boston, Mass. Filed June 28, 1894.

530,507. Controller for Electric Locomotives. John W. Darley, Jr., Baltimore, Md., assignor to the General Electric Company, Boston, Mass. Filed Nov. 16, 1893.

530,516. Suppression of Self-Inductive Obstruction in Electromagnetic Apparatus. Stephen D. Field, Stockbridge, assignor to the American Bell Telephone Company, Boston, Mass. Filed July 24, 1894.

530,541. Apparatus for Controlling Electric Elevators. Nils O. Lindstrom, Union Course, and Orrie P. Cummings, Brooklyn, assignors to the A. B. See Manufacturing Company, Brooklyn, N. Y. Filed Sept. 20, 1894.

530,543. Conduit Electric Railway. David Mason, Schenectady, N Y. Filed June 8, 1893.

530,569. Trolley-Wire Clamp. Montraville M. Wood, Chicago, Ill., assignor to The Ohio Brass Company, Mansfield, Ohio. Filed July 2, 1894.

530,575. Telephone-Transmitter. Arthur F. Boardman, Somerville, assignor of one-half to James D. Leatherbee, Braintree, Mass. Filed Aug. 6, 1894.

530,578. Electric Elevator-Controller. Leroy S. Buffington, Minneapolis, Minn., and Walter C. Jones, Chicago, Ill. Filed Feb. 23, 1894.

530,592 Magnetic Water-Gage. Ljubomir Kleritj, Belgrade, Servia. Filed Mar. 27, 1893.

530,597. Alternating-Current Transformer. Alexander W. Meston, St. Louis, Mo., assignor to the Emerson Electric Manufacturing Company, same place. Filed Jan. 23, 1893.

530,598. Telephone System. Wilhelm Oesterreich, Berlin, Germany. Filed Oct. 12, 1893.

530,619. Electric-Motor-Propelled Elevator. Frank E. Herdman, Indianapolis, Ind. Filed Jan. 31, 1893.

530,637. Electric Cigar-Lighter. Clyde J. Coleman, Chicago, Ill., assignor of one half to Robert Burns, same place. Filed Mar. 24, 1894.

530,648. Fire Alarm and Annunciator System. Fredrick S. Palmer, Boston, Mass. Filed Mar. 24, 1894.

530,661. Switch for Overhead-Trolley Tracks. Charles G. Schmidt, Cincinnati, Ohio. Filed Aug. 13, 1894.

530,674. Trolley-Wire and Support Therefor. Herbert H. Ashley, Springfield, Mass. Filed Aug. 25, 1894.

530,688. Conduit-Railway Trolley. Joseph C. Hawley and William J. Black, Duncannon, Pa. Filed Mar. 22, 1894.

530,706. Insulator. Louis McCarthy, Boston, Mass. Filed Sept. 18, 1894.

530,717. Brush for Dynamo-Electric Machines. Edward T. Platt, Chicago, Ill., assignor of two thirds to William Freise and Charles O. Moyer, same place. Filed June 11, 1894.

530,727. Rheostat. Thomas W. Shelton, St. Louis, Mo. Filed Aug. 20, 1894.

530,748. System of Transmitting and Distributing Electrical Energy. Cummings C. Chesney, Pittsfield, Mass., assignor to the Stanley Laboratory Company, same place. Filed Apr. 19, 1894.

530,751. Shade-Holder for Incandescent Electric Lamps. Nathan W. Crandall and Edgar A. Russell, Wallingford, Conn., assignors to the Housatonic Manufacturing Company, same place. Filed June 18, 1894.

530,762. Electrical Block-Signal Apparatus Urias J. Fry, Milwaukee, Wis., and George M. Basford, Oak Park, Ill. Filed July 5, 1893.

530,763. Block-Signal Apparatus. Urias J. Fry, Milwaukee, Wis., and George M. Basford, Oak Park, Ill. Filed Sept. 17, 1894.

530,764. Primary Battery. George H. Gardner, Boston, Mass. Filed May 12, 1894.

530,773. Electric Motor. Frank E. Herdman, Winnetka, Ill. Filed July 25, 1894.

530,798. Railway-Signal. James V. Richardson, Farmville, Va. Filed May 30, 1894.

530,804. Battery-Switch. Heinrich K. Spangenberg, Germany. Filed July 24, 1893.

530,807. Rail-Cleaner and Car-Fender. John S. Tomer, Pittsburgh, Pa. Filed Apr. 28, 1894.

530,809. Carriage for Elevated Railways. John N. Valley, Jersey City, N. J. Filed Dec. 19, 1893.

530,810. Elevated Railway. John N. Valley, Jersey City, N. J. Filed Dec. 20, 1893.

530,828. Conduit-Railway Trolley. Walter E. Delabarre, Francis M. Frazer, and Robert A. Carrick, New York, N. Y. Filed Jan. 26, 1894.

530,838. Incandescent Lamp. Jacob R. Grove, New York, N. Y., assignor to Walter E. Peck, trustee, same place. Filed May 26, 1893. Renewed May 14, 1894.

530,839. Automatic Fire-Alarm. William A. Guthrie, Durham, N. C. Filed Apr. 26, 1894.

530,867. Primary Battery. William Walker, Jr., Birmingham, and Frank R. Wilkins, Handsworth, assignors of one-third to Jabez Lones, Smethwick, England. Filed June 4, 1894. Patented in England, Dec. 14, 1892, No. 23,007; in Belgium, Feb. 7, 1894, No. 108,431, and in Austria Apr. 27, 1894, No. 1,246.

530,882. Arc-Light Hanger-Board. David J. Cartwright, Boston, Mass. Filed Jan 26, 1894.

530,895. Incandescent Electric Lamp. Edward Kaye, Monaca, Pa. Filed Feb. 4, 1893. Renewed Nov. 10, 1894.

ELECTRICAL AGE

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CONTENTS.

A HAPPY NEW YEAR.

Before another issue of the ELECTRICAL AGE reaches the hands of our friends the year 1894 will have passed into history and its successor will, like the use of electricity, "be in its infancy." We trust the New Year will be a prosperous one to all. The outlook from our point of view seems much brighter than it did last year at this time, and there is abundant evidence that the feeling in the trade is much more buoyant, and that prosperity is returning. A HAPPY NEW YEAR TO ALL.

ANENT OUR COVER.

Our little "diversion" of last week has captivated the hearts of our readers, and we have received so many congratulations on the change of color for the cover that we have decided to adopt the pink hereafter in place of the blue. We had intended to substitute an entirely different color for the blue beginning the first of the year, but the pink having been received with so great favor we have decided to yield to the wishes of our friends in this matter.

PATENT LAW.

Apropos of the telephone patent decision the lecture of Horace Pettit before the Franklin Institute—a portion of which we print elsewhere in this issue—is full of interest. Mr. Pettit gives a very clear and comprehensive review of the law of patents in the United States, and discusses its application in the telephone, electric light and other well-known and important patent cases. It is a timely article and well worth thoughtful consideration. Those who are not lawyers are apt to be more or less biassed in their opinions regarding any patent litigation in which they are in any degree interested, but when the inexorable law is presented to them their errors become glaringly apparent. The cold law stands impregnable, and the principle it contains cannot be changed.

THE TELEPHONE SITUATION.

The decision of Judge Carpenter in the Berliner patent case has excited greater interest in the electrical trade than any previous judicial finding involving the status of telephonic apparatus and all sorts of opinions are expressed regarding the actual effect of the decision on the outside telephone trade. That the Berliner patent is now void is not questioned, and this obstruction to independent manufacture having been removed opens up a wide field for the expansion of the business established by many wide awake concerns in the manufacture of telephonic apparatus. As we pointed out last week, there is no affection in the trade towards the Bell Telephone Company. The opinion is universal that the company has enjoyed a monoply long enough; and to give it a longer time would be manifestly unfair to the public. The opinion seems to be general, too, that the appeal, if it is taken, will avail nothing, and that Judge Carpenter's decision will be sustained. Next month the patent on the use of the induction coil in connection with the telephone transmitter will expire, and this will further widen the breach in the Bell Company's monopoly wall. Thus one by one the main patents are expiring and the obstructions that private enterprise has had to contend with are disappearing.

PRINCIPLES OF DYNAMO DESIGN.

BY

Newton Harrison E.E.

(*Continued from Page 343*)

In the accompanying sketches are examples of the most popular styles of frames. Each possesses different qualifications, which make it valuable for special work.

There are a thousand and one developments of the above types in existence, each differing from the other by some slight change suggested more by the designer's fancy than for any sound, substantial reason. Distorted forms of the above styles have occasionally appeared, but, in general, such startling variations created often for the sake of mere novelty have become defunct.

There are a few machines still in existence capable of great improvement, that were sold by large established companies, but they are all succumbing to the heavy tread of progress and soon will be placed beside other obsolete forms as an historical remnant of engineering practice.

The general statements just given regarding the loss of lines of force from different types of machines cover the ground without expressing exact values. Kapp and other writers have compared the flow or radiation of lines of force from a magnetized body to a primary battery submerged in a badly conducting medium. In such a case there would be a general escape of currents from different parts of the circuit, varying in strength with the length or resistance of their respective paths. Though it is difficult to state with the authority of truth the exact paths through which leakage must occur, we may assume with absolute surety, that between those two points having the greatest difference of magnetic potential the leakage would be the greatest. This analogy between a magnetic and an electric circuit immediately presents to our notice the causes of the most serious cases of leakage.

Referring again to our submerged battery, it is clear that with a given badly conducting medium the less the electromotive force of the battery the less will be the leakage. In like manner with a magnetized body subjected to the influence of a magneto-motive force, as this force becomes greater and greater the means for overcoming the resistance of any air path approaches a maximum value and the loss of magnetic lines correspondingly increases. Naturally enough, with weak magneto-motive forces the iron would sustain proportionately less loss, which in certain cases we might regard as negligible.

We are now confronted with a peculiar fact referred to before, concerning the gradual lack of conductivity for lines of force which iron presents as its magnetization increases.

With a powerful magneto-motive force a bar of iron saturated by its influence will then offer the same resistance to the passage of lines of force as air. Hence, any additional magneto-motive force brought to bear upon the bar would be practically wasted. This state of affairs is what is presented to us by the machines of makers who heavily saturate their iron beyond the point dictated by economy. Kapp, by a special method of his own, has been able to calculate approximately the resistance of leakage for certain types of machines. He bases his method upon two assumptions; firstly, that the resistance is inversely proportional to the linear dimensions of the machine; secondly, that the magnetic resis'ance of the iron is assumed to be a function of the saturation coefficient.

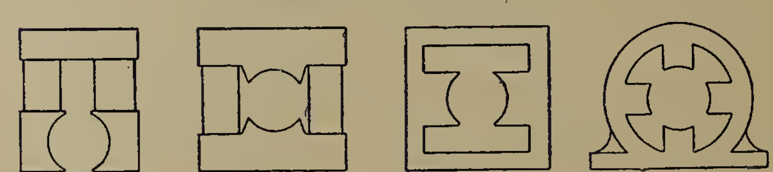
If N be the number of lines passing through the armature and N_1 be the number of lines in the core when saturated, then the ratio of $\frac{N}{N_1}$ is the saturation coefficient. The determination of the magnetic resistance with a known induction, N, is the product of the magnetic resistance due to the dimensions of the iron, that is to say, its length and cross-section and an expression called a "tangent function." The value of the "tangent function" is supposed to correctly represent the increase of magnetic resistance due to an increase of induction. As the value of this "tangent function" has been the basis for tables used by many designers in England as a valuable guide, it will be very briefly explained.

The tangent of an angle can be readily found by consulting a table of cosines and tangents at the back of any trigonometry. The function given by Kapp is written as follows:

$$\frac{\tan.\left(\frac{\pi}{2} K\right)}{\frac{\pi}{2} K}$$

In which $K = \frac{N}{N_1}$ = saturation coefficient.

CHARACTERISTIC TYPES.



Single Horseshoe. Consequent Pole. Iron Clad. Mutipolar.

This "tangent function" is multiplied by the quantity $\frac{l}{a\,b}$

where l = length
$a\,b$ = area of cross-section.

Kapp used a unit of 6,000 lines of force and the inch instead of centimeter. He has constructed a table giving for various inductions per square inch, the "tangent function" for armature and fields. (See table on page 363.)

To use the table we determine the cross-section of iron in armature and magnet core; by then assuming a certain total induction we can find the specific induction. Consulting the table the value of the tangent function for armature and field corresponding to that number of lines per square inch is found. The value of $\frac{l}{a\,b}$ being known, it can be immediately multiplied by the tangent function. Adding to this the resistance of the air gaps, and multiplying by the total induction in Kapp units, will give the exciting power needed to send the lines of force through both iron and air space. This magneto-motive force, divided by the resistance of leakage, will cause a certain leakage expressed by the formula

$$X = M M F \quad \mathcal{K} = \frac{X_1}{r}$$

For single horseshoe types the resistance of leakage is represented by

(*Continued on Page 363.*)

ON THE PRODUCTION OF ROTARY MAGNETIC FIELDS BY A SINGLE ALTERNATING CURRENT.*

BY LUDWIG GUTMANN.

I wish, now, to bring to your notice a method of generating a rotary magnetic field by a single alternating current or its field, without condensers or choking coils. This is accomplished by a device brought out by me some three years ago.

If we have a closed coil moving in an alternating

FIG. 1.

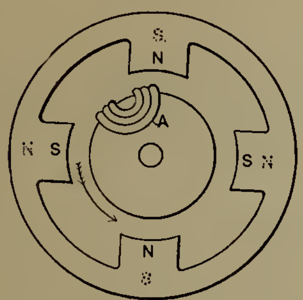
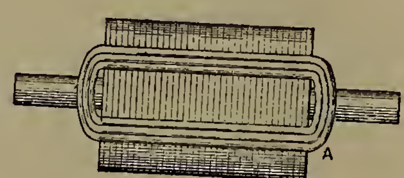


FIG. 2.



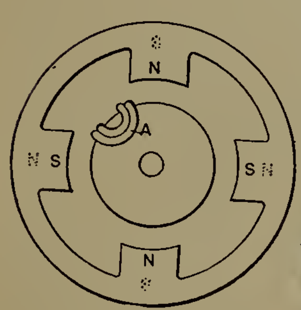


FIG. 3.

FIG. 4.

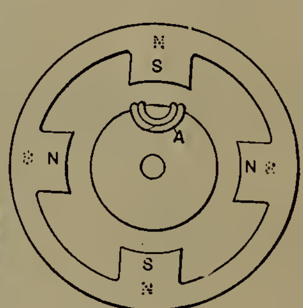


FIG. 5.

FIG. 6.

magnetic field, or better, between the poles of *a field magnet* as illustrated in figs. 1 and 2, energized by alternating currents, then the coil A will be repelled from the pole, owing to the secondary field which it establishes, so long as it cuts, or is threaded by the lines of force of the field. The consequence is that it will rotate and place itself between the north and south pole, Fig. 3, where it reaches a *stable magnetic equilibrium*, as I like to term it, because in this position it acts like a pendulum properly suspended, Fig. 4. Any motion imparted causes the pendulum to make a few oscillations and come to rest, and similarly any attempt made to move the coil into an energized field will cause it to be repelled, and after a few oscillations it will remain at rest between the poles. It is repelled in either direction, because as soon as it approaches a strong magnetic flux currents are induced in its windings and create an opposing field. The same coil can be in unstable magnetic equilibrium (Fig. 5), if it stands just in front of a pole, in which position it would act like a pendulum which is balanced with the weight above the point of support (Fig. 6). Both are in unstable equilibrium; the least motion to the left or right imparted to either will cause them to accelerate in the direction of the impulse, and to assume a position of stability (Figs. 3 and 4). In this position, Fig. 3, the coil is therefore currentless. *This stable position is the natural position of synchronous motors in operation.*

* * *

If such a synchronous motor is held behind the phase when rotating under load, a heavier current is induced in the spools which accelerate the armature and keep it in step. If, however, the motor runs in harmony, and suddenly a great deal of the load is taken off, then the armature has a tendency to go more quickly, but in this case opposing currents are generated in the windings which retard the speed of the armature and keep it back to remain in step, or in stability.

* * *

It will be remembered that Prof. Ferraris obtained a rotary magnetic field and rotation by influencing one coil carrying a primary current, by another at right angles thereto carrying secondary currents. Here we have two phases from a single source, Fig. 7. To obtain a multiple of phases we may take two or three iron cores A, and surround them with coils B, like the links of a chain, Fig. 8, so that the secondary coil of transformer 1 is the primary of transformer 2, and so on; or we may design a specialcore for a transformer, and create a rotary magnetic field by applying to one coil a primary current from the line, and to another coil a secondary current from a transformer, whereupon, by the rotary field obtained, polyphased currents may be taken through other coils on the transformer. These methods have, however, one drawback, and that is that the phase will change more or less in lag with difference in load, while for many purposes it is most essential that for efficient working the phase should remain at the same constant angle. This desideratum has been accomplished by the device under consideration, and any suitable number of currents lagging in phase may be obtained from a single alternating current.

To obtain a rotary magnetic field in or by a stationary body, at least two electric or electromagnetic forces of definite phase relations, acting at an angle to one another and changing at periods harmoniously, are essential requirements.

If, however, we allow the body, or part of the same, to be movable, we may substitute mechanical rotation primarily as an adjuster of the periodicity and phase of one of the two forces; the fundamental relation between the two forces must in this case also be the same as in the other; namely, they must work in harmony, and the periodicity and phase of one force determines the periodicity and phase of the other. If the second force is a current, it must be one of the same period or some harmonic of that period; if it is rotation, it has also to be synchronous or harmonic. We can now clearly understand why, when rotating the armature, in an ordinary alternating current field we have no system of polyphased currents and no rotary field, simply because the armature rotation does not stand in any relationship whatever to the alternations; but as soon as the speed does so, there are generated polyphased current lagging in phase at a fixed angle and a rotary magnetic field.

There is a difference whether the armature is influenced by a single alternating current, or by several, causing themselves a rotating energizing field. Nevertheless, in either condition the armature is in magnetic stability, and this state is the reason that it remains

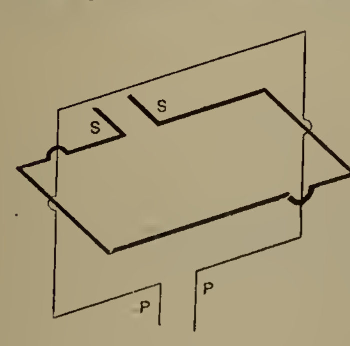


FIG. 7.

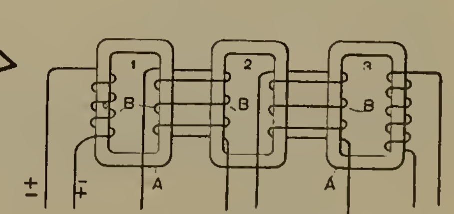


FIG. 8.

stationary in the first case, and that it rotates in the second. The reason that the motor starts in the second case is evidently because the inducing magnetic field is itself rotating in the stationary field magnet core. As said before, it is considered necessary for the proper operation of the armature for giving maximum torque, that if placed in an alternating current field of force, the armature rotation should have a definite relation to the alternations.

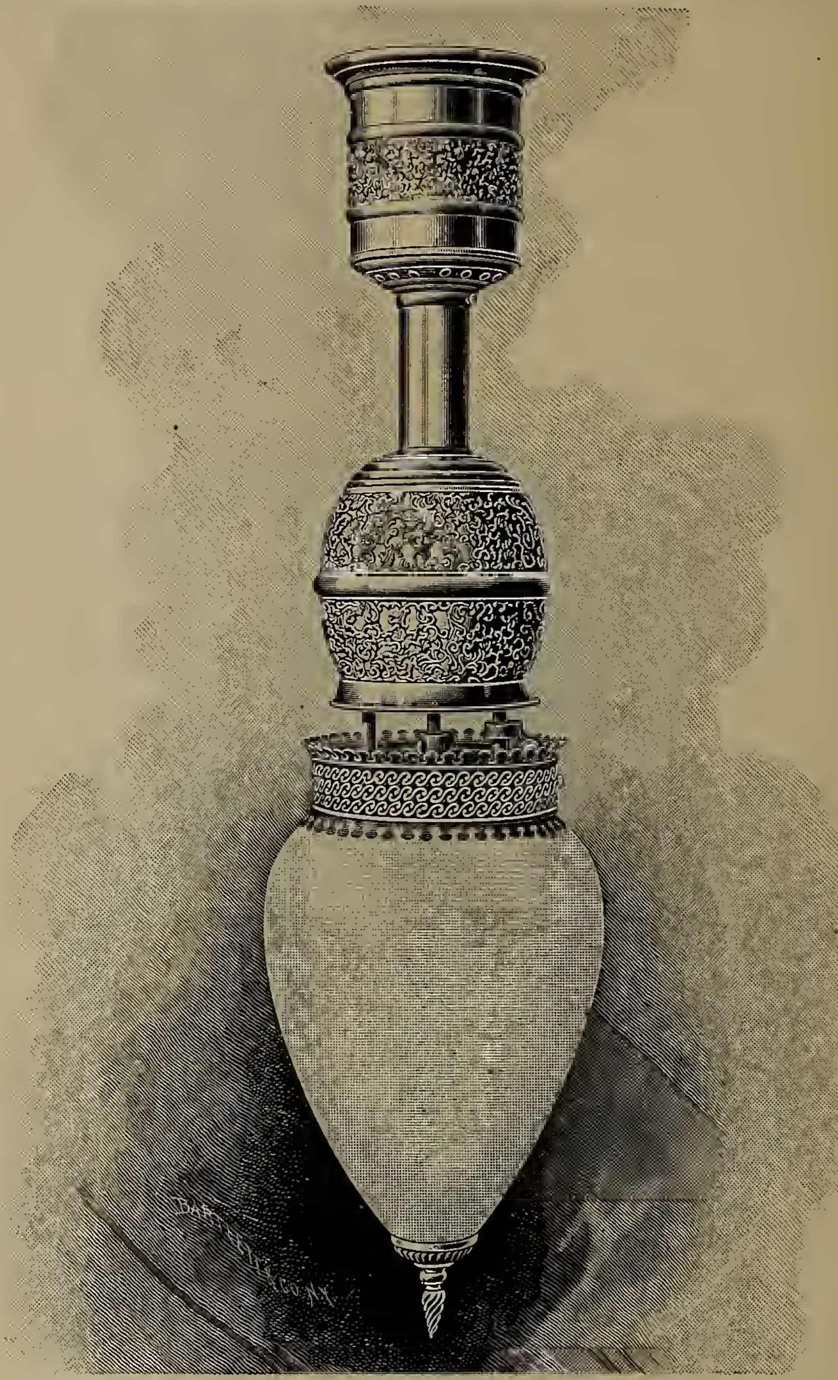
*Abstract of paper presented at the 92d Meeting of the American Institute of Electrical Engineers, New York and Chicago, December 19, 1894.

the "plunger" type, and was designed to break its full rated capacity at 500 volts, or nearly 4,700 H. P. It was made for the General Electric Co., to be used in the Delaware avenue power house of the Philadelphia Traction Co. The total length of the handle from the pivot is 41½ inches. The switch complete is very compact in form, and reflects great credit upon the maker.

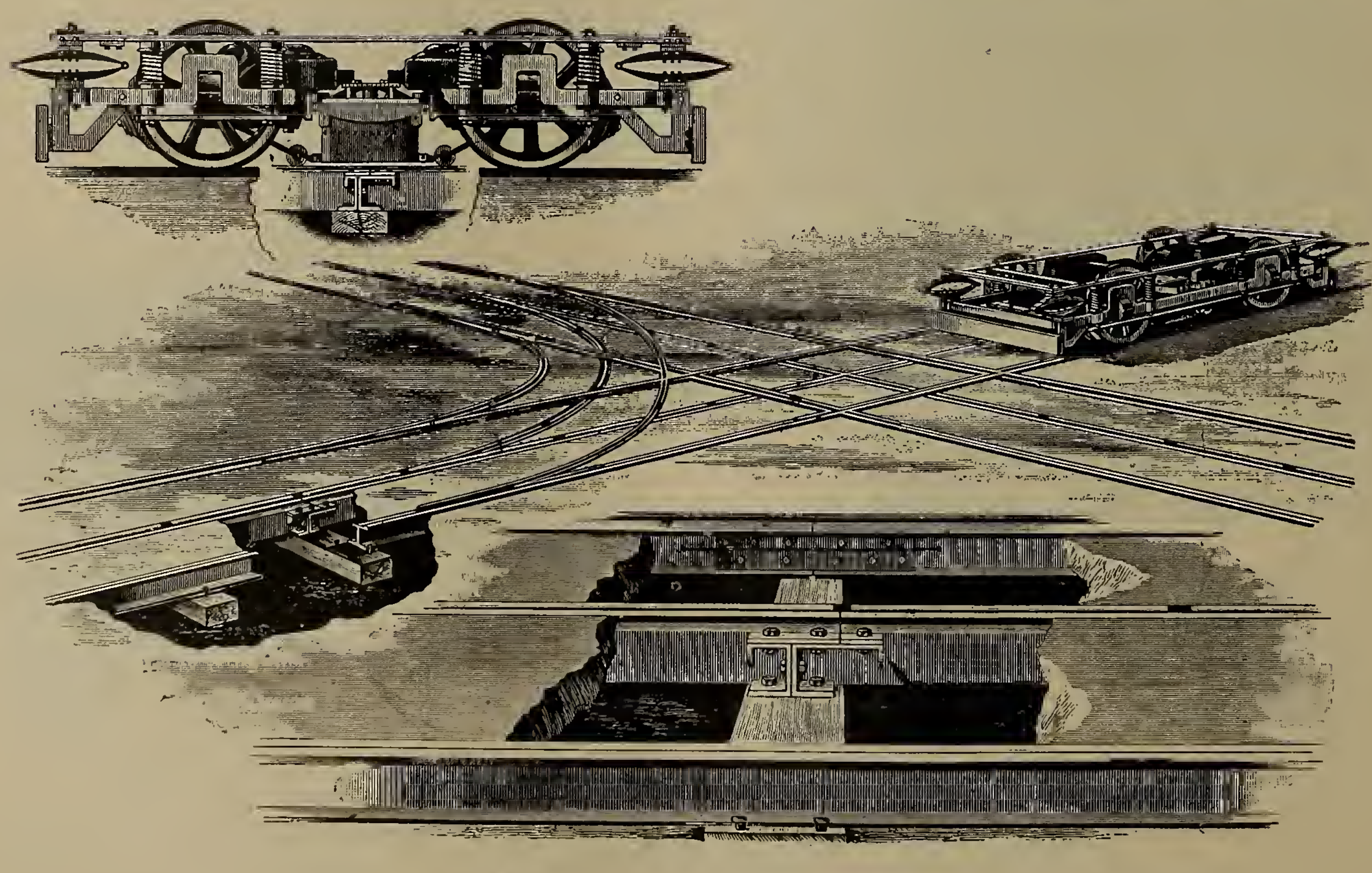
The Solar arc lamp made its bow in public last summer. It is finished in oxidized silver and depends from a handsome wall bracket. It is of the single carbon type and takes eight amperes at 44 volts. It is one of the handsomest lamps made, and appropriate for use amid the most elegant surroundings. The Solar lamp is made by the Solar Arc Lamp Co., 351 and 353 Jay street, Brooklyn. The company recently received an order for its lamps from one of the most prominent technical institutions in Europe.

At the Atlanta convention of the American Street Railway Association, last October, a model of the "New Electric Railway System" was exhibited for the first time. This system was invented by James F. McLaughlin, of Philadelphia. Existing trolley lines can be equipped with this system with very little alteration. A "controller"—which is the feature of the system—is bolted to the bottom of the car. To equip the roadbed a space of eighteen inches in width is dug between the rails, the conduit fastened down on top of the sleepers, and the street repaved or cemented over the conduit, leaving a flat strip of metal exposed. The strip is divided into insulated sections. There is no slot. It is stated that the system is very simple in its mechanical features. The "controller" embodies all the essential features. This system is said to be safe, cheap and durable.

The Electric Construction and Supply Company, of New York, makers of the celebrated arc lamps for incandescent circuits, added to its long list a lamp of beautiful design. The company's latest lamp is designed for direct-current circuits of any pressure above 60 volts, and is made either single or "twin." There are no dash-pots or clock mechanism in its construction, and there is nothing to get out of order. All the lamps made by this company are economical in their operation ; and give a beautiful white and steady light. Thousands of them are in daily use, and giving unqualified satisfaction. They are seen in the largest stores—particularly dry goods establishments—halls, and private and public places. Over 2,000 of this company's lamps are in use for commercial lighting on Edison circuits in Brooklyn alone.



ELECTRIC CONSTRUCTION AND SUPPLY CO.'S INCAND SCENT LAMP.



NEW ELECTRIC RAILWAY SYSTEM.

THE LAW OF INVENTION.*

BY HORACE PETTIT.

THE LAW OF PATENTS IN THE UNITED STATES.

Most civilized countries have made provision for the protection of inventors in their inventions. This moral right of the inventor of exclusive property to his invention for a limited period of time, and the benefit which is to be derived by the public by such stimulus to invention, has been fully recognized.

In the United States the inventor's right is now based solely upon the Constitution of the United States and Federal legislation. I do not mean to say that the individual States have no right to grant patent privileges to their citizens, or to those residing within the State; on the contrary, there is high authority for the proposition that the individual States have still this right should they desire to exercise it.

The Federal Government has only the powers and privileges which have been granted it by the individual States or by the people, which powers and privileges are derived from the Constitution of the United States.

The Constitution, Article I, Sec. 8, provides that "The Congress shall have power . . . to promote the progress of science and useful arts by securing for limited times to authors and inventors the exclusive right to their respective writings and discoveries."

In the case of Martin *vs.* Hunter's Lessee (1 Wharton R., 304), it was held: "The Government of the United States can claim no powers which are not granted to it by the Constitution; and the powers actually granted must be such as are expressly given, or given by necessary implication." This doctrine does not apply to the independent States. Their powers are sovereign powers, but limited by the powers which they have conferred upon the Federal Government through the Constitution.

Daniel Webster said, with much force: "Our Constitution is one of enumeration, and not of description."

This grant of power by the States to the Federal Government, it is contended by Chancellor Kent, does not, by the terms of the grant contained in the Constitution, confer or imply an *exclusive* grant therefor; that is, it does not confer such an exclusive grant as to preclude the individual States from granting through the proper channel protection to inventors, if the State should see fit to do so.

Bearing upon this question of the concurrent right of individual States to grant patents for inventions, Chief Justice Kent, in the case of Livingstone and Fulton *vs.* Van Ingen (1812) (9th Johns, 507), held as follows:

"If the grant is not inconsistent with the power of Congress to regulate commerce, there is as little pretence to hold it repugnant to the power to grant patents. That power only secures, for a limited period of time, to authors and inventors, the exclusive privilege to their writings and discoveries; and as it is not granted by exclusive words to the United States, nor prohibited to the individual States, it is a concurrent power which may be exercised by the States in a variety of cases, without any infringement of the Congressional power. A State cannot take away from an individual his patent right and render it common to all citizens. This would contravene the Act of Congress, and would be therefore unlawful."

We should want no better authority than that of Chancellor Kent. Were the authority less eminent, we should accept the doctrine with much caution.

SECTION 4886.

It is unnecessary to follow this question of State rights further; let us proceed to a more intimate consideration of the law and the cases. By the Constitution the power was given to *Congress*; it was incumbent upon Congress to act.

The acts of Congress passed since the date of the Federal Constitution relative to patents are numerous. These numerous acts we will not pause here to separately consider, but must pass immediately to the law as it is contained in the Revised Statutes of the United States.

Section 4886 of the Revised Statutes of the United States is as follows:

"Any person who has invented or discovered any new and useful art, machine, manufacture or composition of matter, or any new and useful improvement thereof, not known or used by others in this country, and not patented or described in any printed publication in this or any foreign country, before his invention or discovery thereof, and not in public use or on sale more than two years prior to his application, unless the same has proved to have been abandoned, may, upon payment of the fees required by law, and other due proceedings had, obtain a patent therefor."

This brief section embodies substantially the backbone of the patent law of the United States as it exists today, and yet these few lines are required to be interpreted and re-interpreted in almost every suit litigated involving the patentability of an invention. Volumes of decisions have been written upon it, and volumes will continue to be written so long as it or any like statute exists.

It may safely be said that in no branch of litigation does each case "stand upon its own bottom" so thoroughly and so completely, and require such independent review as do the cases involved in patent litigation.

This brief section absolutely defines who is entitled to a patent, and it defines what things are the subjects of patents, which no court in the United States can gainsay. But the courts interpret. Many cases are on the border line, which renders just interpretation frequently exceedingly difficult.

What is that "border line" of invention upon which so many litigated patents serenely rest? It is as marked and well defined as that imaginary line drawn in the fair sex, on the one side of which the girl is a blushing bud, on the other a full blown rose. Where are you going to draw the line of demarcation? Ask of the highest Court of Appeals, and perchance it will give you no fixed infallible rule. Know that line, then you will know what is and what is not *patentable invention.*

WHAT IS PATENTABLE INVENTION!

I desire at this point to say that even now in *doubtful* litigated patents, the practical commercial results of the invention serve as a powerful guide to the courts, as it has done in the earlier times, in determining the question of *patentability.* A careful examination of the cases bears out this view.

Where a mere doubt exists at the time of application regarding the novelty and patentability of an invention, it is generally resolved, as it should be, in favor of the applicant, and the courts, when subsequently called upon to pass upon such patent, will, as they should, be considerably guided, where such a doubt as to patentability still exists, by the fact that the invention in question has proved commercially successful.

THE TELEPHONE CASES.

As a usual rule, however, in the class of cases just referred to it will be found that where an invention has proved successful commercially, there is some *inherent reason* for it residing in the invention itself. This may be illustrated, for instance, by the celebrated telephone cases, where a mass of alleged anticipatory testimony,

* From lecture delivered before the Franklin Institute, Philadelphia.

some of it very strong, was produced. It is true that the credibility of some of the testimony was very much doubted by the court, but Mr. Bell had in his favor throughout the whole proceedings the fact that he had described a successful operative means of transferring to, or impressing upon, an undulatory current of electricity, the vibration of air produced by the human voice in articulate speech, in such a way that the speech was carried to and received by a listener at a distance on the line of the current. Never before had such an invention been given to the public; it was one of the greatest inventions of the age, and naturally it would have taken very strong evidence of anticipation to have defeated his patent (American Bell Telephone Cases, 126 U. S., 863).

The Bell Company rested their entire case upon the fifth claim of the Bell patent, which is as follows: "The method of, and apparatus for, transmitting vocal or other sounds telegraphically, as herein described, by causing electrical undulations similar in form to the vibrations of the air accompanying the said vocal or other sounds, substantially as set forth."

It is interesting to note that when Bell applied for his patent he had never actually transmitted telegraphically-spoken words so that they could be distinctly heard and understood at the receiving end of his line; but as stated by Mr. Chief Justice Waite, in delivering the opinion of the court, "In his specification he did describe accurately, and with admirable clearness, his process; that is to say, the exact electrical condition that must be created to accomplish his purpose; and he also described, with sufficient precision to enable one of ordinary skill in such matters to make it, a form of apparatus which, if used in the way pointed out, would produce the required effect, receive the words, and carry them to and deliver them at the appointed place. The particular instrument which he had and which he used in his experiments did not, under the circumstances in which it was tried, reproduce the words spoken, so that they could be clearly understood; but the proof is abundant, and of the most convincing character, that other instruments, carefully constructed and made exactly in accordance with the specification, without any additions whatever, have operated and will operate successfully."

It will thus be seen that, although Bell did not give to the public at the date of his application for a patent, a commercially operative device, and never up to that time had constructed one himself, he did, nevertheless, describe and claim such a device in his application as would enable others skilled in the art to make a successful operative commercial device. Perhaps it may safely be said that at the date of Bell's application he had not been as successful in his actual experiments as some of those who had experimented before him, but they had never completed, either in an actual device, or upon paper, the invention to the extent to which Bell had perfected it.

Mr. Chief Justice Waite said, *inter alia:* "Some witnesses have testified that they were unable to do it (construct an apparatus from Bell's patent); this shows that they, with the particular apparatus which they had, and the skill they employed in its use, were not successful; not that others, with another apparatus, perhaps more carefully constructed, or more skilfully applied, would necessarily fail. As was said in Webster Loom Company *vs.* Higgins (105 U. S., 580,586), 'when the question is whether a thing can be done or not, it is always easy to find persons ready to show how not to do,' if one succeeds that is enough, no matter how many others fail. . . . The law does not require that a discoverer or inventor, in order to get a patent for a process, must have succeeded in bringing his art to the highest degree of perfection. It is enough if he describes his method with sufficient clearness and precision to enable those skilled in the matter to understand what the process is, and if he points out some practicable way to put it into operation. This Bell did."

(*To be Continued.*)

WHAT IS ELECTRICITY?

BY SYDNEY F. WALKER.

Readers of my previous articles upon this subject will remember that the view I have ventured to put forward as to the nature of electricity is that it is simply a mode of motion, just as heat, light and sound are, but at a different rate, and possibly in a different manner, to either of those forces. I have already pointed out the close similarity that exists between the different forces named and electricity, in the fact that conduction takes place in all of them under very much the same laws; that the presence of any one of them, electricity included, in any body increases the apparent size of that body; and that all, though necessarily in different degrees and with different substances, possess the property of altering the chemical constituency of compound bodies.

Seeing that the different forces represent different forms and rates of motion, we should necessarily expect that there would be diversities in the similarities of their resultant action, and, further, we should expect that some properties would be peculiar to one or more rates of motion, to one or more of the forces, but not common to all. The more features of similarity, however, that we find between a force supposed to be outside the group and those known to be inside, the stronger does the argument become that the outsider is really one of the group. If, therefore, we can show that electricity or electric waves are reflected and refracted as heat and light rays are, we shall have a strong argument in favor of my contention that electricity is a mode of motion, like the other physical forces.

As students of electrical literature are aware, the late Professor Hertz went a very long way towards proving this, and he actually succeeded in obtaining reflection of electromagnetic waves What Professor Hertz actually proved was, that if in the path of a series of electromagnetic waves created by an induction coil an object be placed capable of reflecting those waves, just as mirrors reflect waves of light or heat, the actual phenomena of reflection were obtained. My object in drawing attention to this is the hope that some of those who have the time and the appliances at their disposal will carry on Professor Hertz's experiments to their logical conclusion, and prove or disprove my supposition that an electrically-charged body is sending waves into space, just as a luminous, a heated, or a sounding body does, and that these waves may be caused to reflect and possibly also to refract.

In order to pursue this investigation with advantage it may be well to enquire what we mean by reflection, since it will be evident that a substance that reflects one of the physical forces may not reflect another. To follow the theory I ventured to put forward in one of the earlier articles, the rate of motion already existing in any particular body on which a ray impinges may be such as to combine readily and fully with the motion brought by the ray when the latter is, say, a ray of heat, while it may not be able to combine with a ray of electricity, supposing such to exist. In the case of the reflection of light rays, we see this selective property exercised all around us. Thus, a substance we know as black has the property of absorbing and, on the theory enunciated above, of combining with the whole of the motion brought by the impinging ray. A substance we know as red is only able to absorb a portion of the motion, reflecting the remainder out again, and giving us the phenomena of color. A substance that is white, as we know, absorbs very little of the motion brought by an impinging ray, reflecting nearly the whole of it; while, again, bright polished substances, such as mercury, silver and to a lesser degree copper, and other colored metals have the property, not only of reflecting a mass of light rays, but of reflecting every ray brought to them in the exact inverse order in which they arrive.

To reflect electric rays, then, we require to find a substance that does not readily absorb a charge of electricity, or, in other words, one which, while it is a poor conductor, has also a small electrostatic capacity. An experiment I think that should prove successful might be made with a large hollow metal sphere charged to a very high potential, and the neighborhood explored with a sheet of ebonite and a light pith ball. If waves of electricity are given out by the highly-charged sphere, just as waves of sound are given out, say, by a tuning-fork, evidence of them would be found and of their reflection. Possibly a careful consideration of some of the phenomena of electrostatic induction may lead to the conclusion that this also is only a form of reflection. —London *Electrical Engineer.*

AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS.

At the ninety-second meeting of the American Institute of Electrical Engineers held at 12 West 31st street, New York, December 19, a paper was presented by Mr. Ludwig Gutmann, of Chicago, "On the Production of Rotary Magnetic Fields by a Single Alternating Current."

In the absence of the author the paper was read in abstract and the discussion opened by Dr. M. I. Pupin and continued by Messrs. Wolcott, Kennelly and Burnett.

At the meeting of Council in the afternoon the following associate members were elected :

Blackall, F. S., N. Y. City Representative Crocker-Wheeler Elec. Co., 126 Liberty street, N. Y. city.

DeRyckere, G., Professor in Electrical Engineering, Grand University, Belgium ; residence, Boulevard Frere Orban 18.

Dey, Harry E., 342 Tenth street, Brooklyn, N. Y.

Graham, George Wallace, Secretary, Interior Telephone Co., 203 Broadway, N. Y.

Lane, Vance, Manager and Supt. Construction, Nebraska Telephone Co., Omaha, Neb.

Lardner, Henry Ackley, Instructor in Electrical Engineering State College, Pennsylvania.

Moses, Percival Robert, Student of Electrical Engineering, Columbia College, N. Y.

Pratt, Chas. A., Electrical Engineer, The Independent Elec. Co , Chicago, Ill.

Privat, Louis, Electrician, Cicero Water, Gas and Electric Light Co., Oak Park, Ill.

Shedd, John C., Professor of Physics and Applied Electricity, Marietta College, Marietta, Ohio.

Vanderslice, G. Hamilton, Westinghouse Electric and Mfg. Co., Pittsburgh, Pa.

Reist, Henry G., General Electric Co., Schenectady, N. Y.

Trafford, E. W., Electrical Engineer, Richmond Railway and Electric Co.

Jackson, Henry, Telegraph Superintendent and Engineer, The Lancashire & Yorkshire Railway Co., Horwich, Bolton-le-Moors, Lancashire.

Rouquette, William Frederick Blakeway, Proprietor Rouquette & Co., 74 University Place, N. Y.

Uhlenhaut, Fritz, Jr., Electrical Engineer, Philadelphia, Pa.

A committee was also appointed by council to consider the question of an Index of Electrical Literature. The committee is as follows : Prof. F. B. Crocker, chairman ; Messrs. Edward Caldwell and A. E. Kennelly, Professor W. M. Stine and George D. Shepardson.

IRRIGATION BY ELECTRICITY.

Electric power will, no doubt, be gradually introduced in the development of the work of reclaiming the now valueless lands in the western section of our country. There are thousands upon thousands of acres of land that are practically valueless, mainly on account of the absence of rain. If some practical method of irrigation were introduced, much of this land would be made productive.

Irrigation Age, in a recent issue, prints an interesting article on the subject of using electric power for the irrigation and the reclamation of these lands.

It is a well-known fact that in nearly all the arid land regions artesian wells can be obtained at a depth of from 300 to 600 feet, the water in these wells rising to within fifty feet of the surface. In some localities they flow. There are many places where abundance of surface water can be had by digging only a few feet. Especially is this the case near streams. To utilize water-power costs much less than steam.

A power plant is imperative. The full capacity of a 10-horse power electric motor will yield power equal to a 10-horse power engine, and, if its capacity be not overworked, will last indefinitely. The same may be said of dynamos without regard to size.

The cost of a 15 horse-power motor is $500. Foundations, power house, two 500 horse-power dynamos with engines directly connected, and everything ready for operating, could be constructed for about $36,000. The power house, when run by steam, should be placed at a railroad switch. To construct for water-power might cost as much, but the operating expenses would be much less.

A 600-foot well can be sunk for $1,500. It takes 27,154 gallons of water to cover an acre one inch deep. A 15 horse-power motor will pump 750 gallons per minute, and raise the water fifty feet. Seven hundred and fifty gallons will cover forty acres one inch deep every twenty-four hours, or 280 acres every week. One well will furnish water during the irrigation season, from May 1 to August 31, to cover 280 acres seventeen inches deep. This is an abundance for almost any crop, and a great deal more than most crops require. The water could be pumped into a ditch or reservoir. The well could be sunk where most convenient, as the power comes to it by wire.

One thousand horse-power will run fifty-six 15 horse-power motors, and will allow 15 per cent. loss for transmission of power from dynamos to motor. The lines for transmission, including poles, wires, etc., would cost from $8,000 to $10,000. Thus we see that 1,000 horse-power would furnish an abundance of water for fifty-six times 280 acres, or 15,680 acres, about 24½ sections, at a cost, not including ditches and reservoirs, of about $160,000—a very little over $10 per acre. A larger amount is often expended in clearing some Eastern lands of timber and stones.

It takes three pounds of coal per horse-power per hour, or 72,000 pounds for twenty-four hours, at a cost of from $1 to $2 per ton, according to freight, or $72 per day for coal. The other power-house expenses, including oil, can be run for $18. One man, with the use of a horse, can look after ten motors, making an expense of $10 per day, giving a total operating expense of $100 per day, or $12,300 for 123 days, the entire irrigating season, less than $1 per acre.

In valleys where the fall of streams is not sufficiently rapid to admit of taking out ditches, ditches can be built, the stream dammed, and the water raised to the required height by pumps through means of pipes, each pump working by motor. It makes little difference whether the water be raised perpendicularly or otherwise.

UNDERGROUND WIRES AND ROCKET SIGNALS.*

BY CHIEF J. J. LEDDEN, BALTIMORE.

Nothing is more vitally necessary to a fire department than a prompt, efficient and absolutely reliable telegraph system. It is, as it were, the nerves of the body without which the department proper, which may be compared to the muscles, cannot perform its functions definitely or satisfactorily. Anything, therefore, that interferes with this system paralyzes for a time the entire department. There is always the danger from storms, where wind may blow down a portion of the line, or cause the crossing of wires with those carrying a heavier current, or lightning may strike poles or wires, carrying destruction to the boxes or other valuable machinery in its path. Then there is the danger, as was the case on July 19th in Baltimore, of fire penetrating the central office and rendering the entire system useless. I have no doubt many of you are familiar with these dangerous and vexatious experiences. The primary remedy is of course to place all wires underground, by laws compelling all outside companies to do so, as well as to have the fire alarm wires themselves placed there. The next best remedy, if the former could not be accomplished, would be to place the fire alarm wires at least there, where they would be out of the way of danger and trouble.

On account of the expense, of antagonistic interests and various other causes, municipal authorities are slow to act in these matters, and the subject naturally suggests itself to a chief engineer of a fire department what remedies he can adopt in case of accident to the telegraph system. In my own city we have had so much experience in that line that I have been compelled to devise several schemes for our relief, which have proven effectual and which, I think, will be of interest to this body. In the first place, the member on watch on the floor of engine or hook-and-ladder house is instructed that when relieved and before retiring he must go to the roof or tower of the house and look around for indications of fire, and if a light is discovered within bounds of first-alarm boxes, he will notify the commanding officer of the company, who will respond with apparatus, and if light is beyond bounds of first-alarm boxes, he will notify company in neighborhood of such indications to investigate; the watches are so regulated that every five or ten minutes a man is on top of one house or another on the outlook; and in numerous instances the apparatus of the department was on its way to a fire before even a box is pulled for it. I have mentioned this to show the efficacy of a tower-watch at any time. During a storm this tower-watch is made constant, and in the event of the disability of the fire alarm telegraph the following system has been adopted:

When a heavy storm occurs, a tower-watch must be maintained on each engine, hook and ladder and chemical house, and should a light be seen by tower-watch within the bounds of the company's first-alarm boxes, the member on watch will notify the commanding officer of his company, who will immediately respond with apparatus, and upon arriving on the fire ground, should it be deemed necessary to signal for a second alarm, the commanding officer or a district engineer, if present, will make all possible haste to the nearest engine, hook and ladder or chemical house and send up from the roof of same three white-light rockets, and companies that respond to boxes in vicinity of light will respond on rocket signal; and should a third alarm be deemed necessary then three blue-light rockets will be sent up, and companies that respond to boxes in vicinity of light on third alarm will respond on rocket signal; and should it be deemed necessary to signal for the four two's, then six red-light rockets will be sent up, and all companies that respond to boxes in vicinity of light on second and third alarms will immediately respond on rocket signal. Watches in tower of companies that have responded when signal is understood, will remain in tower until they have each sent up one red-light rocket so as to let the person signalling know that the signal is understood, after which they will make all possible haste to the fire ground.

It may be urged that the rocket signal is only effective at night. This is true to some extent, but our experience is that the largest fires occur at night, when they get a great headway before being discovered, and need the additional help of second and third-alarm companies. During the day the probability of a fire being discovered in its incipiency is greater, and it would not often get away from the first-alarm companies that answer, and should it be of greater magnitude than they could handle, it would be visible to the watches of other houses and answered by other companies accordingly. This system has been found to work very well on several occasions, notably so on the occasion of the fire July 19, damaging the central telegraph office before mentioned. We were then practically without any telegraph service for several hours, and availed ourselves of neighboring telephones connected with the Telephone Exchange for the purpose of communication between the several companies. This worked very well, and was far safer than the telephone used by the department, had it been available, for the reason that the telephone company have the greater part of their wires underground. Our city has made provisions for burying the fire-alarm wires, which will soon be carried out, much to our relief.

Again, I cannot leave this subject without reverting to the constant danger to property and a menace to the lives of citizens and ourselves with the overhead wires carrying heavy currents present. After a few years the insulation of such wires wears off, they are dangerous to handle, other wires dropping on them carry death and destruction wherever they may reach. It therefore becomes us to protest in every possible manner against a continuance of this danger and to insist that all overhead wires interfere with and often entirely prevent the operation of the fire department, and that they should be placed underground as the only safe and proper remedy.—*Fire and Water.*

* Paper read at the Montreal convention of the National Association of Fire Engineers.

Electric Railway Data.—Mr. Lemuel W. Serrell, mechanical and constructing engineer, Postal Telegraph Building, New York City, has just issued a neat little pamphlet entitled "Electric Railway Data for Construction and Dividends." The cost of construction of electric railways is given in considerable detail, and the subjects are rendered very clear and comprehensive by the aid of tables and drawings. The pamphlet has several half-tone views of electric railways. It will be found very valuable to those interested in this industry.

(*Concluded from Page* 354.)

$$r = \frac{680}{\sqrt{l\, d}}$$

and for inverted horseshoe types the formula becomes

$$r = \frac{460}{\sqrt{l\, d}}$$

where l = length of path in armature core
d = distance between the two poles.

The magnetic characteristic can be predetermined by the above method and a curve obtained for different magnetic inductions. Kapp, by his method, so roughly outlined determines the loss by considering all possible sources of leakage as but another circuit of great reluctance, having in total a resistance called by him "leakage resistance," to distinguish it from the actual reluctance of the machine itself.

As an illustration, were the magnetic resistance of the machine at a given induction to be one, and the leakage resistance of the frame ten, then a loss of ten per cent. of the lines of force will occur at the specified magnetic flux due to the additional paths of wasteful lines.

We then produce in the core of the field magnets a flow of lines equal in total to the sum of the leakage and useful lines.

KAPP'S TABLE.

1 Kapp line = 6,000 Lines of Force.

Lines per square inch. Absolute.	Kapp	Tangent function. Armatures.	Fields.
6000	1	1.00	1.005
12000	2	1.01	1.013
18000	3	1.01	1.021
24000	4	1.02	1.041
30000	5	1.03	1.069
36000	6	1.04	1.104
42000	7	1.04	1.147
48000	8	1.08	1.202
54000	9	1.11	1.273
60000	10	1.14	1.362
66000	11	1.17	1.489
72000	12	1.22	1.654
78000	13	1.26	1.891
84000	14	1.29	2.250
90000	15	1.40	2.853
96000	16	1.49	4.624
102000	17	1.57	7.707
108000	18	1.79	Infinite
114000	19	1.96	
120000	20	2.18	
126000	21	2.52	
132000	22	3.05	
138000	23	3.92	
144000	24	5.61	
150000	25	10.82	
156000	26	Infinite	

(*To be Continued.*)

ELECTRICAL TABLES.

"ELECTRICAL TABLES and MEMORANDA," is the title of a valuable little reference book for engineers, electricians and others interested in the electrical science. It contains a great deal of valuable information and a number of illustrations and diagrams. It is only $1\frac{7}{8}$ by $2\frac{5}{8}$ inches in size, and can easily be carried in the vest pocket. The author of this convenient little work is Prof. S. P. Thompson, and the price is only 50 cents per copy. For sale by the ELECTRICAL AGE Publishing Co., World Building, New York.

PERSONAL.

Mr. James W. Godfrey, whose features are presented herewith, and who is so well-known in the electrical trade, took the management of the New York Insulated Wire Company in the Spring of 1887, when the company was still in its infancy. He established agencies for the company in the principal cities throughout the country and secured as such some of the best known individuals and firms.

In 1890 the Chicago agency and salesrooms were established, and their success is so well-known that it is not necessary to go into details. Success everywhere attended Mr. Godfrey's efforts to build up the business, and as an individual his progress in the insulated wire field has been wonderful. He is one of the best known men in the trade, throughout the extreme length and breadth of the country. On December 1 Mr. Godfrey severed his connection with the New York Insulated Wire Company. He is now representing the India Rubber and Gutta-Percha Insulating Company of New York, and has a suite of rooms at 15 Cortlandt street,

J. W. GODFREY.

where he has his headquarters. Mr. Godfrey will hereafter handle Habirshaw high grade wires, which are manufactured by the company last named, and we congratulate this concern on its good fortune in securing the services of so able a manager and salesman as Mr. Godfrey.

Mr. Frank Harrington, well known through his association in the past with the Western Electric Company, the Tropical American Telephone Company, and lately with the New York Insulated Wire Company, has resigned his position with the company last named. He will, on January 1, 1895, join forces with "General" J. W. Godfrey in pushing Habirshaw wires and cables. Mr. Harrington's influence, in addition to that of the "General," will work wonders for the India Rubber and Gutta-Percha Insulating Company.

Mr. James B. Olsen, so well and favorably known to the electrical trade as one of the most able representatives of the New York Insulated Wire Company, has resigned his position with that company. He will join Messrs. Godfrey and Harrington in the interest of Habirshaw wire. The trio is about the strongest that could be possibly brought together for one purpose. Mr. Olsen was for several years the Chicago representative of the New York Insulated Wire Company, but on account of sickness in his family he was compelled to leave that city and its climate and return East. He was retained at the New York headquarters until the time of his resignation. Mr. Olsen was very successful in the New York company's interest. The India Rubber and Gutta-Percha Insulating Company has secured a matchless team in these three gentlemen.

ELECTRICAL SANITATION.

In a communication to the State Department, C. W. Chancellor, United States Consul at Havre, France, makes the following report regarding M. Hermite's process of electrical sanitation :

Sanitary questions are of such importance that I need make no excuse for describing in a consular report a new process, which, it is claimed by the inventor—M. Hermite—will overcome many of the difficulties inherent in the ordinary, crude method of dealing with town sewage. This process may be appropriately called "electrical sanitation."

The researches of Faraday, the eminent English chemist, made more than half a century ago, into the effect of the electric current on a solution of chloride of magnesium, was, no doubt, the starting-point or germ from which M. Hermite evolved his system, which he has conducted experimentally in Havre, Rouen, Lorient, and other French towns.

This so-called system is based on the electrolysis of sea water. The electric current is used to decompose the chloride of magnesium, while the chloride of sodium serves as a conductor. The result is a liquid disinfectant of great power, which is almost odorless, leaves no residuum when used for purposes of flushing, and is said to be inoffensive. It is further claimed that the solid organic matters in sewage are consumed or dissolved in this liquid, leaving an odorless fluid, incapable of fermentation, and containing only a few phosphates, the salts of ammonia, and the salts of the disinfectant. The action of the liquid on germ life is peculiar. In an address delivered at the Hotel de Ville, Havre, on the sanitation of the city, M. André Dubosc, the eminent savant, gave a very clear explanation of the way in which microbes are destroyed by the Hermite liquid. He said :

Microbes may be divided into two great classes—anaërobiotic organisms, which exist without air, and anërobiotic organisms requiring air to live. On the anaërobies, or microbes living without air, the action of the compound of chlorine is simple, as the freeing of its oxygen causes their instant death, inasmuch as in presence of that gas in excess, as their name indicates, they can not exist. With regard to the aërobies, their death is brought about by chemical means The fatty principles, particularly abundant in sewage matters, are specially concerned ; the oxygen is absorbed, the volatile fatty acids liberated, and these undergo so strong an oxidation that they often result in the appearance of formic acid. The equilibrium of the chemical medium of the microbe being thus destroyed, it perishes as an individual would perish after swallowing vitriol or inhaling sulphurous acid gas.

Other experts who have looked into the system, while admitting the disinfecting properties of the electrolyzed sea water, or mixture of sodium and chloride of magnesium, have expressed some doubt as to whether the liquid could be produced in sufficient abundance and at a sufficiently cheap rate for large towns, including the sewers and streets to be irrigated with it. But the experiments at Havre, where there is an unlimited supply of sea water, have demonstrated quite the contrary, so far, at least, as quantity is concerned ; but there is not a unanimous consensus of opinion on the question of economy. It may be safely said, however, that the application of the system would have the advantage of saving a large proportion of the water usually employed for the flushing of soil pipes and drain pipes, as well as the much larger quantity employed in flushing sewers and washing gutters. How far this would compensate for the expense of the plant, etc., must, of course depend upon the value and quantity of water ordinarily used.

An adequate and wholesome supply of water is one of the problems which confronts every community, and it should not be forgotten that the demand increases steadily with the expansion of population and the growth of civilized habits. At present, about one-half of most water supplies is wasted in flushing drains and sewers and in cleaning streets, and it is quite conceivable that the use of electrolyzed sea water for these and other purposes, in towns not remote from the seaside, would add immensely to the store of potable water. But, apart from this important question, a system under which sewage can be robbed of all poisonous and noxious properties by chemical treatment is an ideal one. The use of antiseptics is becoming a new law of life. It now remains only to apply it to the disposal of our sewage, and thus to free soil pipes and sewers of all septic matters would be to destroy some of the deadliest diseases afflicting us.

Although sea water renders the application of the Hermite method considerably cheaper, it is not essential to it. When sea water is not procurable, a solution of chloride of magnesium can be used instead. Here a parallel chemical action is produced, giving precisely similar results. In every instance a central station has to be constructed and supplied with the necessary electric plant and convenient tanks, in which the disinfectant is prepared in sufficient quantities. By a simple arrangement of pipes the electrolyzed water is distributed through the streets, like the water for domestic use or like gas. It can also be conveyed into houses; and the contents of waterclosets, after being treated with the disinfectant, will help to purify the main drains and sewers, instead of adding to their general contamination. The hygienic character of dwellings, so far as the absence of sewer gas is concerned, would obviously be greatly increased by this means, since there would be none of this deadly gas to escape through defective pipes and traps ; and it has, moreover, been demonstrated by French bacteriologists that all these microscopic forms of life which "live and move and have their being" in sewage, and which wage a constant war upon the human race, will rapidly perish in the electrolyzed solution.

NEW YORK NOTES.

Office of the Electrical Age,
World Building, New York,
December 24, 1894.

The firm of Bloomer Bros. & Co., 26 Cortlandt street, was dissolved on December 18.

The Standard Paint Co., of 2 Liberty street, has issued a little circular from its roofing department regarding its P. & B. preservative paint. This material is the best that can be had for preserving roofs. The circular contains many testimonials of a very complimentary character regarding the satisfaction given by this company's roofing material.

J. P. Freeman, electrical inspector, Association of Fire Underwriters of the District of Columbia, Washington, was in town last week.

ELECTRICAL AGE

Established 1883. An Illustrated Weekly Electrical Journal. 10 cents per copy

VOL. XIV.—No. 398. NEW YORK, DECEMBER 29, 1894. Subscription, $3.00 per year. Foreign Countries, $5.00 per year.

SEE ADVERTISEMENT PAGE V.

The New York *Herald's* new building has one of the finest electric plants in New York. It consists of four large dynamos of 3,000 incandescent light capacity, and also several motors for various work. The most attractive feature of the plant is the fine artistic arc lamps in the press room. For this establishment the question of light is an important feature, and, after long trial, the Clark Electric Company's lamps were selected as being the most suitable. The Clark Company had a special fixture made for the purpose, which comprises a combination of electric arc light and gas, the gas being used when electricity is not needed.

Mr. A. S. Vance, formerly with H. Ward Leonard & Co., has opened an office at 136 Liberty street, as general contractor, electrical engineer and dealer in lamps and supplies.

The sheriff has placed an attachment with Neftel, O'Connor & Company (corporation), electrical and contracting engineers, 126 Liberty street. The attachment is for $11,704 in favor of Bernard F. O'Connor, for salary and money loaned.

Mr. Joseph Sachs will, on January 4, 1895, deliver a lecture before the Department of Electricity, Brooklyn Institute of Arts and Sciences The title of his lecture will be "Substitutes for the Trolley." The lecture, which will be held at the Edison Building, 360 Pearl street, will be illustrated.

The Commercial Cable Company is distributing a card on one side of which is a reprint of the description, by its special correspondent on board the "Faraday," of the laying of the Commercial Company's third Atlantic cable; on the other side are given various views showing the progress of the work on both sides of the ocean. It is an interesting souvenir and is in keeping with the spirit of this enterprising company.

Early in the morning on December 23, a fire started on the floors above the large electrical supply house of The E. S. Greeley & Company, 5 and 7 Dey street, this city. The company's stock was damaged more by water than by fire, and the loss will be between $25,000 and $30,000. The company, however, will not be at all embarrassed by the damage to its stock, because it has a large reserve stock to draw from, and business will go on just the same as if nothing had happened.

W. T. H.

NEW CORPORATIONS.

The Chicago & North Street Railway Company, Chicago, Ill., by W. W. Beatty, J. H. Smith and M. Skinner. Capital stock $2,000,000.

The Valparaiso Gas & Electric Company, Valparaiso, Ind., by Jesse Scribner, Otis E. Turner and Oscar H. Olsen. Capital stock, $120,000.

The Detroit Railway Co., Detroit, Mich., by Green Pack, Albert Pack, Chas. L. Pack, Henry A. Everett and Chas. W. Mason. Capital stock, $1,000,000.

Detroit Electric Lighter Company, Detroit, Mich , by Wm. R. McGraw, chairman; Louis C. Sherwood, vice-chairman; Leopold Godfrey, secretary; Israel T. Cowles, treasurer, and Thos. S. Jerome, general counsel. Capital stock, $50,000.

Berien Springs Water-Power Company, Berien Springs, Mich., by Geo. H. Murdock, Roscoe D. Dix, T. L. Wilkinson and others, with a capital stock of $50,000.

The Susquehanna River Electric Company, Baltimore, Md., by Moses H. Houseman, Geo. K. McGraw, Winfield J. Taylor, of Baltimore, and Charles R. McConkey, of Peach Bottom, Pa. Capital stock, $100,000.

The Keystone Traction Company, Lancaster, Pa., by John J. Patterson, J. Hay Brown, Silas M. Patterson and John D. Skiles, of Lancaster, and W. B. Gilven, of Columbia. Capital stock, $10,000.

POSSIBLE CONTRACTS.

The Boston Electric Light Company is preparing plans for a large fireproof building to be used for storage business.

G. W. Myers, of Kansas City, Mo., representing a syndicate, has purchased the Electric Light and Power Company's plant in Chillicothe, Mo., for $25,000.

The Hot Springs, S. D., City Council has granted a franchise for an electric railway in that place.

The South Yuba Water Company, Sacramento, Cal., has applied for a franchise to bring electric energy into that city, for light, power and heating purposes. The company claims to be able to furnish 4,500 horse-power.

The Americus Light and Power Company, Americus, Ga., has been awarded the contract to put in additional street lights. A new and larger dynamo will be installed for the purpose.

The Mayor of Athens, Ga., can give information regarding plans to utilize water-power for the generation of electricity in the interests of that city.

The electric light plant in Oskaloosa, Ia., was destroyed by fire recently; loss $30,000.

The West Jersey Traction Company has been granted the right of way through Palmyra, N. J. The company will maintain ten arc lights on its line within the city limits.

The County Commissioners, Warren, O., have granted a franchise for an electric railway from Niles to Youngstown.

The plant of the Robinson Company, manufacturers of electrical apparatus, Bellwood, Pa., has been sold by the receiver to a company of Altoona capitalists. The new management will resume operations.

A. C. Pond, Boston, Mass., is reported to be interested in a scheme to build an electric railway from New Haven to various points within a radius of 30 miles of that city.

The Knights of Pythias, Charleston, S. C , will erect a new building which will require an electric light plant. D. G. Zeigler, of Cameron, S. C., has prepared the plans.

D. Lowenberg, Norfolk, Va., has the contract for a new business block for Hecht & Hirschler.

The Citizens' Bank of Savannah, Ga., will erect a new building. M. T. Lewman & Co., of Louisville, Ky., are the contractors.

The Wear-Brogher Dry Goods Company, of St. Louis, Mo., contemplate the erection of a large building to cost $400,000.

There is talk of erecting a new Union station at Sumter, S. C. S. R. Kennelly, of Wilmington, N. C., can give further information.

Work will begin on the Annapolis & Bay Ridge Electric Railroad, Annapolis, Md., on January 1. J. C. Musgrove, Philadelphia, is the president.

W. A. Hemphill and the Hale Investment Co., of Atlanta, Ga., are each interested in a project to build electric railroads in that city.

King & Cooke, Mammoth Springs, Ark., have secured a franchise to erect an electric light and power plant.

The Crescent City Traction Co., Crescent City, Fla., has received the contract to light that city by electricity.

A company is being organized in Brunswick, Ga., to establish an electric light system.

The Mayor of Baltimore, Md., can give information regarding the project of the Board of Commissioners of Druid Hill Park to construct an electric light plant.

The Baltimore & Ohio Railroad Co. will install an electric plant in its new shops at Cumberland, Md.

The Natchez Electric Railroad Co., Natchez, Miss., will build an electric plant. Further information can be obtained from Rufus R. Learned.

The Baltimore City Passenger Railroad Company, Baltimore, Md., will extend the Eutaw Street line.

Address Julius Fishburne, Charleston, S C., regarding a proposed electric street railway in that city.

It is reported that the Kansas City Cable Railway, Kansas City, Mo., has decided to introduce the trolley system on its line from Westport to Rosedale.

The San Antonio Rapid Transit Company, San Antonio, Texas, has decided to extend its lines.

Calderon Carlyle, H. L. West and W. P. C. Hazen, Washington, D. C., are interested in a proposed electric road in that city.

TELEPHONE NOTES.

The Southern Telephone Company has secured a franchise in Fayetteville, N. C., and will build an exchange there.

J. D. Anderson and A. E. Smith, Rockhill, S. C., are organizing the Rockhill Telephone Company with a capital stock of $5,000.

All the wires, poles and other property of the American Telephone and Telegraph Co., in Connecticut, were, according to a dispatch from Bridgeport, on December 21, attached in a suit for $20,000 by B. F. Squire and his wife. Mrs. Squire was driving to church one Sunday in November last, when her horse took fright at a pile of old wires that had been removed from the defendant's poles, and ran away. Mrs. Squire and her daughter were injured; hence the suit.

TELEPHONE PATENTS ISSUED DECEMBER 18, 1894.

Telephone Speaking-Tube System.—Thomas C. Wales, Jr., Boston. (No. 531,078).

Telephone Transmitter.—David A. Kusel, St. Louis, Mo. (No. 531,194).

CALENDARS.

Mr. Alfred F. Moore, 200 and 202 North Third street, Philadelphia, the well-known manufacturer of insulated wires and cables, is out with a monthly calendar for 1895. It is large and clear.

CATALOGUE.

The Goulds Mfg. Co , of Seneca Falls, N. Y., manufacturers of pumps and hydraulic machinery, have issued a handsome catalogue of their various machines. The book is finely illustrated and some valuable hydraulic tables are given.

TRADE HOLIDAY GREETINGS.

The American Electrical Works, Providence, R. I., never forgets its friends on special occasions. This year it displays its usual originality in sending out its holiday greetings to the trade . It consists of a heavy card in the centre of which is a portrait, in colors, of one of the company's honored friends. The likeness is recognizable at once. The idea is a first rate one. The American Electrical Works, headed by the genial Phillips, display considerable taste in their souvenirs, greetings etc., which are always unique.

TRADE NOTES.

Mr. C. E. Sargent, of Chicago, will on January 1 next, become the Chicago representative of the Ball & Wood Co., the well-known engine builders of New York. Mr. Sargent's headquarters will, for the present, be in the Home Insurance Building. He has long been identified with engine interests in the West, and is well-known in this industry. The Ball & Wood Co. are fortunate in securing so worthy a representative, and their interests in the West will certainly be greatly benefited by this acquisition.

J. Jones & Son, of 67 Cortlandt street, New York city, are sending out a little neat but deceitful Christmas card. It has a little bag attached to it with a pair of turkey's legs sticking out of the top. On opening the bag, however, the turkey disappears and a printed circular is found in its place, breathing the Christmas greetings of the firm.

S. M. Balzer, manufacturer of Vernon fare and counting registers, has moved his factory from the corner of Worth and Centre streets to more commodious quarters at 370 and 372 Girard avenue, New York city, while his office will be in the Taylor Building, 39 and 41 Cortlandt street.

WOVEN WIRE BRUSHES.

The Belknap Motor Co., of Portland, Maine, are the patentees and manufacturers of the best woven wire commutator brush on the market.

SOMETHING ABOUT ADVERTISING.

It is now generally conceded that judicious advertising is a profitable investment. No one more thoroughly appreciates its potency as a factor in procuring and developing business than those upon whose shoulders rest the interests of the great railroad corporations of this country. Every endeavor is made by them to present the salient features of their re pective lines as prominently as possible.

Take as an illustration the publicity given the famous Empire State Express of the New York Central—palpably the result of clever advertising. Its record has been heralded the world over as the fastest train in existence today.

One of the novel methods that has been employed to make this train familiar with everyone has just come to our notice. It is the co-operation of the railroad and the manufacturer in joint advertising. We have before us a handsomely designed label advertising a locomotive black finishing varnish, just placed on the market by the Buckeye Paint and Varnish Company, Toledo, O., styled "999 Locomotive Black." Forming a part of the trade-mark is a miniature cut of engine No. 999 and underneath the legend, "New York Central's Empire State Express Engine 999, Fastest Locomotive in the World." Another instance is the Empire State Express writing tablet—at present so popular with the school children—manufactured by the Smith & White M'f'g Company, of Holyoke, Mass. On the cover of this tablet is an exquisite half-tone reproduction of the Empire State Express.

The interests of the manufacturer and the railroad are inseparable, each being dependent upon the success of the other, and it is obvious that this co-operative advertising must be productive of the very best results.—*Buffalo Evening News.*

Electrical and Street Railway Patents.

Issued December 18, 1894.

530,951. Electric Conduit. Thomas T. La Pointe, James H. Flanagan, and Charles A. Thompson, New Haven, Conn. Filed Nov. 23, 1893.

530,954. Trolley-Wire Finder. Frederick F. Meyer and William S. Meyer, Newark, N. J. Filed Mar. 14, 1894.

530,956. Hand Operating Mechanism for Electric Locomotives. Andrew W. Mitchell, Boston, Mass. Filed Apr. 14, 1892.

530,957. Finger-Board Telegraph-Key. Elmer E. Mullinix, Burlington, Kan. Filed July 31, 1894.

530,975. Circuit-Closer for Burglar-Alarm Systems. Alfred Stromberg, Chicago, Ill. Filed May 24, 1894.

530,976. Burglar-Alarm System. Alfred Stromberg, Chicago, Ill. Filed May 24, 1894.

531,002. Electric Program-Clock. John L. McCaskey, Waynesborough, Pa., assignor to Frederick Frick. Filed Sept. 13, 1893.

531,005. Electric Converter. Frank C. Prestly, San Francisco, Cal. Filed Feb. 16, 1894.

531,026. Car-Fender. George W. Engel and William C. Juram, Philadelphia, Pa. Filed Sept. 11, 1894.

531,070. Controlling Device for Elevators. Alonzo B. See and Walter L. Tyler, Brooklyn, N. Y. Filed Aug. 24, 1894.

531,078. Telephone Speaking-Tube System. Thomas C. Wales, Jr., Boston, Mass., assignor to the American Bell Telephone Company, same place. Filed Apr. 7, 1894.

531,130. Electrical Switch-Setting and Locking Device. Karl Moderegger, Vienna, Austria-Hungary, assignor to Siemens & Halske, Berlin, Germany. Filed Feb. 8, 1893. Patented in Germany Dec. 6, 1891, No. 65,810, and in Austria-Hungary, Dec. 14, 1891, No. 42,614 and No. 73,712.

531,146. Signal Lamp for Electric-Railway Cars. Chas. H. Baker, Detroit, Mich. Filed Apr. 24, 1894.

531,151. Trolley-Track, William H. Brodie, Brooklyn, N. Y. Filed Oct. 4, 1894.

531,153. Electric Meter. Theodor Bruger, Bockennem, near Frankfort-on-theMain, Germany, assignor to Hartmann & Braun, same place. Filed June 22, 1894.

531,155. Fender. James M. Cable, Brooklyn, N. Y., assignor of one-half to Michael Spall, same place. Filed Apr. 5, 1894.

531,188. Sounder. Frank F. Howe, Marietta, Ohio. Filed Jan. 15, 1894.

531,194. Telephone-Transmitter. David A. Kusel, St. Louis, Mo. Filed Aug. 6, 1894.

531,214. Electric Safety Appliance for Railroads. Edward L. Orcutt, Somerville, Mass. Filed Nov. 2, 1893.

531,234. Automatic Street-Car Fender. Jean T. Van Gestel, New York, assignor of one-fourth to R. H. Sherwood, Bensonhurst, N. Y. Filed Nov. 10, 1893.

531,246. Rotary Motor. Oliver Arnold, Leicester, Mass., assignor of one-half to Malcom G. Clark, same place. Filed Mar. 8, 1894.

531,258. Fender for Street-Cars. William H. Brock, Brooklyn, N. Y. Filed June 4, 1894.

531,268. Brake and Power Controller for Electric Cars. Andrew W. Mitchell, Boston, Mass. Filed Jan. 22, 1894.

531,275. Street-Car Motor. John Radomski, Baltimore, Md., assignor of one-half to Mieczyslaw Barabasz, same place. Filed July 13, 1894.

531,284. Electric Block-Signaling System. Adoniram J. Wilson, Port Chester, N. Y., assignor to the Hall Signal Company, of Maine. Filed May 14, 1894.

531,288. Incandescent Electric-Lamp Socket. Charles H. Balsley, Connellsville, Pa., assignor of one-fourth to G. W. Bryner, same place. Filed Apr. 20, 1894.

531,291. Guide for Trolley-Wheels. William H. Dickerhoof, Cincinnati, Ohio, assignor of one-half to George W. Pollock, same place. Filed July 23, 1894.

INDEX TO ADVERTISERS.

National Electric Light and Street Railway Associations.

AMERICAN STREET RAILWAY ASSOCIATION.

Next meeting, Montreal, Que., October, 16, 17 and 18, 1895.

President, Joel Hurt, Atlanta, Ga.; Vice-President, W. Worth Bean, St., Joseph, Mich.; 2d Vice-President, John M. Cunningham, Boston, Mass.; 3d Vice-President, Russell B. Harrison, Terre Haute, Ind., Secretary and Treasurer, William J. Richardson, Brooklyn, N. Y.; Executive Committee, Henry C. Payne, Milwaukee, Wis.; W. H. Jackson, Nashville, Tenn.; D. G. Hamilton, St. Louis, Mo., C. C. Cunningham, Montreal, Canada; J. N. Partridge, Brooklyn, N. Y.

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Next meeting, Cleveland, Ohio, February 19, 20 and 21, 1895.

NEW YORK STATE STREET RAILWAY ASSOCIATION.

Next meeting, Albany, N. Y., third [illegible]

President, G. Tracy Rogers, Binghamton; First Vice-President, John H. Moffitt, Syracuse; Second Vice-President, W. W. Cole, Elmira; Secretary and Treasurer, William J. Richardson; Brooklyn; Executive Committee, D. B. Hasbrouck, New York; John N. Beckley, Rochester; Daniel F. Lewis, Brooklyn.

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Next meeting, January 7, 1895.

THE STREET RAILWAY ASSOCIATION OF THE STATE OF NEW JERSEY.

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Secretary and Treasurer, Charles Y. Bamford, Trenton; Executive Committee, Officers and C. B. Thurston, Jersey City; H. Romaine, Paterson; S. B. Dod, Hoboken.

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MICHIGAN STATE STREET RAILWAY ASSOCIATION.

Next meeting, Grand Rapids, December, 1894.

President, W. L. Jenks, Port Huron; Vice-President, W. Worth Bean, St. Joseph; Secretary and Treasurer, B. S. Hanchett, Jr., Grand Rapids; Executive Committee, the Officers and David H. Jerome, Saginaw, and [illegible]

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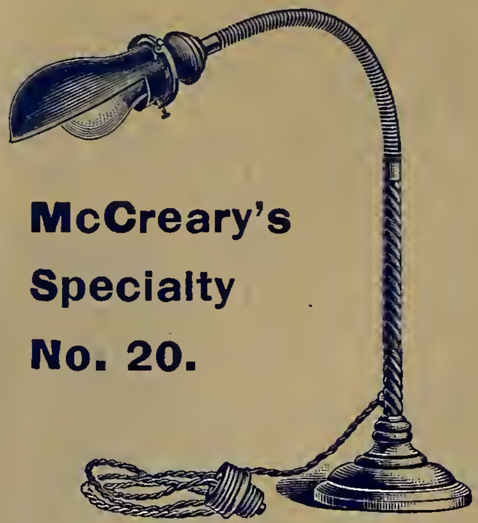

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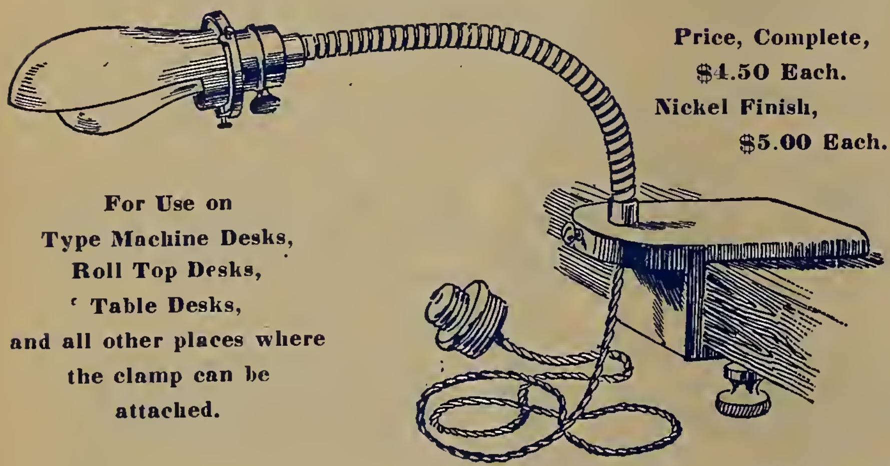

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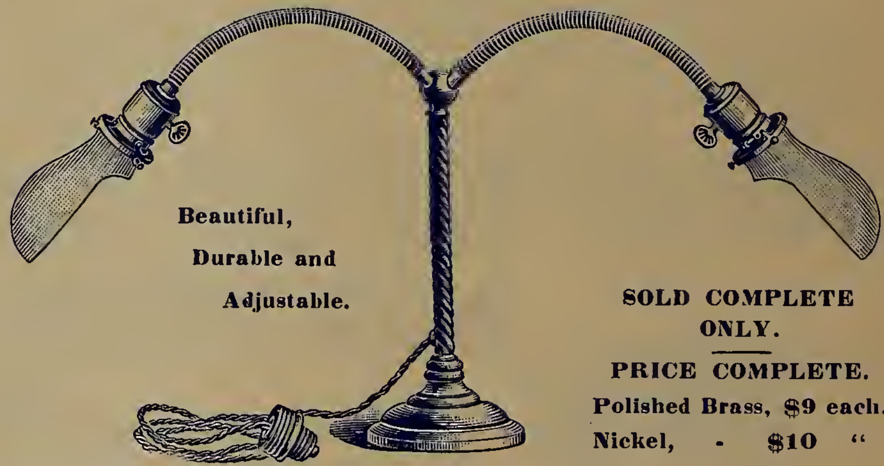

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1. **Patent No. 290,121, Electrical Conductor.** A conductor for carrying the heavy currents in electric lighting, and the distribution of power by electricity, and for other purposes.

2. **Patent No. 290,122, Electrical Conductor or Cable for Lighting and other Systems.** A conductor or cable for supplying electric lamps, motors, and similar apparatus, designed to obviate or lessen the danger to life and property, liable to occur with ordinary conductors.

3. **Patent No. 281,223, Electric Conductor.** A conductor or cable having the insulating material between the several layers of wires, strips, or the like, electroplated (when desired) so as to secure strength with economy of material and space, a valuable invention, new and novel.

4. **Patent No. 292,694, Insulated Conductor of Electricity.** A fireproof compound for bare or insulated wires.

5. **Patent No. 139,690, Printing and Dial Telegraph and Circuits therefor.** A combination of a dial or printing instrument in one main-line circuit upon one base; a unique and valuable device.

6. **Patent No. 305,022, Self-Sustaining Electric-Battery.** A battery of large and constant electromotive force, and to obviate polarization.

7. **Patent No. 310,724, Secondary Battery and Means for Transporting the Same.** The object of this invention is to accumulate electric energy in suitable storage-chambers at natural sources, and convey the same to desirable points, by land or water, in apartments adapted to the vehicles conveying the same; also for a device for running trains, etc., by dispensing with the third rail.